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THE MULTIPLIER EFFECT OF PUBLIC INVESTMENTS

A QUALITATIVE INTEGRATION OF THE OUTPUT-BASED APPROACH

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To Carlo and Mariasole,

parents who unconditionally

"invest" love in their sons.

Context of Research

The activity of research of this thesis has mainly been developed during a period of international mobility at the University of Navarra (Pamplona, Spain).

The Supervisor of the whole work has been professor Vincenzo Rebba (University of Padua), who has shown a strong interest in the field of research and who has wisely directed the study.

This thesis also owns much to professor Cernin Martínez Yoldi (University of Navarra), former Consultant at the World Bank and former "Director General de Política y Promoción Económica" for the Government of Navarra.

In fact, we have met several times during my period in Pamplona and we shared interesting and critical discussions about the object of research, which definitively have enriched my vision and have had a great influence in the development of the thesis.

Also noteworthy has been the meeting with professor Joseph E. Stiglitz, to whom I have addressed a specific question about one of the issues of this work.

The choice regarding the language of the thesis has been English, because although it is not the one which I best master, it is the more known vehicular language between the people involved in the work, and it turns out to be the most appropriate for the international context wherein the research activity has taken place.

INDEX

Introduction

"Development is about transforming the lives of people, not just transforming economies"

Joseph E. Stiglitz[1]

The study of social sciences is characterised by an ambitious task: applying the methodological rigour of science to an object that is complex, subjective, multidimensional, and it is quite hard to summarize in assertive conclusions.

A particular difficulty lies in the fact that the possible findings present implications which pertain reality, to which we belong.

The consequence is that the conclusions to which we may reach, inevitably have to come to terms with their meaning for human life, to their normative significance, and to how they properly describe the concrete situations.

This translates into the incessant need to reflect on the content of social sciences achievements, by raising questions regarding their exhaustiveness and pertinence.

Neither economics, thus, is exempt from the need to ask these questions and to search for satisfactory answers.

Do economics faithfully represent the reality that is being asked to describe? What is of relevance in the economic findings? Which are the implications of economic studies for describing and changing reality?

Such a list of questions could continue unabated, and acquire specificity for the most disparate issues belonging to economic theories.

In our case, the aim of this work is thus to address a relevant topic of economic theory: the multiplier effect of public investments, by trying to integrate the

[1] The quotation is taken from the book *Making Globalization Work (Stiglitz, 2006).*

traditional approach with further considerations (regarding aspects that are characterized by strong qualitative implications).

Since its first wording by Richard F. Kahn[2] (who focused on the increase of employment generated by an increase of investments), and its role in the theory of countercyclical fiscal policy in John M. Keynes[3] (who put the emphasis on the increase of national income as consequence of public spending), the multiplier effect gained a foothold in economic analysis as an expression of public investment outcomes of generating income in the whole economy.

The consequence being that the success of public intervention in creating prosperity by boosting the economy is often evaluated on the base of the multiplier effect of public spending.

The purpose of the thesis is not to carry out a general critic to this theoretical construct, but to question its exhaustivity as a satisfactory synthesis of the effects stimulated in economy and society by public investments.

In fact, the basic premise is that the traditional approach to the multiplier effect (based on output) exclusively measures the amount of further production triggered by public investments, but it has little to say about the qualitative characteristics of such an output increase.

A core issue underlying this work is thus if it is possible to provide a wider approach to the public investment multiplier, which also may consider other crucial features of the effect stimulated, in addition to the ones merely based on output.

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[2] Richard Kahn (1905-1989), student of John M. Keynes and professor at the King's College of Cambridge, provided a key contribution to express the concept of the multiplier effect.
In fact, before the publication of *The General Theory of Employment, Interest and Money (Keynes, 1936),* Kahn wrote an article in 1933 about the multiplier effect of investments in the creation of employment.

[3] John Maynard Keynes (1883-1946), was a British economist, highly considered to be the "father" of Macroeconomics and one of the most influent thinker of 20th century. He is primarily remembered for the support to public intervention in the economy when the aggregate demand is insufficient to guarantee the full employment of economic resources. His theories still have an enormous influence in economics and he inspired economic schools of thought such as the Neo-Keynesians and the Post-Keynesians.

To put it plainly, this work aims to develop a reflection over those multiplier effects of public investments that are not limited to the "size" and the quantitative dimension of economic growth, but that may go beyond this perspective embracing the content, or quality, of such a growth.

Therefore, on the one hand, an analysis of the factors determining the measure and the consequences of the multiplier effect, will be carried out.

This issue presents a particular relevance because it leads to several economic and political implications with regards to the excellent potential of the public intervention and public investments.

On the other hand, several considerations aimed to complement the approach of measurement of reality with a deeper attention on those qualitative aspects, albeit representable by indicators, that do lend themselves less to an exhaustive objective measurement, will be provided.

In this sense, the basic idea of this thesis runs counter to the scientific approach typically positivist, and that also has huge influences in economics, whereby everything that is relevant is measurable, while everything that is not measurable is not relevant.

Instead, perhaps is not the opposite true, that the most significant use to be inexplicable?

Thus, it should not be surprising the fact that several points will try to comply with a dual necessity: on the one hand, better representing reality through an analysis of the objective measurement, but, on the other, adopting a perspective with the awareness that there is much more to consider and that often "the most important" eludes us.

Both aspects are indispensable, since only satisfying the first aspect would lead to considerations methodologically rigorous but scarcely relevant, whereas inspiring the analyses only to the second would lead to arbitrary analyses.

However, given the complexity of the integration that it is proposed to deal with, this thesis will be a too modest effort for providing definitive answer about the issues in question, which deserve further scientific research.

Nonetheless, the work will fully achieve its goal if, at least, it will contribute to highlight the limitation of the output-based perspective to the multiplier, and to draw attention to the most important aspects that must be considered so as to provide a more faithful and fair analysis of reality.

The discussion of the fundamental issues will be organised as follows:

Chapter I mainly focuses on those factors and features which determine the quantitative dimension of the multiplier effects.

Several points will be explained, mainly what the multiplier effect of public investments is, what the differences with the multiplier of other type of spending change are, as well as some reliable estimates of current multiplier effects, and thus what the basic reasonings are to such values.

Finally, chapter I will anticipate some of the core issues of next chapters by means of the economic research about the so called “welfare multiplier”.

Then, Chapter II will put more emphasis on the characteristics regarding the catalyst of the multiplier effect, that in our case is public investment.

It will thus be explained how, through the multiplier effect, public investments can boost economic growth and can potentially have a crucial impact on society.

Public investments as a countercyclical tool, the different spillovers generated by different investment funding, the role of investments in human capital compared to the ones in physical capital, and the key role of education and healthcare for leading to a better and more equal society, will represent the most relevant issues to be addressed.

Finally, Chapter III will deal more in depth with the main limitations of the output perspective.

The attention will be on the problems related with output measurement, such as the ones that involve Gross Domestic Product as non-exhaustive indicator in addressing the purpose in question.

Then, the work will devote special attention to the environmental sustainability as a crucial dimension in evaluating public investment spillovers, and to the improvement of quality of life: ultimate goal to which public intervention should tend.

In conclusion, the main findings and considerations that have risen by this thesis will be summed up briefly.

Chapter I: A Quantitative Approach to the Multiplier Effect

1.1 The multiplier effect and the marginal propensity to consume

One of the most remarkable findings of Keynesian work is highly considered to be the strong relation described between income, demand and supply, that leads to the famous equation:

$$Y = C + I + G + (X - M)$$

Where *Y* can be the output as well as the aggregate demand[4], *C* the consumption, *I* the investments, *G* the government expenditure and *X* and *M* represent the foreign sector, that is to say Import and Exports.

The basic idea of this equation is that the output does not depend only on technological and resource-based factors, but mainly on the Aggregate Demand.

Y expresses the Aggregate Supply but according to Keynes, in the short-run it is the consequence of the Demand present in the economy, with the result that one person's spending is another person's production and income.

This idea implies the relevant implication that, since in a market economy people make a living selling things or providing their labour, the increase (decrease) of some group spending leads to increase (decrease) another group income, triggering a chain reaction of spending behaviour changes *(Krugman, Wells, 2013, p. 18).*

In other words, an increase of *C*, *I* or *G* increases the supply as well as the income of economic agents.

The just described basic reasoning also provides an explanation of economic crises and recoveries.

In fact, an initial rise (fall) in aggregate spending leads to changes in income, but the process does not stop here, since the rise (fall) in income will lead to further spillovers in aggregate spending, and so on.

[4] In this case, we are assuming that the market of goods and services is in equilibrium.

But how does this chain reaction work? Let us assume that one out of *C, I* and *G* – let us say private investment in infrastructure -, rises by €100 000 over the next years.

This fact generates an increase in income of €100 000 as direct effect, by assuming that each euro spent on the works translates into a euro's worth of income for the people involved in the economic activity, such as the employees or other agents involved in the supply chain.

The process carries on and the rise in aggregate output increases the disposable income of households which, likewise, leads to an increase in consumer spending.

Such an increase in consumer spending, in turn, will boost the output of firms yet again, so that another increase in disposable income will occur.

This new disposable income will lead to another round of consumer spending, in a process that seems to be theoretically unabated.

Nevertheless, the general income, output, and consumption that are generated by the initial stimulus of €100 000 are not infinite but finite.

The reason is that there are many factors implying that the level of income generated at each further level of the process continues to shrink.

The most important of these reduction factors derives from the behaviour of consumers, who do not use to spend the whole amount of additional disposable income, preferring to save a part of it.

In fact, the relationship between disposable income and consume implies that the second is a growing function of the first, that is that if income increases, the spending does the same, but with a lower proportion.

As pointed out by J. M. Keynes, "*The fundamental psychological law [...] is that men [and women] are disposed, as a rule and on average, to increase their consumption as their income increases, but not as much as the increase in their income" (Keynes, 1936, p.96).*

Given an increase in disposable income, the part that is devoted to the consume takes the name of Marginal Propensity to Consume (MPC), such that:

$$\text{MPC} = \frac{\Delta \text{ Consumer Spending}}{\Delta \text{ Disposable Income}}$$

Conversely, the part of such an increase in income that is not spent is devoted to saving, and it is expressed by the Marginal Propensity to Save (MPS):

$$\text{MPS} = \frac{\Delta \text{ Consumer Saving}}{\Delta \text{ Disposable Income}}$$

MPC and MPS are both positive and less than unity, such that:

$$\text{MPC} + \text{MPS} = 1$$

In light of these considerations, we are now able to describe the chain reaction produced by the initial investment as a dynamic process that triggers the creation of new income and consumption over the time, but with a progressively low size.

Assume that an investment increase of x euros takes place.

Granted, then, that such an increase will translate into an increase of the production of x euros, the supply will satisfy the increased demand generated by the investment.

The increase in the supply will translate into an increase of the disposable income, equal to x, that will become consumption or saving.

In this case, given the marginal propensity to consume, the additional disposable income leads to a rise in consumption that is equal to x·MPC.

The generated consumption will scale up the production yet again, to the extent of x·MPC, which fosters an equivalent increase in the disposable income that will stimulate a further increase in consumption equal to (x·MPC)·MPC.

The process described thus far can potentially continue as in Table 1.1

Table 1.1 Generated Consumption

Stage	Increase in the demand at beginning of the stage	Increase in production and income ΔY	Consumption generated ΔC
1	x	X	x·MPC
2	x·MPC	x·MPC	$x \cdot MPC^2$
3	$x \cdot MPC^2$	$x \cdot MPC^2$	$x \cdot MPC^3$
4	$x \cdot MPC^3$	$x \cdot MPC^3$	$x \cdot MPC^4$
5	$x \cdot MPC^4$	$x \cdot MPC^4$	$x \cdot MPC^5$
N	$x \cdot MPC^{n-1}$	$x \cdot MPC^{n-1}$	$x \cdot MPC^n$

Given the simple chain reaction described thus far, in which we have not yet considered taxes and international trade, we can easily calculate the amount of GDP produced in the process.

The net result of the chain reaction set off by the initial stimulus of x euros is a change in real GDP that is multiple of the initial change.

The size of such an increase of production and income is the sum of the values of the ΔY column.

Suppose that:

$$n \to \infty$$

That is to say that the chain reaction carries on until there is still some income transfer, as in our description.

Granted, thus, that an infinite series of the form $1 + x + x^2 + x^3 + x^4 + \ldots$, where x is between 0 and 1, is equal to $1/(1-x)$ (*Barozzi, 1998*), our series of $x + x \cdot MPC + x \cdot MPC^2 + x \cdot MPC^3 + x \cdot MPC^4 + \ldots$, is equal to $x \cdot 1/(1 - MPC)$.

Therefore, we can now express the multiplier effect, that is to say the ratio of a change in income to any autonomous change in spending (in our example investment spending) that causes it.

In fact, as we have seen, the initial increase of investment has led to the following change in income:

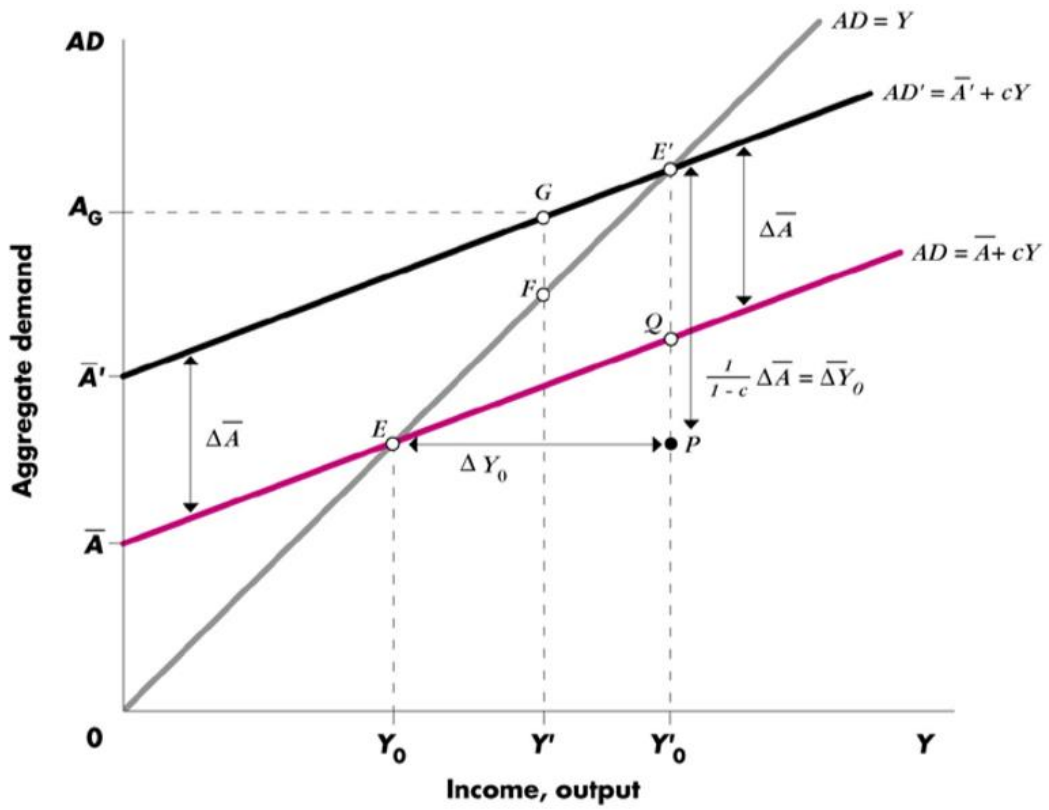
$$\Delta Y = \Delta I \frac{1}{1 - MPC}$$

In our example, we have considered an increase in the demand, but obviously also the drop of demand will produce a chain of effects that are described by the same considerations, but with an opposite result.

In other words, the fall of demand of x euro will cause a decrease of income that is equal to x multiplied by the multiplier.

The multiplier effect over income and production that is boosted by an increase in autonomous expenditure can also be represented graphically as in chart 1.1.

Chart 1.1 Increase in spending and multiplier



Source: Dornbusch (2014)

In the chart provided by Dornbusch *(Dornbush, 2014, p. 207)*, *E* represents the initial equilibrium between demand and output (Y_0).

The increase in autonomous expenditure is represented in the graph by the increase in aggregate demand from $\bar{A}$ to $\bar{A}$**'**, that means a rising shift of the demand curve.

Since the aggregate demand has increased and is higher than $Y_{0,}$ the aggregate output scales up until it reaches *Y'*, that generates further consumption, leading the demand to the level $A_{G.}$

The following increase in production ends to re-establish the equilibrium at point *E'*.

Given that the related level of income is Y'_0, the change in income that has been needed to achieve the new equilibrium is $\Delta Y = Y'_0 - Y_0$.

At this point, it is important to highlight relevant findings such as the fact that the increase in autonomous spending leads to a multiple increase in income toward a new equilibrium and that the larger the MPC, the larger the multiplier effect.

Nonetheless, the MPC is not the only element that influence the size of the multiplier, and the description of the multiplier provided so far is still simplified.

Other relevant factors affecting the multiplier will thus be introduced in the following point.

1.2 Multiplier effects in an open economy with taxes

The reasoning developed thus far is characterized by the implicit hypotheses that in our economy there are no taxes and trade abroad, and that the part of income that is saved does not generate any multiplier effect.

Nevertheless, they are all assumptions that are not true in real world *(OECD Data, Internet[5]; World Bank Data, Internet[6][7])*[8], and a reconsideration of the aforementioned assumptions affects the size of the multiplier effect calculated.

In fact, the degree of taxation as well as the openness to foreign market, and the speed in which one person's saving becomes another person's investment, lead to negative or positive spillovers on the magnitude of the multiplier.

For example, an initial stimulus in demand of x euros that leads to an increase of income of x euros will not become completely disposable by the consumers if they pay taxes on the income increase.

Because part of the rise in real GDP is collected in the form of taxes, disposable income only rises by $x \cdot (1 - t)$ (where t is the tax rate and is a fraction between 0 and 1).

Therefore, considering the presence of taxes, the consumption generated by the increase of GDP in each stage of the ripple effect described in table 1 is not equal to $x \cdot MPC^n$ but to $x \cdot (MPC \cdot (1 - t))^n$.

On the base of that, and given the reasoning of point 1.1, the multiplier effect triggered by an increase in autonomous spending by x euros becomes the following:

[5] In https://data.oecd.org/tax/tax-revenue.htm#indicator-chart
[6] In https://data.worldbank.org/indicator/NE.IMP.GNFS.ZS
[7] In https://data.worldbank.org/indicator/NE.EXP.GNFS.ZS
[8] For instance, in 2016 the average level of tax revenue in OECD countries was almost 35% of GDP, with a substantial number of European countries presenting even higher rates, while the tax on personal income presented an OECD average that was around 8,5%.
Also noteworthy is the degree of trade openness, since according to the World Bank the imports have represented the 27,9% of world GDP in 2016, while exports of goods and services achieved the 28,5% of world GDP in the same year.

$$\Delta Y = x \cdot \frac{1}{1 - (MPC \cdot (1 - t))}$$

The main implications that can be drawn is thus that the higher the tax rates, the lower the multiplier, even if is important to acknowledge that the reduction due to the presence of *t* does not represent money that is "lost", but that is collected by the state.

In an open economy, another element that implies a reduction in the value of the multiplier effect is the Marginal Propensity to Import (MPM), that is to say the amount imports increase or decrease with each unit rise or decline in disposable income.

While exportations lead to a multiplier effect in income because they represent consumption of goods and services produced in a country, importations lead to the opposite effect.

In fact, they represent income that does not translate into consumption within the country, reducing the multiplier effect *(Martínez, 2017, pp.227-228).*

Granted than a part of the disposable income will leave the country, the additional consumption (generated at each stage of the ripple effect triggered by an increase in autonomous spending by x euros) is no more $x \cdot (MPC \cdot (1 - t))^n$ but $x \cdot (MPC \cdot (1 - t) \cdot (1 - MPM))^n$.

The multiplier effect in an open economy with taxes is thus expressed as follows:

$$\Delta Y = x \cdot \frac{1}{1 - (MPC \cdot (1 - t) \cdot (1 - MPM))}$$

As a result, the more a country tends to import, the less the multiplier effect within the country is.

On the contrary, an increase in autonomous spending in a foreign country may generate induced multiplier effects in the domestic market that exports toward the country where the spending occurs.

The bottom line is thus that the higher the share of imports and exports over GDP, the shorter the multiplier effect from a domestic increase in spending, but the

higher the "imported" multiplier effects stimulated by an increase in foreign markets spending.

However, this conclusion is the consequence of an economics approach that is based on the national perspective, and if we adopt a more international view of the multiplier the importance of it all decreases (*Martínez, 2017, p.233)*.

Another factor that is extremely relevant for our issue is the efficiency and speed in which the savings become investments.

In fact, even if we will still consider the marginal propensity to save as an element that curtails the multiplier, it is important to highlight that in an economy where the saving-investment system is efficient, savings are not just money that does not translate into consumption, but rather a source of new spending in the form of investments.

Given all these caveats, we may now focus on the different multiplier effects that derive from a Government decision.

1.2.1 Government spending multiplier

We consider the Government spending as the spending that is carried out by the public sector in order to achieve the goals of public interest that justify public intervention in the economy *(Martínez, 2017, p.223*).

Government expenditure is an extremely important element of the aggregate demand and starting from the second half of the 20th century it has reached an outstanding size, representing more than 40% of GDP in most of OECD countries (OECD Data, Internet[9])[10].

As in the case of other factors of the Aggregate Demand, a rise in Government expenditure leads to a ripple effect of consumption and income increase, whether it is in the form of spending in goods and services or in public investments.

[9] In https://data.oecd.org/gga/general-government-spending.htm

[10] In 2016, only a minority of OECD countries had a level of general Government spending/GDP ratio below 40%, such as USA (37,8%) and Japan (39%). Most of the countries presented a percentage included between 40 and 50, such as UK (41,5%), Spain (42,2%), Germany (44,2%) and Italy (49,4%). The General Government Spending/GDP is even higher in the case of other European countries such as, for instance, Belgium (53,2%), Denmark (53,6%) and France (56,4%).

The multiplier effect generated by such an increase in Government spending ΔG is expressed as follows:

$$\Delta Y = \Delta G \cdot \frac{1}{1 - (MPC \cdot (1 - t) \cdot (1 - MPM))}$$

However, even if the equation that describes government spending in goods and services multiplier and public investments multiplier is the same, in reality these two forms of spending use to be characterised by several differences regarding, for instance, the size of the multiplier generated over the years as well as qualitative aspects of spending and social consequences.

1.2.2 Transfer multiplier

The Government may decide to transfer a certain amount of money directly to the citizens or, more likely, to a specific group of people.

The most famous form of such a measure is the bonus, that consists in an additional amount of money that is transferred on account of the fulfilment of a specific requirement or of a praiseworthy conduct (e.g. baby bonus).

The multiplier effect stimulated by this kind of spending is considerably reduced compared to the government spending multiplier.

The main reason being that, unlike the investment multiplier, in case of transfers also the initial consumption is subjected to the reduction due to the marginal propensity to save.

In fact, while in public investments the spending is completely directed to a specific goal, in transfers we deal with an additional disposable income that do not translate completely into spending, since the transfer recipient may decide to save a significant part of it.

In fact, the multiplier effect of transfer and bonuses ΔGtr can be expressed as the following:

$$\Delta Y = \Delta Gtr \cdot \frac{MPC}{1 - (MPC \cdot (1 - t) \cdot (1 - MPM))}$$

As a result, the transfers can stimulate an increase in consumption and income due to the multiplier effect, but the result of such a ripple effect will be affected to a greater extent by the personal decision of consumption and expectations factors, unlike the investment multiplier in which it is theoretically easier to channel the spending toward more productive use.

As a consequence, the multiplier effect could be small if the transfer recipient decides to save a relevant part or to spend it on imported goods.

This concern is also consistent with the theory of the permanent income hypothesis, whereby a person's consumption at a point in time is determined not just by the current income but also by the expected income in the future (*Friedman, 1957, pp. 20-37).*

1.2.3 Tax multiplier

In order to understand the ripple effect generated by a change (either increase or decrease) in the tax level, the multiplier is crucial.

In fact, an increase (decrease) in the amount of taxes that are collected from citizens' disposable income leads to a decrease (increase) in the general income, according to the chain reaction of consumption described repeatedly thus far.

With regards to an increase in the tax level, it occurs an effect of further consumption restriction that deserves to be considered, even in light of the tendency to underestimate such a negative spillover in the aggregate demand *(Mody, 2012).*

In fact, conversely to what claimed by the theory of expansionary austerity[11] *(Alesina, 2009)*, the size of consumption and output loss owing to fiscal austerity turns out to be substantial *(IMF, 2010)*, as pointed out, for instance, by the

[11] According to the theory of expansionary austerity, the reduction of government expenditure and the increase of taxes lead to interest rate fall and private investments rise, boosting the economy. This theory has been strongly criticized because of the rough underestimation of the multipliers used to underpin this idea *(Blanchard, 2013)*, and because of the empirical evidences about the effects of austerity measures, leading to "*a clear negative relationship between austerity and growth" (Krugman, 2015).*

experiences of asterity measures that have followed European sovereign debt crisis (2009-2012) and East Asian and Russian financial crises (1997-1998).

On the other hand, a measure that phase tax out will stimulate further consumption that would have not taken place in case of higher taxation.

The logic is the same as the transfer, because in both cases the recipient (either of the bonus or of the tax cut) will benefit of an increase of disposable income that translates into consumption or saving.

The multiplier effect that even in this case is stimulated by the increase in demand can be expressed as follows:

$$\Delta Y = \Delta T \cdot \frac{MPC}{1 - (MPC \cdot (1 - t) \cdot (1 - MPM))}$$

Where ΔT is the additional amount of money that derives from the tax decrease (therefore leading to $+\Delta Y$) or increase ($-\Delta Y$).

However, the multiplier effect encouraged by a tax cut is subjected to similar considerations as the ones carried out with regards to the transfer multiplier.

In fact, the size of the multiplier, unlike the case of the Government spending multiplier, can be extensively affected by psychological factors related to the consumer.

For instance, the recipient of the tax cut could decide to save the whole amount of the new disposable income (e.g. because the citizen has negative expectations about the future) or to spend it in imports.

As a consequence, the tax multiplier tends to be considerably lower than the Government spending multiplier, and it is more difficult to channel the generated consumption toward specific sectors or goals.

Having said that, it is fair to acknowledge that although we can agree that the tax multiplier is smaller and "dispersive" under a quantitative point of view, every measure of fiscal policy (either spending or taxation) pertains a qualitative analysis that is much more open and wide.

After this relevant introduction to the different multipliers and their general features, this work will mainly focus on the multiplier effect generated by an increase in one of the most important part of Government spending, that are the investments.

A study of such a multiplier is extremely relevant since, as mentioned above, investments present the property of channelling the spending toward a specific goal.

As a result, they trigger a multiplier effect that uses to be positive, by raising output both in the short term (because of demand effects) and long term (as a result of supply effects) *(Abiad, 2015).*

1.3 Recent estimates of the multiplier effect in developed and developing countries

Given the wide presence of different theories, models and techniques to estimate the multiplier effect present in an economy, the value of such a valuation is controversial, and it is not easy to provide a certain measure that may be accepted by the scientific community.

The reasons for the aforementioned discordance are copious, such as the impossibility to estimate a unique value of that factors affecting the multiplier (the MPC, MPM…) for a certain economy in a certain time, and the complexity to forecast all the possible spillovers of an increase in a certain spending.

Nevertheless, a reliable approximation of the multiplier effect is not impossible to achieve, and it can be extremely useful in order to take appropriate decisions about fiscal policy.

On the base of that, the aim of this section is to provide some noteworthy valuations of the multiplier effect in recent years, both in developed and developing countries.

Needless to say, the value of the multiplier effect can change considerably depending on the different economic frameworks, structural factors, and periods, but also on the study approach used.

Between the 1930's and the 1960's, the valuation of the multiplier effect were obviously different, but typically higher than 1.

This finding is relevant because this measure can provide a justification of the spending in deficit carried out frequently in that period, since such a multiplier is supposed to increase the income and to finance the initial investment *(Marcuzzo, 2017, pag.11).*

Such a consensus changed with Milton Friedman's finding that consumption is not a function of the current income, but rather of the expected income in future years *(Friedman, 1957, pp 20-37),* and with Robert Lucas and the neo-classical

theory, that believe in the inefficiency of public intervention, leading to low valuations of the fiscal multiplier, relegated only to the short-run.

Until the 2007-2008 crises, most of the academic literature considered low valuations of the multiplier, as result of analyses based on the rational expectations of economic agents that foresee and neutralize public action[12].

Nevertheless, the crisis and the contribution it made to economic research have provided the multiplier with new popularity.

In fact, while in the 1950's and 1960's the valuations of the multiplier were around 2, and from the 1990's to the crises the econometric valuations provided much lower values between 0,5 and 0,7, in the 2009 the IMF and EU pointed out valuations of the multiplier between 0,9 and 1,7 (*Marcuzzo, 2014, pp. 157-168).*

A key role to reach such a finding was also represented by austerity policies, that have shown the effects of a decrease in autonomous spending, leading to more appropriate estimates of recent multipliers.

Despite the presence of more sophisticated models and rigorous researches, estimating the value of the multiplier today is not less controversial than in the past.

In fact, the results often diverge, as outlines, just to provide some examples, the underestimation of fiscal multipliers after the crises that had led to too optimistic global growth forecasts *(Mody, 2012)*, and the recent debate between orthodox Keynesians and new Keynesians about designing models that can provide more truthful estimates *(Cogan, 2010).*

However, since the aim of this work is not to carry out an evaluation of the different models used to estimate the multiplier, we will restrict ourselves here to provide distinguished recent values, selected on the base of the fact that present valuable peculiarities: they are international in scope (analysing different

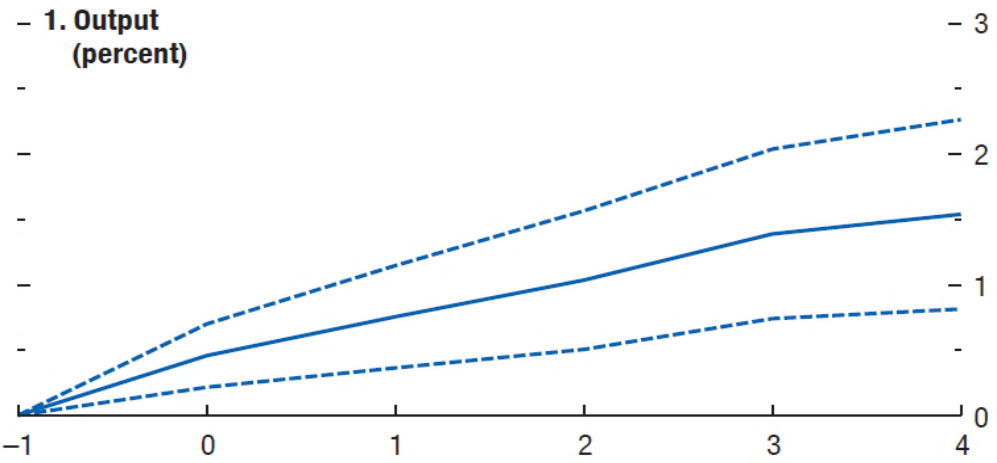
[12] In many neoclassical theories, the assumption that economic agents use to set up rational expectations often leads to blame public intervention as ineffective or even detrimental. A known example is the analysis of fiscal policies carried out by Robert Lucas, that moves from the traditional IS-LM model with the assumption that the expectations of economic agents are rational.

economies), are provided by respected economists or institutions, and mainly focus on the multiplier effect of public investments.

According to the IMF World Outlook 2014, empirical evidences in advanced economies shows that an increase in infrastructure public investment have statistically significant effects on the output, both in the short and long term (Chart 1.2).

Chart 1.2 Effect of Public Investment in Advanced Economies

Public investment shocks have a statistically significant and long-lasting effect on output. They also typically reduce the debt-to-GDP ratio, though the decline in debt is statistically significant only in the short term. The level of private investment rises in tandem with GDP.



Source: IMF (2014)

In fact, *"an unanticipated 1 percentage point of GDP increase in investment spending increases the level of output by about 0.4 percent in the same year and by 1.5 percent four years after the shock" (IMF, 2014)*.

The IMF is not the only source of this estimate, since other studies also provide similar multipliers, such as, for instance, Coenen and others (Coenen, 2012, pp 22-68), that come to the same conclusion with several DSGE models.

Needless to say, this estimate cannot fit for every country analysed, and according to the IMF, the multiplier tends to change substantially across countries depending

on many factors, such as the presence of economic slack and the monetary accommodation.

In fact, during economic crises and under accommodative monetary policies the multiplier is considerably higher.

Two other relevant factors outlined by IMF economists are the way in which the investment is financed, and the public investment efficiency.

As regards to the first, it is interesting Abial and others' finding that the multiplier is higher when investments are financed by issuing debt *(Abial, 2015)*, but we will deal with this thorny topic later in Chapter II.

With regard to the last, the IMF points out that "*in countries with high efficiency*[13] *of public investment, a public investment spending shock increases the level of output by about 0.8 percent in the same year and by 2.6 percent four years after the shock*" *(IMF, 2014)*, while the value is definitively narrower in countries with low efficiency.

At this point, it is thus essential to emphasize this remarkable qualitative consideration about public investment: it does not make much sense to estimate a value of the investment multiplier without considering centrally the efficiency of the investment which has been studied, because such a feature turns out to be the key dimension determining multiplier size.

[13] According to the IMF, the economic and social impact of public investments in infrastructure critically depends on its efficiency. The efficiency is estimated by comparing the value of public capital, that represents the input, with measures of infrastructure coverage and quality, that are the output (the measuring of public investment performance can be delve into *IMF, 2015, pp 27-35*). IMF economists point out that *"improvements in public investment management (PIM) could significantly enhance the efficiency and productivity of public investment" (IMF, 2015),* since the presence of Institutions which shape the planning, allocation and implementation of investments make these investments more predictable, efficient, credible and productive *(IMF, 2015)*. In practice, the priorities for strengthening PIM institutions are different across Advanced Economies (AEs), Emerging Economies (EMs) and Low Income Developing Countries (LIDCs): *"AEs should ensure that their fiscal and budgetary frameworks provide stable and sustainable bases for investment planning across levels of government. EMs should adopt more rigorous and transparent arrangements for the appraisal, selection, and approval of investment projects. LIDCs should focus on strengthening the institutions related to the funding, management, and monitoring of project implementation" (IMF, 2015)*.

With regard to developing economies, the multiplier effect estimated by the IMF seems to be slightly lower than in advanced economies, relying on the approaches built on the work of Corsetti, Meier and Müller *(Corsetti, 2012)* and Kraay *(Kraay, 2010)*.

The output of these model is an estimate of developing economies multiplier between 0,5 and 0,9 *(IMF, 2014)*, even if the Warner analysis suggests a relatively higher multiplier, between 1 and 1,3 *(Warner, 2014)*.

However, the above-mentioned work of Corsetti and others *(Corsetti, 2012)* is not important mainly for the general estimate but also for another relevant finding already hinted: output and consumption multiplier are unusually high during time of financial crisis.

The increase in the multiplier after the crisis is also highlighted by an economic research carried out by many economists for Standard & Poor's *(Ann Bovino, 2015)*, which stands out for the impressive extent of the study, providing specific estimates of the multiplier effects in more than 20 countries around the world, and focusing on the effect of an infrastructure investment rise.

What stands out from this work is that the economic effects of increasing public spending on infrastructure will be concrete and substantial in G20 countries, because of the multiplier effect generated by a rise in spending of 1% of real GDP running as high as 2.5 in three years (2015-2017).

In fact, the results produced using Oxford Economics' Global Economic Model (Oxford Economics, Internet[14]) point out that infrastructure spending boosts output growth through demand in the short-run and supply in the long-run, leading to multipliers higher than 1.

The estimates are listed as follows in Table 1.4 *(Ann Bovino, 2015)*, jointly with the projected job gains, estimated according to the model used and to Okun's Law *(Okun, 1962)*.[15]

[14] In https://www.oxfordeconomics.com/global-economic-model

[15] The estimates of these multipliers are the result of a simulation developed with the Oxford Economics' Global Model, considering an increase in infrastructure investment of 1% of GDP. For

Table 1.2 The Effects of an Increase in Investment of 1% of GDP

Country	Multiplier effect (2015-2017)	Projected job gains (maximum above baseline)
U.K.	2.5	343,000
Brazil	2.5	418,000
China	2.2	600,000
India	2.0	350,000
Argentina	1.8	68,000
U.S.	1.7	730,000
Japan	1.5	31,000
Canada	1.4	61,000
Italy	1.4	136,000
France	1.3	109,000
Mexico	1.3	193,000
South Korea	1.3	14,000
Germany	1.2	157,000
Indonesia	1.0	38,000
Australia	1.0	5,000
Eurozone	1.4	627,000

Source: Ann Bovino (2015)

As can be seen from Table 1.4, these results are higher than 1, that is to say that each additional €1 spent by G20 Governments in 2015 would have increased real GDP by more than €1 (even €2,5 in UK) by 2017.

However, there is a feature of these estimates that is not consistent with IMF's valuations: in Standard & Poor's Economic Research investment multiplier is higher in emerging regions than in developed countries, whereas according to the IMF it was true the opposite.

The discordance about developing countries multipliers is probably too wide to be explained only by the relatively different periods of the studies, since the economic scenarios considered are not so different, and it most likely may be explained through the differences with regards to the weight given to the inefficiencies in public spending (central in IMF estimates) and to the possible negative spillovers.

However, estimates higher than 1 also characterize European Union countries, as pointed out by Table 1.3 *(Ann Bovino, 2015)*, with a multiplier effect of 1,4 within EU.

developing countries, the projected job gains have been calculated with the hypothesis that unemployment falls by 1% when GDP rises by 3%, according to Okun's Law.

Table 1.3 The Effects of an Increase in Investment of 1% of GDP in EU

Country	Multiplier	Maximum gain in employment
Germany	1.2	157,000
France	1.3	109,000
Italy	1.4	136,000
Spain	2.0	107,000
Eurozone	1.4	627,000
Netherlands	1.8	34,000
Austria	1.3	18,000
Belgium	1.1	24,000
Ireland	1.6	12,000
U.K.	2.5	343,000
Sweden	1.1	20,000
EU		1,068,000

Source: Ann Bovino (2015)

The presence of such a substantial multiplier effect in European Countries probably is determined also by the fact that most of them are still at or near low points in their cycles, and thus an investment rise has significant effects on GDP growth.

With regards to the Eurozone, it is important to highlight that, given the strong trade links between EU countries[16], an increase in the investments of a member state also leads to scale up GDP in other EU countries, thus suggesting to consider the region as a whole.

In conclusion, the bottom line of this review of estimates is that, despite the predictable disagreements with regards to final values, in recent years the multiplier effect seems to be substantial and higher than 1 in the most important countries.

[16]As outlined by the Economic Research considered *(Ann Bovino, 2015)*, on average, 60% of imports and exports of European countries remain within the European Union.

This finding is due to many factors that have contributed to guarantee its size, such as the current monetary policy scenario, the economic slack, and the need for public investments.

However, beyond this general conclusion, it is also important to bear in mind that the multiplier effect can present different values across different sectors, that can be analysed with specific input-output table designed for each area.

1.4 The limits of output multiplier and the welfare multiplier

"I hold a firm belief: We will not change our behaviour unless we change the ways we measure our economic performance" (Stiglitz, 2010, p.vii).

This effective sentence, stated by president Nicolas Sarkozy in the foreword to the book *Mismeasuring our lives (Stiglitz, 2010)*, summarizes the idea that the way in which we measure a performance substantially affects how we try to achieve the goal in question.

In line with such a belief, having reached this point of the work it is necessary to acknowledge a critical issue: the economic measure of the effects considered by the multiplier effect, although it being extremely important, it presents several limits.

The idea that the performance of an economic system should mainly be based on the amount of goods and services produced, although widespread throughout human history and even in the current economic thought[17], must be questioned.

In fact, this work aims to point out that the production of an economic system is not the goal for which such a system should be organized, but rather the means to achieve other ends present in society.

On the base of that, the role of production as a measure of economic system success is right and relevant only if the increase in production overlaps with an improvement in those dimensions that determine the achievement of society goals.

Unfortunately, this is not consistent with real experience, and it often occurs that an increase in income does not move in the same direction as well-being, health, happiness.

Granted, then, that the traditional multiplier effect mainly concerns the output triggered by an initial investment, the critical issues of an exclusively output-

[17] Let us think, for example, about the belief, typical of illuminism and Industrialism afterwards, that the general progress will coincide with the progress of technology and production. The debate around this issue is characterised by a strong philosophical interest, but we need only to consider how relevant is currently the GDP to evaluate an economic system and we realise the influence extent of the aforementioned idea also in performance evaluation.

based perspective fully involve the output multiplier, thereby leading to essential considerations about its role and utility.

In fact, the output multiplier tells us about how much output, consumption, and income are stimulated by an investment, but it does not tell us about the characteristics of this output, consumption and income (such as the destination, the utility, the distribution and the non-output spillovers).

The possible contradiction is thus that a certain investment with high multiplier can be, hypothetically, scarcely beneficial, or even detrimental, to an economy and society, and another investment with lower multiplier could be, instead, extremely positive.

This suggests us to integrate the output-approach with relevant measures and considerations aimed to make up for the deficiencies ontologically structural to traditional multiplier.

Since this chapter moves from the "traditional" and quantitative approach[18] to the multiplier effect, we will leave to a specific chapter (chapter III) the analysis of the goals to which society and economics should move towards and that the multiplier is not able to express properly.

However, the limits of the output multiplier described above provide with the opportunity to present a further interesting contribution to this issue that derives from a "quantitative" model (similar with the models used to estimate the traditional multiplier), that aims to express the welfare produced instead of output and consumption.

Inspired by Mankiw and Weinzierl *(Mankiw, 2011)* (who point out that traditional models assessing the welfare effects fiscal policies are misleading because they ignore GDP composition), and by Sims and Wolff *(Sims, 2014)* (who highlight a

[18] The distinction between a quantitative and qualitative approach is conceptual, and it is fair to acknowledge that often it does not hold. In fact, the quantitative analysis is characterized by relevant qualitative issues, and even the qualitative analyses of economic issues need quantitative features. As a consequence, the distinction about a quantitative and qualitative approach to the topic we are dealing with sometimes may be ephemeral, but it does not lose its conceptual utility.

negative correlation between output and welfare multiplier[19]), the IMF economists Ganelli and Tervala *(Ganelli, 2015)* use a New Keynesian DSGE model to analyse the welfare multipliers of public investments.

They measure the welfare multiplier as *"the consumption equivalent change in welfare for one dollar change in government spending" (Ganelli, 2015),* with a model that presents a sophisticated parameterization in which output multipliers are consistent with IMF estimates provided in 1.3.

Needless to say, the results of Ganelli and Tervale are the consequence of a specific interpretation of welfare that is effective but could be debatable, and the model used, although sophisticated, still presents several characteristics of traditional output perspective.

Having said that, Ganelli and Tervale's welfare multiplier remains an interesting attempt to provide an estimate that mainly focus on welfare instead of output, yet placing themselves in an empirical and quantitative approach.

However, the main finding of such a research is that the domestic welfare multiplier of public infrastructure is positive and equal to 0,8, that is to say that each euro spent for public infrastructure investments raises domestic welfare and private consumption by 0,8 euro.

The finding is relevant because it implies that in current scenario public infrastructure investments use to have positive effects on welfare, and not only on output.

However, in line with IMF studies about investment multiplier *(IMF, 2014)*, high productivity of investment is the key to fully reaping investment benefits and wise public investment management is essential to ensure a positive welfare multiplier *(Ganelli, 2015).*

[19] The degree of correlation between the output multiplier and the welfare multiplier is a complex but interesting problem to deal with, and the studies about this field of research should be improved. For instance, it is enormously relevant to understand if Sims and Wolff (Sims, 2014) conclusions are confirmed or questioned by other evidences. However, in light of the findings of this work, it should be shared Sims and Wolff concern that the *"output multiplier is likely to be a poor measure of the welfare effects of a government spending shock" (Ganelli, 2015)*.

Another relevant result of the study is that, consistently with what we have claimed thus far, the output multiplier and, at this point even welfare multiplier, are much more substantial in public investments that in general public spending.

In fact, according to Ganelli and Tervale, investment output multiplier is 1.5 (the result is consistent with many estimates provided in 1.3) while the cumulative multiplier of public consumption is 0,42, and investment welfare multiplier is 0,8, whereas, surprisingly, in the case of public consumption is even negative and equal to -0,3[20] *(Ganelli, 2015).*

The comparison between output and welfare multiplier in public consumption and public investment is summed up in Table 1.4[21] *(Ganelli, 2015),* in which CM is the Cumulative Multiplier, PRs the periods and NPV the net present value.

Table 1.4 Output and Welfare Multipliers of Public Consumption and Public Investments

	CM, 4 PRs	CM, 8 PRs	CM, 12 PRs	CM, 16 PRs	CM, 20 PRs	NPV of output multiplier	Welfare multiplier	World Welfare multiplier
Consumption	0,44	0,41	0,41	0,41	**0,42**	0,46	**-0,30**	-0,28
Investment	0,58	0,79	1,0	1,3	**1,5**	3,2	**0,77**	0,91

Source: Ganelli (2015)[22]

The world welfare multiplier, as pointed out by Table 1.6, is even higher than the welfare multiplier because the welfare spillover effect on the foreign economy are

[20] This is the result of two effects that are in contrast, because if on one hand public consumption yields utility increasing welfare, conversely welfare is affected by higher taxes. According to Ganelli and Tervale *(Ganelli, 2015),* the result turns out to be negative because the weight of public consumption in private utility is not large enough to make up for the fall in private consumption due to higher taxes.

[21] The cumulative multiplier expresses the cumulative change of output over the cumulative change of spending, the periods last three months, and the net present value fiscal multiplier is the sum of output discounted at the steady state interest rate and divided by government spending discounted likewise *(Ganelli, 2015)*.

[22] The data of Table 1.4 are provided by a table present in the work of Ganelli *(Ganelli, 2015)*, where there is also other information. Table 1.4 is thus a synthetic version of Ganelli's table.

positive, as the change in the terms of trade[23] that occurs in the model points out that foreign consumption rises by more than foreign output, and thus foreign agents' consumption increases with higher proportion than their labour supply.

Ultimately, we can conclude that welfare effects of public investments are not always correlated with output effects, and the output multiplier, even if it does not lose its utility, is not able to catch many relevant aspects that need a wider analysis to be sufficiently considered.

This suggests us to evaluate the utility and matter of a public investments with the value of its output multiplier but also with a broad combination of aspects that are essential to consider.

Therefore, we will address in this work several basic dimensions, such as the countercyclical effectiveness, the financing method, the utility for society and the sustainability, thus leading to a wider and inclusive concept of "multiplier".

[23] The terms of trade is the ratio between the price of a country's exports divided by the price of its imports *(Krugman, 2015, p. 142).* If the terms of trade rises, it means that export price has increased with respect to import price.

Chapter II: Public Investment Multiplier: a Catalyst for Economic Growth?

2.1 Investments during crises and countercyclical spending

In economic literature, it is commonly said that in the long-term market economies tend to achieve the equilibrium between aggregate supply and aggregate demand *(Roncaglia, 2004, pp.110-115),* despite the occurrence of momentary disequilibriums in the short-term.

However, it is important not to behave as the Voltaire's Candide who believed to live in the best of all worlds possible, thus recognizing that markets often are not in equilibrium, leading to tough crises which eventually severely hit both the economy and society.

In fact, even assuming, as marginalists claim, that markets fix the possible imbalances and reach the equilibrium in the long-term, historical and empirical experience make it evident that the costs of the crises in the short-term are burdensome and painful.

Consequently, it is fundamental to face economic busts with measures of economic policy that may make the crisis less hurtful (instead of waiting for the long-run stabilization).

In other words, as J. M. Keynes claimed in this effective quotation, *the "long run is a misleading guide to current affairs. In the long run we are all dead. Economists set themselves too easy, too useless a task if in tempestuous seasons they can only tell us that when the storm is past the ocean is flat again" (Keynes, 1923, p. 80).*

This does not mean that Institutions should always intervene to oppose a decline of aggregate demand, since in some cases public intervention can bring negative spillovers (e.g. for the crowding-out effect, or for a delay in the intervention), that make the policies damaging.

Nevertheless, in general it is possible to justify an intervention of economic policies aimed to correct a negative shock of demand, for instance with the goal of decreasing unemployment or stabilizing prices.

To deal with these issues of macroeconomic policy and to understand how crises and recoveries work[24], the multiplier effect and the role of investments are fundamental.

In fact, crises tend to expand and eventually become harmful to the whole economy because of the negative ripple effect triggered by a drop of demand.

The multiplier effect can provide an explanation of this dangerous vicious cycle: the initial decrease of demand leads to a decrease of supply, which translates into lower profits or job losses that, in turn, determine a reduction of disposable income.

Granted that less income implies less further spending, the unpleasant chain reaction continues, and the loss of disposable income in the whole economy ends up being equal to the initial loss of demand multiplied by the multiplier.

In light of this vicious cycle, Governments can rely on a variety of policy tools that are indeed called "countercyclical", because they are aimed to reverse the cycle.

It is precisely in this reasoning that the multiplier and public investments stand out for their crucial relevance.

Given that, with crises, consumption falls and aggregate demand drops, the Government goal is to foster consumption again and to give a fresh boost to demand.

Nevertheless, stimulating private spending is not an easy problem to tackle with, because in times of crises the marginal propensity to save grows, within a disposable income that has already been curtailed by the aforementioned ripple effect.

[24] In this case, we refer mainly to crises of aggregate demand. Also in crises of supply shock the multiplier effect and investment play a strategic role, but other considerations and further discussion should be carried out.

In light of this, even the decision of carrying out a tax cut to increase disposable income (and therefore consumption) may turn out to be poorly successful, since the higher propensity to save might translates into savings most of the additional disposable income.

Unfortunately, contrary to what believed by Jean-Baptiste Say[25] and the marginalists[26], in the short-term the tendency to save does not directly enhance private investments[27] *(Cesaratto, 2016, pp. 123-143).*

In fact, the latter derives from the choice of companies that are different economic agents, with different preferences, to who decides to save *(Keynes, 1936)*.

Private companies mainly base their investment decisions on the demand expectations: if entrepreneurs expect a robust and persistent growth of aggregate demand, they will invest, otherwise, if the demand expectations are hardly confidence inspiring, they will avoid carrying out substantial investments.

This is the reason behind the fact that during crises private investment is properly the demand component that tends to decline more intensively.

Granted, though, that consistently with what pointed out thus far and with empirical experience, investments are the *primum movens* of aggregate demand and growth, thus recoveries pass through the possibility to reactivate the ripple effect of consumption and production stimulated by investments.

The most common countercyclical tool disposable by Public Institutions to encourage investments is highly considered to be the expansionary monetary policy, aimed to make investments more attractive by means of interest rate decrease.

---

[25] Jean-Baptiste Say (1767-1832) has become famous for his famous economic "law", claiming that supply creates its own demand. Within his theory (disproved by the Keynesian Copernican revolution whereby it is the demand that determines supply) we find the assumption that savings are equal to investments.

[26] Consistently with Say, marginalist economists believes that the market equilibrium also implies the overall equality between savings and investments *(Cesaratto, 2016, pp. 95-96*). Nevertheless, at least in the short-run, this assumption is often contradicted by empirical experience.

[27] The trend is different in the long-term, when there is a stronger correlation between savings and investments. In light of this, it has to be drawn the conclusion that the speed with which savings become investments plays an important role in stimulating growth.

In fact, the investment function states that investments (I) depend negatively on the real interest rate r, and positively on the change in GDP (Y) and on Tobin's q[28] *(Burda, 2005, p. 147)*.

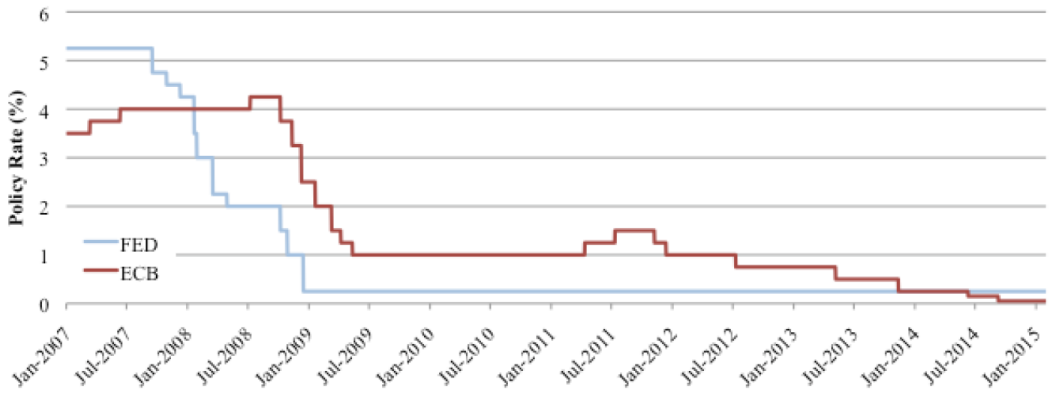
$$I = I\,(r, \Delta Y, q)$$

Hence, the idea is that by lowering real interest rates investors will no longer postpone the investment decision, realising that conditions are favourable to borrow money.

In addition, and contrary to Keynes' concern that *liquidity trap* could not enable to reduce interest rate to the desired level, it has to be acknowledged that central banks are provided with powerful means to achieve more than considerable reduction of real interest rates.

Let us think for example of the non-conventional monetary policies carried out during the past few years by ECB and FED which, by means of the *quantitative easing* and the so-called *forward guidance*, have succeeded in reaching real interest rates close to zero (Chart 2.1).

Chart 2.1 Policy Rates of U.S. Federal Reserve and European Central Bank



Source: Kang (2015)

[28] Tobin's q is equal to the firm's value as priced by the stock market, divided by the cost to replace the capital goods incorporated in existing firms. In fact, according to q-theory of investment, the behaviour of aggregate investment is related to Tobin's *q*. *"When Tobin's q is greater than one, installed capital in the existing firm is more valuable than what it would cost to purchase it new and start a new firm from scratch" (Burda, 2005, p.142)*.

Unfortunately, even though Central Banks have the means to succeed in providing low interest rates, such a policy could not be sufficient, since companies may decide not to invest anyway.

The reason being that the level of private investments is not directly determined by interest rate, because the role of the profits forecasted by entrepreneurs, based on demand expectations, remains decisive *(Roncaglia, 2004, pp.215-217).*

In other words, even without completely agreeing with Cesaratto and other heterodox economists' finding that investments are *insensitive* to interest rates *(Cesaratto, 2016, p.147)*, this evidence ought to be acknowledged: the expectations of future profits, and not low interest rates, turn out to be the *ubi consistam* of investment choice.

The bottom line is thus that, consistently with Kalecki's work *(Kalecki, 1943)*[29], monetary policies alone tend to be an unsatisfactory tool for boosting growth, since they rely on entrepreneurs' reaction that may not occur because of pessimism and lack of confidence.

On the base of that, the problem is thus how to fill the present gap between the insufficient spontaneous investments and the level of investment that is needed to expand demand and reverse the downward cycle of consumption and production brought by the crisis.

In this situation, where investments are needed but monetary policy has revealed its mediocre outcomes, fiscal policy and, specifically, public investments, can be characterised by an outstanding countercyclical effect.

In fact, unlike monetary policy, fiscal policy directly intervenes in the effective demand, increasing output and stimulating further spending through the multiplier effect.

[29] Michal Kalecki (1899-1970) believed that only interventionist and direct fiscal policies would have made possible to foster the economic growth needed to reach full employment. Using the polish economist's words, *"stimulation of private investment does not provide an adequate method for preventing mass unemployment" (Kalecki, 1943, p. 4).*

Furthermore, in the case of public investments the multiplier effect tends to be higher than in the case of other kinds of spending, leading to more robust ripple effects of consumption and output increase.

On the base of that, it should not be surprising that (after the backfire to demand due to austerity measures) the consensus about the importance of fiscal stimulus, as springboard to recovery, has grown over the last years, embracing economists who are historically hostile to public intervention *(Feldstein, 2009)* as well as Keynesians authors *(Skidelsky, 2016)* and central banks economists *(European Central Bank, Internet[30])*[31].

Ultimately, it can be stated that in the event of demand crises, Governments can play an active role in enhancing economic growth, through the wise and effective implementation of public investments with robust multiplier effect.

However, it must also be acknowledged that government spending is not positive in every case, and it is therefore fundamental to adopt a pragmatic attitude, which is aimed to understand all the possible spillovers of public intervention.

[30] In https://www.ecb.europa.eu/pub/economic-research/resbull/2016/html/rb160701.en.html

[31] In a report of the European Central Bank published on July 2016, ECB's economists have stated that *"policies aimed at stimulating aggregate demand should play an even more important role in the economic policy mix" (European Central Bank, Internet)*, referring to the need of more intense monetary and fiscal policies.

2.2 The role of the type of funding

Granted that a rise in Government expenditure can boost aggregate demand and encourage recovery, now it is important to deal with the other implications related to such a spending rise.

In this regard, the first problem that a policy maker has to face is how to finance the additional spending.

As we know, there are three possible ways to follow: raising taxes, issuing public debt, or printing new money.

However, at least in recent years, the Government choice tends to be limited to the first two options, since printing a substantial value of money implies high inflation or such a prerogative is not disposable because conferred to an independent Central Bank.

Therefore, the comparison that will be carried out pertains public investments with balanced budget, and debt financed.

The issue will be addressed considering the value of the multiplier effect for each mode of financing, as well as the problem of financial sustainability.

2.2.1 Balanced budget investments

The additional Government spending can be financed by raising taxes.

As a consequence, the equilibrium between revenue and expenditures is thus ensured.

On the one hand, the spending thus generates a positive multiplier effect in the economy but, on the other hand, the tax raise implies a reduction of stimulated spending due to the tax multiplier.

However, as outlined by the Haavelmo Theorem *(Dornbush, 2010, pp. 111-112)*, the difference between the public investment multiplier and the tax multiplier is positive.

In fact, assumed that $\Delta G = \Delta T$, the final income increase ΔY is the following:

$$\Delta Y = \Delta G \cdot \frac{1}{1 - \left(MPC \cdot (1 - t) \cdot (1 - MPM)\right)} - \Delta T \cdot \frac{MPC}{1 - \left(MPC \cdot (1 - t) \cdot (1 - MPM)\right)}$$

With the result that the final income increase is equal to the initial spending:

$$\Delta Y = \Delta G$$

Nevertheless, although the balanced budget multiplier tends to be positive, the restrictive effect of the tax raise curbs significantly the expansionary effects of public investments.

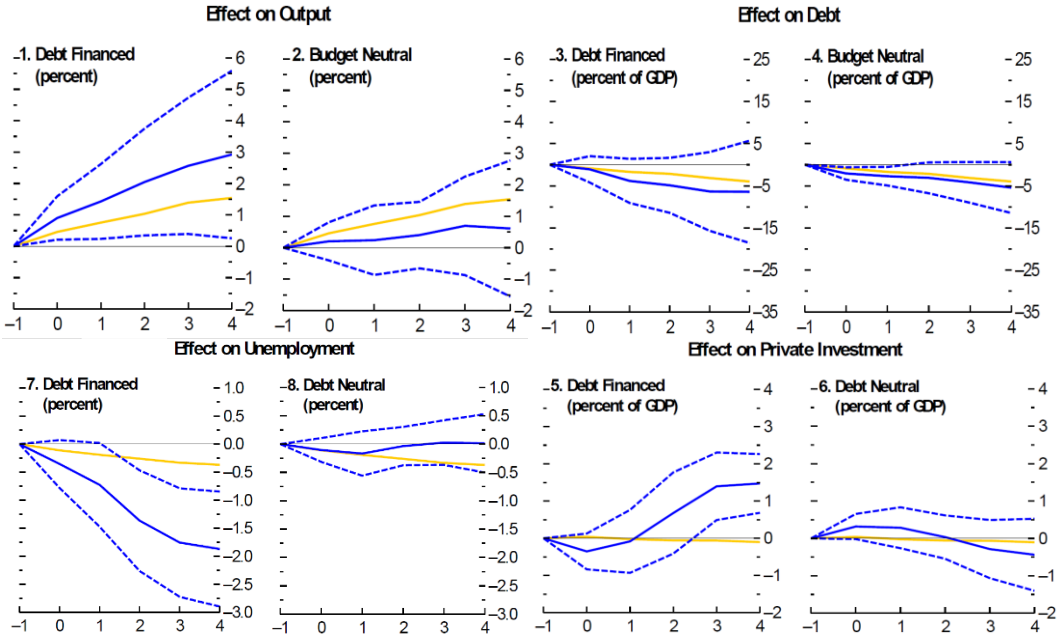
In fact, the output effects of the stimulus, albeit present, tend to be smaller when public investment shocks are budget-neutral than when they are debt-financed, since the latter does not present the recessive aspects of taxes.

This theoretical truism is also confirmed by recent empirical studies of IMF economists: in a sample of 17 OECD economies, it has been detected that "*Government projects financed through debt issuance have stronger expansionary effects than budget-neutral projects that are financed by raising taxes" (Abiad, 2015).*

In addition to lower effects on output, IMF economists claim that budget-neutral investments also present other particular trends compared to debt-financed investments: it seems that, on average, they lead to similar reduction to Debt/GDP ratio in the medium term (since they do not issue debt, but they boost less output), they have less impact on unemployment, and in the medium term they crowd in less private investments.

These findings are summed up in Chart 2.2.

Chart 2.2 The Effect of Public Investment in Advanced Economies: The Role of Mode of Financing[32]



Source: Abiad (2015)

However, the result of this study does not allow to appreciate an important advantage of budget-neutral investments, namely the financial sustainability.

In fact, although it seems that, in the considered OECD countries, the economic scenario and the substantial output effects have enabled debt-financed investment to reduce Debt/GDP ratio, it is fair to acknowledge that it is not always like that.

Specifically, under certain conditions (for example with high interest rates and spontaneous economic boom) and in the case of poorly efficient spending, budget-neutral investment is supposed to have a better impact on Debt/GDP.

2.2.2 Debt-financed investments and debt problems

As already outlined, the multiplier effect of debt-financed investment tends to be considerably higher than budget-neutral investments.

The reason behind is easily grasped: the spending generated without collecting taxes translates into a stronger demand shock.

[32] The years are on x-axis; t=0 is the year of the shock; the dashed lines denote 90 percent confidence bands, while solid yellow lines represent baseline results.

Having said this, and despite the mentioned findings of Abiad and others *(Abiad, 2015)*, the possible problems generated by issuing debt should not be underestimated.

In fact, debt-financed investments may lead to several scenarios, included between two opposite borderline cases: in the first, debt rises to finance the investment, but the demand shock and the consequent economic boom lead to sustained growth and reduction of Debt/GDP ratio; in the second, instead, because of various reasons (e.g. elevated financing costs, low efficiency of investments) the growth stimulated is insufficient to reduce the Debt/GDP ratio, which starts to increase and cause serious problems.

As a consequence, the ideal long-term policy should be the one that, during time of crisis, takes advantage of the substantial multiplier effect of debt-financed investments, but then pays back the issued debt during time of growth.

In fact, even if Public Debt is elevated in a certain period of time, it does not excessively hurt and it is not a source of concern if the estimated growth rate is sustained and the investors expect guaranteed repayments in the future.

Therefore, the appropriate goal should be to stabilize the ratio of Debt/GDP rather than the debt level itself.

The reason being that *"if the government's debt grows more slowly than GDP, the burden of paying that debt is actually falling compared with the government's potential tax revenues" (Krugman, 2013, p. 398).*

It is thus appropriate to rely on pushes of debt-financed investments to stimulate the economy during crises, but only when necessary (in a "responsible way"), in order to avoid explosive interest rates and not to risk to lose the possibility to spend when another crisis will occur[33].

[33] Unfortunately, historical experience tells us that Governments have not always been so virtuous. In fact, politicians are often tempted to run deficits because this allows them to carry out popular political actions without raising taxes. It is sufficient to look at OECD Data about Deficit/GDP ratio (OECD Data, Internet) to see that in most of developed countries the Deficit has been persistent, both in years of crises and of growth.

The reason being that if Debt/GDP is considered as “unsustainable”, the derived problems can be painful, severely hitting both Government and the economy and exacerbating debt sustainability concerns.

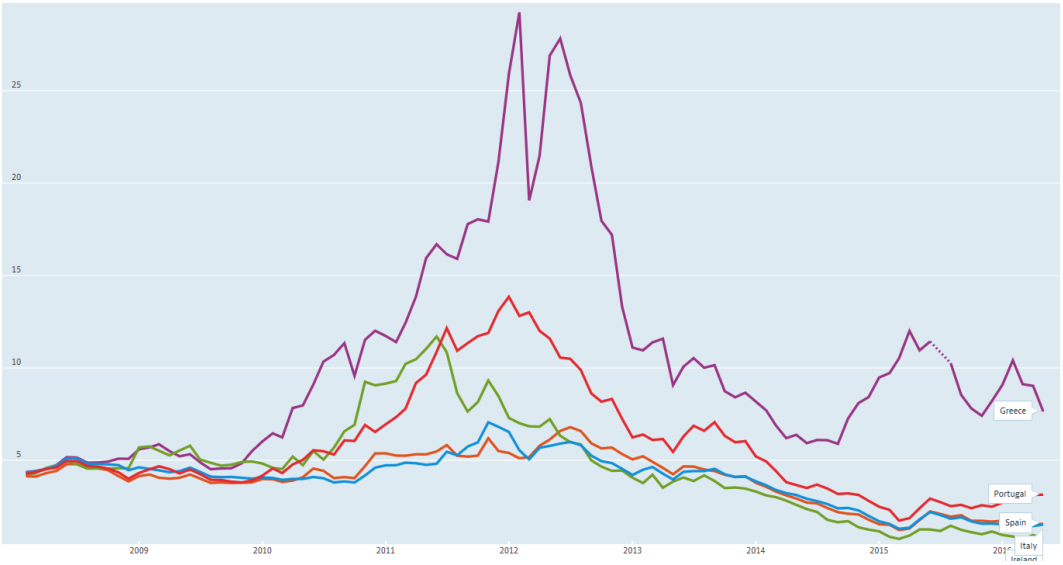
The main problems of persistent and increasing Debt/GDP ratio are highly considered to be three: interest expenditure, redistributive problems, and the crowding out effect.

The first stems from the fact that running deficit, by increasing public debt, place financial pressure on future budgets.

Nonetheless, the impact of current deficit on future budgets also turns to be immediate, since Government must pay back the debt with interest rates that, when the debt is substantial, can be very elevated.

Let us think, for instance, of the European crisis of sovereign debts, that has been characterized by vertiginous interest rates due to elevated risk premiums, that have jeopardized the financial stability of countries such as Greece, Portugal, Spain, Italy and Ireland (Chart 2.3).

Chart 2.3 Long-term Interest Rates PIIGS



Location	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Greece	4.8	5.2	9.1	15.7	22.5	10.1	6.9	9.7	8.4	6.0
Ireland	4.5	5.2	6.0	9.6	6.0	3.8	2.3	1.1	0.7	0.8
Italy	4.7	4.3	4.0	5.4	5.5	4.3	2.9	1.7	1.5	2.1
Portugal	4.5	4.2	5.4	10.2	10.5	6.3	3.8	2.4	3.2	3.1
Spain	4.4	4.0	4.3	5.4	5.8	4.6	2.7	1.7	1.4	1.6

Source: OECD Data, Internet[34]

The problem is extremely relevant because if every year the Government has to pay back substantial interests, the revenue will have to be permanently higher than the spending (excluding interests on debt), with consequent restrictive effects on the economy.

The case of Italy is emblematic: the country is permanently running deficit from more than 35 years *(European Commission, Internet*[35]*)*, although the primary balance (difference between revenues and spending, excluding interests) is in surplus from more than 20 years *(MEF, Internet*[36]*).*

[34] In https://data.oecd.org/interest/long-term-interest-rates.htm
[35] In http://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm
[36] In http://www.mef.gov.it/inevidenza/article_0045.html

The reason behind is that Italy (as other countries with permanent high Debt/GDP ratio) is forced, by its past debt issuance, to collect by the citizenship more than what is provided in terms of services.

This issue leads us the second problem mentioned, that is the redistributive spillovers of debt issuance.

In fact, granted that the interest payment is financed with taxes paid by citizens, and that the interests are the profits of government bond owners, a redistributive effect takes place, mainly from the "workers" to the "savers".

Since, on average, bonds are bought by middle and high-income people or by financial institutions, in the long-term the described redistributive effect turns out to be regressive.

Finally, another possible negative spillovers of debt-financed investment push is the crowding out effect: the phenomenon for which expansionary fiscal policy ends up reducing investment spending by the private sector.

As it is related to a wider issue, which is the relationship between public investment and the other components of aggregate demand, the problem of crowding out will be addressed in the next paragraph.

2.3 The relationship between public and private investments: crowding out and crowding in effects

As we know, the aggregate demand is composed by several components, gathered in the famous IS equation:

$$Y = C + I + G + (X - M)$$

According to the reasoning developed thus far, public investment can be a catalyst to economic growth because of the stimulus to aggregate demand.

Needless to say, this idea should be downsized if we imagine that the increase in *G* leads to a reduction of other components of demand, negatively balancing part of the expansionary effect.

Therefore, it is important to address the issue of the relationship between the increase in public investment spending and other demand constituents.

With regard to consumption, the problem has already been discussed: the multiplier effect precisely represents the phenomenon whereby an increase in autonomous spending (in this case, public investments) triggers an increase of consumption.

After all, the countercyclical feature of public investment derives from this positive spillover of induced spending in the economy, whose quantitative manifestation is held by the multiplier value.

Instead, when investments are financed by raising taxes, the increase in spending due to investment multiplier is mitigated by an inverse multiplier effect based on the tax increase.

Here again, the overall effect on consumption uses to be positive, even if the restrictive effect on consumption generated by taxes should not be underestimated[37], especially in poorly progressive tax system[38].

[37] For instance, in the case of austerity measures (that have been carried out in Europe in last years), the consumption loss due to tax raise turned out to be higher than the estimates, since it was underestimates the multiplier effect of taxes *(Blanchard, 2013)*.

Having said that, now the focus will be on how private investments react to public investments.

When public investments are financed by debt, the expansionary effect on demand could be jeopardized by the occurrence of the so-called "crowding out effect".

This phenomenon takes place when the expansionary fiscal policy makes interest rates grow, therefore reducing private spending and, specifically, investments *(Dornbush, 2010, p. 169).*

The reason being that, *when the economy is at full employment and Government borrows funds in the financial markets, it is competing with firms that plan to borrow funds for investment spending. As a result, the government's borrowing may crowd out private investment spending, increasing interest rates and reducing the economy's long-run rate of growth*" *(Krugman, 2013, p. 397).*

In addition, according to David Romer, interest rates also affect investment through other channels, such as the impact on agency costs, since a raise in interest rates increases the total amount the entrepreneur must pay the investor *(Romer, 1996, p. 377).*

Then, in the case of small open economies with flexible exchange rate, the Mundell-Fleming model *(Mundell, 1963)* points out that higher interest rates jeopardize fiscal policy effectiveness because if they increase, the exchange rate appreciates, and exports drop.

In fact, according to uncovered interest parity, if domestic interest rate (r) increases, the exchange rate (e) appreciates with respect to the world, assuming that the expected exchange rate ($E(e)$) and the foreign interest rate (r'') are stable.

$$r = r'' - \frac{E(e) - e}{e}$$

Nevertheless, as outlined by Corsetti *(Corsetti, 2012)*, we should not think that this theoretical assumption is always true in reality, since *"several recent studies*

[38] Since low-income people are characterized by higher marginal propensity to consume, a tax raise that involves less wealthy citizens will lead to higher reduction in the aggregate consumption.

have documented exchange rate depreciation (instead of appreciation) *after a spending increase, contrary to the prediction of standard theoretical models" (Corsetti, 2012)*[39].

After all, the crowding out hypothesis are not always fulfilled, as shown by an empirical study carried out by IMF, which draws the following conclusion: "*within the sample of 17 advanced economies employed in the estimation, the empirical evidence suggests that historically, debt-financed public investment shocks have not led to increases in funding costs, as proxied by sovereign real interest rates" (Abial, 2015).*

The reason behind may be the one explained in paragraph 2.1: there is not always a perfect correlation between interest rates and investments, since the role of demand expectations is crucial in determining both sovereign real interest rates and private investment choice.

However, the correct conclusion should not be that crowding out effect does not take place.

Indeed, public investment may actually crowd out private investment, especially when the economy is at full employment and when private investments are already spontaneously present because of a solid growth (with entrepreneurs that give more importance to the cost of borrowing).

A wiser conclusion to draw is thus that crowding out effect *may* occur, under certain conditions and with certain macroeconomic scenarios (e.g. high inflation with full employment), whereas often, under other conditions, it is prevalent the phenomenon whereby public investments "crowd in" private investments.

Indeed, granted that investments are affected by demand expectations, and that a change in output behaves as *accelerator* of investment demand *(Romer, 1996, pp. 360-361),* a public investment raise may encourage further private investment.

Let us think for example about public investments that enhance infrastructure that are needed in a specific industrial sector.

[39] The part of the quotation between parenthesis has been added.

The firms operating in that sector, as well as entrepreneurs interested to run a new business, will take advantage of the better infrastructure conditions, investing in the economic activities benefited by those improvements.

For instance, in developing countries the possibility of carrying out local private investments is necessarily subjected to the improvement of physical infrastructures, that enables an adequate economic framework.

Consistently with this, Eden and Kraay analysis[40] found the evidence of crowding in effect in low-income countries due to Government investment, with an extra dollar of Government investment scaling up private investment by roughly two dollars, and output by 1.5 dollars *(Eden, 2016).*

However, public investments can be a catalyst for private investments not only in low-income countries.

In fact, even beyond the classical crowding in concept, we can identify several examples in which Government investment has been the driver to the birth, development, and success of private sectors that eventually has reached maturity and autonomy.

Let us think, for instance, to the historical examples of machinery industry in Germany, developed by Nazis Government in the 1930s, or internet in USA, started by a project of the Ministry of Defence in the 1960s.

Also noteworthy are other cases, such as electronics and computers in South Korea, baked by Government in 1960s, or the Spanish sectors of wind energy, stimulated by the regional Government of Navarra in 1990s, and of high-speed rail, financed by national Government in 2000s.

In fact, is it taken for granted that the current competitiveness of firms such as those of high-technology sector in America or of infrastructure-building in Spain have had as *conditio sine que non* the support carried out by Government in past years, which fertilized the economic "humus" for private development.

[40] The analysis *(Eden, 2016),* carried out by World Bank economists Maya Eden and Aart Kraay, considers a sample of 39 low-income countries.

In these examples, we have taken into account outstanding long-term effects, because of the importance of public intervention in developing industrial sectors.

Nevertheless, when the issue of the crowding in effect is addressed, is more common to deal with it in terms of demand-side aspects in the short and medium term.

In fact, the case could rise in which Government spending boosts the demand for goods, which in turn increases private demand for new output sources, such as factories.

This positive spillover, in contrast with crowding out effect, raises the question of which of the two effect is more likely to happen.

The correct answer is that it depends on other variables of the macroeconomic scenarios.

For instance, it seems that during time of growth and full employment the probability of crowding out effect may increase, whereas in time of slower growth the crowding in effect is far more likely.

Fortunately, the estimates of the multiplier effect take these negative and positive spillovers into account, with the value of the multiplier that tends to be smaller than one when it is expected a substantial crowding out effect.

Instead, when it is estimated that, in a certain economic scenario, debt-financed investments will not crowd out private investment, but rather the opposite, the multiplier will be higher.

In light of the carried out considerations, it should thus not be surprising that the output and consumption multipliers are found to be unusually high during times of financial crisis *(Corsetti, 2012).*

2.4 Public investments in physical capital and in human capital

When public investments are being discussed, the objects of the analysis can have different natures.

In fact, the areas where public Institutions play a role and actively intervene in economic activity are various, with the term of "public investment" that does not only refer to the most classic example often considered, that are infrastructures.

The case of infrastructure is probably the run-of-the-mill considered investment because, although some of them are built by the private sector, most of infrastructures are provided by Government or are subjected to public regulation and to forms of public support.

Nevertheless, as said, the galaxy of public investment is much wider, and include investments in physical capital as well as in human capital.

The former pertains physical resources that are created in order to be used in the production of other goods and services, such as machines, roads, and buildings.

The latter, according to the traditional definition, concerns the improvement of the quality of work, that is generated by education and knowledge.

Nevertheless, as duly argued by Smith and Max-Neef *(Smith, 2011)*, such a definition of human capital is the questionable refection of a *"discourse where people, just as machines or raw materials, are instruments in production" (Smith, 2011, p. 114).*

On the contrary, human capital must be considered as a resource of value regardless of its contribution to the production process.

With respect to physical capital, the more significant public investments are gathered, once again, under the extended concept of infrastructures.

Within this set, we refer to roads and highways, railway and power lines, information and water distribution networks, bridges and *"all internal facilities of a country that make business activity possible" (BusinessDictionary, Internet[41]).*

Infrastructures are a key element for growth, since they serve as support of economic activity, with the consequence that insufficient infrastructures represent a substantial obstacle for development, both in developing and developed countries[42].

Essential infrastructures that are often unduly not emphasized, whilst being *conditio sine qua non* of development, are basic health measures such as disease control and drinking water supplies.

In addition, within public sectors such as healthcare and education, the satisfactory presence of advanced infrastructures is a determining element for providing high-quality services.

However, the nature of services such as education and healthcare leads the outstanding relevance of human capital to the hearth of the debate, with public investments in such a field that turn out to be a core issue.

In fact, according to several economic theories, in a long-term perspective the growth rate of economies is based on the *propensity to save* for capital accumulation (in accordance with endogenous growth model) and on *technological progress* (in accordance with Malthusian, neoclassical and neo-Keynesian models) *(Dornbusch, 2010, pp. 490-497),* but this vision presents at least a substantial limit that must be highlighted.

Specifically, the impact on economic activity of technological progress require certain competences to be properly delivered, that pertain the characteristics of the people involved in the process.

[41] In http://www.businessdictionary.com/definition/economic-infrastructure.html

[42] It has been estimated *(Ann Bovino, 2015)* that there are global infrastructure investment needs in the tens of trillions of dollars. Today, infrastructures quality and corresponding investments are considered as poor and insufficient also in several developed countries, such as Italy and United Kingdom.

On the base of that, at the end of the 1980s several authors started to emphasize human capital as the main vehicle by means of which technological progress enter economic and social system *(Dornbush, 2010, p. 498).*

Human capital, as all the other types of capital, can be built up over time, through different ways, such as professional education, on-the-job training, and personal study during leisure time.

However, the context in which public Institutions have a more direct impact and responsibility in this regard, is the formal education at school and university.

In fact, human capital largely depends on the Government expenditure in education, which is how much a country decides to *invest* in the education of future generations.

In this respect, education as an investment in human capital makes sense because the market and non-market benefits are realized over an extended period of time *(Daly, 2012).*

Granted, thus, that the quality of education provided by a country to its citizenship has an enormous impact on the growth rate, higher public investments in education system are the key to enable a solid growth over years.

Nonetheless, public investments in education are not just about economic growth, they are also about the creation of an individual and collective value that goes far beyond, that elevates the single person and all society toward a overall development.

In addition, the effects of this "human development" lead to real and concrete positive repercussions, whose extent over time is barely imaginable, as highlighted, for instance, by the studies about the *social capital*[43] *(Putnam, 2000) (Almagisti, 2016)*[44].

[43] The *social capital* may be defined as those resources inherent in social relations which facilitate collective action. Social capital resources include trust, norms, and networks of association representing any group which gathers consistently for a common purpose.

[44] Marco Almagisti, in line with the work of Robert Putnam, emphasizes the importance of the *social capital* in making a society (and also an economic system) more resilient, efficient, and liveable. For instance, in societies where it is present a higher degree of *social capital* (because

Another relevant form of investment in human capital that can be carried out by Government is the investment in Research and Development (R&S).

The issue is particularly crucial in light of the fact that technological progress is the driver for long-term output growth.

Indeed, given that new technologies and technology improvements are made possible by scientific findings, the R&D becomes, in turn, the essential catalyst for long-term growth.

Nowadays, most of the research activities are delivered by more competitive and innovative firms (especially larger companies), that systematically invest in such a field with the goal of, for instance, creating a new product or adding features to old products.

Then, there are the R&D activities that takes place in research centres financed by Government or other public Institutions.

The utility of these centres pertains, on the one hand, private companies, which can take advantage of the findings and technological improvements achieved, receiving a substantial benefit and improving their competitiveness.

On the other hand, also the whole citizenship stands to gain in reason of the scientific findings that may have a direct positive impact in citizens' life, for instance because of the discovery of the cure for a certain disease.

In general, then, the correlation about economic growth and R&D is confirmed by several studies, such as Beyza Bayarçelik and Taşel, who empirically find *"a positive and significant relation between R&D expenditure and the number of R&D employees in influencing economic growth" (Beyza Bayarçelik, 2012)*.

Furthermore, the absolute value of public investments in human capital also stands out in comparison to investments in infrastructure.

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historically accumulated), public Institutions are more efficient and respected. Conversely, in societies where there is less *social capital*, the implementation of public policies is less effective and public intervention turns out to have harder results in the improvement of people's life.

In fact, as investment in physical capital, the investments in education, healthcare and R&D can lead to a robust growth with high output multiplier, by boosting production both in the short term (through stimulus to demand) and in the long-term (accelerating technological progress).

But investments in human capital, unlike investment in physical, leads with far less likelihood, to negative spillovers, and present an individual and social value regardless of the economic impact.

In fact, in some instances the utility and social value of physical investments may be, at least, questionable, and consistent with an idea of economic development that could imply harmful costs (e.g. environmental problems), as it will be considered in more depth in chapter III.

The bottom line is thus that investments in human capital and in research and development represent the window for a sustained and better economic growth, with positive repercussions both in the short and long-term, but also with a social value that goes beyond the strictly-economic perspective.

2.5 Public investments to reduce inequality: education and healthcare

In assessing whether economic growth is generating real social progress, one of the most important variables is the level of inequality in a society.

The problem of inequality is fully in line with the issue of investments in human capital, and the reason can be explained by the point of view of one of the most distinguished economist in the field of research related to these issues, that is professor Joseph E. Stiglitz[45].

The specific reference to this famous author is due to the fact that the activity of research of this work has been enriched by the opportunity to personally address a question[46] to the professor of Columbian University, with regards to this topic.

The specific question had as object which are the most important long-term investments that a Government should carry out in order to reduce inequality.

The answer of the professor, consistently with the content of his several publications, emphasized the role of a real access to universal education, to guarantee more equality of opportunities.

In fact, according to Stiglitz, the strongest single course for perpetuating inequality is inequality of educational opportunities, as can be seen very clearly in the data across countries and in American data.

In United States, economic segregation has grown in the last 25 years and the disparity in educational opportunities has increased, with very high tuition fees that make the idea of attending university "inconceivable" for many students whose parents are not wealthy.

[45] Joseph E. Stiglitz is University Professor at Columbia University and Chief Economist at the Roosevelt Institute. He was member and chairmen of US president's Council of Economic Advisers under Clinton administration and senior vice president and chief economist of the World Bank from 1997 to 2000. He was rewarded with the Nobel Memorial Prize in Economic Sciences in 2001. From 2011 to 2014, he was president of the International Economic Association (IEA). Stiglitz's work focuses on public economics, income distribution, asset risk management, corporate governance, international trade and globalization.

[46] The question was asked at the end of the conference "Capitalism, Inequality and Globalization", organized by the "Universidad Publica de Navarra" (UPNA), that took place in Pamplona on the 21st of May 2018.

Then, Stiglitz also highlights the importance of a universal access to healthcare, so as to provide who is now excluded from health system with adequate care.

The bottom line of the reasoning developed by the American economist is that, to reduce inequality, all those investments needed to guarantee equality of possibilities, such as education and healthcare, are crucial.

It has to be acknowledged that the answer provided by professor Stiglitz actually highlights a core issue that merits being dealt with in more depth, and the reasons for this agreement will thus be exposed.

First of it all, the fact that public investments in education and healthcare are a catalyst for growth and development also by means of their strategic role against the perpetration of inequalities definitively deserves to be emphasized, in addition to all the other positive features that have already been mentioned.

Then, the issue acquires special relevance also in light of the heightening of income polarization experienced by several countries over last years.

In fact, even though the inequality among countries has decreased with globalization, inequality within individual countries has increased, gaining, on average, more than two percentage points in terms of the Gini coefficient between 1990 and 2010 *(Antonio Zavala, Internet[47]).*

Global economic powers are the ones with more impact on this global trend, such as the United States (but also China and India), where the Gini coefficient rose by five percentage points between 1990 and 2013.

Neither Europe is an exception, with the Gini coefficient which has increased between 2006 and 2016 in most of the countries of the old continent *(Eurostat, Internet[48]),* as summed up in Table 2.1.

[47] In https://antoniozavala.com/2015/12/23/inequality-and-globalization-foreign-affairs/
[48] In http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tessi190&plugin=1

Table 2.1 Inequality raises in European countries

	Denmark	France	Germany	Italy	Spain	Sweden	UK
2006	23,7	27,3	26,8	32,1	31,9	24	32,5
2016	27,7	29,3	29,5	33,1	34,5	27,6	31,5

Source: Eurostat, Internet[49]

The problem has intensified with the crisis, which has stopped the past growth of income, that up to the that time had partially anesthetized the perception of inequality.

However, the criticality of the described scenario leads us to a fundamental consideration.

Inequality is not something inevitable, since its value have changed over time, and it can be reduced or, conversely, can become more pronounced.

In other words, we may say that inequality is a political choice *(Stiglitz, 2015, pp. 139-143),* and not an economic necessity.

Indeed, such a problem does not pertain the analysis of public investment effects just because of its size and seriousness, but also in reason of the importance of public intervention in dealing with this issue, since public policies are decisive in determining the future degree of inequality.

The reason being that market economy is an extraordinarily efficient economic system in providing elevated amount of goods and services, but it does not lead to an equitable distribution of such a production.

Thus, with the market that takes care of the primary distribution of income, public intervention is vital to guarantee a more equal secondary distribution that is aimed to partially make up for the possible distortions inherent to the primary one.

[49] The source of the data is Eurostat (in http://ec.europa.eu/eurostat/tgm/table.do?tab=table&init=1&language=en&pcode=tessi190&plugin=1), but the selection of the years of data and the countries is autonomous. In Eurostat can be seen also the Gini performance of all the other European countries.

The role of Government in the redistribution of wealth can be carried out through different ways.

On the one hand, income differences can be reduced via redistribution through taxes and benefits, or by reducing differences in pre-tax incomes.

In this regard, a crucial aspect is the principle of progressive taxation, toward which fair tax system ought to tend.

Nevertheless, albeit determinant, this is not the topic of this work.

In fact, on the other hand, income differences can be alleviated through the implementation of public investments that enable the so-called equality of opportunities.

As a consequence, the Government should carry out investments aimed to provide disadvantaged citizens with the same opportunity to lead a more than dignified life as the advantaged ones.

The main method is establishing a concretely universal education and healthcare system.

At the basis of this guideline, we find several justifications regarding ethical aspects as well as economic reasons.

Under an ethical perspective, perpetuating inequalities is unacceptable because it means impeding to provide different people with the same possibilities.

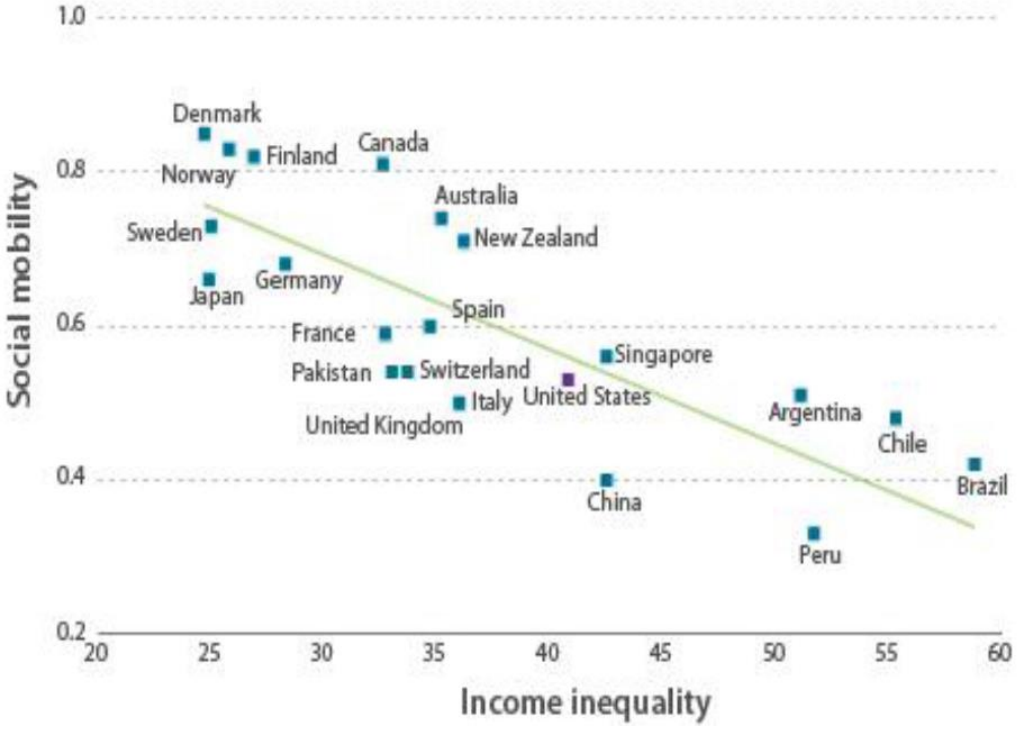
In practice, if an education of quality is not accessible to everyone, *de facto* many people are deliberately condemned to have far less opportunities to lead a better life, under several point of views.

For instance, "*though education is not the only determinant of an individual's future wages, there is a systematic correlation between the level of education and wages" (Stiglitz, 1986, p. 317).*

Unfortunately, in last years the insufficient investment in the common good, such as public education, has determined a decline in social mobility and an increase in

inequality, given that, as represented in Chart 2.4, the two phenomenon are correlated.

Chart 2.4 Countries with larger income differences experience less social mobility



Source: World Bank, Internet[50]

Nevertheless, there are also several more economic reasons underpinning the fact that elevated levels of inequality are mephitic for economy and society.

Indeed, there is a particularly large body of evidence that low social mobility reduces economic growth and reduces the efficiency of an economic system.

Granted, thus, that the perpetration of inequality impedes social mobility, the presence of a consolidated wide gap between incomes turns out to be a substantial obstacle to the development of economy as a whole.

For instance, *"in rich and poor countries, inequality is strongly correlated with shorter spells of economic expansion and less growth over time and with more*

[50] In http://www.worldbank.org/content/dam/Worldbank/Event/safetynets/4.%20Corak_Inequality%20Opportunity%20Mobility.pdf

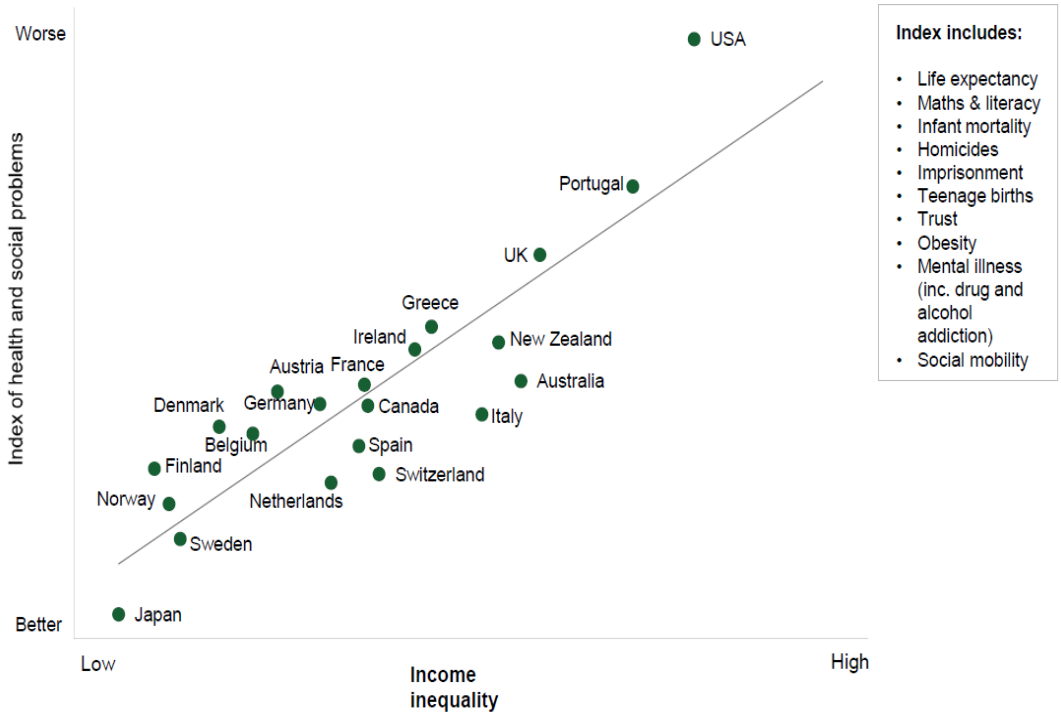
frequent and more severe boom-and-bust cycles that make economies more volatile and vulnerable to crisis" (Social Europe, Internet[51]).

Therefore, as outlined by Stiglitz, economies become more efficient and productive with more equality *(Stiglitz, 2012, pp. 143 187).*

A more unequal society, on the one hand, presents a perspective of cripple growth, and on the other, leads to several problems that not only affect the people at the bottom negatively, but society as a whole.

In fact, as pointed out by Chart 2.5, higher inequality is correlated with the occurrence of more health and social problems.

Chart 2.5 The Relationship between Inequality and Health and Social Problems



Source: Wilkinson (2009)

The reason behind is shown by the British epidemiologist Kate Pickett:

> *"Although the impact of inequality tends to be most severe lower down the social ladder, outcomes are worse even among the better off, because*

[51] In https://www.socialeurope.eu/inequality-essential-wellbeing

inequality damages the whole fabric of a society – increasing social divisions, status insecurity and status competition. […] There is a particularly large body of evidence linking greater inequality to worse population health; hundreds of studies show us that, in more equal societies, life expectancy is longer while the mortality rates are lower. [..]. There is also substantial evidence linking greater equality to better social relationships within societies –levels of social cohesion, including trust and social capital, are higher in more equal countries. Indicators of women's status and equality are generally better and rates of both property, crime and violence, especially homicides, increase as income differences widen" (Social Europe, Internet[52]).

Granted, therefore, that investments in education and healthcare are crucial to guarantee more equality of possibilities, they end up increasing long-term growth through social mobility.

In fact, public investments that enable equality of opportunities and reduce inequality lead to further positive effects, both under an economic and social perspective, compared to investments that have less impact on distributional dimensions.

Also noteworthy is the reason whereby investments that increase the income of less wealthy people present a stronger impact on consumption, since the marginal propensity to consume of poor is higher than the one of the rich.

On the contrary, the investments that end up only increasing the income of the people at the top make consumption plummet, with a lower multiplier effect.

The reason being that wealthy people spend a smaller part of their disposable income compared to the ones that have less, with the former that tends to save the 25%, while the latter spends all their income *(Dynan, 2004, pp. 397-444)*.

In addition to consumption, "equalitarian" investments also present a better impact on welfare, since, consistently with Arthur Cecil Pigou and the long tradition of the *welfare economics*, a euro added at the top adds little or no welfare compared to a dollar added at the bottom.

In light of these evidences and of the reasoning developed, a conclusion can thus be drawn that the investments aimed to improve equality of opportunities, such as

[52] In https://www.socialeurope.eu/inequality-essential-wellbeing

education and healthcare, are characterized by outstanding effects in the long term, both in terms of economic growth and social progress.

Chapter III: Limits of Traditional Output Perspective and Possible Solutions

3.1 The limits of GDP

It was on the 18th of March 1968, while he was running for the USA Presidency, that Robert F. Kennedy gave the following famous speech:

> *Our Gross National Product, now, is over $800 billion dollars a year, but that Gross National Product […] counts air pollution and cigarette advertising, and ambulances to clear our highways of carnage. It counts special locks for our doors and the jails for the people who break them. It counts the destruction of the redwood and the loss of our natural wonder in chaotic sprawl. It counts napalm and counts nuclear warheads and armored cars for the police to fight the riots in our cities […]. Yet the gross national product does not allow for the health of our children, the quality of their education or the joy of their play. It does not include the beauty of our poetry or the strength of our marriages, the intelligence of our public debate or the integrity of our public officials. It measures neither our wit nor our courage, neither our wisdom nor our learning, neither our compassion nor our devotion to our country, it measures everything in short, except that which makes life worthwhile (John F. Kennedy Library, Internet[53])*[54].

As shown by this speech, the Gross Domestic Product, although it is often considered the most important indicator about the "state of health" of a country, it has also been criticised by politicians and economists because of the limits of such a measure as reliable indicator of economic and social progress.

Obviously, GDP is an indicator and, as such, it provides a certain information that is the result of how the indicator is designed.

The subject of criticism, consequently, does not involve as much the measure of GDP in itself, but rather what GDP does not measure as well as the relevance and sense that is often inappropriately conferred to such an index.

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[53] In https://www.jfklibrary.org/Research/Research-Aids/Ready-Reference/RFK-Speeches/Remarks-of-Robert-F-Kennedy-at-the-University-of-Kansas-March-18-1968.aspx

[54] This is an extract of a wider speech that Robert F. Kennedy gave in the University of Kansas on 18th March 1968. The speech dealt with national affairs as well as with international affairs, such as the war in Vietnam. This extract about GDP is highly considered to be the most famous part of the speech, and it reflects the tendency of Robert F. Kennedy, recurring in his presidential campaign, to emphasize the relevance of moral values and social ties, instead of material aspects.

However, the aim of this work is not just to show the limitations of GDP, that can be deepened by consulting the references present in this paragraph, but to understand such an issue in light of the fact that the traditional approach to the multiplier is based on output.

Granted, thus, that GDP is the indicator used to measure and express output multiplier, the fact of being aware of the corresponding characteristics, limitations, and contradictions, plays an extremely important role in our wider idea of multiplier effect.

First of all, a critical issue about GDP is that it mainly considers market production, therefore excluding arbitrarily productive activities that are not provided through the markets, such voluntary work and household production.

Nevertheless, these activities are characterised by an outstanding social value and present a relevant positive impact in the whole economy both as regards production of goods and services *(Stiglitz, 2010, pp. 49-54*) and development of human capital *(Lara, 2010, pp. 53-54).*

Needless to say, given the fundamental importance of the amount of human capital in an economy and in a society, it is evident that in this sense the output-multiplier presents a substantial inadequacy.

Thus, it is crucial to also consider those "multiplier" effects involving non-market activities and human capital, when analysing public investment effects.

In addition, GDP presents the further limitation of not dealing with wealth distribution, without accounting for variance in income of different part of population.

Given that it exclusively measures the amount of production and not the corresponding distribution in the economy, it does not allow to understand the evolution of social cleavages and inequality.

Furthermore, it does not either provide information about the stock of accumulated wealth of a country.

To make up for these deficiencies, on one hand GDP should focus on income and consumption instead of output *(Stiglitz, 2010, p. 56)*, additionally considering income and consumption jointly with wealth *(Stiglitz, 2010, pp. 12-13)*.

On the other hand, we must bear in mind that average measures of per-capita GDP and wealth do not describe how the available resources are distributed, and neither average consumption illustrates how people effectively benefit from the resources in question.

Therefore, we have to consider the dissimilar situation across different groups, by supplementing the average indicators with the median value of income, consumption and wealth *(Stiglitz, 2010, p. 44)*.

In fact, it could occur that GDP per capita remain unchanged or increase, while income distribution become less equal, and only analysing the variance in GDP jointly with distribution indicators, and the average index jointly with the median ones, we can have a more lucid idea of social and economic reality.

These considerations are also extremely relevant with regards to the output-multiplier, because, first of all, they suggest to focus the attention toward the changes that involve consumption, income, and wealth, instead of restricting the analyses just to the output[55] stimulated by the investment.

Secondly, the considerations concerning GDP estrangement to distribution and inequality issues point out a further fundamental reflection: the output-multiplier tells us about how much additional production, consumption and income have been stimulated, but it has little to say about which the group of population that have benefitted from the additional GDP estimated by the multiplier are.

Such a reasoning also presents crucial political implications, because sometimes the effectiveness and success of an investment plan depend more on the capability

[55] Needless to say, GDP should be the same regardless of the approach used to estimate it, whether it is the output, spending, or income approach *(Mankiw, 2013, pp. 16-17)*.
Nevertheless, the findings about limitations of GDP, even in light of the considerations carried out by the Commission on the Measurement of Economic Performance and Social Progress *(Stiglitz, 2010)* suggest to look at income and consumption (considered jointly with wealth) rather than production, because they allow a better evaluation of material well-being.

to benefit specific groups and social contexts than on the quantitative multiplier effect as a whole.

In addition, this issue also leads to further GDP limits and qualitative considerations.

We previously outlined the GDP deficiency about non-market activities, but the information provided by GDP is highly considered to be opaque even within the market activities considered.

In fact, it measures the amount of production but it does not describe neither the composition of such a production nor which are the consumer of these products.

In fact, it goes without saying that, in case of aggregate supplies with dissimilar composition, the difference is substantial and the social effects will diverge, although the quantitative size of GDP may be the same.

At the same time, the difference is relevant also with respect to the consumers of such a production, as it is not irrelevant if the final goods are consumed by households, firms or Government.

These essential considerations about the relevance of composition involve two relevant issues that cannot be avoided in our analysis of output-based limitations and public investment effects.

The first pertains the negative externalities, namely the social and environmental impact of productive activities, which imply costs and decrease in life-conditions.

In fact, GDP does not account for the costs that community has to pay in terms of environmental damages and, in a situation in which humans consume yearly more than earth can produce *(Carra, 2010, p.8)*, we need to state a problem of sustainability, that will be deepened in 3.2.

In this regard, GDP does not distinguish between "good" production that, without jeopardizing healthcare and environmental sustainability, increases human well-being and human capital, and, instead, other forms of production that worsen life-conditions and damage environment, leading to the need of defensive

expenditures[56] *(Stiglitz, 2010, pp. 36-38)*, still considered in GDP despite being the cost to face the effects of other GDP components.

The second issue about GDP composition concerns the quality of output, since GDP presents the limitation of focusing in the amount of goods and services without properly considering the change in quality of these products.

The concept of quality can refer to the objective improvement of specific products that should be more adequately measured in GDP *(Stiglitz, 2010, pp. 24-25)*, but also, in an issue that involves many considerations already outlined, the qualitative "nature" of different products.

In other words, GDP measures the quantity of goods produced and not their qualitative dimensions such as importance, utility and social value.

Nonetheless, in line with Jabier Martínez *(Santacoloma, 2011, pp. 111-136)*, this work aims to point out precisely that it is more important the "content" (the quality) of development rather than its mere quantity.

As a consequence of the evident limitations of GDP as indicator of dimensions that are so fundamental, even the output multiplier thus turns out to be the expression of a quantitative increase (or decrease) in production that does not provide the essential information about composition, externalities, quality, of such a change.

Accordingly, the limitations of GDP listed thus far point out that our wider vision of the multiplier should consider as central the composition and quality of the multiplier effect stimulated by public investments, as well as externalities produced, wealth distribution, and social value.

[56] Defensive expenditures, that are aimed to protect society members from threats to current welfare, are represented by, for instance, cleaning up industrial disasters, treating socially-conditioned diseases, or military spending to protect national interests from real or perceived threats *(Daly, 2012 p.5)*.

3.2 Sustainability

It is commonly known that the higher the multiplier effect, the better it is for the economy because, given that the multiplier represents the output stimulated by an increase in autonomous spending, the higher multipliers lead to a sustained growth.

Under the point of view of economic growth, such an enthusiasm for robust multipliers is completely justified because, especially in the case of investment multipliers, they disclose that output will scale up both in the short term (because of demand effects) and long term (as a result of supply effects) *(IMF, 2014).*

Nonetheless, in a wider and more qualitative approach to the multiplier effect, we must bear in mind that the "quantitative" dimension of development is not always beneficial in a normative sense *(Krugman, 2013, pp. 40-41),* and therefore it is crucial to deal with the problems arising from economic growth.

In the 19th and in the first half of 20th century it was hegemonic the paradigm whereby an increase of the amount of goods and services in the economy would have led to better conditions, with the economic growth as independent variable, reagent, of social progress.

As a matter of fact, fossil fuels were cheap and abundant, and people had barely begun to consider that, over time, unbridled growth would also have presented negative spillovers.

We should not be surprised that economic growth was the unquestioned goal, because improving human well-being actually required adequate infrastructure, widespread and open access to goods and services, and enhanced political and economic participation *(Costanza, 2012).*

Although the idea whereby economic growth directly implies prosperity and progress also continued to be mainstream in the second half of last century, in public and academic debate new points of view started to stand out for their criticism toward the prevalent conception of growth, such as Meadows and others, that gathered all their perplexities in the report *The Limits to Growth (Meadows, 1972).*

This work highlighted the risks of the sharp growth the world was experiencing, also identifying the economic boom as the main cause for environmental problems such as pollution, scarcity of resources and ecosystem devastation.

The report, based on the computer simulation *World3*[57] *(Wikipedia, Internet*[58]*)*, forecasted the consequences of an unabated growth of production, population, and relative consumption, over terrestrial ecosystem.

The evidences of such a concern have been growing over time, especially due to the effects of climate change that are becoming increasingly manifest, with a scientific consensus about man-made causes *(NASA, Internet*[59]*).*

Therefore, today as never before, the *"indications of natural limits, such as climate disruption, biodiversity loss, and water scarcity, demonstrate the need for a new approach. Not only is it becoming increasingly obvious that GDP-directed development is ecologically unsustainable; survey research shows that it is no longer improving well-being and happiness in developed countries" (Costanza, 2012).*

In light of the described scenario, we must hence introduce the problem of sustainability as crucial in our analysis.

The traditional output perspective, indeed, turns out to be ill-suited in the interpretation of growth and development processes, since it unduly relegates the problem of sustainability and environment protection as subordinate.

[57] The model *World3* was designed specifically to investigate five major trends of global concern, such as accelerating industrialization, rapid population growth, widespread malnutrition, depletion of non-renewable resources, and a deteriorating environment. Meadows and others provide a pessimistic view about the sustainability of our economic system, because if the growth trends of the dimensions analysed continue unchanged, the limits to growth will inevitably be reached sometime within the next one hundred years. They claim that, reached that point, the most likely result will be a rather sudden and uncontrollable decline in both population and industrial capacity. However, they believe that these growth trends can be altered in order to establish a condition of economic and environmental stability that is sustainable far into the future. They warn that only striving as soon as possible for this second outcome rather than the first, the possibility to get satisfactory results will be high. In fact, the later people and States begin working to attain it, the narrower will be their chances of success *(Meadows, 1972)*.

[58] In https://en.wikipedia.org/wiki/World3

[59] In https://climate.nasa.gov/scientific-consensus/

Nonetheless, in our historical period the problem of sustainability can no longer be considered as marginal in the evaluation, but rather as a core dimension, absolute value, and inspiring element of economic activity.

As a consequence, even the study of public investments can no longer deal with sustainability as a mere characteristic of the process, but rather as a discriminating factor in assessing the effects generated by public intervention.

The main implication for our work is thus the awareness of the importance to introduce environmental damages and natural resource impoverishment into account of the effects generated by public investment, in accordance with our consideration of "multiplier effect" aimed to move beyond a mere output-based vision.

Regrettably, such an operation presents several problems that imperil the methodological rigour and may lead to arbitrary choices in the estimation of overall effects, although the urgency and outstanding relevance of this issue requires not to not give up tackling with it.

Specifically, even though we have no doubts in stating that the evaluation of public investment environmental costs is fundamental, it is not so easy to introduce the problem of sustainability properly into such an evaluation and to consider the environmental impact jointly with strictly-economic effects.

In fact, the operation of estimating objective environmental costs implies several theoretical and practical problems, that involve complicated choices regarding the *quid*[60] as well as the *quomodo*[61] of measurement.

The two main reasons being that future eco-environmental developments cannot be predicted perfectly, and that there is no perfect knowledge about how these developments are going to affect well-being *(Stiglitz, 2010, p. 121).*

[60] To take account of the "environmental effects" of a public investment and the production stimulated, we have to identify which are the present and future repercussions that can be ascribed to such an economic activity. In other words, we have to agree about what to measure.

[61] After having identified the effects attributable to the increase in production, we have to express these effects in the form of a value. Therefore, we have to agree about some methodological criterions that allow an estimate provided with impartiality and not arbitrariness.

Therefore, some caveats are necessary.

First of all, since even the definition of sustainability is controversial, the first step to take is the clarification of which aspects we want to consider, within a concept that can have a much wider meaning.

The idea of sustainability involves heterogeneous dimensions such as the financial sustainability, the wealth sustainability, and the ecological sustainability.

The financial sustainability pertains the process whereby the spending has been financed as well as the possibility to carry out the spending without negative spillovers in the future that indeed depends on financial aspects.

Specifically, the convenience of a public investment should also be judged with regards to the process and consequences of its financing, already debated in Chapter II.

However, we will not deal with this dimension of sustainability here, since its nature requires a separate analysis.

The second dimension of sustainability that is noteworthy with respect to our study pertains a much wider and complex sense, that is the sustainability of current well-being.

It involves a vision of sustainability that is based on wealth, with a stock-based approach.

The basic idea is the comparison between current and future well-being (that depends on the amount of resources that are passed on to next generations).

The future well-being will derive from the handed down resources that present several forms, such as physical capital (machines and building), human capital (constituted through expenditure in education), health (as future result of current spending), and the quality of institutions.

In other words, *"future well-being will depend upon the magnitude of the stocks of exhaustible resources that we leave to next generations"* and *"on how well we*

maintain the quality of all the other renewable resources that are necessary for life" *(Stiglitz, 2010, p. 98).*

Such an idea of sustainability is central in our analysis, since public investments play a key role in determining future well-being, as already outlined in paragraph 2.4 and 2.5.

Nonetheless, even this aspect of sustainability requires an independent analysis with respect to the accounting of the multiplier effect.

Such a topic, that we refer to the third chapter of *Mismeasuring our lives (Stiglitz, 2010)* for a deeper dissertation, cannot be included directly into the account of the multiplier effect, since it pertains an issue that is as essential as destined to separate examination.

In fact, the nature of this approach to the sustainability problem requires to be expressed by further indicators[62], that are specifically designed to answer a question that is different from the questions related to the multiplier effect.

On the base of these caveats, we now hope that the reasons why we decided to directly include the effects that pertain a problem of environmental sustainability are clear, leaving to separate considerations the effects concerning other aspects of sustainability.

Having reached this point, and given all these considerations about what aspects of sustainability ought to be considered within the multiplier and which ones are more effective to examine separately, it thus remains to clarify how to introduce environmental effects into the estimate.

The environmental effects, such as the increase in air pollution, natural resources impoverishment, or ecological damages, can be expressed by two different group of indicators: monetary indicators and physical indicators.

[62] In fact, the interpretation whereby sustainability pertains the preservation of current well-being involves a problem that is too wide to be included in the same index of a problem such as the estimate of public investment effects. The indicators have to be different, because the problems are different. Relevant indicators to deal with this conception of sustainability are, for instance, the heterogenous combination of *Sustainable Development Indicators (Eurostat, Internet)* provided by Eurostat.

To better understand the sustainability problem, it is necessary to jointly consider various indicators of both groups, because the issue is complex and cannot be summarised to just some index.

Nonetheless, our ambitious goal is to provide a monetary estimate of environmental effect that may integrate the output-perspective.

Since environmental effects do not present a market value, and even the natural resources that are monetary sizable have a market value that can depreciate, the path to be followed is to use imputed "accounting prices" based on some objective physical or economic model of how future damage to the environment will affect well-being *(Stiglitz, 2010, pp. 119-120).*

To carry this out, we identify two possible ways.

The first recalls the methodology characterizing the *Index of Sustainable Economic Welfare* (ISEW) *(Stockhammer, 1996)* and the *Genuine Progress Indicator* (GPI) *(Talberth, 2006).*

These indicators, by focusing on consumption, obtain some evaluations of the costs of water, air, and noise pollution, and also try to account for the depreciation of natural capital and for the costs of environmental degradation (losses in terms of wetlands, farmland and primary forest, as well as depletion of natural resources, CO_2 damage, and decrease of ozone level).

Specifically, *"natural resources depletion is valued by measuring the investment necessary to generate a perpetual equivalent stream of renewable substitutes" (Stiglitz, 2010, p. 105).*

The other approach on which we can rely on to integrate the environmental effects to the output effects, refers to the *System of Environmental Economic Accounting* (SEEA*) (System of Environmental-Economic Accounting, Internet*[63]*).*

The SEEA, currently designed by a committee of experts in the United Nations[64], gathers together environmental and economic information in a common

[63] In https://seea.un.org/

framework to measure the contribution of the environment in the economy and the impact of the economy on the environment *(System of Environmental-Economic Accounting, Internet).*

In particular, there is one of the category of accounts provided by the SEEA that can be used for our purpose.

In such a category, the impact of the economy on the environment is accounted in monetary terms with the aim of adjusting the existing *Standard National Accounts* (SNA) *(UN Statistics Division, Internet[65]).*

Specifically, three sorts of adjustments to SNA are considered: those relating to resource depletion (the overuse of environmental assets as inputs to the production process), those regarding defensive expenditures (expenditures that are needed to face environmental damages), and those concerning to environmental degradation (the value of the drop of resource quality) *(Stiglitz, 2010, pp. 104-107).*

This methodology has a particular interest and suitability for our work because it leads to a final estimate that has the form of GDP, but environmentally-adjusted.

In fact, the results of these adjustments are often called "Green GDP", since the idea is to compute an environmental-adjusted GDP that considers the consumption of natural capital.

Obviously, even these possible solutions are characterized by the set of problems we discussed (such as the controversial assignment of monetary values to some effects considered, and the uncertain forecasting of future scenarios).

However, we believe that these estimates, albeit sometimes questionable, have an outstanding value and their study and application should be extensively improved.

By implication, even the account for the effects stimulated by public investment ought to be guided by this idea.

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[64] The UN Committee of Experts on Environmental-Economic Accounting (UNCEEA), created in 2005.

[65] In https://unstats.un.org/unsd/nationalaccount/sna.asp

3.3 Quality of life and alternative indicators

The production of goods, services and, more in general, every sort of economic activity, should be based on the improvement of the quality of life.

As already outlined *(Santacoloma, 2011, pp. 111-136),* what really matters about development is not the size of production increase, but rather the qualitative dimension of such a development.

In fact, if not directed to improve life-conditions, economic activity turns out to be meaningless.

In this regard, the improvement of life-conditions does not only represent the end of economic policies, but also a responsibility, since public intervention modifies, for better or worse, society and its organization.

Granted, thus, that as outlined by the studies about life-conditions *(Stiglitz, 2010, pp. 67-68),* quality of personal life depends to a large extent on how societies are organized, public intervention and, specifically, public investments, have the responsibility to carry out the modification of society toward an improvement in people's lives.

Needless to say, the output perspective does not lend itself to understand the change in life-conditions, that ought to be analysed by specific indicators.

Whereas with environmental effects the effort of including them into the multiplier effect has been ambitious and complex but still possible, such an operation is not practicable with the indicators of quality of life.

The reason behind this limitation is not that an improvement in quality of life dimensions cannot have an economic value, which actually is evident, as pointed out for example by the observed employment increase due to better quality of life *(Shapiro, 2006)* or the positive repercussions to production due to better health *(Meerding, 2005).*

Instead, the reason why it cannot be accounted jointly with traditional economics spillovers is that quality of life is ontologically multidimensional, with the impossibility to translate many factors into a monetary value.[66]

In fact, quality of life is a broader concept than economic production and standard of living, it is subjective and multidimensional, encompassing positive and negative features of life *(Barcaccia, 2013)*, and including the entire range of factors that influences what we value in leaving, reaching beyond its material and economic side.

We take for granted that the resources and disposable income are an insufficient metric for the quality of life, and many of the underlying factors of human well-being are tied to people's life circumstances, that cannot be expressed as resources with imputable prices.

3.3.1 Subjective dimension and objective features shaping quality of life

The operation of defining and assessing quality of life involves philosophical issues and different theoretical approaches *(Stiglitz, 2010, pp. 68-71)*, that, despite the differences, converge and eventually agree upon some fundamental aspects and findings.

First of all, every reliable research and evaluation ought to consider subjective measures of life-condition as well as objective features, since both undoubtedly contribute to determine the quality of life.

The former is indispensable because only people can provide information on their own subjective preferences, states, and values.

It is thus outstandingly important and useful to detect life satisfaction, that involves cognitive evaluations, positive affects and negative affects, which in

[66] However, we must outline that such an impossibility does not derive from the absence of monetizable effects of life-condition improvement, but rather to the difficulty to carry out such an estimation with a rigorous methodology independent from too evident normative decisions.
Let us think for example to an enlargement of the relationship network, that represents an improvement in quality of life: even though such a change will likely have also several positive effects in the economic field (better probability to find a new job, lower need -with relative costs- for some sort of services, improvement in health…) is extremely difficult, and perhaps even ethically questionable, to estimate in a monetary value the whole changes.

addition to express life assessment, also allows us to understand the relationship between the dimensions of quality of life and the objective factors shaping these dimensions.

To demonstrate that personal satisfaction often differs from income condition, we only need to consider the fact that *"in most developed countries younger and older people report higher evaluation of their life than prime-age people, a pattern that contrasts sharply with levels of income for the same group" (Stiglitz, 2010, p. 66).*

Also noteworthy is the agreed finding whereby unemployment implies a strong negative impact of people's quality of life.

The widespread presence of various negative affects (sadness, despondency, stress) and low life self-assessment in unemployed people points out that *"the costs of unemployment exceed the income-loss suffered by those who lose their jobs, reflecting the existence of non-pecuniary effects among the unemployed and of fears and anxieties generated by unemployment in the rest of society" (Stiglitz, 2010, pp. 66-67).*

In fact, unemployment generates several social costs that are not easy to estimate but whose wide range is unquestionable, leading to rising crime, increasing suicides *(Boseley, 2015),* worsening social dislocation (increased divorce, worsening health and life expectancy), and growing inequalities.

This evidence is extremely pertinent for our work because it highlights a crucial consideration: an increase in public investments that leads to an unemployment decrease, implies an added social and economic value that goes far beyond what the additional employment entails in terms of production and GDP.

Hence, with a drop of unemployment rate, (in addition to traditional output multiplier) we have also to appreciate further extremely important "social" multiplier effects.

With regards to the objective features, we have to identify what the relevant dimensions that shape the quality of life are.

Fortunately, despite the inevitable discordance due to different value judgements, there is a relatively high consensus about the most important features to consider.

Specifically, they are the following:

1. Material standard of leaving

Although having blamed income and wealth as insufficient factors to determine quality of life, they are still outstandingly important elements.

In fact, material standard of leaving directly affects life conditions, but also influences indirectly other features.

Let us think for example of the fact that in many countries only wealthy people can access an adequate healthcare and educational system.

2. Healthcare

Health is a fundamental factor that both determines the length and the quality of people's lives.

Enhancing healthcare leads to reduced social costs and to increased productivity, but also to a direct improvement in citizenship's lives that goes far beyond measurable benefits.

In fact, although it is quite hard to estimate, an investment that improves health system implies further monetary positive spillovers in the economy as well as qualitative improvement in society, that have to be considered.

3. Education

Education is definitely a strategic resource to provide the skills and competences underpinning economic production *(Stiglitz, 2010, p. 71)* (thus determining a concrete economic value) but also it "*matters for quality of life independently of its effects on earning and productivity. Education is strongly associated with people's life evaluations […]. Further, better-educated people tipically have better health status, lower unemployment, more social connections and greater engagement in civic and political life" (Stiglitz, 2010, p. 71).*

Consequently, education not only leads to a whole range of monetary and non-monetary returns to the individual, but also to an immeasurable number of benefits for the society as a whole.

Also noteworthy is that, if this set of monetary and non-monetary social returns is due to an improvement of education occurred on the base of certain public investments, what we have here is the case of effects ascribable to the wider estimate of public investment "multiplier".

4. Personal Activities and Job condition

Quality of life depends on the activities carried out in order to generate income (i.e. job) as well as all the other activities that are not closely directed to such a goal.

In this sense, we refer to the importance of how people spend their time.

It is evident that the quality of paid work and the corresponding working conditions substantially affect quality of life, for instance determining personal satisfaction, health conditions, and repercussions of private life.

Also relevant is the situation and degree characterising domestic activities and unpaid work, commuting time (that should be considered to evaluate the "quality" of paid work) and leisure time (whose quantity and quality is fundamental) *(Stiglitz, 2010, pp. 73-78).*

5. Social Relationships

Needless to say, the quality and the extension of social relationships enormously affects the quality of life.

We need not to remember the philosophical debate about the man as *social animal (Laurenti, 2007)* or scientific studies about the importance of sociability and relational goods in shaping positive feelings *(Becchetti, 2008),* to understand that quality of life is enormously affected by the quality and extension of social relationship.

On the one hand, social connections provide people with a social network that turns out to be a source of several benefits, such as working possibilities, economic and psychological help, physical security.

On the other hand, social connections lead to report higher life-evaluations, regardless of all the other practical advantages.

In addition, as outlined by Robert Putnam studies about *civicness (Putnam, 2000)* and the literature about *Social Capital (Almagisti, 2016),* social relationships shape a "capital" that over the time produce several further positive spillovers which benefit individuals, society, and institutions (for instance, by increasing institutions efficiency).

6. Political Voice and Institutions

Political voice and the presence of liberal and democratic institutions are not marginal elements in shaping quality of life.

In fact, the possibility to participate in political life, to express personal opinions, to dissent with certain public decisions, to denounce injustices, and to have an active role in framing public policies, makes the difference in determining life-evaluation, even in the case in which material well-being is guaranteed.

However, the presence of political voice does not only positively affect citizens and their possibility to influence decisions that directly concern themselves, but also determines positive spillovers with regards to public policies and institutions, leading to a stronger process of *accountability* and political *responsiveness (Almagisti, 2016, pp. 35-45).*

Therefore, consistently with our findings, the size of economic growth is not the only dimension to evaluate, since it is also determinant the *process* of development, that is to say the political and legal framework in which such a development is carried out.

As a consequence, a form of economic growth[67] that is not respectful of political freedoms and human rights presents a substantial difference *(Smith, 2011, pp.112-113)* to the development carried out in a democratic and liberal context.

7. Environmental Conditions

As more widely claimed in paragraph 3.2, environmental conditions have vital importance for several issues, such as economic growth, sustainability, but also quality of life.

In fact, as pointed out in *Mismeasuring our Lives (Stiglitz, 2010),* environmental conditions have an impact in individual life-conditions in various ways:

> *"They affect human health both directly (through air and water pollution, hazardous substances and noise) and indirectly (through climate change, transformations in the carbon and water cycles, biodiversity loss and natural disasters that affect the health of ecosystems). Secondly, people benefit from environmental services, such as access to clean water and recreation areas, and their rights in this field (including rights to access environmental information) have been increasingly recognized. Third, people value environmental amenities or disamenities and these valuations affects their actual choices (e.g. of where to live). Lastly, environmental conditions may lead to climatic variations and natural disasters, such as drought and flooding, which damage both the property and the lives of the affected populations" (Stiglitz, 2010, pp. 81-82).*

Presumably, air pollution is the more evident environmental effect that comes to our mind, and it actually causes 12 million deaths and higher health diseases each year[68] *(Upton, 2016)*, but as the extract outlines, the negative repercussions to quality of life due to environmental reasons have a more impressive extent.

8. Security (both physical and economic)

The people's feelings of safety represent a further feature that contributes to shape quality of life, and, when absent, might completely jeopardize the personal life-evaluations.

[67] Let us think, for example, to the experience of many countries in which economic growth has been developed in a context in which human rights and political freedoms were not ensured.

[68] Such a number of deaths is estimated to increase to 36 millions of dollar in 2060, when the overall direct market impact (in terms of lower worker productivity, higher health spending, and lower crop yields) due to air pollution, could exceed 1% of GDP, or 2,6 billions of dollar each year *(Upton, 2016)*.

In this regard, we consider two different forms of security: physical and economic.

The former is threatened by all the imperil physical integrity factors, such as crime and natural disasters.

Although today's western society is not objectively more dangerous than the past *(Eurostat, Internet[69])*[70], and the opportunities to lead a safe life have been increasing, the importance of security and of "feeling safe" have become enormously more important *(Bauman, 2000)*.

In fact, the extent of the emotional impact of crimes for society goes far beyond the consequences affecting crime victims, and it is thus crucial to also consider, without underestimating, the importance of "perceived" insecurity to determine quality of life.

The latter, which is economic security, pertains the certainty about material conditions that may be threatened by different risks, such as unemployment, illness or senility.

These risks can have negative spillovers in the personal sphere as well as in the work one, leading, for instance, to tensions in family life or lower productivity.

It is easily detectable that the objective features described thus far can often present a correlation (with an improvement in one of them that leads to better conditions also in another one).

Let us think for example of the fact the people with higher disposable income, or who have more education, tend to have a longer life and to suffer less health problems.

[69] In http://ec.europa.eu/eurostat/statistics-explained/index.php/Crime_and_criminal_justice_statistics

[70] In most western countries, the number of crimes has decreased respect to the past.

However, it is fundamental to separately consider these features, bearing in mind that there is not a perfect correlation and that better situations in some aspect necessarily does not imply a higher quality of life.

An interesting example is provided by the fact that conventional economic measures can diverge significantly from non-monetary measures of people‘s health or education *(Stiglitz, 2010, p. 68).*

For instance, even though Italy presents a GDP per capita that is almost 3 time that of Colombia, it has a lower percentage of people with tertiary education (OECD Data, Internet[7172])[73], and although USA has a GDP per capita that is higher than Spain, people from the Iberian country present a life-expectancy at birth that is four years higher *(OECD Data, Internet[74]) (World Bank Data, Internet[75])[76]*.

Once again, empirical experience suggests integrating the output perspective with a wider range of indicators, if we want to acquire a better understanding of reality.

3.3.2 Alternative Indicators

The characteristics of a multidimension object of study such as quality of life do not allow to carry out a direct monetary integration to an output indicator, specifically GDP.

This reasoning also involves the multiplier effect of public investments, that cannot present an accounting of all quality of life aspects jointly with the output effects.

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[71] In https://data.oecd.org/gdp/gross-domestic-product-gdp.htm
[72] In https://data.oecd.org/eduatt/adult-education-level.htm
[73] In 2016, Italian GDP per capita was 38 380 dollars/ capita, while Columbia was characterized by 14012 dollars/capita. Nevertheless, the percentage of people between 25 and 64 years old with tertiary education was 22,2 % in Columbia and 17,7% in Italy *(OECD Data, Internet)*.
[74] In https://data.oecd.org/gdp/gross-domestic-product-gdp.htm
[75] In https://data.worldbank.org/indicator/SP.DYN.LE00.IN
[76] In 2017, USA had a GDP per capita of 59 535 dollars/capita, while in Spain it was 38110 dollars/capita *(OECD Data, Internet)*. However, life expectancy at birth is 83 years in Spain and 79 years in USA *(World Bank Data, Internet)*.

In fact, as claimed with regards to the sustainability problem, such an integration is possible when the non-output effects considered can still be translated into monetary values.

As a consequence, improvement in health and education theoretically may be accounted for, since they can be object of imputations (justified by their evident economic value), but it still remains too ambitious to carry out such an accounting operation with all the features of the quality of life.

The bottom line is thus that to properly understand all the wide range of effects stimulated by public investment, it is indispensable to also rely on other indicators.

Economic and statistic literature have provided several alternative indicators, that share the ambition to make up for the "qualitative" deficiencies ontologically structural to the output-base perspective, such as the *Gross National Happiness* (GNH) *(GPIAtlantic, Internet[77])*, the *Subjective Well-Being* (SWB), the *Human Development Index* (HDI) *(IndiaStudyChannel, Internet[78])*, the *Benessere Equo e Sostenibile* (BES) *(Taralli, 2013)*, and the already cited *Index of Sustainable Economic Welfare* (ISEW) and *Genuine Progress Indicator* (GPI) (paragraph 3.2).

We will briefly explain the main characteristics of HDI and BES, that represent two laudable results of multi-criteria indicators.

The *Human Development Index* is an indicator that is increasingly used in the world with the aim of measuring country's overall achievement in its social and economic dimensions.

Developed by the Pakistani economist Mahbub ul Haq for the United Nations Development Programme (UNDP), the HDI is a composite index of three different measures: standard of living, life expectancy at birth, adult literacy rate (that are measured as a logarithmic function of GDP and adjusted to purchasing power parity).

[77] In http://www.gpiatlantic.org/conference/papers/mcdonald.pdf

[78] In http://www.indiastudychannel.com/resources/141517-New-method-of-calculation-of-Human-Development-Index-HDI.aspx

This index, although it does not consider some important aspects, such as environmental problems and inequality (introduced in the *Inequality-adjusted Human Development Index*), it is relevant as an effective integration of education and health to material standard of living.

Another significant alternative indicator is the BES, developed by Italian Institutions (ISTAT and CNEL) with the goal of evaluating society progress, through measures of social development, environmental sustainability, and inequality, accompanied to economic progress.

This index, unlike the HDI and other mentioned indicators, presents a wider extent of the features considered, providing a more complete analysis of "qualitative" development.

In fact, it is determined by 12 dimensions and corresponding indicators, specifically: health, education, work and life-times conciliation, economic well-being, social connections, politics and institutions, security, subjective well-being, landscape and cultural heritage, environment, research and development, quality of services *(Istat, 2017).*

Unfortunately, the BES (unlike the HDI) does not have an international diffusion and it is almost mainly just used in Italy, which makes it quite impossible to carry out useful comparisons between different countries and economic contexts.

However, in a world where it has become apparent that economic growth is not synonym of improvement in people's life, the use and diffusion of these kind of indicators should be extensively encouraged and developed.

Conclusions

The issues that have been addressed throughout this thesis pertain several aspects of public investment output-multiplier and of its limitations, providing an heterogenous set of conclusions which eventually share a specific purpose.

In fact, they all contribute to prove one of the first premises of this work: analysing the multiplier effect of public investments with a merely output-based approach turns out to be restrictive and does not enable the understanding of several fundamental dimensions.

Thus, in this concluding section, a selection of salient findings will be summed up and some final considerations will be provided**.**

The comparison between the different type of multipliers have shown that, theoretically, the public investment multiplier tends to be the more substantial and effective one than the others, raising output both in the short term (because of demand effects) and long term (as a result of supply effects).

The multiplier's value is the result of several key factors, such as: the investment efficiency, the macroeconomic scenario, the type of funding, and the possible occurrence of crowding-out and crowding in effects.

In general, the current estimates of the multiplier effect are positive and higher than 1, due to many reasons, such as the current monetary policy scenario, the economic slack, and the need for public investments, which make public investment a strategic countercyclical tool and a potential catalyst for economic recoveries.

Nevertheless, also noteworthy is the finding whereby traditional models assessing the welfare effects fiscal policies are misleading because they ignore GDP composition, and, consistently, welfare effects of public investments are not always correlated with output effects.

However, certain investments, more than others, are characterized by a positive impact on economy and society.

It is the case of the investments in education, healthcare and R&D, which can lead to a robust growth with high output multipliers, increase social mobility and reduce inequality, but also present a social value that goes beyond the strictly-economic perspective.

Then, the analysis of the limitations of GDP have led to the raise of specific considerations about how to provide a wider conception of multiplier.

In fact, since GDP does not lend itself to express some relevant information and does not account for the costs that community has to pay in terms of environmental damages, a wider approach is needed.

On the one hand, the multiplier effect should account for all those further effects that can be expressed in a reliable monetary variable.

This is possible with many environmental effects and with many positive repercussions of education and healthcare investments, which may integrate the output-perspective.

$$"Wider\ "Multiplier = Output\ multiplier + environmental\ effects + further\ effects\ of\ education\ and\ healthcare$$

On the other hand, the multiplier effect should also be considered jointly with a separate set of indicators, which may provide a better understanding of the qualitative dimensions regarding the effects generated by public investments.

The bottom line is thus that, if we want to acquire a more faithful image of reality, the way to follow is the integrated analysis of all those relevant aspects in shaping a sustainable economic development and in improving people's lives.

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