A GREEN NEW DEAL IN EUROPE: TOWARDS A NEW GROWTH MODEL

The global financial crisis required a substantial involvement of governments, first to rescue banks and second to boost depressed economies. Consequently, government debt and deficits surged. In striking contrast with the rest of advanced economies, higher deficits and debts in the euro area fed a sovereign-debt crisis. The necessary involvement of European governments, while still needed, was abruptly cut off, and austerity measures were instead adopted. They were finally followed by the US government, under an amazing fear of "hellenization" (Krugman, 2013).

In the past, fiscal austerity tended to be associated with large cuts to public investment[1]. The downward trend in public investment came at the cost of deteriorating public infrastructure and was at odds with the Lisbon agenda of "creating the most innovative area in the world" by 2010.

The decrease in public investment urged a debate about fiscal rules: the fiscal deficit limit at 3% of GDP which was included in the Stability and Growth Pact in 1997 made it possible to sacrifice public investment and meanwhile to maintain parts of current spending in order to match the deficit ratio. This policy did not question the adequacy, relevance and effectiveness of public spending, but rather endorsed an understanding of fiscal policy from the sole viewpoint of accounting.

Some economists like Blanchard & Giavazzi (2003), Fitoussi & Creel (2002), and Cacheux (2002) promoted a different view of fiscal policy, without giving up the requirement of adopting a fiscal rule in the EU. They proposed the adoption of a "golden rule of public finance" in the EU. According to this rule, government borrowing should not exceed net government capital formation over the cycle; hence, current expenditures would have to be financed out of current receipts.

The theoretical rationale for excluding net public capital expenditures from the public deficit target is usually linked with the requirement of spreading the costs of public capital formation over the years during which they will be used. An additional advantage with this rule should be noted. With European countries aiming at achieving the Lisbon agenda (in the past) or Europe 2020 (currently), there should be scope to improve infrastructure and human capital for which *public* capital (considered quite widely and loosely) is crucial. An important goal of expanding investment is to boost potential and actual output[2]. Nevertheless, promoting output in a purely quantitative sense is not the only rationale for undertaking public investment. Rather there are important qualitative concerns. Public investment provides public goods like transport infrastructures which

1. Balassone and Franco (2000) documented the path of fiscal restraint before adopting the euro in the late 1990s and showed a decrease in public investment. See also EC (2003) and notably, table III.3 which shows that fiscal consolidation induced by high debt levels and the need to satisfy the Maastricht criteria coincided with relatively large cuts in public investment.

2. The seminal contribution to the debate on "productive public capital" is Aschauer (1989). Bom & Lighthart (2009) made a meta-analysis on this topic and conclude that the output elasticity of public capital spending is positive.

benefit users and directly or indirectly improve total factor productivity. Public investment may also improve the educational attainment in the population – as well as supporting the protection of the environment and a more equitable distribution of income and wealth[3].

Balassone & Franco (2000), then Buti *et al.* (2003), raised criticisms against the golden rule of public finance. First, they argued that a rule of this kind would drive up public debt[4]. Second, they argued that the ability of excluding public investment from the deficit target would bias the cost/benefit analysis of public projects, at the expense of costs[5]. Third, they argued that a "golden rule", promoting public investment, would result in a bias in favor of physical assets, at the expense of health and education expenditures. Indeed, the definition of "public investment" in national account statistics includes transactions that lead to changes in the stock of physical capital (like the construction of infrastructures or the purchase of computer hardware), but excludes large amounts of expenditures related to the accumulation of human capital, like training or R&D[6].

The Stability and Growth Pact underwent two reforms, one in 2005 and the latest in 2011, and none endorsed the "golden rule of public finance". However, this is certainly not the time for a new package of reforms. We do not advocate the adoption of a golden rule in the near future.

However, one can be puzzled by the recent evolution of net public investment in the euro area (see Figure 40). Though the decrease has been substantially higher in the US economy than in the euro area, the gradual drop in net public investment since 2002, that accelerated in 2008 at the very moment euro area member states implemented expansionary fiscal impulses, is striking. Despite the relative decrease in potential output after the global financial crisis, it turns out that the drop in net public investment has been faster.

The change in net public investment is quite at odds with the requirement of a "golden rule". As Figure 41 shows, most OECD countries decided to implement a restrictive fiscal stance (the structural primary balance rose substantially in proportion to potential output), but in so doing they did not maintain net public investment at its pre-crisis (already-reduced) level. On the contrary, the clear correlation shows that net public investment reduction has been used as a major engine for fiscal austerity.

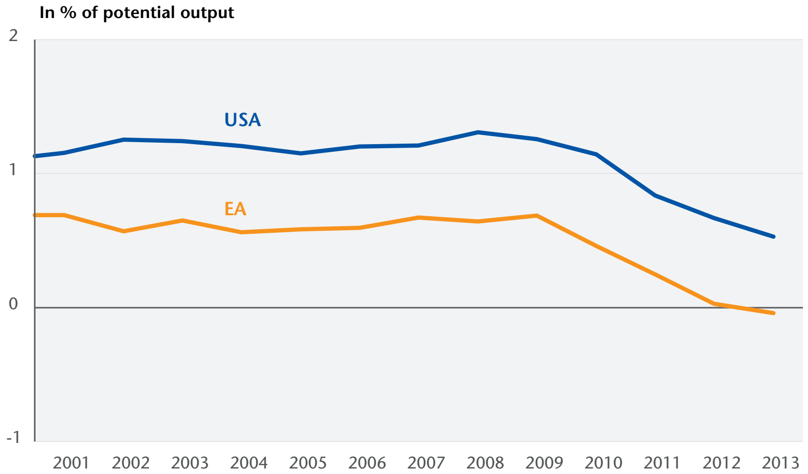
3. See Melonio & Timbeau (2006), Allegre *et al.* (2012) on public spending in education.

4. However, an endogenous limit to the increase in public investment does exist: with higher debt producing high interest payments, and with interest payments accounted as current spending, governments face the requirement to raise tax receipts if public investment increases (Creel, 2003). Under the assumption that an upper limit exists for compulsory levies (Blanchard, 1990), governments will then face an upper limit for spending on public investment. The contribution of public investment to the debt-to-GDP ratio will face a limit.

5. Provided that governments internalize the existence of an upper-limit on public investment (see previous footnote), they face the incentive to implement the most appropriate projects (Creel, 2003). Rational governments should not deviate from an unbiased cost-benefit analysis.

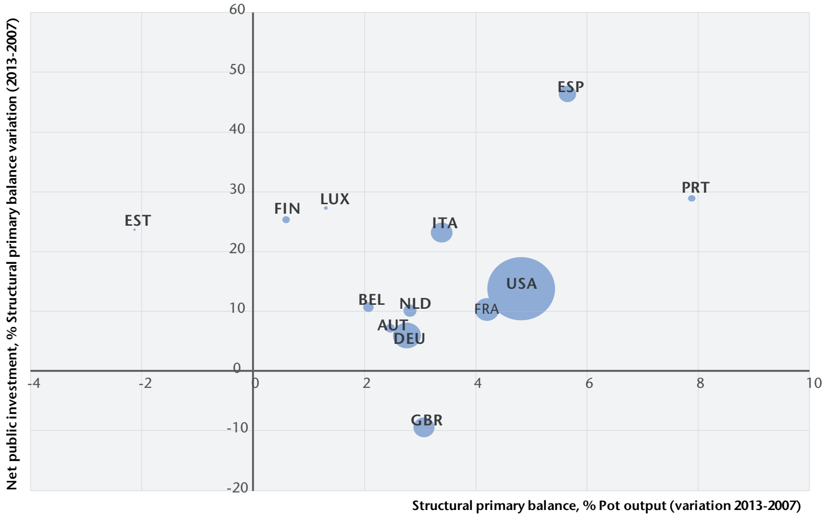
6. Le Cacheux (2002) and Blanchard and Giavazzi (2003) argued that a change in accounting rules was necessary, in order to complement the « golden rule » with a rule defining what type of public spending can be counted as « public investment ». Until now, the distinction between current and investment expenditures has essentially been conventional.

Figure 40. Net public investment



Source: OECD.

Figure 41. Combination of discretionary fiscal stance and net public investment



Sources: OECD, OFCE-IMK-ECLM computations.

The change in net public investment in the euro area is also at odds with the economic, environmental and social ambitions of Europe 2020. At least since the beginning of the global financial crisis, a need has opened up for the EU to catch up on sacrificed public capital expenditures if the objectives of Europe 2020 are to be considered still on the agenda.

Since the onset of the financial and economic crises, the drop in European public investments has amounted to 2% of GDP, or around €240 billion. In the present chapter, we propose an estimate of the investments necessary to fulfill the environment- and energy-related objectives of the Europe 2020 agenda, notably to target transport infrastructure, energy renovation of residential and tertiary buildings, expansion of renewable energy supply capacity, and improvements to the electrical grid.

These investments, which are not currently planned nor budgeted, are summarized in Table 19. Until 2020, they would total an average of €194 billion annually for the entire European Union, or 1.5% of the GDP of the EU27, and €133 billion for the euro area – 1.4% of EA17's GDP.

Table 19. Average annual investments for a Green New Deal in Europe (billion euros. 2013-2020)

	Transport	Energy renovation	Renewable energy	Electrical network	Total investment	% of 2012 GDP
AUT	1.81	1.79	0.64	0.11	4.35	1.4
BEL	1.83	2.34	0.73	0.19	5.09	1.4
BGR	0.98	0.22	0.71	0.02	1.93	4.9
CYP	0.06	0.00	0.06	0.17	0.29	1.6
CZE	2.59	0.87	0.58	0.00	4.04	2.6
DNK	0.64	1.58	0.88	0.14	3.24	1.3
EST	0.35	0.10	0.19	0.03	0.67	3.8
FIN	1.66	0.74	1.09	0.08	3.57	1.9
FRA	12.53	10.55	6.43	0.88	30.39	1.5
DEU	12.35	21.29	5.92	3.01	42.57	1.6
GRC	1.22	0.84	0.83	0.03	2.92	1.5
HUN	1.63	0.62	0.69	0.01	2.95	3.0
IRL	0.65	0.27	0.48	0.39	1.79	1.1
ITA	8.18	5.27	3.73	0.71	17.89	1.1
LVA	0.39	0.09	0.24	0.04	0.76	3.4
LTU	0.43	0.16	0.36	0.07	1.02	3.1
LUX	0.09	0.09	0.04	0.03	0.25	0.6
MLT	0.03	0.01	0.01	0.00	0.05	0.7
NLD	1.86	2.06	1.16	0.33	5.41	0.9
POL	6.65	2.56	2.65	0.29	12.15	3.2
PRT	1.06	0.33	0.73	0.15	2.27	1.4
ROU	3.40	0.82	1.58	0.07	5.87	4.5
SVK	0.76	0.45	0.30	0.03	1.54	2.2
SVN	0.41	0.14	0.18	0.03	0.76	2.2
ESP	5.85	2.16	4.31	0.48	12.80	1.2
SWE	2.97	2.13	1.11	0.20	6.41	1.6
GBR	9.62	6.84	4.97	1.90	23.33	1.2
EA17	50.70	48.43	26.83	6.65	132.61	1.4
EU27	80.00	64.31	40.60	9.39	194.30	1.5

Sources: OFCE-IMK-ECLM computations.

1. Construction of a European investment plan

The construction of a large-scale European investment plan, consistent with the policy recommendations of the European Commission does not make for a simple exercise. First, it requires the definition of a Business As Usual (BAU) scenario, which represents the most likely outcome if projects and financing already decided were to be fulfilled unmodified. This hypothesis is completed by some assumptions on the trend of the economy until 2020. Once this first scenario is defined, an alternative scenario can then be drawn, which features the investments necessary to meet the mid-term (2020) and thus long-term (2050) European economic, energy and climate targets. Achieving these targets would open the way to the high performance, low-carbon European economy called for by European authorities, but from which austerity policies promise to take us ever further away.

We have sought to make the definition of our investment scenario consistent with the European Commission objectives. Various European roadmaps, such as the EU climate and energy package (EC, 2007), the Roadmap to a low-carbon economy in 2050 (EC, 2011a), or the White Paper on Transport (EC, 2011b) provide relevant milestones to shape economic policy at the Member State level.

1.1. The Investment Scenario in Transport

In an integrated European economy, investment needs in the transport sector must be defined at the European level. This has long been a European competence: the trans-European transport network or TEN-T projects are for instance all drawn up at the European level.

The White Paper on Transport sets a wide range of objectives that define a transport policy oriented towards decarbonized transport uses:

- "Developing and deploying new and sustainable fuels and propulsion systems",
- "Optimizing the performance of multimodal logistic chains, including by making greater use of more energy-efficient modes", notably:
  - "30% of road freight over 300 km should shift to other modes such as rail or waterborne transport by 2030, and more than 50% by 2050"
  - "Triple the length of the existing high-speed rail network by 2030, […] and by 2050, complete a European high-speed rail network"
- "Increasing the efficiency of transport and of infrastructure use with information systems and market-based incentives"

Transport projects currently account for the largest share of project financing conducted by the EU. This is necessary if the EU is to achieve its environmental targets, as the transport of goods and people will have to be increasingly carried out using modes alternative to road transportation. Similarly, it has been shown that investments in transport infrastructure have much larger effects if they are made on large geographical areas (Roy, 2004). The European scale seems most appropriate.

Infrastructure investments would also represent a large lever of economic action to foster long-term growth. Indeed, a number of studies (Long & Summers, 1991) have shown important correlations between growth and infrastructure investments. Infrastructures, like all publics goods, generate specific positive externalities. Investing in rail or waterway transportation would for example decrease transportation costs, reduce travel times and increase the volume of traffic. Besides, the shift from road to rail transport reduces negative externalities, such as greenhouse gas emissions or the social cost of road mortality. Transport network development also contributes to the expansion of market size. Finally, investments in transport infrastructure allow the establishment of joint public-private financing. This type of financing allows the commitment of public funds to be reduced.

The first step in the calibration of the investment scenario is to define a business as usual (BAU) scenario. Based on the TEN-T data and projecting the total amount until 2012 we obtain €859 billion or an annual investment of €123 billion for the BAU.

According to the goals exposed in the White Paper on Transport[7], the total amount of investment required to match the expected demand for transport services is €1,050 billion for the infrastructure (with €550 dedicated to the development of the TEN-T by 2020, the remainder being spent until 2030) and €500 for the equipment. Given the voluntary aspect of the proposed investment plan, the completion of all these investments is advanced to 2020.

The investment scenario is then simply the difference between these investment needs as estimated by the European Commission and the BAU projection made above.

In order to distribute this aggregate investment across Member States, we have considered two indicators that reflect the main issues arising from such a large-scale investment plan, efficiency and equity.

To characterize the need for efficiency, we consider that investment in additional transportation capacity will be determined by the current state of the rail network. Most exchanges, both in terms of passengers and goods, can be expected to occur within the economic heart of the EU. Since the investments considered are dedicated to modernizing the network and building large corridors for the freight and passenger traffic, they are likely to target countries which already belong to the core of the European transportation network – and thus have a large existing railway system. We thus assume that the allocation of the total investment amount across countries is going to be driven by the relative size of each national network.

We then use the ratio of each country's GDP per capita, in PPP, to the average EU level to weigh the share of investment made in each Member State so that less wealthy countries receive more than their wealthier counterparts. For instance, while Germany represents 20.6% of the European GDP, it would only receive 16.85% of the total investment based on its sole indicator, since it's one of the richer European country (as measured in GDP per capita, in PPP).

The final allocation across countries is computed using both indicators, weighted equally. The resulting magnitude of the investment made in each country thus takes into account both its level of economic development (as less wealthy member states need to benefit from a larger share of the total investment

7. We notably consider paragraph 55: "*The cost of EU infrastructure development to match the demand for transport has been estimated at over €1.5 trillion for 2010-2030*".

than warranted by their GDP share within the EU) and the size and development of its railway network (as investment is going to be made in countries already having a large transport network.

Below, in Table 20 the annualized distribution of allocations:

Table 20. Annual additional transport investment by country (billion euros. 2013-2020)

Austria	Belgium	Bulgaria	Cyprus	Czech Rep.	Denmark	Estonia
1.81	1.83	0.98	0.06	2.59	0.64	0.35
Finland	**France**	**Germany**	**Greece**	**Hungary**	**Ireland**	**Italy**
1.66	12.53	12.35	1.22	1.63	0.65	8.18
Latvia	**Lithuania**	**Luxembourg**	**Malta**	**Netherlands**	**Poland**	**Portugal**
0.39	0.43	0.09	0.03	1.86	6.65	1.06
Romania	**Slovakia**	**Slovenia**	**Spain**	**Sweden**	**UK**	**TOTAL**
3.40	0.76	0.41	5.85	2.97	9.62	**80.00**

NB: These amounts must added to the BAU investments to obtain the overall expected annual investment in transportation over the period.
Source: OFCE-IMK-ECLM computations.

Our investment plan includes both spending on fixed infrastructure (construction or renewal of tracks,) and capital expenditure (rolling stock, materials, energy). To finance this plan, it is important to distinguish these two types of expenditures. Indeed, as specified in the first, second and third European railway packages[8], infrastructure spending are intended to be financed by public expenditure (and thus debt), capital expenditure should be funded by the private sector.

1.2. The Investment Scenario in Energy Efficiency

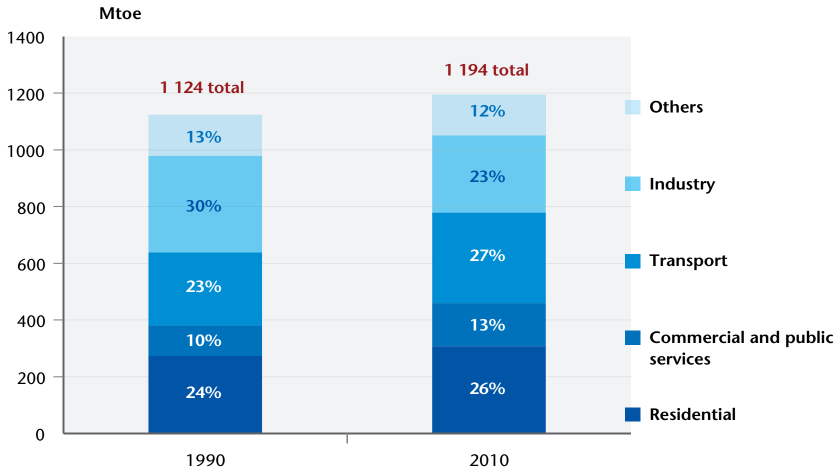
As part of its Europe 2020 strategy, the European Union has endorsed a series of three climate and energy targets to be achieved by 2020 (EC, 2007). One of these "20-20-20" targets calls for a 20% improvement in the EU's energy efficiency by 2020. However, it is also the target that appears least likely to be met, notably because the target is non-binding: while primary energy consumption has been trending down in the EU since 2007, the decrease remains too slow. The European Commission estimates that current efforts towards energy efficiency would have to be doubled to achieve the 20% improvement target by 2020 (EC, 2011c).

Since 1990, a large part of the energy consumption growth has happened in the buildings sector. Buildings now represent close to 40% of final energy consumption in the EU, while they only accounted for 34% in 1990 (Figure 42). Over the past 20 years, buildings energy consumption in Europe has grown by 1% a year, while overall energy consumption was only growing at 0.3%. The central role of the buildings sector in reducing energy consumption has been confirmed by the European Commission's recent assessment of energy savings potentials

8. As defined by directives 2001/12, 2001/13, 2001/14; 2004/51, 2004/52, 2004/53, 2004/54; 2007/57, 2007/58, 2007/59

(Fraunhofer-Institute, 2009), with up to 48% of energy savings technically achievable by 2020 in the EU attributable to residential and tertiary buildings.

Figure 42. Energy consumption in the EU, 1990 and 2010



Source: IEA.

However, given that the construction rate in most Member States hovers around 1%[9], and that the demolition rate is at least an order of magnitude smaller (Thomsen & Flier, 2009), the renewal rate of the European building stock is very low. Capturing the energy savings potentials of the buildings sector therefore requires a large-scale energy renovation program, which would make use of the best available technology to deeply retrofit existing buildings.

Such a program, conducted throughout Europe, would trigger massive investments in the buildings sector. While a lot of attention has been devoted to the estimation of energy savings potentials in the EU, few studies have tried to assess the actual volume of investment necessary to achieve those savings and their associated economic impact. In a recent report, Copenhagen Economics (2012) estimated that under a "High energy efficiency" scenario, which would imply the full adoption of best available technologies as outlined above, annual gross investments to achieve savings in the buildings sector coherent with the 2020 EU targets would reach 65 billion euros from 2013 to 2020.

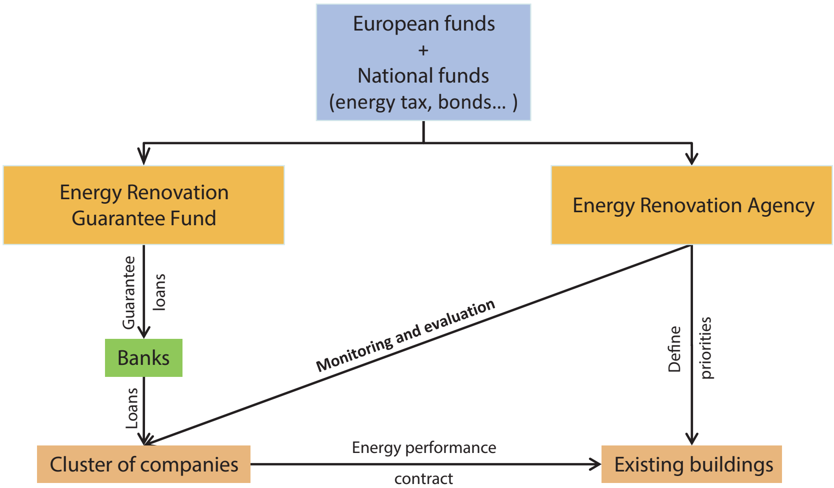
The overwhelming majority of this massive funding need would not have to be covered by public investments. However, government policy and public funds do have a key role to play in ensuring energy renovations can be funded. Deep energy renovations are expensive, with average costs ranging from 300 up to 450 euros per square meters across Europe (Copenhagen Economics, 2012). Besides, they are complex operations that require the coordination of many different

9. Source: Eurostat.

competencies – a task which requires expert knowledge that cannot be expected from households seeking to retrofit their homes.

Overcoming both of these obstacles require innovative solutions. Drawing from experience gained through initiatives such as the German KfW Building Rehabilitation Program (Schröder *et al.*, 2011), the British Green Deal[10], or the American PACE program[11], Saheb *et al.* (2013) proposes a new market framework to finance and manage energy renovation (Figure 43).

Figure 43. Market framework to enable large-scale energy renovation



In this model, an Energy Renovation Agency reporting to the government will be needed to supervise the entire energy renovation process. When a dwelling is to be renovated, the Agency sets up a tendering process to be answered by a cluster of companies that combines all the expertise necessary to successfully carry out the energy renovation. To finance the renovation, the cluster of companies takes out a long-term loan that will be reimbursed using future energy savings.

These savings are guaranteed by an energy performance contracting between the cluster of companies and the dwelling – that is, companies are responsible for the successful reduction in the energy consumption of the renovated dwelling. It is important to note that just as in the PACE program, the energy performance contract is tied to the dwelling itself, and is to be transferred in case of a change in ownership. Finally, to facilitate the involvement of commercial banks, loans granted to finance energy retrofits would be guaranteed by an Energy Renovation Guarantee Fund, thereby mitigating uncertainties on the actual magnitude of future energy savings.

10. https://www.gov.uk/green-deal-energy-saving-measures
11. Property Assessed Clean Energy, http://pacenow.org/about-pace/

While such a stylized model would need to be adapted to fit the local context specific to each country, it provides a number of mechanisms to overcome most of the usual roadblocks in the way towards large-scale energy retrofits in Europe. Moreover, in such a scheme, existing public funds already targeting energy retrofits at the national and European levels could be leveraged to trigger the investments needed to capture energy savings in the buildings sector conducive to the achievement of Europe's 2020 energy efficiency target.

To estimate the impact of such an investment towards energy renovation on the European economy, investment needs were estimated for each country. Spending requirements were first broken down across sectors (households and services) and energy use (heating and insulation, water heating, air conditioning and ventilation, and lighting), following Copenhagen Economics (2012). These amounts were then distributed across countries, proportionately to their corresponding expected energy savings, as estimated by Fraunhofer (2009). Finally, investment needs were adjusted for differences of labor costs in the construction sector of each country, obtained from Eurostat. The resulting estimates are reported in Table 21.

Table 21. Annual energy renovation investments by country (billion euros. 2013-2020)

Austria	Belgium	Bulgaria	Cyprus	Czech Rep.	Denmark	Estonia
1.79	2.34	0.22	0.00	0.87	1.58	0.10
Finland	**France**	**Germany**	**Greece**	**Hungary**	**Ireland**	**Italy**
0.74	10.55	21.29	0.84	0.62	0.27	5.27
Latvia	**Lithuania**	**Luxembourg**	**Malta**	**Netherlands**	**Poland**	**Portugal**
0.09	0.16	0.09	0.01	2.06	2.56	0.33
Romania	**Slovakia**	**Slovenia**	**Spain**	**Sweden**	**UK**	**TOTAL**
0.82	0.45	0.14	2.16	2.13	6.84	**64.31**

Source: OFCE-IMK-ECLM computations.

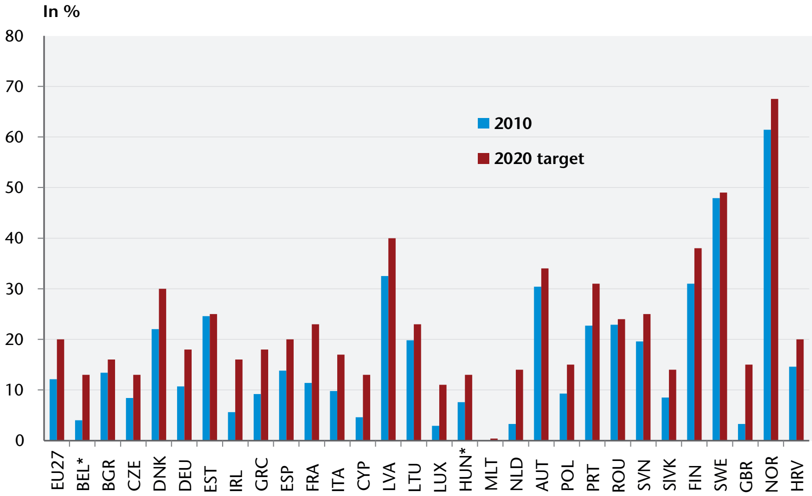
1.3. The Investment Scenario in Renewable Energy and Network integration

The European Union aims to reach at least 20% of its final energy consumption from renewable energy sources (RES) by 2020. This objective has been enacted in the EU Directive 2009/28/EC, which gives a framework for EU Member States' policy, improves the legal basis for investors, calls for national action plans and creates cooperation mechanisms to help achieve the targets in a cost-effective way. The National Renewable Energy Action Plans (NREAPs) set out how each Member State aims to achieve its national target in three sectors: electricity, heating and cooling, and transport. The quantity of renewable energy produced within the EU-27 increased overall by 72.4% between 2000 and 2010, equivalent to an average increase of 5.6% per year, and total investments increased to about €40 billion annually in 2009[12]. Despite the challenges posed by the financial and economic crises, RES investments have remained high over the last two years. The

12. Source: Eurostat

EU climate and energy package has contributed to this development (EC, 2011c). Figure 44 shows the share of renewable energy in gross final energy consumption in 2010 and the indicative targets that have been set for each country for 2020. The average share of renewables in gross final energy consumption stood at 12.5% in the EU-27 in 2010.

Figure 44. Share of renewable energies in gross final energy consumption



Source: Eurostat.

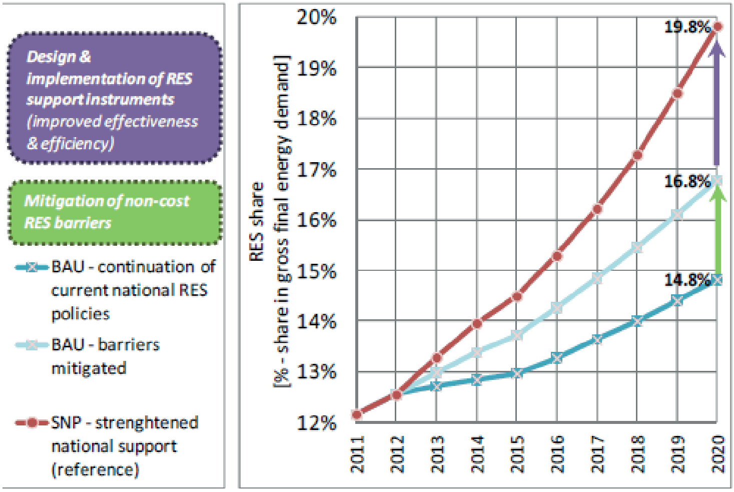
Given objectives set out in NREAPs, EU Member States expect the share of renewable energy to reach 20.7% of gross final energy consumption by 2020 (EREC, 2011). However, according to the recent European research report RE-Shaping (Ragwitz *et al.*, 2012), this trajectory appears more ambitious than warranted by currently implemented and planned policy measures. Based on the Green-X business-as-usual scenario[13], the current policy mix is likely to result in a RES share in gross final consumption of about 15% by 2020 (Figure 45). This BAU scenario, which implies that all relevant energy policies and energy market structures remain unchanged until 2020, is compared to a scenario of "strengthened national policies" (SNP), which considers improved financial support as well as the mitigation of non-economic barriers that hinder an enhanced RES deployment.

Based on Green-X model estimation, annual RES investments in BAU scenario is €86.2 billion, while in a strengthened national policies scenario, annual investments would reach €126.8 billion. These investments include capital expenditure,

13. The model Green-X has been developed by the Energy Economics Group (EEG) at the Vienna University of Technology under the EU research project "Green-X–Deriving optimal promotion strategies for increasing the share of RES-E in a dynamic European electricity market". Initially focused on the electricity sector, this modelling tool, and its database on renewable energy (RES) potentials and costs, has been extended to incorporate renewable energy technologies within all energy sectors.

support expenditure and additional generation cost. The investments needed to achieve the European renewable energy target by 2020 are considered to be the gap between these two scenarios, and have been estimated for each EU Member Estate. The aggregate European-wide amount is distributed across countries proportionally to their net realizable potential until 2020[14]. The realizable potential from the Green-X database represents the achievable potential in 2020 assuming that all existing barriers can be overcome and all driving forces are active.

Figure 45. Gross final energy demand in the EU-27 according to the BAU case



Source: European research project RE-Shaping, Green-X model.

Table 22. Annual additional RES investments by country (billion euros. 2013-2020)

Austria	Belgium	Bulgaria	Cyprus	Czech Rep.	Denmark	Estonia
0.64	0.73	0.71	0.06	0.58	0.88	0.19
Finland	**France**	**Germany**	**Greece**	**Hungary**	**Ireland**	**Italy**
1.09	6.43	5.92	0.83	0.69	0.48	3.73
Latvia	**Lithuania**	**Luxembourg**	**Malta**	**Netherlands**	**Poland**	**Portugal**
0.24	0.36	0.04	0.01	1.16	2.65	0.73
Romania	**Slovakia**	**Slovenia**	**Spain**	**Sweden**	**UK**	**TOTAL**
1.58	0.30	0.18	4.31	1.11	4.97	**40.60**

NB: These amounts must added to the BAU investments to obtain the overall expected annual investment in renewable energy supply over the period.
Source: OFCE-IMK-ECLM computations.

14. Estimate the gap between realizable potential in 2020 and production in 2009.

The intermittent nature of renewable energy supply can be in a large part mitigated through improvements made to the electrical grid. Notably, a number of pan-European interconnection projects have been put forth to help connect regions across Europe that are rich in different renewable resources (mainly wind and solar) – thus lowering the intermittency risk for interconnected regions.

In a recent report (ENTSO-E, 2012), the European Network of Transmission System Operators for Electricity (ENTSO-E) has estimated the additional investments necessary to accommodate the projected increase in renewable electric capacity and mitigate its intermittency. It was estimated that €100 billion in new investments would be needed over the next 10 years for the entire European grid, along with a detailed country-by-country assessment based on pan-European interconnection projects known to date. These estimates were used as the basis for calculating additional investment needs as follows:

Table 23. Annual additional investments in the electrical grid by country (billion euros. 2013-2020)

Austria	Belgium	Bulgaria	Cyprus	Czech Rep.	Denmark	Estonia
0.01	0.11	0.19	0.33	0.02	0	0.14
Finland	France	Germany	Greece	Hungary	Ireland	Italy
0.48	0.03	0.17	0.04	0.88	0.03	0
Latvia	Lithuania	Luxembourg	Malta	Netherlands	Poland	Portugal
0.29	0.15	0.08	3.01	0.03	0.39	0.71
Romania	Slovakia	Slovenia	Spain	Sweden	UK	TOTAL
0.07	0.03	0.03	0.07	0.2	1.9	**9.39**

NB: These amounts must added to the BAU investments to obtain the overall expected annual investment in the electrical grid over the period

2. Simulation of the investment plan

Based on the detailed analysis carried out above, we propose a large-scale European public investment plan, which aggregates all sectoral investments outlined previously. Such a plan would amount in effect to a coordinated fiscal stimulus throughout Europe. Investments are distributed in each Member State as follows:

Table 24. Aggregate annual investment in each country (billion euros. 2013-2020)

Austria	Belgium	Bulgaria	Cyprus	Czech Rep.	Denmark	Estonia
4.35	5.09	1.93	0.12	4.21	3.24	0.67
Finland	France	Germany	Greece	Hungary	Ireland	Italy
3.57	30.39	42.57	2.92	2.95	1.79	17.89
Latvia	Lithuania	Luxembourg	Malta	Netherlands	Poland	Portugal
0.76	1.02	0.25	0.05	5.41	12.15	2.27
Romania	Slovakia	Slovenia	Spain	Sweden	UK	TOTAL
5.87	1.54	0.76	12.8	6.41	23.33	**194.3**

Source: OFCE-IMK-ECLM computations.

To assess the macroeconomic impacts of this investment plan on GDP, employment, the balance of trade, or the evolution of the public deficit, we need to make use of a European-scale macroeconomic model. However, given the complexity of the modelling exercise, the national investment plans had to be aggregated. In this section, we distinguish between Germany and the rest of the euro area.

We use the New Keynesian DSGE model FiMod, which was designed to conduct fiscal policy simulations by Stähler & Thomas (2012). It is a two region model of a currency union in which one region represents a member state (in our case Germany) and the second region the rest of the union (here the rest of the EMU, REMU). Both regions are modeled in an identical fashion, but structural differences between regions are captured to some extent by choosing different parameterizations for each region. As in most medium scale DSGE models designed for quantitative assessments, there are nominal wage and price rigidities, and consumption and investment expenditure are subject to habit formation and investment adjustment costs, respectively. Furthermore, the labor market is subject to Diamond-Mortensen-Pissarides type search and matching frictions, implying the existence of unemployment and more persistent employment and output dynamic than in DSGE models without such frictions. The model also features a fraction of non-optimizing households who simply consume their disposable income.

The government in each of the regions derives income from taxation of private consumption, labor income (with a distinction between taxes paid by the employer and the employee) capital income and lump sum taxes. Government expenditures include spending on unemployment benefits and other transfers, government consumption and government investment. The public capital stock has positive effects on the total factor productivity of private enterprises.[15] Hence the model allows for a variety of feedback mechanisms between the government budget and the general economic situation.

The model's parameters can be broadly divided into three groups. One group is calibrated such that the steady state values of important ratios, such as the share of imports in Germany and REMU's GDP or the government investment-to GDP ratio corresponds to averages of these variables calculated over the 2000-2012 period.[16] The second group was taken from Stähler & Thomas (2012) and concerns the degree of matching frictions and the productivity of public capital. The third group comprises parameters also found in more conventional DSGE models, such as the degree of investment adjustment costs or nominal price and wage rigidities. These parameters were taken from the estimation of the ECB's "New Area Wide Model" in Christoffel *et al.* (2008).[17]

15. The elasticity of production with respect to public capital is set to η=0.015, which is within the range of estimates in the literature (see Aschauer (1989), Nadiri and Mamuneas (1994), Holtz-Eakin (1994) Kamps (2004), Leeper *et al.* (2010)).

16. An exception is the government debt-to-GDP ratio, for which the 2012 annual average was used.

17. The exceptions are the Calvo (1983) parameters for new and existing matches, which at 0.9 are calibrated substantially higher than in the estimation of the NAW in order to avoid unreasonably strong effects on inflation. However, higher nominal wage flexibility would only strengthen the GDP effects of the investment initiative simulated below by further depressing the real interest rate over the first 10 quarters.

2.1. Simulation design

We simulate an increase in government investment across the EMU of 1.5% of GDP. The increase is allocated across the EMU such that the increase in Germany amounts to 1.7% of GDP, while the increase in the rest of the EMU (REMU) amounts to 1.4% GDP. It is kept in place for 8 years. Furthermore, based on market expectations[18], the current weak economic outlook and the fact that the ECB and other forecasters expect inflation to undershoot the ECBs target for a "prolonged period", we assume a fixed nominal interest rate for 10 quarters, after which monetary policy responds to output and inflation according to the interest feedback rule in the model.

Strong boost to euro area GDP

As can be seen from Figure 46, the increase in government investment would provide a strong boost to euro area GDP due to substantial crowding in of private consumption and investment, especially during the first half of the program period. The EMU-wide cumulative multiplier, calculated over the duration of the government investment increase (i.e. 8 years), equals 2.[19]

The increase in government investment has both an immediate effect on aggregate demand and output and, via the gradual increase in the public capital stock, a highly persistent effect on the productivity of private enterprises. It thus affects private expenditure through a number of channels, most of which have been discussed in the literature on the effects of fiscal policy at the zero lower bound in DSGE models (e.g. Christiano *et al.* (2011), Coenen *et al.* (2012), Eggertsson (2009), Woodford (2011)). Higher employment raises the real disposable income of households and thus consumption of non-ricardian households. Furthermore, the combination of higher expected inflation associated with the increase in output and a constant nominal interest rate cause a decline in the expected real interest rate, which supports the consumption of forward looking households. Private investment is elevated by an increase in Tobin's Q driven chiefly by expectations of higher future demand and, to a lesser extent, by the lower expected real interest rate.

Furthermore, the persistent increase in total factor productivity implies that future marginal costs and thus inflation are lower for any given level of output and employment. This mechanism dampens the increase in the nominal interest rate which occurs once monetary policy starts following its interest feedback rule after 10 quarters and contributes to making private investment more profitable, as compared to what would be observed in response to a pure demand side stimulus without such supply side effects. Finally, the presence of matching frictions in the labor market imply that marginal cost and inflation are positively related to the change in employment, which also tends to render monetary policy more expansionary once monetary policy returns to following its interest feedback rule. These

18. As of November 24th 2013, the EONIA swap rate for 24 month contracts equaled 0.165%.
19. The cumulative multiplier over h quarters is calculated as

$$m(h) = \frac{\sum_{i=1}^{h} dY_{t+i}}{\sum_{i=1}^{h} dG_{t+i}},$$

where dY_{t+i} and dG_{t+i} denote the deviation of real GDP and government investment from the baseline.

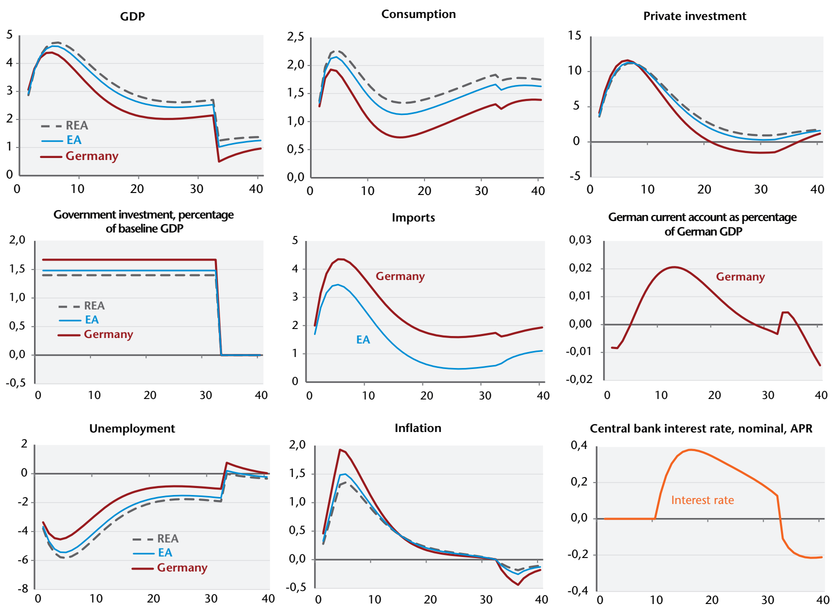
mechanisms imply that the beneficial GDP effects of the program extend for a much longer period than the 10 years plotted in Figure 46.

As is shown in Figure 47, the EMU wide government debt-to-GDP ratio declines persistently and in the last year of the program is still about 8 percentage points below its baseline. Somewhat less than half of this improvement is due to higher inflation, which lowers the real burden of debt, followed by the direct negative effect of the GDP increase on the debt-to-GDP ratio due to the presence of GDP in the numerator. Finally, the increase in economic activity lowers the primary deficit below the baseline for somewhat more than three years. Lower expenditure on unemployment benefits and increased revenue from labor income taxes are mainly responsible for overcompensating the direct budgetary consequences of higher government investment (Figure 48).

The investment initiative would thus provide a welcome boost to the weak recovery of the euro area economy and would also help to stave off the risk of deflation.

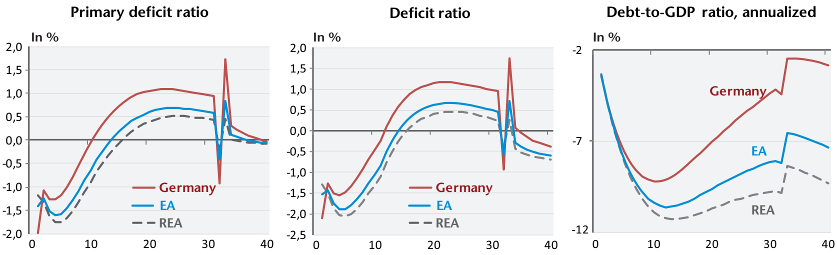
Figure 46. Macroeconomic effects of the investment initiative (FiMod)

Deviations from baseline in % or percentage points (PP), quarters



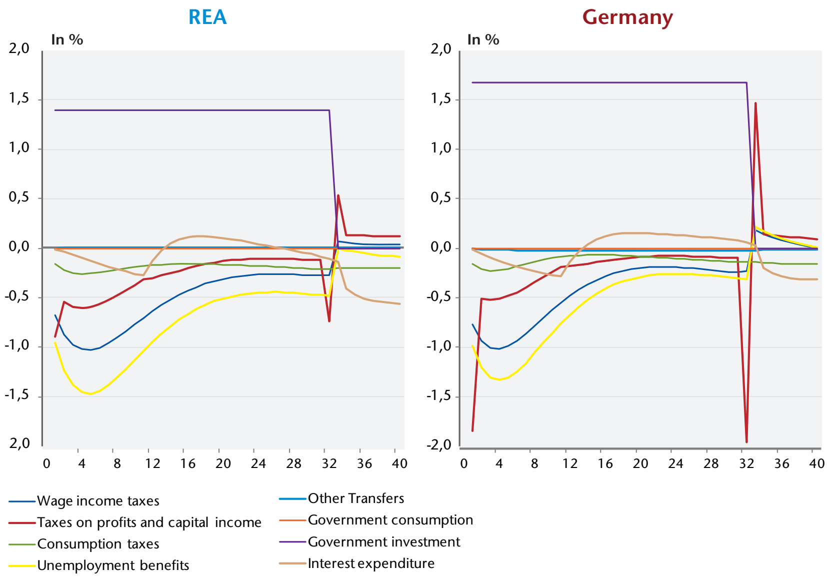
Source: OFCE-IMK-ECLM computations.

Figure 47. Effect of the program on the public finances



Source: OFCE-IMK-ECLM computations.

Figure 48. Decomposition of the program's effect on the primary deficit as a share of baseline GDP



Note: Positive numbers imply that the deviation of the respective expenditure or revenue component from its baseline increases the primary deficit.
Source: OFCE-IMK-ECLM computations.

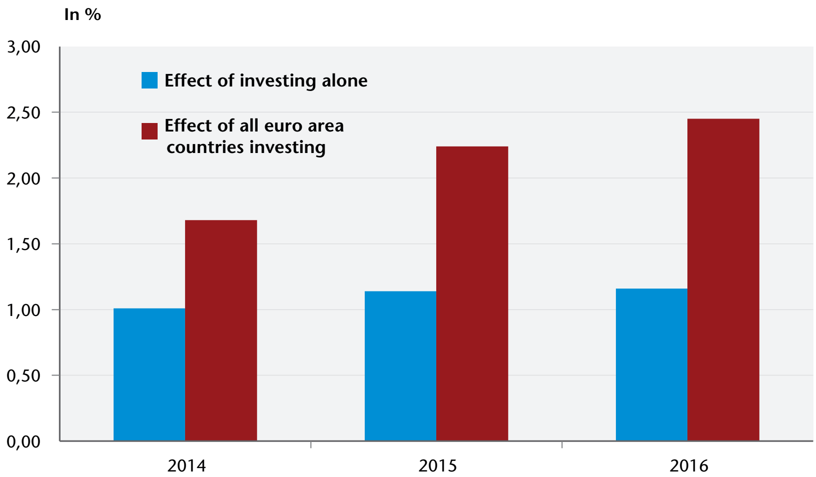
2.2. Short run effects of an investment plan in the euro area

In addition to the FiMod simulation, the investment plan has also been simulated on the international macroeconomic model HEIMDAL (Hansen & Bjørsted, 2011) for a shorter time horizon. The following calculations show the effects of increasing public investments in the euro area by 1.5 percent of GDP on average from 2014-2016. All euro area countries would benefit from coordinating fiscal policy. If done simultaneously, expanding or contracting the economy simultaneously throughout the euro area has an amplifying spill-over effect on each individual country.

To illustrate the importance of the spill-over effects, we have modeled an investment plan where Spain is the only county contributing to the plan as well as an investment plan where all euro area countries contribute. In the calculations below Spain's public investments are increased by 1.4% of GDP in 2014-2016. In the scenario where all euro area countries increase government investments, investment is increased by an average of 1.4% of GDP except for Germany who increase government investments with 1.7% of GDP (see Box 10 for a short description of the HEIMDAL model and underlying assumptions behind the calculations). Figure 49 shows the individual as well as the spill-over effect on GDP for Spain.

If Spain implements an individual investment plan of 1.4% of GDP in 2014-2016, by 2016 the deviation of GDP from its baseline will be 1.2%, assuming that the rest of the euro area keeps public investments unchanged. If, on the other hand, Spain invests as part of a coordinated euro area investment plan, the deviation from the baseline in 2016 will be 2.5%. Spain will not only experience positive effects from its own investments, but also from investments in the other euro area countries. These increase growth and domestic demand, which will increase Spain's exports, and will create even more jobs than if Spain alone raises investment.

Figure 49. Effect of the program on GDP in Spain

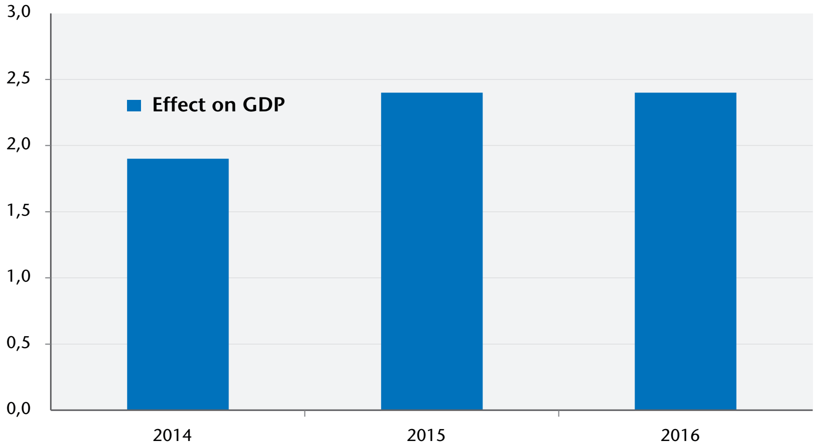


Note: Deviations from baseline GDP, %.
Source: OFCE-IMK-ECLM computations.

In the euro area as a whole the GDP-level is lifted by 2.4% compared to its baseline level in 2016 as a consequence of the investment plan (Figure 50). The cumulative multiplier of the investment plan equals 1.9 over the 2014-2016 period.

Table 25 shows in more details the spill-over effects from a coordinated investment plan in the euro area.

Figure 50. Effect on GDP in the euro area



Note: Deviations from baseline GDP, %.
Source: OFCE-IMK-ECLM computations.

Table 25. Effect for Spain from a coordinated investment plan

Effect in 2016

	Spain investing alone	All euro area countries investing (Effect of investing + spill-over effect)
Change in GDP (percent)	1.2	2.5
Change in employment (10000 pers.)	17	44
Change in export (percent)	0.4	4.7

Sources: OFCE-IMK-ECLM on basis of HEIMDAL.

Increased domestic demand will increase employment. Table 25 shows that a coordinated investment plan can create up to 440,000 jobs in Spain in three years compared to only 170,000 jobs if Spain implemented an individual investment plan. That is a spill-over effect of about 260,000 jobs in Spain. The increase in domestic demand will also have a positive effect on exports.

The implementation of a coordinated investment plan in the euro area will have strong positive effects on employment in the euro area. Table 26 shows the increase in employment in the individual countries.

After increasing public investments for three years, the total increase in employment amounts to almost 3.5 million people in the euro area.

ECLM has conducted a similar simulation for ETUC, where an investment plan increases public investments in the European Union by 2% from 2015-2019 (ETUC, 2013). The results from the experiment were an increase in EU-27 employment by 5.8 million people in 2019 as well as an increase in GDP by 4.9 percent relative to the baseline.

Table 26. Employment effects in the euro area

Effect on employment in 1000 persons

	2014	2015	2016
BEL	40	70	80
FIN	30	60	70
FRA	320	570	610
DEU	540	1.030	1.210
ITA	130	260	220
ESP	200	360	440
EA	1.680	3.210	3.480

Sources: OFCE-IMK-ECLM on basis of HEIMDAL.

Box 10. Short description of the HEIMDAL model and assumptions behind the calculations

HEIMDAL (**H**istorically **E**stimated **I**nternational **M**odel of the **Da**nish **L**abour movement) is an international model developed by The Economic Council of the Labour Movement (ECLM). The HEIMDAL model focuses on the world economy.

HEIMDAL describes the economy in 15 OECD countries, including 13 European economies: Denmark, Sweden, Norway, Finland, Germany, France, Italy, Netherlands, Belgium, Spain, UK, Poland, the Czech Republic, USA and Japan. In addition, the model also accounts for the rest of the world trade.

Each country is described with its own country model. The relations of each country model are estimated on annual data, which generally covers the period 1960-2012. The model structure and the estimated relations are based on the methods and theories traditionally used in the macroeconomic simulation models. The individual country models are based on a Keynesian theoretical background in the sense that production and employment are determined by aggregate demand in the short run. In the long run prices and wages will to changes in unemployment and capacity utilization, e.g. a fall in unemployment will increase wages and prices which in turn affect competitiveness and lowering export and increasing import which lowers the aggregate demand. A major source of inspiration for the applied relations has been the Danish models ADAM, SMEC and MONA together with the international models INTERLINK (OECD), NIGEM (NIESR) and QUEST (EU-Commission).

The economies are interlinked by a broad range of transmission mechanisms which includes:

- Quantities and prices in the foreign trade
- Interest rates and exchange rates
- Wages both directly through the wage relation and indirectly through prices)

Some of these transmission mechanisms are functions of empirically determined relations (e.g. the foreign trade), whereas the interest rate and exchange rate transmissions are functions of both estimated relations and user defined reaction functions.

In the above calculations it is assumed that Germany increases government investments with 1.7% of its GDP in 2014-2016. The rest of the euro area increase government investments by 1.4% on average in 2014-2016.

In the simulations the short term interest rate and exchange rates are kept exogenous.