Innovation Investment and Economic Recovery

A Green Paper for Successful Economic Policies

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Expectations

The world has not yet emerged from the consequences of the economic crisis of 2008. But it seems clear that the crisis today has affected different countries and regions more than others, and this led to substantial changes in the relative positions of economic strength of countries and regions. While emerging countries are continuing to catch-up with the Triad, some observable differences are also affecting the economic growth patterns of the United States, Europe and Japan. The United States has so far more successfully managed to grow through innovations in a variety of key areas (from ICTs to bio-tech). Europe and Japan are rather lagging behind this performance of the US, and this is visible in a range of economic indicators. Our verdict, and argued as such in this report, is that **European countries are not capitalizing fully on their competences and capabilities for economic recovery**.

What to do, to design the right policies, is to identify the right questions, to compile the available evidence and benchmark countries and regional performance.

There are many voices among economists, the policy community and businesses leaders, that proclaim that austerity measures deepened, rather than alleviated, the impact of the economic crisis, and that a new path should be trotted (Blanchard, 2016). Many authoritative economic commentators have openly declared that a new recovery in Europe will need more investment (IMF, 2014, chapter 3).

But investment is a rather general economic category and a strategy for economic recovery should qualify it. Firstly, should new investments be driven mainly by the business sector, with governments focusing on wider framework condition, or, should governments play a more direct role and directly promote their own projects? Secondly, if the latter, what should these projects be? And is there any difference between investment across industries, regions and technologies?

This green paper serves as a vehicle to invite opinions, discuss evidence and data in order to help identify policy instruments and inform policy development. We aim to gather suggestions from a variety of voices, ranging from policy makers, business analysts, businessmen and academe. We invite comments on three main themes associated to the potential of innovative investment to generate a sustained economic recovery:

1) What is going on? Are we experiencing a technological revolution or are we entering into a secular stagnation?

2) What is being done and is it successful (enough)? Are the current economic policies implemented in Europe, including the Junker Plan, effective instrument to combat the economic slump?

3) What should be done differently or additionally? Where should we invest? Is investment in infrastructure less effective than investment in science and innovation?

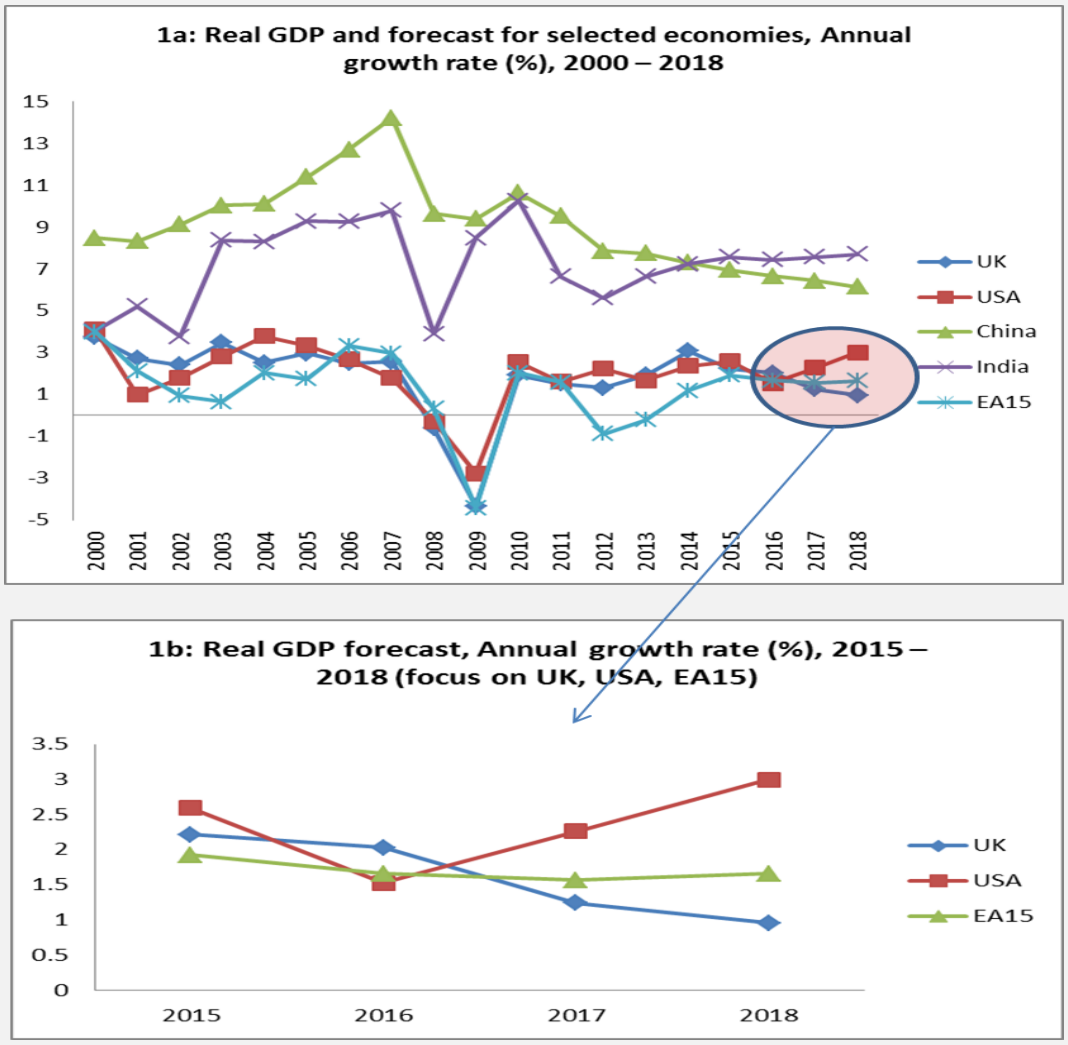
But before to do that, we will in the next section report and discuss some few basic data.

Background: The fall of public and private investment since the beginning of the economic crisis in Europe

The 2008 economic crisis has been most dramatic for European countries because here the negative impact on economic growth has lasted longest. Following on from the crisis, most of the member countries of the European Union went into a double dip recession while other countries, including the US and the UK, did not. In this section we take into account the following: i) changes and forecasts in GDP growth rates; ii) changes and forecasts in aggregated investment; iii) changes in investment by sector – public vs private sector; iv) changes in the resources devoted to Research and Development (R&D).

In Figure 1 we start by reporting *annual growth rates in real GDP* for selected economies and the European region.

Figure 1 - Real GDP and forecast for selected economies, annual growth rate (%)



Source: OECD statistics (https://data.oecd.org/gdp/investment-forecast.htm). EA15 refers to the 15 countries in the euro area that are members of the OECD.

The differences in the path of recovery between the Eurozone and the UK, compared to the US, are startling by looking at the forecast up to 2018 (figure 1a), which shows a significant recovery taking place in the US, a very moderate growth in the Eurozone (here represented by the 15 members of the Euro that are also members of the OECD, EA15) and a steady fall in the UK. In addition, many European countries have high rates of unemployment, problems with the sustainability of national public debts, and, more recently, also fresh warnings in the banking systems; while, a return to robust demand momentum has not taken hold.

Figure 2 - Investment (GFCF) and forecasts, Annual growth rate (%), 2000 – 2018

Figure 2.a Investment (GFCF), Annual growth rate (%), 2000-2015

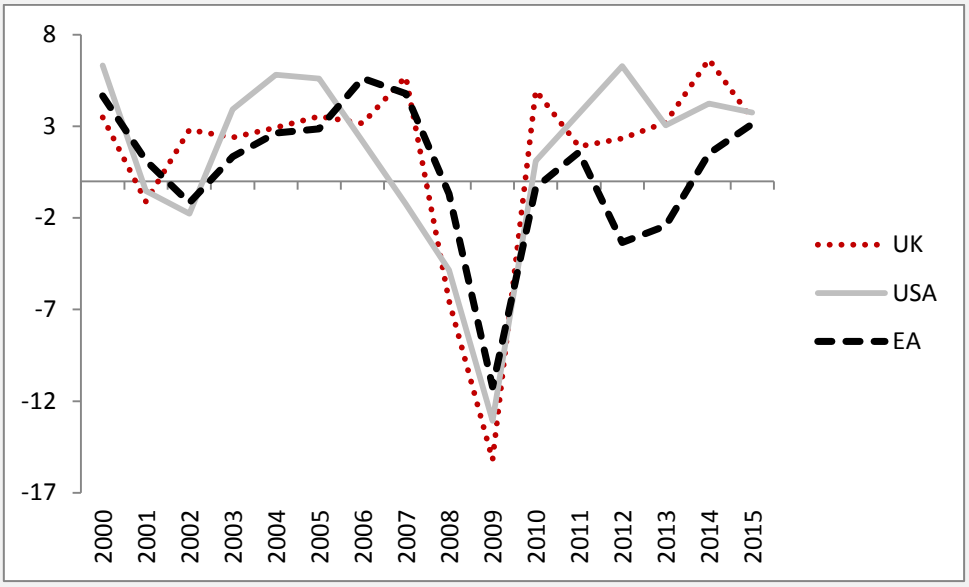
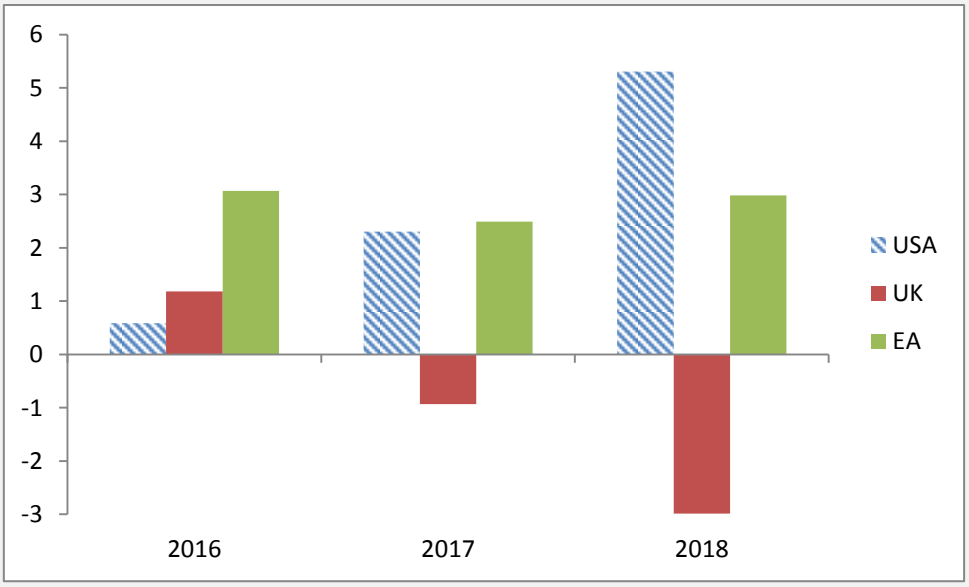


Figure 2.b Investment (GFCF) forecast, Annual growth rate (%), 2016 – 2018



Source: OECD statistics (https://data.oecd.org/gdp/investment-forecast.htm). EA15 refers to the 15 countries in the euro area that are members of the OECD.

In the long term, fixed investment grows in a steady and predictable way along with GDP. This would suggest that investment would have picked up after Europe reached the bottom of the crisis. A study carried out by the European Commission (2013) shows that this stable long-term relationship between investment and economic activity broke down in 2008 (see also EIB, 2016 and ECB, 2016). Figure 2a shows a huge drop in annual growth rate of the gross fixed capital formation in the years 2008-2009, followed by another slump in the case of the Eurozone, a moderate double dip for the US and a more recent drop also in the UK. In both the Eurozone and the UK, the rate of growth of investment is significantly below the year before the crisis (2007). By looking at the forecast (Figure 2b), the landscape is particularly gloomy for the UK where investments are expected to be reduced, while one can observe a moderate recovery for the Eurozone although not comparable to the more dynamic rebound of the US.

In Figure 3 we disaggregate by *private and public investments*, both of which fell in the years following the financial and sovereign debt crisis.

Private investment dropped 1 ½ percentage points from 13 % of GDP to 11.5 % of GDP in 2008 (Figure 3.a). This is followed by a modest recovery back to 12% in the latest figures - 2015. The change of private investment is indicative of the struggle of private businesses to seek, identify and seize opportunities for growth, despite borrowing rates close to zero for several years now.

After being stable at around 3% of GDP for more than a decade, public investment in the euro area started to increase in 2005, reaching 3.7% of GDP in 2009 (see Figure 3b). After 2009 public investment fell to a ratio of just below the pre-crisis average of 3% of GDP. This drop in public investment is linked to the fiscal adjustment programmes undertaken in several countries in the Euro area (Bosch 2013, Truger and Paetz 2013; Wren-Lewis, 2015)

The part of investment that is a major concern for Europe's growth potential is *investment in innovation*. There is plenty of evidence that the private sector cut innovation expenditures during the crisis (Archibugi et al., 2013; Archibugi and Filippetti, 2011). But also the public sector has reacted to the crisis in a so-called pro-cyclically way and total expenditure on public R&D has declined in many European countries (Makkonen, 2013). If protracted over time, a reduction in investment, both fixed capital investment and R&D investment, will have long-term negative effects on economic growth and productivity. Table 1 reports the percentage of total gross domestic expenditure on R&D by source of funds.

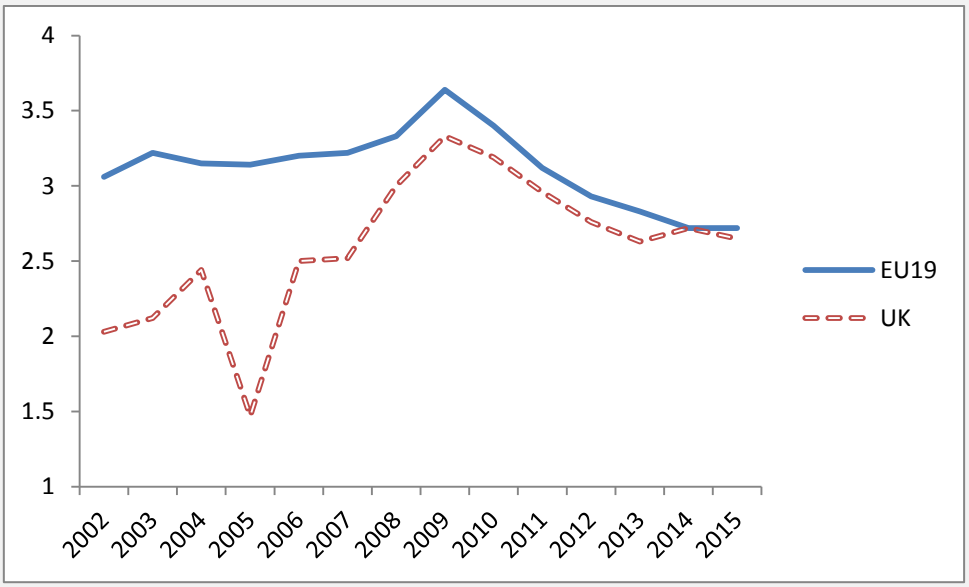
Table 1 shows that from 2003 the relative share of private funded R&D has increased in the Euro area, the United Kingdom and the Unites States. Remarkably, the share of government funded R&D has decreased.

A final point, not visible in the figures and table we selected above, is that there is evidence that these patterns are stronger in the European peripheries. A clear trend emerges, in which the disparities between the stronger core countries of Europe and those in the periphery widen potentially as a result of different rates in investment overall and in particular in innovation and R&D both in the public and in the business sector (Archibugi and Filippetti 2011; Izsak and Radošević, 2016). This is jeopardizing economic convergence across Europe, and ultimately putting cohesion at risk.

Figure 3 Investment, Percentage of GDP, by sector, 2002-2015

Figure 3a - Investment by the business sector, 2002-2015, (% GDP)

Figure 3b - Investment of the government sector, 2002-2015, (% GDP)



Source: Eurostat statistics 2016 (http://ec.europa.eu/eurostat/web/products-datasets/-/tec00011). EU19 includes European countries of the Euro.

This evidence points to the following:

a) The decline in economic growth is severe in Europe not only in comparison to emerging countries, but also to the United States.

b) At the same time the investment needed for growth is lacking and neither the private or public sector is providing it. This leads to wonder if any next recovery could actually occur without a substantial rise in investment.

c) ***The fact that government expenditure on R&D turned out pro-cyclically (with a relative decline as economies contracted) did not help any return to long-term economic growth.***
d) ***There are substantial and increasing asymmetries across European countries, with peripheral countries worse affected, and such differences are putting cohesion in Europe at risk.***

On the ground of these facts we can discuss the issues we raised above.

Table 1 – Gross domestic expenditure on R & D by source of funds, 2003–2014, (% of total gross expenditure on R & D)

	Business enterprise sector			
	2003	*2008*	*2013*	*2014*
Euro area (19 countries)	55.6	56.3	56.6	56.9
United Kingdom	42.2	45.4	46.2	48.0
United States	63.3	63.5	60.9	61.0
	Government sector			
	2003	*2008*	*2013*	*2014*
Euro area (19 countries)	36.7	34.6	33.3	32.9
United Kingdom	31.7	30.7	29.1	28.4
United States	30.7	30.4	27.7	27.6

Source: Eurostat statistics 2016 - R & D expenditure (http://ec.europa.eu/eurostat/statistics-explained/index.php/R_%26_D_expenditure). Data for 2014 for USA our own estimation based on National Science Foundation data.

Topic #1: Is the engine of creative destruction grinding to a halt? Technological revolution or secular stagnation?

Since Schumpeter's writings, we are well aware that innovation is a main driver of fluctuations in income. **What are the mechanisms that link innovation and growth in the current economic situation?** There are, at least, three different views about the role that technological change could, and would, play to foster future economic growth. 1) The first is the view of the pessimists about what can be delivered by technological advance, who argue that the world is experiencing a drought in technological opportunities, that hampers innovation activities and stifles economic growth. 2) The second is the camp of those that argue that technological solutions are ready and available, but that, so far these have been not properly used. The actual problem of economic recovery is therefore not generating new technological opportunities, but rather finding radically different ways of exploiting existing opportunities in the social and economic spheres. 3) The third, call it the view of the optimists about scientific and technological progress, claims that an economic recovery should be driven by a new wave of innovations that build on new technological opportunities if they are properly unlocked.

1) The first view is a revival of the old secular stagnation hypothesis of Alvin Hansen and others and today supported by Larry Summers (2013) and Robert Gordon (2016). According to Summers, the industrialized world suffers from an imbalance resulting from an increased propensity to save and a

decreased propensity to invest. Excessive saving acts as a drag on demand, reducing growth and inflation. This imbalance between savings and investment pulls down real interest rates. Where significant growth is achieved—as in the United States between 2003 and 2007—it comes from dangerous levels of borrowing that translates excess savings into unsustainable levels or types of investment. According to this view, recent technological change has had an adverse impact on investment in certain sectors. As Summers explains "think about Airbnb's impact on hotel construction, Uber's impact on automobile demand, Amazon's impact on the construction of malls, or the more general impact of information technology on the demand for copiers, printers, and office space. And in a period of rapid technological change, it can make sense to defer investment lest new technology soon make the old obsolete".

In *The Rise and Fall of American Growth*, Robert Gordon (2016) argues that the IT revolution is a minor diversion compared with the inventions that occurred during second industrial revolution—electricity, motor cars and aeroplanes—that changed lives profoundly. He suggests that the IT revolution is altering a narrower range of activities. This view is shared by Tyler Cowen (2011) who argues that in the early 20th century there were many "low hanging fruits" for the world economy to collect, such as antibiotics, electricity-powered factories, radio, TV, planes and automobiles. But these have all been exploited. As we run out of low hanging fruits, we run out of technological opportunities and growth slows down. In brief, according to the pessimists "the creative destruction described by Joseph Schumpeter is kaput" (The Economist, 2016).

2) A second view is more likely to see the economic slowdown as a consequence of slow or under-use of current technological opportunities. A different use of the already available technologies in the economic and social fabric is all that is required to increase employment, income and well-being (Lundvall, 2016).

3) According to a third and more optimistic view, the fundamental mechanism of creative destruction described by Schumpeter and his followers are in principle working. Resources, and notably public resources, should be employed to unleash the power of the existing technological opportunities. This view makes the assumption that technological opportunities are there, that they can guarantee new jobs, new prospects and growth, provided the economic and social systems allow for their exploitation and diffusion (Perez, 2010; Archibugi, 2016). What is needed to achieve long-term economic recovery, therefore, is to invest more in the related sciences and the technologies in order to offer to the business sector more near market solutions that can be turned into a new generation of products and processes.

To support any of the three views requires an understanding of what is a genuine technological revolution. In the early 1980s, Freeman (1984) identified five criteria aimed at identifying the emerging technologies with the greatest potential for impact. The criteria he introduced to assess the potential of a specific technology are the following:

- drastically reduce the costs of many products and services
- dramatically improve the technical characteristics of many products and processes
- have a pervasive effects that penetrates through different sectors and industries, i.e. the potential to become what is now labelled a general purpose technologies
- be socially, politically and environmentally acceptable

In our view, these five criteria still provide useful guidelines that can help identify which technologies can have a revolutionary economic and social impact.

We invite academic colleagues, policy-analysts and the business community to:

- *Express their views on the suitability and completeness to identify technological revolutions of the criteria above;*
- *Suggest ways to measure these and other relevant criteria and their variations over time and across countries and industries.*

Business analysts invest much time in exploring market and technological opportunities. Their view is different from those of public policy analysts. Business analysts are more likely to focus on how technological opportunities can open up new markets and generate new products, processes or services. A highly detailed attempt to identify new and valuable technological opportunities was published by the McKinsey Global Institute (Manyika et al., 2013). The McKinsey report sets out to identify the key technologies that are expected to have a major impact by 2025. The top technologies identified are all in the ICT area. The top four, *mobile Internet*, *automation of knowledge work*, *Internet of things* and *cloud technology* all belong directly to the ICT cluster. The next two, *advanced robotics* and *autonomous vehicles*, only seemingly belong to the machinery and transport industries yet the core innovative component is their software. The next six emerging technologies are predicted to have a lower economic impact, but are also associated to a broader knowledge base. These predictions are certainly not surprising since they are based on what is already visible. An important argument put forward by those in the group of optimists is that new technological opportunities emerge much quicker than predicted by forecasting (Archibugi, 2016). *What are the other relevant foresights that should be considered for science and technology policy?*

We should also pay attention to the fact that the business opportunities foreseen by the business community do not necessarily correspond also to the areas where there are new relevant scientific developments. Not necessarily is there a correspondence between the scientific content of an innovation on the one hand and the economic impact on the other hand. And even less is there a correspondence between the social goals pursued by governments and economic growth. There can be differences between public aims and policies and business strategies, as the case of climate change shows.

These views discussed in this section raise some important questions about the right economic policies for economic recovery:

1) ***Did the crisis come about because the potential of a current techno-economic paradigm has exhausted?***
2) ***Which technologies and associated market opportunities will lead on the path of economic recovery?***
3) ***Which innovations will drive the new economic recovery? To what extent will they be based on social, organizational or technological components?***
4) ***How to overcome differences between public policies priorities in science and technology and business strategies?***
5) ***Do we have appropriate indicators to measure the economic potential and impact of the new technological opportunities in a changing context?***

Topic #2: Junker Plan or Horizon 2020? How do we encourage investment in Europe?

We observed in the background section of this report that the economic crisis has brought about a sharp drop in investment across Europe. That drop extends to investments in infrastructure and in science and innovation. The European Union has decided to tackle this investment gap by launching the Infrastructure Investment Plan (the Juncker Plan) and by creating the European Fund for Strategic Investments (EFSI) in partnership with the European Investment Bank (EIB) with a higher risk-taking capacity in order to mobilise at least EUR 315 billion additional finance for investment over three years.[1]

The Juncker Plan has been criticised on two grounds. Specifically, some have questioned the "additionality" issue of investments activated through the fund. A preliminary study by Bruegel (Clayes and Leandro, 2016) claims that most of the projects financed are not additional, that is, they would have been funded all the same. If this is so, the Plan is not fulfilling its main aim, i.e. addressing failure in business sector investment.

The second critical remark argues that the **Junker Plan is only a modest, second best**. The optimal choice would have been that of setting in motion a **massive European public investment plan** either through the European Investment Bank, through the member states (with, for instance, the help of an improved investment clause to exempt public investment from fiscal rules), through a reoriented European Stability Mechanism, or through another institution created for the occasion (Quadrio Curzio, 2014). This argument has gained ground. The International Monetary Fund (IMF), among others, has called for the need of a big push in public investment for recovery (IMF, 2014). Particularly in the current economic landscape of close-to-zero interest rates, IMF argues that "debt-financed projects could have large output effects without increasing the debt-to-GDP ratio, if clearly identified infrastructure needs are met through efficient investment". The German trade union confederation DGB has proposed ''A Marshall Plan for Europe", envisaging a public investment plan of the magnitude of 2 % of Europe's GDP per year over 10 years. The scope for a European industrial policy has been also recently advocated (Pianta and Zanfei, 2016).[2]

Also in the light of the recent request by the EIB to extend the Junker Plan to 2020 with additional resources, some key questions should be raised:

1) ***Is the Junker Plan an effective tool and does it counteract low investment in the private sector?***
2) ***Does Europe need additional resources through debt, and, where should those go?***
3) ***Does Europe need a new golden rule for investments?***

[1] See here: http://www.eib.org/efsi/; and here: https://ec.europa.eu/priorities/jobs-growth-and-investment/investment-plan_en.

[2] For a discussion on "Which Industrial Policy Does Europe Need?", see http://archive.intereconomics.eu/year/2015/3/which-industrial-policy-does-europe-need/

Topic #3: The role of public policy for investment recovering in Europe: is it time for an infrastructure push or a science & research push?

The current economic climate in Europe is characterized by a slow recovery, low demand and inflation. This is despite prolonged accommodative monetary policies. Real interest rates are at an historical low and are expected to remain lower than the pre-crisis levels for the foreseeable future. In this economic landscape, many have wondered: **is this a good time to increase public infrastructure investment?** A study from the IMF (2014, in particular chapter 3) demonstrates the positive impact on economic growth of a fiscal stimulus driven by investment in infrastructures. The observations in the IMF report can be summarized as follows:

- The stock of public capital (a proxy for infrastructure capital) as a share of output has declined significantly over the past three decades across advanced, emerging, and developing economies.
- Increased public investment raises output, both in the short-term, because of demand effects, and in the long-term, as a result of supply effects.
- For economies with clearly identified infrastructure needs and efficient public investment processes, and when there is economic slack and monetary accommodation, there is a strong case for increasing public infrastructure investment.

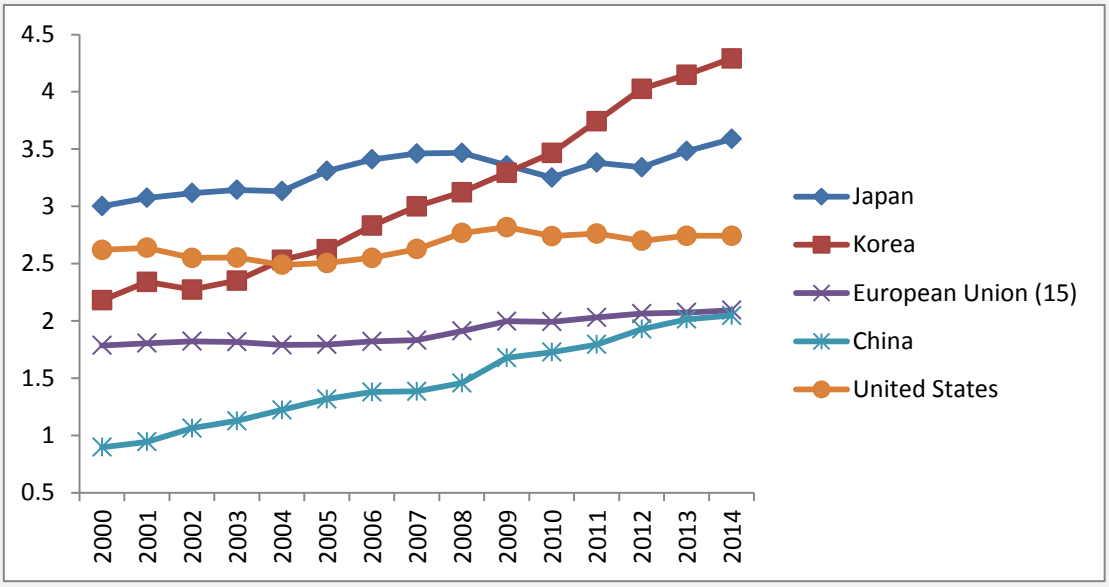
A fiscal stimulus by means of public investment directed towards funding infrastructure projects is the quintessential *Keynesian* response to a major recession with a lack of demand from the private sector.

While public investment in infrastructure projects can certainly contribute to recovery, it has been argued that investments directed to the opening up of new scientific and technological opportunities has greater effects. State-led, public investment policies have, in the past, demonstrated to be a key generator of major technological breakthroughs, that unlock their value once they encourage and attract future private businesses. This is the case of the ICT sector, and, more recently, the case of green technologies (Mazzucato, 2013; Tylecote, 2015).

But there is also a specific need in the European Union to raise the investment in science, technology and innovation. While scientific and technological developments applied to industrial production have been one of the distinctive factors of European industrialization (Landes, 1969), Europe has been, firstly surpassed by the United States, then by Japan and South Korea, and now may find herself in a race for new scientific and technological solutions also with China and other emerging economies. A simple look at the gross domestic spending on R&D/GDP shows it (see Figures 4).

Figure 4 could justify a **boost in public R&D expenditure in Europe** in order to reduce the technology gap with the United States and Japan and to prevent to be bypassed by China and other emerging economies. A substantial increase in R&D was already indicated in the year 2000 as one of the priorities of the European Union with the Lisbon strategy, and confirmed at the Barcelona European Summit in 2002. As well documented, not much has been done in order to approach the ambitious goals indicated then. In light of the economic crisis that is still dominating the European economy, it seems that a major boost in R&D is also a viable strategy to foster economic recovery.

Figure 4 - Gross domestic expenditure on R&D, 2000–2014, GERD as a percentage of GDP



Source: OECD Main Science and Technology Indicators statistics.

An example of counter-cyclical public spending in research is the American Recovery & Reinvestment Act of 2009 (ARRA) put in place in the United States. The recent ARRA legislation provides an unprecedented level of funding ($8.2 billion in extramural funding) to the National Institutes of Health (NIH) to help stimulate the US economy through the support and advancement of scientific research.[3] The aim of this program was explicitly that of creating new jobs and spurring investment in the long-term. According to a report from the Executive Office of the President Council of Advisers[4] the Recovery Act saved or created about 6 million job-years, where a job-year is defined as one full-time job for one year. In addition, the Recovery Act alone raised the level of GDP by between 2 and 3 per cent from late 2009 through mid-2011. Finally, the return on investments in the Recovery Act is expected to elevate the productivity of the American economy long after the direct spending, thanks to projects initiated in areas such as transportation, high-speed rail, transformative energy technologies and renewable energy technologies, health information technology, and broadband infrastructure.

For policy makers to consider are the following differences between the two options of a) investing in infrastructure and b) providing funding for research. First of all, there is a different timing of the multiplier effect. An increase in public infrastructure investment affects output both in the short-term, by boosting aggregate demand through the fiscal multiplier and potentially crowding in private investment, and in the long-term, by expanding the productive capacity of the economy with a higher infrastructure stock. By contrast, investment in research tends to exert its positive effects mostly in the long-term.

Secondly, investment in infrastructure and research also differ in terms of their multiplying impact. The IMF report included estimates that 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

[3] Note that Horizon 2020 in 2014 is 9 billion of Euro.
[4] The Report can be found here: https://www.whitehouse.gov/sites/default/files/docs/cea_arra_report.pdf.

percent four years after. Further, it shows a relevant effect of crowding-in of private investment. Estimating the impact of public investment in research on economic growth and job creation requires macro models of a kind that is unfortunately quite scarce. The available evidence shows that social returns from public R&D varies according to the capacity of countries to reap the benefits from research, and that social returns seem to be higher than private return (David et al., 2000). A recent simulation in Europe estimates a remarkable multiplier effect on GDP growth and jobs, but these positive effects will only be reached in the long-term (Veugelers, 2016). Historical accounts of the role of publicly-funded research have shown that this type of policy brings about major technological change both directly and indirectly. Directly, by encouraging crowding in of public investment in research (Mazzucato, 2013). Indirectly, through processes such as serendipity where casual scientific discoveries have led to the introduction of radically new technologies (Gillies, 2015).

Thirdly, another major difference between putting public money towards infrastructure projects or initiatives funding research is that of choosing the project to be funded. In the case of infrastructure projects this seems to be more straightforward with established criteria for choosing the project, such as increasing mobility among urban centres, obsolescence of the infrastructures, improving the capacity of public services (school, hospitals) in growing areas. In all these cases uncertainty and failure play a moderate role. In the case of publicly funded research, one has to consider that investing at the frontier of research encompasses fundamental uncertainties which come with high possibilities of failure. However, reducing uncertainty encourages the crowding in of private firms.

Fourthly, any investment in research (even when the project ultimately fails to deliver) brings about an increase in human capital, not comparable with investments in infrastructure projects, which is a major driver of long-term economic growth.

Finally, there are substantial spillover effects when the new knowledge produced through the research activity increases the social pool of freely available knowledge which can be used for further technological improvements.

This raises the following key questions:

1. ***What type of publicly funded investment is more appropriate in the current economic landscape?***
2. ***Do we need a European public infrastructure push or a public research push for recovery?***
3. ***Which innovation policies can make the biggest contribution to economic recovery?***
4. ***What specific innovation initiatives oriented towards business are most useful: e.g. Small Business Research Initiatives, R&D Tax Credits, Knowledge Partnerships and Networks?***

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