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# THE IMPACT OF COHESION AND RURAL DEVELOPMENT POLICIES 2007-2013:

## MODEL SIMULATIONS WITH QUEST III

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*Regional and Urban Policy*

# > EXECUTIVE SUMMARY

Cohesion policy is the Union's main instrument to promote regional development and reduce disparities among the Union's Member States and regions. It concentrates its support in the fields of R&D, support to SMEs, education, or transport, telecommunication, social and environmental infrastructure.

Cohesion funding is allocated to all Member States and regions in the EU but relative to their GDP the amounts accruing to the less developed ones are much higher than elsewhere. In some countries, it represents more than 3% of GDP, financing a substantial part of public investment.

The EU rural development policy supports rural areas in tackling their economic, environmental and social challenges. Its main strategic objectives are to foster the competitiveness of agriculture, to ensure the sustainable management of natural resources and to promote a balanced territorial development of rural areas.

For the 2007-2013 programming period, the EU allocated €347 billion for cohesion policy and €96 billion for rural development. Member States allocations were divided into annual amounts which must be spent within two or three years, depending on the country, over the period 2007-2015.

This paper provides an assessment of the potential impact of cohesion and rural development policies for the programming period 2007–2013 using QUEST. The model simulates the impact of policy interventions on a large number of economic variables relevant to cohesion and rural development policies such as GDP, employment, wages, productivity, or corporate investment.

Simulations show that cohesion and rural development policies affect many key economic variables. Overall, the simulations shows that the interventions improve the structure of the EU economies and hence their competitiveness. In particular, they have a positive and significant impact on the productivity of factors of production, as result of direct investment in technology but also of enhanced business conditions encouraging investment in tangible and intangible assets.

As a result, interventions substantially increased GDP, in particular in the Member States which are the main beneficiaries of the policies. The highest impact is found in Hungary (+ 5.3%) and Latvia (+ 5.1%) as well as in Poland (+4.3%). The impact is also substantial in EU-15 Member States like Greece (+2.2%), Portugal (+1.8%) and Spain (+0.7%) which benefited from support of the Cohesion Fund.

Finally, cohesion and rural development policies yield high value for money. As expected from policies supporting investments in key engines of growth, a substantial part of their effects progressively increases over time and only emerge in the long run. However, once they produce their full impact, the interventions prove to benefit to the whole Union even if they are concentrated in its less developed places.

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# The Impact of Cohesion and Rural Development Policies 2007-2013: Model Simulations with QUEST III[☆]

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**Abstract**

For the 2007-2013 programming period, the EU allocated €347 billion for cohesion policy and €96 billion for rural development. The funds were used to finance programmes promoting growth and development across the Union. The paper provides an ex-post impact assessment of these programmes based on a set of simulations using QUEST, a DGSE model with semi-endogenous growth. The results show that the interventions contributed to enhance economic performance of the EU Member States, in particular of the less developed which are the main beneficiaries of the policies. They also suggest that the policies yield good value for money, especially in the long run.

*Keywords:* Cohesion Policy, Rural Development, endogenous growth, R&D, dynamic general equilibrium modelling.
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[☆]The views expressed in this paper are those of the authors and should not be attributed to the European Commission.

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cannot provide information on their net global impact. The programmes produce many direct and indirect effects which implies that in order to fully capture their impact on the EU economies, one need to use analytical instruments capable of tracking how the policies affect the allocation of resources in a general equilibrium perspective.

In this paper, the potential impact of cohesion and rural development policies for the programming period 20072013 is assessed using QUEST, a model developed by the Directorate General for Economic and Financial Affairs of the European Commission. The model simulates the impact of policy interventions on a large number of economic variables relevant to cohesion and rural development policies such as GDP, employment, wages, productivity, or corporate investment. This type of approach allows to examine the outcome of various policy scenario taking into consideration the manner in which interventions affect the allocation of resources throughout the economy, thus enabling an analysis of policy impacts at the macroeconomic level.

The paper is organised as follows. Section 2 explains the value added of analysing this type of policy interventions by means of model simulations. Section 3 gives the scale and scope of the policies by detailing where and how the financial resources involved were spent. Section 4 describes QUEST and its main features. Section 5 presents the results of the simulations. Finally, section 6 concludes.

## 2. The use of models for assessing the impact of cohesion and rural development policies

When looking at the impact of cohesion and rural development policies on macroeconomic variables such as GDP, employment or productivity, we first need to differentiate between short-term (mostly demand) and long-term (supply-side) effects.

Short-term effects occur mainly during the period when the programmes are being implemented in the form of projects on the ground (e.g. road construction, training schemes, etc.). These interventions boost output and employment (e.g. construction workers, trainers), thereby increasing income and hence demand, which to some extent translates into another increase in output(so-called Keynesian multiplier effect).

The policies also enhance the structure of the economies and increase the productivity of its factors of production. These supply-side effects are likely to progressively build up in time and last long after the implementation of the interventions is over, therefore only becoming significant in the medium to long-term. For example, the impact of investment in R&D typically takes time to become apparent but its output gains can be significant and continue to increase long after spending is discontinued.

Second, interventions do not only have direct impacts but also indirect ones. For instance, projects in the field of transport directly boost demand in the short run (e.g. increase in public consumption) and improve the structure of the economy in the long run, with a combined positive

impact on GDP. At the same time, these interventions increase labour demand which can fuel wage and price inflation, thereby adversely affecting GDP. These feedback effects are often difficult to pinpoint.

Cohesion and rural development policies are also likely to generate important spillover effects and externalities outside the economies directly benefiting from the funds. Examples include the demand expansion in the beneficiary country leading to higher exports from other countries, or R&D innovations in one economy generating technological progress in other economies. Again, such spillover effects are not accounted for when examining the outcomes of projects.

Third, economic performance is affected by a wide range of other developments which happen to coincide with the interventions, including other policy actions or changes in the business cycle. The specific impact of the policy under analysis can therefore not be identified by simply looking at the data included in the national and regional accounts. In order to capture the impact which can be attributed to the policy, one would need to compare the world as it is with what it would have been without the policy which obviously cannot be observed in reality.

The use of macroeconomic models allows to partly address these issues. First, models can be used to simulate the world without the policy and hence provide a solid counterfactual against which the impact of the policy can be assessed. Second, they allow simulating both the short-term and long-term impacts of the policy and take the interaction between direct and indirect effects into account. Third, models account for the spill-over effects and externalities and thereby give a full assessment of the policy impact. Finally, models help tracing back the effects of the policy interventions and shed light on the channels through which the policy produces its impact on the economy.

Macroeconomic models have often been used to assess structural policies and their economy-wide impacts. Cohesion policy is no exception to this. For years, the Directorate General for Regional and Urban Policy of the European Commission (DG REGIO) has assessed the impact of its programmes with the help of models such as HERMIN (Bradley *et al.*, 2003) or EcoMod (Bayar, 2007). QUEST has also often been used in the past for assessing the impact of cohesion policy. For instance, Varga and in 't Veld (2011a) conduct an ex-post impact assessment (i.e. based on actual expenditure) of the 2000-2006 programmes implemented in the main beneficiaries of the policy, namely the 10 Member States which joined the Union in 2004 plus Germany, Greece, Italy, Ireland, Portugal and Spain while Varga and in 't Veld (2011b) provide an ex-ante analysis of the policy (i.e. taking into account the resources allocated by the policy to the Member States rather than the actual expenditure) covering the same countries plus Bulgaria and Romania. Compared to these earlier contributions, this paper considers the impact of both cohesion and rural development policies and takes into account the actual expenditure of the 2007-2013 programmes implemented in all Member States of the Union. Other institutions have also analysed the EU cohesion policy using economic models. For instance, based on its multi-region model GIMF (Global Integrated Monetary and Fiscal) the IMF has assessed the potential impact of the EU cohesion transfer in the new Member

States from 2004 to 2015 (Allard *et al.*, 2008).

Finally, difficulties to absorb the funds have sometime been reported in some countries. Since the analysis presented in this paper is based on the expenditure effectively executed by the Member States, it implicitly account for this issue. However, some authors (see for instance Ederveen *et al.* (2006)) have argued that funding is not always used so as to maximise its impact. The reasons usually invoked for such sub-optimal use of policy resources are related to possible rent-seeking activities and diversion due to protectionism and market rigidities. However, in absence of quantified evidence concerning the degree to which cohesion and rural development funding is optimally used, macroeconomic models cannot incorporate this aspect and their results should therefore be interpreted as providing the potential impact of the policies, i.e. the one that would emerge if resources are directed to the most effective projects.

## 3. Cohesion and rural development policies: coverage and allocations

The EU funds covered by this exercise include the ERDF, CF, ESF and the EAFRD. The EU payments for cohesion and rural development have reached the level of almost €383 billion during the 2007-2013 programming period, of which 76% are represented by the structural and cohesion funds (ERDF, CF and ESF). The data used for the simulation of cohesion and rural development policies is based on several sources as follows.

The EU expenditure for ERDF and CF correspond to advance and interim annual payments reported in the SFC database of DG REGIO over the period 2007 - October 2015, subject to two adjustments. First, these data do not give details concerning the categories of expenditure in which investment took place. However, this information is available from the Work Package 13 of the ex-post evaluation 2007-2013 (European Commission, 2015) which breakdowns total expenditure for 2014 into 86 categories covering the areas in which support has been provided (Appendix 1 lists the 86 categories of expenditure). This was then used to approximate the distribution of the funds across the categories of expenditure for the other years. Second, at the time they were collected data on payments (i.e. funding which has been used by the beneficiary) was available until early October 2015. In order to approximate total EU payments until end 2015, we assumed that the countries which, by October 2015, had not reached an execution rate of 95% would in the end absorb at most the same level as in year 2014[4].

Similarly, for the ESF total EU expenditure over the period 2007-2015 is proxied by the advance and interim annual payments, subject to the assumption on absorption described above. The distribution of the fund across priority themes within country is approximated by the distribution of latest decided amounts across these types of expenditure for each country. Data on EAFRD, provided by the Directorate-General for Agriculture and Rural Development of the European

[4]The execution rate corresponds to the share of the programmes financial allocation which has actually been used at a given date. It gives an indication on the capacity of the beneficiary to absorb the funding available.

Commission (DG AGRI), refer to payment requests filed until August 2015, broken down by 46 types of expenditure relevant for rural development (Appendix 1 lists the types of expenditure). For the rural development fund, no further assumption on absorption has been made.

Total actual EU payments and the resulting series for estimated absorption are presented by country in Table 1, columns (1) and (5)[5]. The assumption on absorption for cohesion funding significantly increases the level of payments for Germany, Hungary and Romania. Indeed, the estimation on the total level of payments amounts to 2.5% of actual payments for the period October-December 2015.

The breakdown of total EU payments by funds reported in Table 1 highlight different distributions across countries. First, shares higher than 50% for ERDF and CF in total payments are observed in Easter and Central European countries, as well as in Greece, Italy and Portugal. The highest shares for ESF, on the other hand, are reported in the Netherlands and Belgium (36 and 40% respectively). For EAFRD, the highest shares are observed in Austria and Ireland (79%), followed by Luxembourg (67%) and Denmark (55%).

The time profile of EU payments for the four funds combined is shown in Figure 1. The graph presents the payment profile for two groups of countries: EU-15 (EU members prior to accession in 2004) and EU-12 (EU Members States which joined the EU after 2004).

Overall, the payments made to the two groups of countries are roughly similar (51% of payments in the EU-15 and 49% in the EU-12) but the time profile of annual payments differs. In the first year, for instance, EU payments were 82% higher in the EU-15 than in the EU-12, this pattern being maintained until 2014 when the EU annual payments for the EU-12 exceeded the ones in the EU-15.

The importance of the funds for the Member States economy is better highlighted when expressed as a percentage of GDP (Figure 2). Across years, cohesion and rural development payments range between 0.20% (2007) and 0.52% (2013) of GDP in the EU-15. In the EU-12, they range from 0.41% of GDP in 2007 to 2.78% in 2013. Overall, for the EU-27 cohesion and rural development funding represent between 0.08% and 0.49% of GDP over the period 2007-2015.

In sum, the data on EU payments for the four funds combined highlight the following: 1) the amounts of total payments to the EU-12 and the EU-15 are roughly equal; 2) relative to the EU-12, the EU-15 seem to use funding at an earlier stage of the programming period; and 3) the weight of EU funding is significantly higher in the economy of the EU-12.

## 4. The Model

The model used in this paper is QUEST III which has been developed by DG Economic and Financial Affairs (DG ECFIN) of the European Commission. The model is regularly used for the

[5]The amounts reported in Table 1 differ from those mentioned in the introduction because the former correspond to cumulated expenditures up to 2015 while the latter correspond to the allocation budgeted for in 2006 for the period 2007-2013.

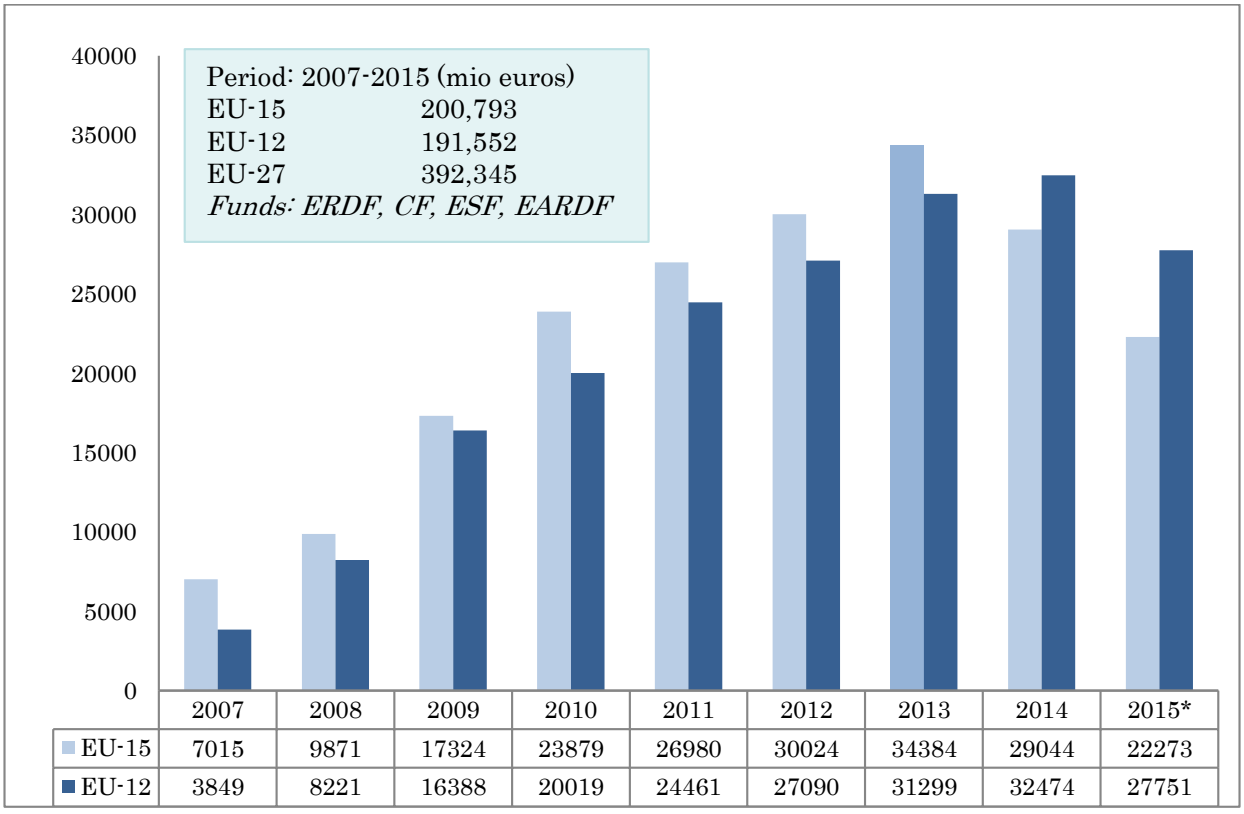
Table 1: EU advance and interim payments 2007- 2015.

| Country | Total actual payments (all funds) 2007-Oct 2015 (mio euro) | Share in Total Payments (col. 1) (%) | | | Estimated payments (all funds) 2007-2015** (mio euro) |
|---|---|---|---|---|---|
| | | ERDF+CF | ESF | EAFRD * | |
| | (1) | (2) | (3) | (4) | (5) |
| AT | 5103 | 0.11 | 0.10 | 0.79 | *5103* |
| BE | 2323 | 0.40 | 0.40 | 0.21 | *2337* |
| BG | 7639 | 0.55 | 0.14 | 0.30 | *7669* |
| CY | 704 | 0.62 | 0.16 | 0.22 | *737* |
| CZ | 24082 | 0.75 | 0.13 | 0.12 | *24082* |
| DE | 32120 | 0.45 | 0.27 | 0.28 | *33265* |
| DK | 1024 | 0.24 | 0.21 | 0.55 | *1048* |
| EE | 3957 | 0.72 | 0.09 | 0.18 | *3957* |
| ES | 36026 | 0.63 | 0.16 | 0.21 | *36026* |
| FI | 3661 | 0.25 | 0.16 | 0.59 | *3671* |
| FR | 19120 | 0.37 | 0.26 | 0.37 | *19710* |
| GR | 21735 | 0.68 | 0.17 | 0.15 | *22529* |
| HU | 23977 | 0.72 | 0.12 | 0.16 | *26590* |
| IE | 3170 | 0.11 | 0.11 | 0.79 | *3185* |
| IT | 29967 | 0.51 | 0.20 | 0.29 | *30284* |
| LT | 8202 | 0.67 | 0.12 | 0.22 | *8202* |
| LU | 142 | 0.17 | 0.16 | 0.67 | *143* |
| LV | 5339 | 0.70 | 0.10 | 0.20 | *5358* |
| MT | 755 | 0.79 | 0.12 | 0.10 | *856* |
| NL | 2060 | 0.36 | 0.36 | 0.29 | *2152* |
| PL | 76075 | 0.70 | 0.12 | 0.17 | *76841* |
| PT | 24391 | 0.57 | 0.27 | 0.17 | *24400* |
| RO | 20094 | 0.52 | 0.11 | 0.37 | *22259* |
| SE | 3464 | 0.25 | 0.19 | 0.56 | *3469* |
| SI | 4659 | 0.65 | 0.15 | 0.20 | *4716* |
| SK | 10087 | 0.70 | 0.11 | 0.18 | *10284* |
| UK | 13006 | 0.36 | 0.29 | 0.35 | *13472* |
| Total | 382881 | 0.58 | 0.17 | 0.24 | *392345* |

Source: DG REGIO. EAFRD data refers to requests for payments until August 2015.
** Estimated absorption until end 2015.

analysis of key fiscal and monetary policy scenarios or for assessing the impact of the structural reforms. For the analysis of cohesion policy and rural development, we adopt the R&D version of QUEST III which is a dynamic stochastic general equilibrium (DGSE) model with semi-endogenous

Figure 1: Time pattern of EU payments, all funds (million euros).




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015* |
|---|---|---|---|---|---|---|---|---|---|
| EU-15 | 7015 | 9871 | 17324 | 23879 | 26980 | 30024 | 34384 | 29044 | 22273 |
| EU-12 | 3849 | 8221 | 16388 | 20019 | 24461 | 27090 | 31299 | 32474 | 27751 |

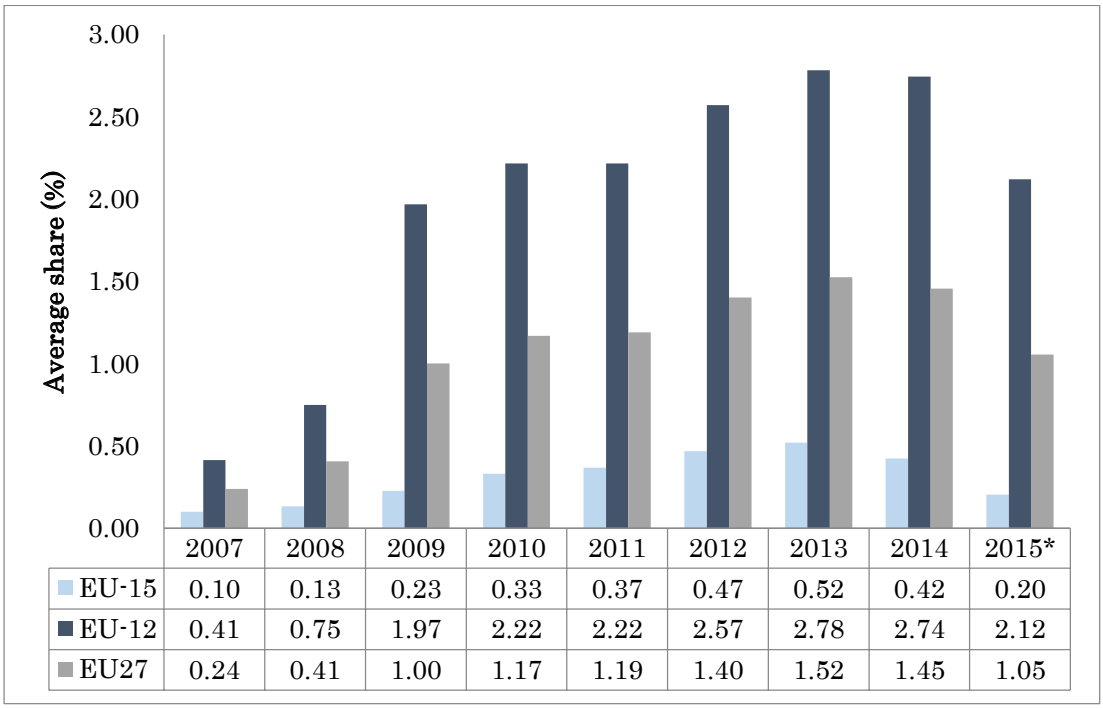
Source: DG REGIO. *Totals for ERDF, CF and ESF in 2015 are estimated until end-year; EAFRD payment requests data until August 2015.

growth based on Jones (1995). The model belongs to the class of New-Keynesian DGSE models that are now widely used in economic policy institutions. It provides a fully micro-founded, integrated and optimization-based representation of the economies of the Member States. Results are produced at the national level on a wide set of economic variables such as for instance GDP, employment, wages, investment or productivity.

QUEST is structured around building blocks which represent the behaviour of fundamental economic agents and interactions. The model describes the dynamics of the system in a general equilibrium framework where changes in the conditions for a particular block are transmitted to the other blocks though various market interactions. The model, the underlying assumptions and the calibration procedure are fully described in Roeger *et al.* (2008) and D'Auria *et al.* (2009).

The model features a R&D sector and two types of firms: the R&D sector produces designs by using high skilled labour as well as the domestic and foreign knowledge embodied in the existing stock of designs. Households buy the patents of designs from the R&D sector and license them to firms producing intermediate goods. These firms are monopolistically competitive and produce varieties of intermediate products using physical capital rented from households. Each from must

Figure 2: Time pattern of EU payments, all funds (as % of GDP).




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015* |
|---|---|---|---|---|---|---|---|---|---|
| EU-15 | 0.10 | 0.13 | 0.23 | 0.33 | 0.37 | 0.47 | 0.52 | 0.42 | 0.20 |
| EU-12 | 0.41 | 0.75 | 1.97 | 2.22 | 2.22 | 2.57 | 2.78 | 2.74 | 2.12 |
| EU27 | 0.24 | 0.41 | 1.00 | 1.17 | 1.19 | 1.40 | 1.52 | 1.45 | 1.05 |

Source: DG REGIO. *Totals for ERDF, CF and ESF in 2015 are estimated until end-year; EAFRD payment requests data until August 2015.

acquire a design in order to start operating. Finally, producers of final goods use a combination of intermediate goods and three types of labour - low, medium and high-skilled. As in Romer (1990), the main engine of endogenous growth consists in the accumulation of knowledge which enhances the capacity of the research industry to produce new designs, eventually leading to increase the number of varieties in the intermediate goods sector and hence the productivity in the final goods sector.

Capital is rented by firms in exchange of interest (or dividends) which are key components of the capital cost. Labour is hired from households against a wage rate which, together with the level of employment, is determined on the labour market. The productivity of firms is also positively affected by the stock of public capital which is provided by the government through public investment. The government also raises taxes which are used to finance its consumption and investment expenditure.

Households can accumulate human capital in the three types of labour skills by participating in education. During the time spent in schooling, individuals are not employed and as a result, they are not included in the labour supply. Nevertheless, the accumulation of human capital increases labour productivity over time.

Varga and in 't Veld (2011a,b) extended the model with multicountry-setting, including the 27

Member States, the rest of the world. The individual country blocks are linked through international trade. The model also allows for international R&D spillovers in order to capture the fact that technology is not fully appropriable and that innovation can be absorbed by non-innovative agents (e.g. through imitation). Support to R&D in one country will therefore also have a positive impact on the level of technology in the rest of the EU. In this respect, the model takes into account the fact that programmes implemented in a particular Member States produce an impact in the other countries by affecting the intensity of trade and/or knowledge flows. The model takes into account the fact that cohesion and rural development policies are financed by contributions of the Member States to the community budget. It assumes that the contribution of each Member State to the community budget is proportional to its GDP and is financed by adapting VAT taxes. Taxes are distortionary and their increase adversely affects economic performance. This negative effect partly offsets the positive impact of the programmes.

The model allows to consider a wide range of policy interventions, some of which being closely related to cohesion and rural development policies. Support to R&D is assumed to facilitate the adoption of innovation by reducing the cost of producing new processes. The government can also help firms by providing subsidies (modelled as reductions in fixed costs) or by easing their access to finance, thereby reducing the cost of capital and encouraging investments. The government plays another key role by providing public infrastructure which contributes to building up the stock of public capital without which firms cannot operate. Public interventions in the field of education increase the efficiency of the schooling system in enhancing human capital which, by increasing labour productivity, contributes to increasing competitiveness and wages.

In general, the analysis is conducted by simulating and comparing two scenarios. The baseline scenario relies on the natural trend in the economy, excluding any policy intervention. The second scenario includes the policy interventions for cohesion and rural development. By comparison with the baseline, it allows to isolate the impacts of the policy on the economy. For a given variable, the difference between the values obtained under the two scenarios is interpreted as the impact attributable to the policy. It is expressed as a percentage deviation from the baseline[6]. The model has been calibrated based on 2010 data and hence accounts for the particular conditions of the EU economies at the time of implementing the 2007-2013 programmes.

## 5. Model simulations

As explained above, investments financed by cohesion and rural development policies are broken down in 86 and 46 categories of expenditure respectively. For the purpose of the simulations, these categories have been used to group investments into five fields of intervention which are relevant

[6]The baseline is established on the basis of assumptions concerning the trends of key variables which is common practice in economic modelling. The results, which correspond to the difference between the baseline and the 'with-policy' scenarios, are independent from the baseline.

for the model: infrastructure, human capital, research and development (R&D), aid to private sector, and technical assistance and other interventions. Appendix 1 shows how the categories of EU investments are mapped into the five fields of intervention. The corresponding policy mix for each Member States is displayed in Table 2 below.

Table 2: Distribution of EU expenditure per fields of intervention (% of total expenditure).

| | Research and Development | Aid to Private Sector | Infrastructure | Human Capital | Technical Assistance and Other |
|---|---|---|---|---|---|
| AT | 4.2 | 72.9 | 8.0 | 11.3 | 3.5 |
| BE | 8.3 | 36.0 | 6.2 | 47.2 | 2.4 |
| BG | 2.4 | 29.0 | 48.6 | 12.3 | 7.8 |
| CY | 4.3 | 42.9 | 30.4 | 18.2 | 4.2 |
| CZ | 9.8 | 20.6 | 50.8 | 15.4 | 3.4 |
| DE | 12.1 | 31.4 | 24.3 | 29.8 | 2.5 |
| DK | 12.5 | 45.5 | 9.0 | 27.9 | 5.1 |
| EE | 12.0 | 22.0 | 54.1 | 10.1 | 1.8 |
| EL | 3.6 | 28.0 | 45.6 | 19.9 | 2.9 |
| ES | 9.7 | 23.6 | 44.2 | 19.7 | 2.7 |
| FI | 9.9 | 59.0 | 9.6 | 18.0 | 3.5 |
| FR | 8.1 | 38.2 | 17.5 | 32.3 | 3.8 |
| HU | 3.4 | 26.8 | 52.0 | 13.3 | 4.5 |
| IE | 2.9 | 68.5 | 14.4 | 12.3 | 1.9 |
| IT | 13.2 | 33.4 | 26.9 | 22.7 | 3.9 |
| LT | 8.5 | 25.2 | 50.5 | 10.6 | 5.1 |
| LU | 7.3 | 60.9 | 11.0 | 17.7 | 3.0 |
| LV | 12.1 | 23.7 | 50.1 | 10.9 | 3.1 |
| MT | 6.5 | 20.3 | 59.4 | 10.5 | 3.2 |
| NL | 14.1 | 29.4 | 13.5 | 39.7 | 3.3 |
| PL | 9.7 | 18.5 | 54.3 | 14.0 | 3.5 |
| PT | 13.0 | 22.2 | 32.7 | 29.1 | 3.0 |
| RO | 2.4 | 27.9 | 42.8 | 19.5 | 7.5 |
| SE | 9.0 | 53.5 | 10.4 | 23.1 | 4.0 |
| SI | 14.4 | 27.5 | 39.8 | 15.6 | 2.7 |
| SK | 6.4 | 21.8 | 53.7 | 14.5 | 3.7 |
| UK | 9.2 | 43.2 | 11.0 | 34.1 | 2.5 |
| *EU-27* | *8.9* | *27.9* | *39.5* | *20.1* | *3.6* |

Source: DG REGIO calculations.

At the EU-27 level, the highest share of payments goes to infrastructure (39.5%), followed by aid to the private sector (27.9%) and support for the development of human capital (20.1%). The share of infrastructure is generally higher in the EU-12 Member States compared with the EU-15 where payments in support to human capital and to the private sector is relatively more important.

Results are first presented for each type of intervention separately (section 5.1) and then for

the full policy package where all interventions are considered together (section 5.2). The figures are reported either for the time horizon 2007-2023 or for two points in time, 2015 and 2023. The year 2015 marks the end of the implementation period and can be considered as a threshold for the short to medium run. However, as already mentioned the effects of cohesion and rural development policies are likely to fully materialize with a lag and results are therefore also reported for 2023 which, 10 years after the end of the programming period, is chosen to represent the long run.

### *5.1. Model fields of intervention*

*Infrastructure*

Infrastructure includes investments in transport, telecommunications, energy, environmental and social infrastructure. These investments are modelled either as government investment (e.g. motorways, railways, infrastructure related to ICT, energy infrastructure, or management and distribution of water) or government consumption (e.g. promotion of biodiversity and nature protection or risk prevention). The first type accounts for more than 91% of the total infrastructure expenditure of cohesion and rural development policies[7].

Government investment is part of final demand for goods and services and as such the interventions in the field of infrastructure falling in this category have a strong short run demand-side effect during the period of implementation. Government investment has also a supply-side effect as it contributes to building up public capital which in turn raises factor productivity. This mostly occurs in the medium to long run when the output enhancing effects of infrastructure investment become stronger. When investment is discontinued, the productivity effect slowly declines due to the depreciation of public capital. In the short run, government investment can also partly crowd-out private investment, although this effect proves rather modest (see Appendix 2).

Accordingly, the impact of investment in this type of infrastructure materialises as soon as projects are implemented (due to the short run demand side effect of the interventions). They also have a long run effect linked to the increase in productivity they generate which continues after the implementation period.

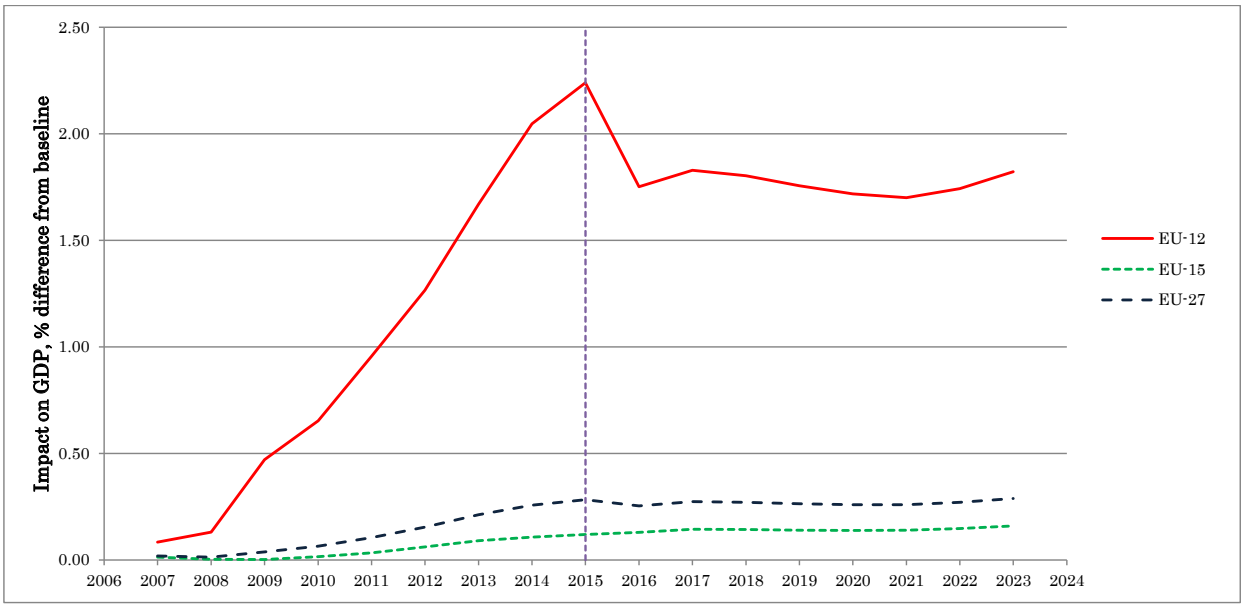
Government consumption is also a component of final demand but it is not expected to have a long-lasting impact on the structure of the economies. As such, interventions of this type only have a short run demand effect which appears during the implementation period.

Figure 3 shows the impact on EU-27 GDP of interventions in the field of infrastructure between 2007 and 2023. The drop in 2015 corresponds to the termination of the programmes after which only the long run supply side effects of the interventions are maintained.

*Human capital*

[7]This classification is disputable and an alternative scenario has been tested where environmental infrastructure is included in the group of infrastructure considered as government consumption. The results of this alternative scenario are quite similar in nature and are available upon request.

Figure 3: Cohesion and rural development policies investment in infrastructure, impact on GDP, 2007-2023 (percentage deviation with respect to baseline).



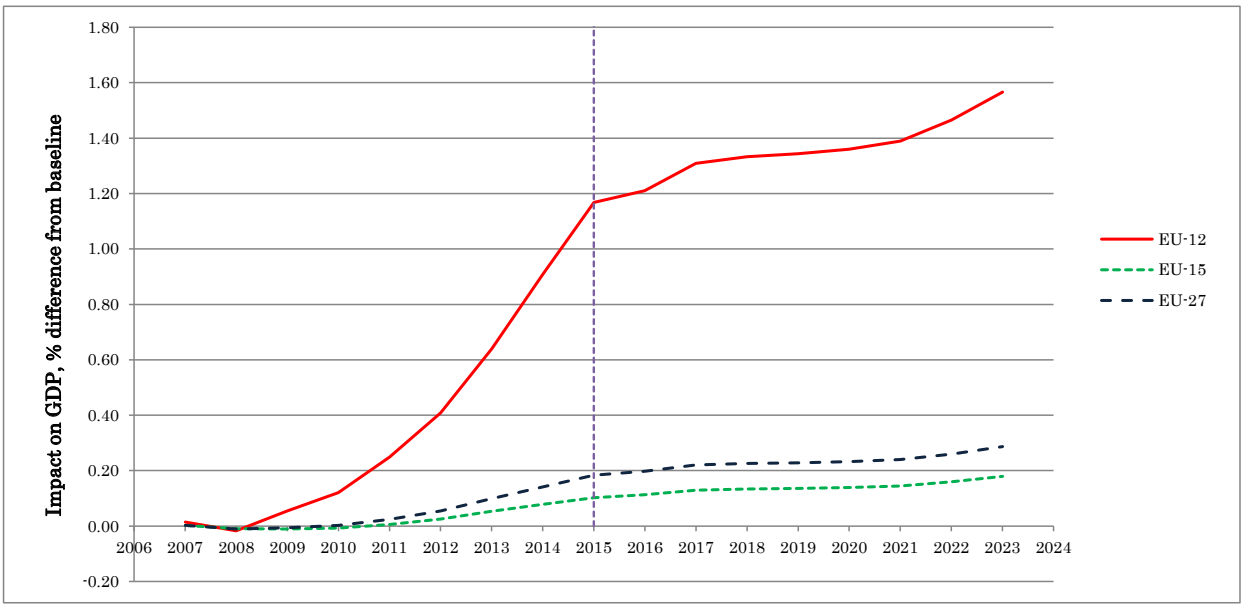

Source: QUESTIII simulations.

Investments in human capital include all spending on educational and vocational training as well as more generally defined labour market interventions. These interventions are modelled as enhancing human capital for each group of skill, which increases labour productivity. This in turn translates into higher real wages and stimulates investment (although this effect comes at a later stage, see Appendix 2). These interventions also increase productivity in the R&D sector which fosters the production of patents and hence eventually raises total factor productivity. The effects of training on average skill efficiencies take time to build up, taking into account cohort effects. Accordingly, the gains in GDP are only becoming apparent in the long run but they are significant and highly persistent (see Figure 4) due to the fact that they positively affect the main engines of long run growth in the model, i.e. accumulation of human capital (direct effect) and of physical capital and technology (indirect effect). However, the impact progressively fades out in proportion to the exit rate of working age population in the long run.

*Research and Development (R&D)*

Support to R&D includes all spending on research, technological development and innovation, including the establishment of networks and partnerships between businesses and/or research institutes. In the model, this is captured as reductions in fixed costs for firms engaged in R&D and reductions in intangible capital costs. Facilitating the production of innovative processes, which in the model is reflected by the increase in the number of patents (see Appendix 3), directly boosts total factor productivity. Increases in R&D activities lead also to reallocate high skilled workers away from the production of final goods, which explains why they can have an initial negative

Figure 4: Cohesion and rural development policies investment in human capital, impact on GDP, 2007-2023 (percentage deviation with respect to baseline).




Source: QUESTIII simulations.

impact on GDP in the short run (see Figure 5). However, in the long term the positive effects on output dominate. As they stimulate the endogenous growth mechanism at work in the model, the impact of investments in R&D tend to strengthen over time, long after the end of the programmes. Accordingly, the effects of this type of interventions takes time to become apparent but the output gains are significant and continue to increase long after spending is discontinued.

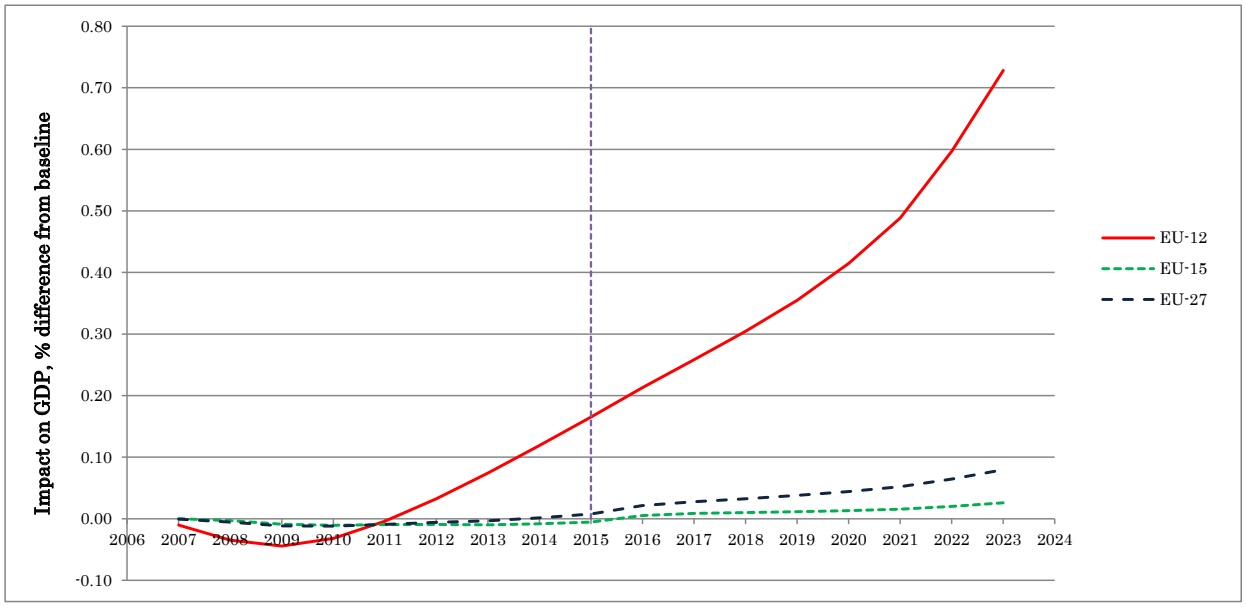
*Aid to private sector*

Aid to private sector includes interventions such as support to small and medium sized enterprises, facilitation to credit, assistance to improve tourism services and cultural investments. It includes also various types of support to rural development by the EAFRD. Part of the interventions is modelled as reductions of fixed costs or of capital costs for tangible capital in the final goods sector, while other interventions are considered as government consumption. The impact of aid to private sector on GDP over time is shown in Figure 6. Aid to private sector triggers increases in private investment (see Appendix 2) and hence accelerates the pace of physical capital accumulation. Other interventions, modelled as increasing government consumption (e.g. in the area of natural or cultural heritage), produce their impact mostly in the short run as they correspond to a subsidy provided during the implementation period.

*Technical assistance and other interventions*

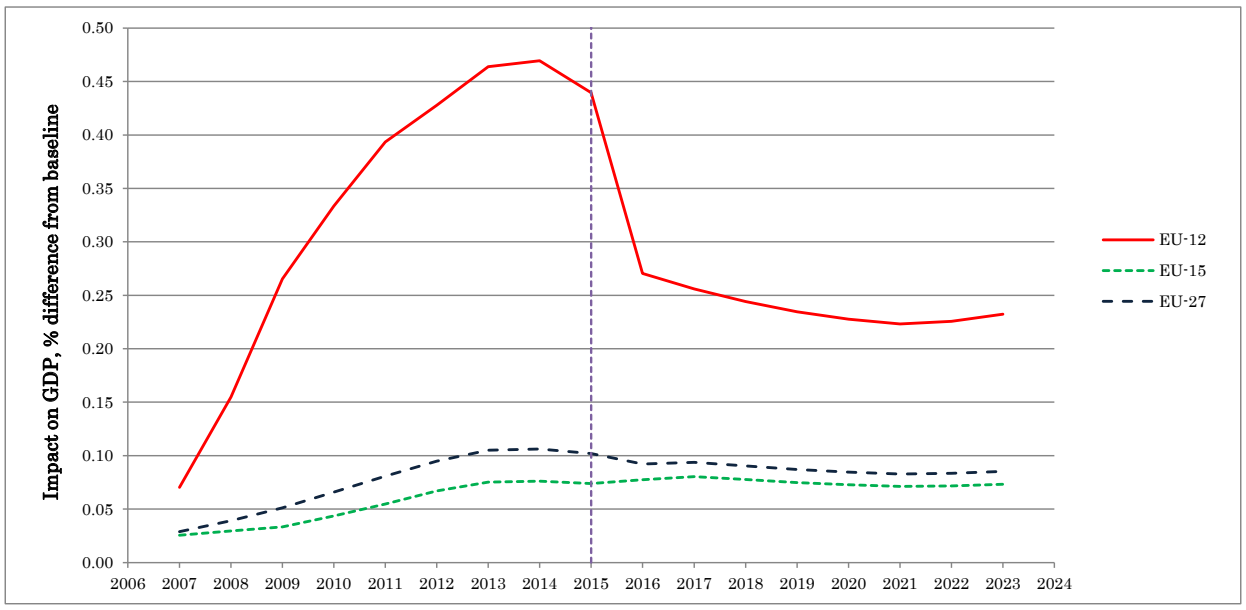
Technical assistance includes investments for building administrative capacity, monitoring and evaluation, as well as various compensations for specific territories. It is modelled as government spending with immediate effects in the short run. This category of intervention is generally modest

Figure 5: Cohesion and rural development policies investment in R&D, impact on GDP, 2007-2023 (percentage deviation with respect to baseline).




Source: QUESTIII simulations.

Figure 6: Cohesion and rural development policies aid to private sector, impact on GDP, 2007-2023 (percentage deviation with respect to baseline).




Source: QUESTIII simulations.

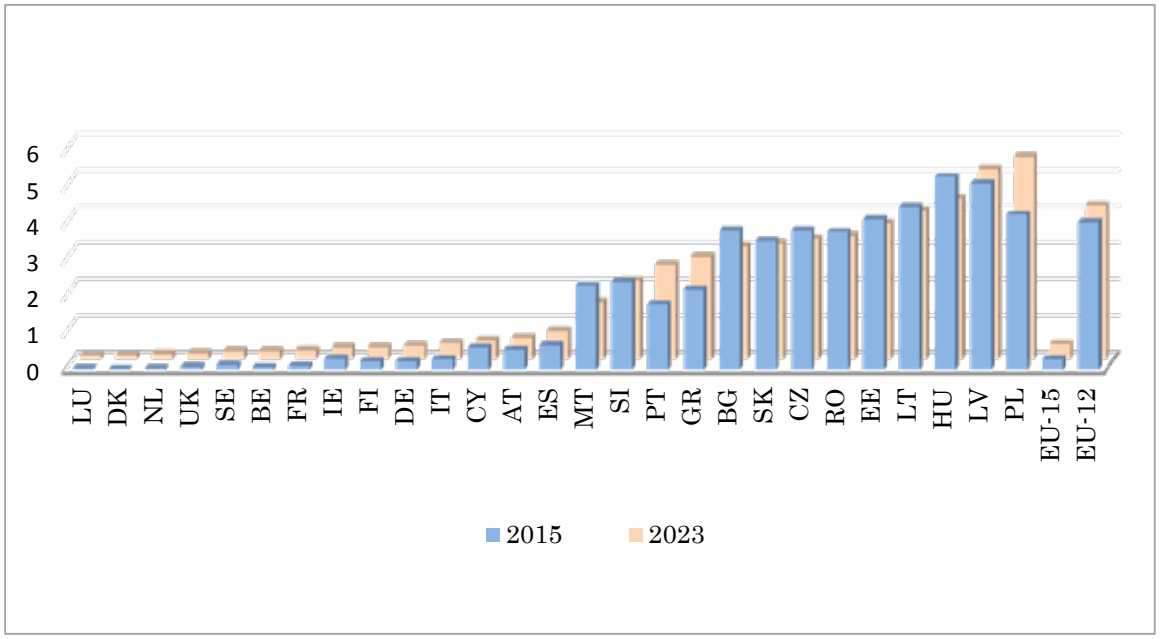
(see Table 2). For the sake of conciseness, although being included in the simulations, the impact of these interventions is not discussed further.

*5.2. Member States policy mix*

*Impact on GDP*

Figure 7 shows the net effect on GDP of EU cohesion and rural policies combining investments in the five fields of intervention during the period 2007-2015. Results are reported for each Member State together with the average for the EU-15, the EU-12 and the EU-27 for the years 2015 and 2023.

Figure 7: Impact on GDP of cohesion and rural development policies, 2015 and 2023 (percentage deviation with respect to baseline).




Source: QUESTIII simulations.

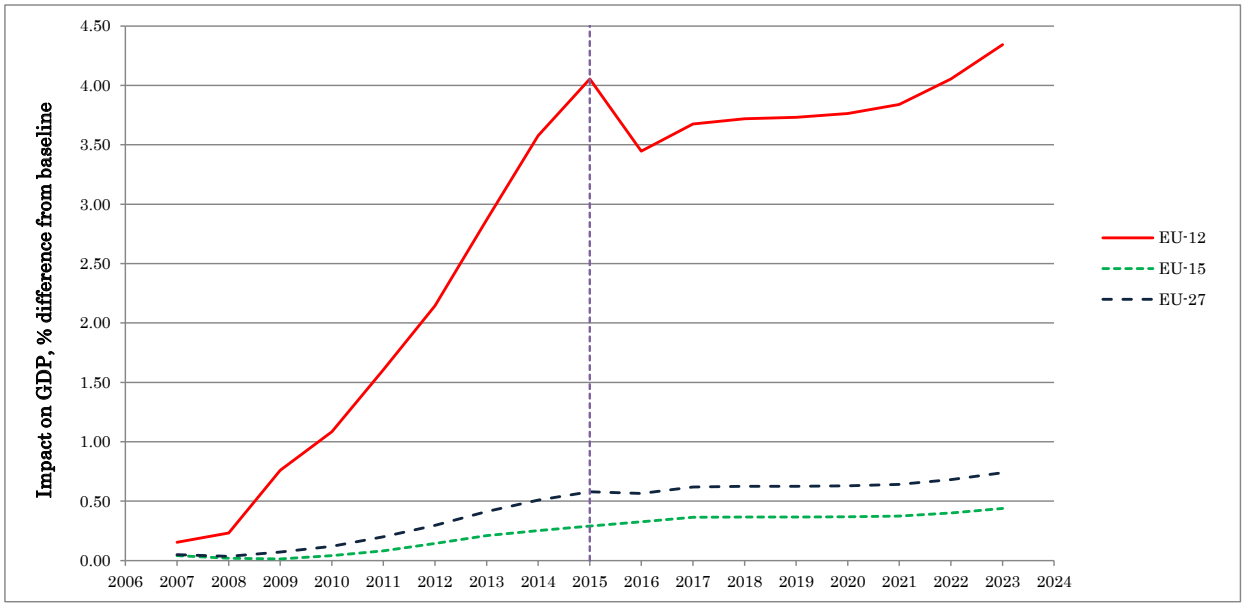
In the EU-12, the impact of the interventions is significant both in the short and in the long run. For example, at the end of the implementation period (2015), GDP in Hungary is more than 5% higher thanks to the policies. The impact is somewhat lower in 2023, GDP being 4.4% higher than in the baseline scenario. In Poland, the impact is also high and contrary to Hungary, it strengthens between 2015 and 2023, increasing from 4.3% to 5.6%. This is partly due to the stronger emphasis of the Polish programmes on investments in human capital and R&D which produce most of their effects in the long run. On average, the impact in the EU-12 is around 4% above baseline both in the short and the long run.

In the EU-15, the impact of cohesion policy and rural development policies is smaller during the implementation period but it strengthens over time. It is the highest in the Member States which benefit from the Cohesion Fund, in particular in Greece (2.2% in 2015 and 2.8% in 2023) and Portugal (1.8% in 2015 and 2.6% in 2023). Interestingly, the impact remains positive even in Member States which are net contributors to the policies. This suggests that the negative

effect of increasing taxes is more than compensated by the boost in productivity brought by the interventions, which is particularly true in the long run. The smaller magnitude of the impact in the EU-15 directly follows from the fact that, compared to the EU-12, the allocation accruing to the States is much lower relative to the size of their economies. However, in absolute terms the gains are rather comparable. Based on the multipliers reported at the end to this section, the €201 billion invested in cohesion and rural policies in the EU-15 have the potential to generate a gain of €134 billion by 2015 and of €548 billion by 2023. In comparison, for the EU-12 the investment of €192 billion would generate a gain of €173 billion by 2015 and of €538 billion by 2023.

Given their orientation towards structural change, cohesion policy and rural development policies need time to generate significant gains. Sizeable impacts of the interventions materialise with a lag, most often long after the programmes are terminated. In the short run, a substantial part of the impact stems from the increase in demand, partly crowded-out through increases in wages and prices. In the long run, productivity enhancing effects of the interventions generate increases in GDP free of inflationary pressures. Figure 8 shows the impact of the policies for the EU-12, EU-15 and EU-27 from 2007 to 2023[8].

Figure 8: Cohesion and rural development policies impact on GDP, 2007-2023 (percentage deviation with respect to baseline).




Source: QUESTIII simulations.

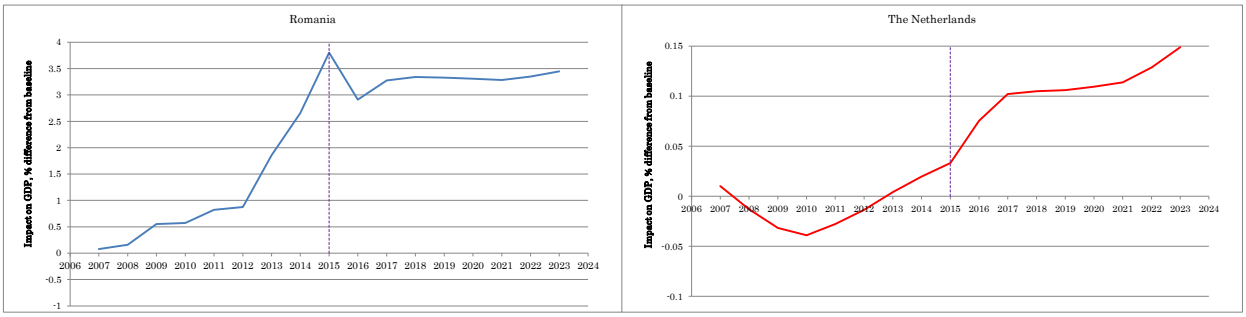
As the time profile of the impact changes significantly from one field of intervention to another

[8]Note that in general, the impact obtained here is higher than in Varga and in 't Veld (2011b) due to the fact that this analysis incorporates rural development funds, which makes the size of the policy injections higher by around 25% and that it covers the programmes implemented in all Member States instead of those implemented in the main beneficiaries only.

(see Figures 3 to 6), the impact of the policies at a given date not only depends on the amount of resources injected in the economy but also on how they are distributed among these fields. In particular, countries which invest heavily in R&D and human capital are more likely to see the impact of the interventions emerge in the long run while countries heavily investing in infrastructure already benefit from the interventions in the short run. This is confirmed by the strong correlation between the share of the funding invested in R&D and human capital on the one hand and the difference between the magnitude of the impact in the short run and in the long run, the former explaining more than 52% of the cross-country variance of the latter. Also, the impact in Member States which are net contributors is likely to be higher in the long run because there is no need to raise additional distortionary taxes once the programmes are terminated.

As an illustration, Figure 9 shows the time profile of the policy impact on GDP for the Netherlands (net contributor investing heavily in R&D and human capital) and Romania (net beneficiary investing heavily in infrastructure). In Romania, the positive effects of the policies already materialise at the beginning of the implementation period while in the Netherlands they only become positive from 2013 onwards.

Figure 9: Cohesion and rural development policies impact on GDP, 2007-2023 (percentage deviation with respect to baseline).




Source: QUESTIII simulations.

*Impact on real wages*

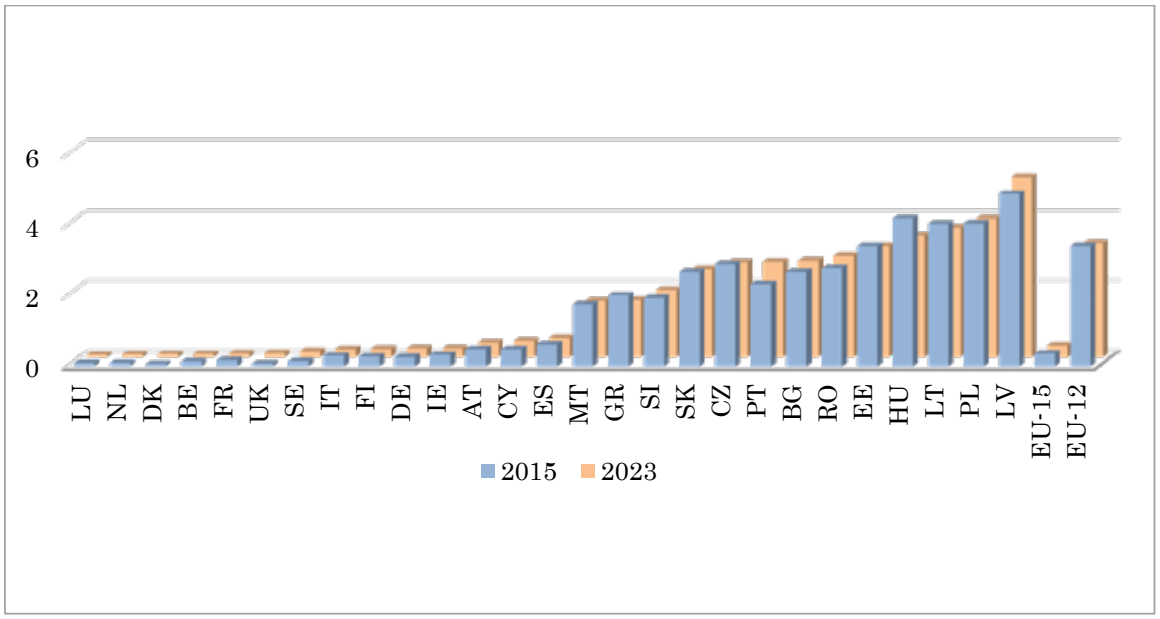
In QUEST, the impact of cohesion and rural development investments on the labour market are primarily reflected through their effects on labour productivity and real wages. Figure 10 shows the net impact of the policies on real wages for years 2015 and 2023.

According to the simulations, the largest effects are expected in the EU-12 Member States and Portugal. For all countries, the impact on real wages persist at comparable levels between the two reference years. By 2023, cohesion and rural policies programmes could contribute to increase real wages by almost 3.3% in the EU-12 and by around 1.0% in the EU-27.

*Impacts on total factor productivity and investment*

The impact of cohesion and rural development policies is also apparent on other key macroeconomic variables such as total factor productivity (TFP) or private investment (Figures 11 and 12).

Figure 10: Impacts on real wages of cohesion and rural development policies, 2015 and 2023 (percentage deviation with respect to baseline).




Source: QUESTIII simulations.

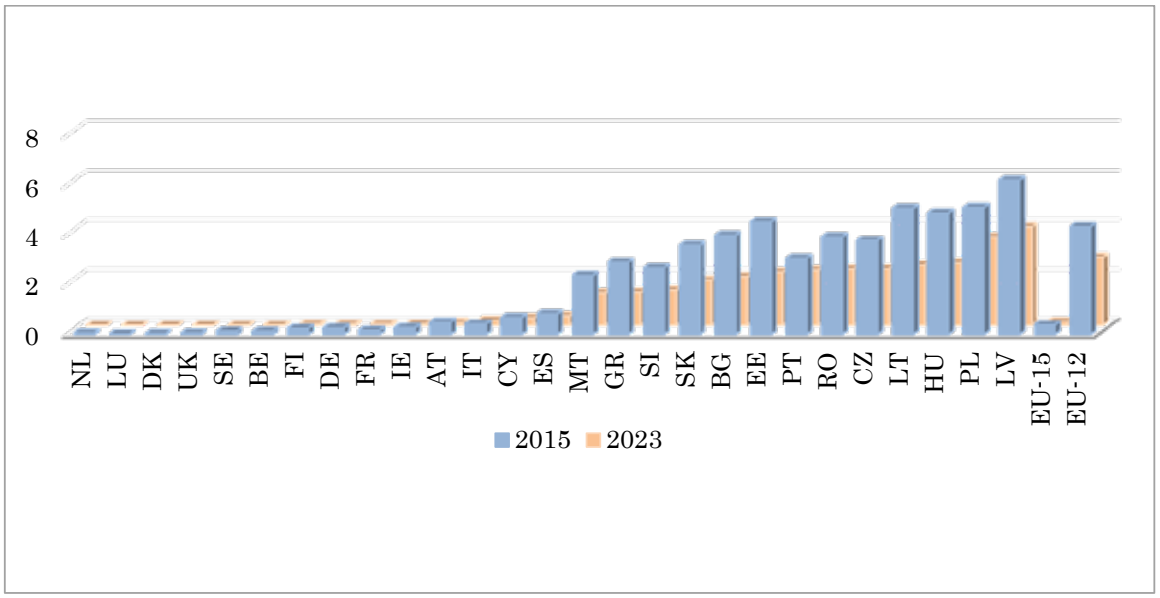
The increase in TFP attributable to cohesion and rural development policies is particularly high in the EU-12, peaking to 4.2% in 2015. By comparison, the average increase in TFP for the EU-15 in the same year is around 0.4%. The impact on private investment is to a large extent indirect as it mainly reflects the improvement of the business environment, notably the increases in factor productivity triggered by the interventions. However, as highlighted above these effects take time to fully materialise and, while in the first place private investment may be partly crowded out by the interventions, the positive impact of the policies appears in the medium to long run. In 2023, for instance private investments in the EU-12 increases by 2.3% due to policies interventions while the increase in the EU-15 is 0.47%.

*Impact on trade balance*

The impact on the country trade balance differs between the EU-12 and the EU-15. For most Member States in the first group, the programmes tend to deteriorate the trade balance due mainly to the increase in economic activity generated by the interventions which triggers an increase in imports. For other Member States, mostly located in the EU-15, the interventions have a positive effect on the trade balance which to a large extent reflects the fact that a significant part of the increases in imports in the EU-12 originates from the EU-15. This corresponds to a trade spill-over effect through which programmes implemented in the main beneficiaries of the policies also produce a positive impact in the other Member States.

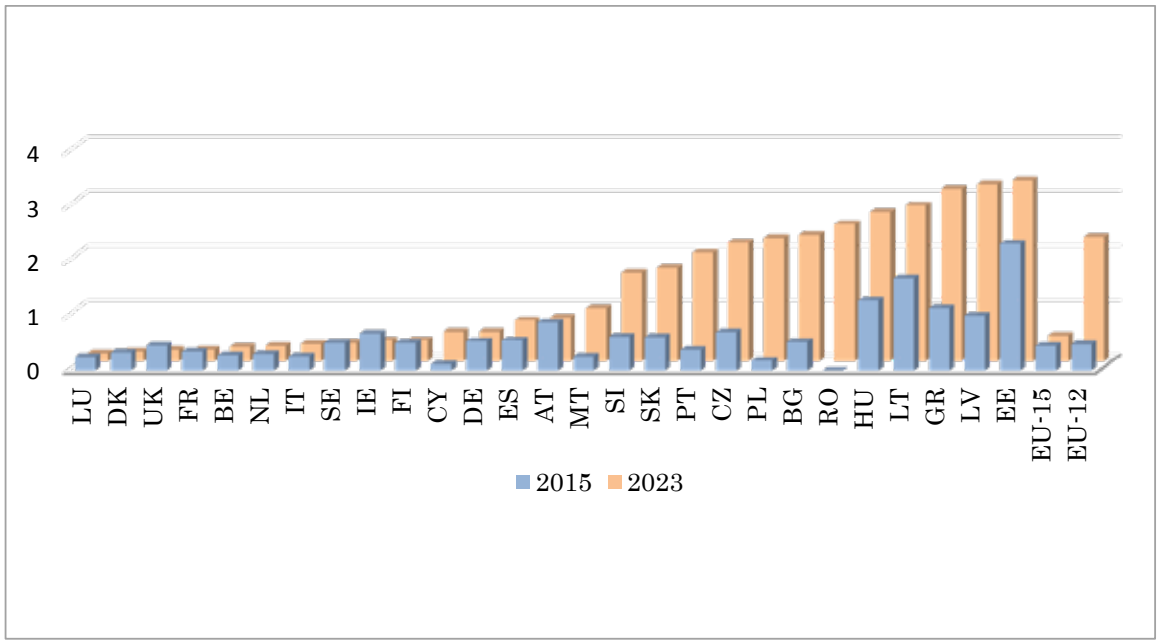
*Cumulative multipliers - Impact per euro spent*

Figure 11: Cohesion and rural development policies on total factor productivity, 2015 and 2023 (percentage deviation with respect to baseline).




Source: QUESTIII simulations.

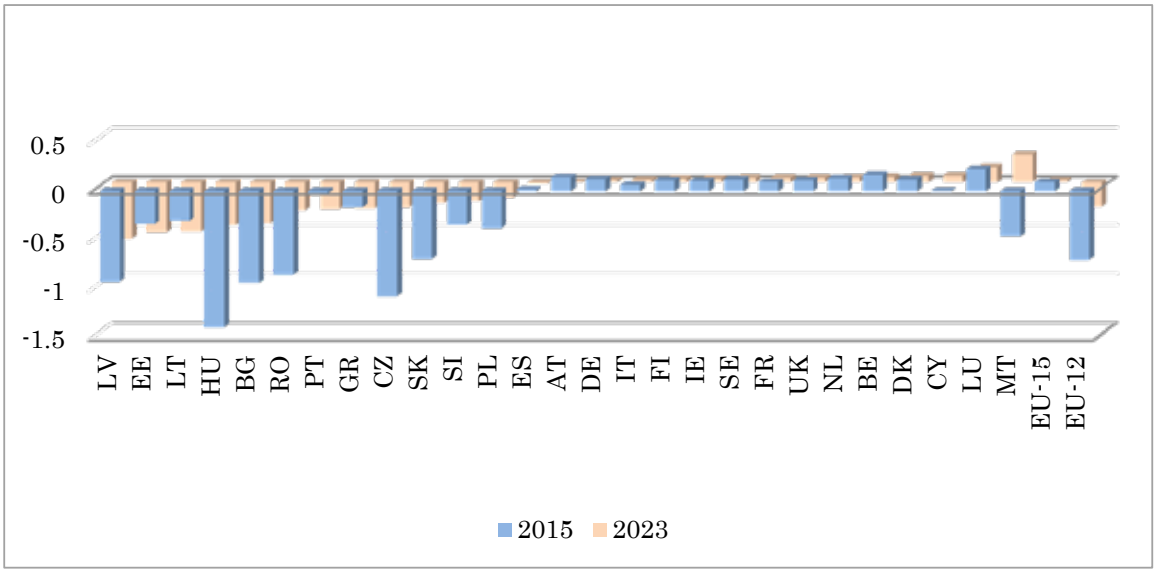
Figure 12: Cohesion and rural development policies impact on private investment, 2015 and 2023 (percentage deviation with respect to baseline).




Source: QUESTIII simulations.

As mentioned above, the impact in each Member States is directly related to the size of the financial support it receives from cohesion and rural development policies. In order to better capture

Figure 13: Impacts of cohesion and rural development policies on Trade Balance as % of GDP, 2015 and 2023 (percentage deviation with respect to baseline).




Source: QUESTIII simulations.

the effectiveness of the interventions, the results of the simulation can be used to calculate the impact, say on GDP, per euro spent which corresponds to the ratio between the cumulated impact on GDP up to a given year and the cumulated amounts spent up to the same year. This is referred as the cumulative multiplier whose value indicates the accumulated GDP effect over the specified period.

Table 3 reports the values of the cumulative multipliers for the EU-12, EU-15 and EU-27. By the end of the implementation period, the cumulative multiplier for the EU-27 is estimated at around 0.78. The values of the multipliers increase significantly in the long run. Again, this is due to the fact that many interventions continue to produce their effects long after they are terminated which implies that in the long run, positive impact on GDP continues to build up after spending has been stopped. By 2023, cumulative multiplier obtained for the EU-27 reaches 2.74 which suggests that the efforts of the Union to allocate resources to cohesion and rural policies generate a potential benefit for all the members of the EU. Note that these figures are in line with those obtained in previous analysis with QUEST (see Varga and in 't Veld (2011a,b)). Over a period of 17 years, such a multiplier corresponds to an annual average return of around 6% which is good value for money but still below usual long run returns on private investment which makes sense for public policies[9].

[9]For instance, between 1995 and 2015 the compound annual growth rate of the SP 500 is 11.3%.

Table 3: Cumulative multipliers, EU-15, EU-12 and EU-27, 2015 and 2023.

| | 2015 | 2023 |
|---|---|---|
| **EU-12** | 0,90 | 2,80 |
| **EU-15** | 0,67 | 2,73 |
| **EU-27** | 0,78 | 2,74 |

Source: QUESTIII simulations.

## 6. Sensitivity analysis

The results obtained from the simulations partly depend on the values selected for a number of key parameters. These values are based on a review of trustworthy empirical analysis and correspond to what is commonly assumed in the economic literature. However, estimations for some parameters sometime significantly vary from one source to the other and the value selected for modelling purposes corresponds to an average hiding a number of quite different estimates. This is for instance the case for the output elasticity of public capital ($\alpha_G$).

Since the seminal works of Aschauer (1989a,b), a huge body of literature has developed on the economic impact of public infrastructure. The question has led to an intense methodological debate as the exercise of estimating the link between public infrastructure and economic performance proved to include many difficulties, from simultaneity among the variables considered in the analysis to reverse causality, or uncertainties concerning the identification of exogenous shocks in VAR-based analysis (see for instance Kamps (2005) or Pereira and Andraz (2012)).

Not surprisingly, if most contributions conclude to a positive and significant impact of public infrastructure on economic performance in the EU, there is no consensus concerning the quantification of this link (see for instance the recent surveys by Pereira and Andraz (2013), De la Fuente (2010) or Romp and de Haan (2007)). For example, De la Fuente (2010) makes a selection of the analyses which are most likely to produce comparable and plausible results for the EU[10]. Across the studies reviewed, the estimates of the elasticity of output to public infrastructure averages to around 0.13 for Spain and 0.18 for regional studies covering other countries. However, dispersion around these averages is quite high with t-stat of 3.99 for Spain and 9.19 for regions of other countries.

For these simulations, we therefore chose a rather conservative approach setting the output elasticity of public capital to 0.10. However, given the uncertainty surrounding the estimation of this parameter, we examine how results change with values of $\alpha_G$ set to 0.075 and 0.125. As shown in Figure 14, results are quite sensitive to the value selected for this elasticity. For example, while the the impact of programmes on EU-12 GDP by 2015 is 4.05% above baseline when $\alpha_G$ is set to

[10]These correspond to studies relying on regional data of the same country. Indeed, differences in the econometric specifications adopted, sample composition and lack of data homogeneity make cross-country studies difficult to use.

0.10, it is 3.5% for $\alpha_G = 0.075$ and 4.61% for $\alpha_G = 0.125$. However, the results do not change in nature and the conclusions drawn from the analysis remain valid.

Figure 14: Impacts of cohesion and rural development policies on EU-12 GDP for alternative output elasticities of public capital.


Source: QUESTIII simulations.

Another source of uncertainty is the parameter corresponding to the Frisch elasticity of labour supply which is included in households' preferences. A large literature provides estimates of the responsiveness of individual labour supply to wage changes but the range of the results obtained is quite large and depends on the data used, the approach selected (e.g. micro vs macro data) or the time, place and population for which the analysis is conducted. Estimates of the Frisch elasticity for men usually range from zero to 0.8. As highlighted by Reichling and Whalen (2017), some authors have found relatively small values between 0 and 0.5 (e.g. Blundell *et al.* (2014), French (2005), Altonji (1986), or MaCurdy (1981)) while others have estimated larger elasticities between 0.5 and 0.8 (Ziliak and Kniesner (2005), Pistaferri (2003), Lee (2001), or Angrist (1991)). Keane (2011) surveys a substantial part of the literature and reports estimates with a range from zero to 0.7 and a median value of 0.2.

For the present simulations, a value of 0.2 has been selected but in order to check the sensitivity of the results to this parameter, values of 0.1 and 0.3 have been used as lower and upper bound alternatives. The results suggest that the values chosen for the labour supply elasticity only have a marginal influence on the results.

## 7. Conclusions

This paper provides an assessment of the programmes implemented under the EU cohesion and rural development policies during the period 2007-2013. It analyses their impact on the European economy based on a set of simulations conducted with QUEST, a dynamic stochastic general equilibrium model with endogenous growth and human capital accumulation. The results show that in general, cohesion and rural development policies brought significant gains and contributed to enhance the structure and the performance of the EU Member States economies.

Interventions substantially increased GDP, in particular in the Member States which are the main beneficiaries of the policies. The results suggest that, following the implementation of the programmes, GDP in 2015 was on average 4.1% higher in the Member States which joined the Union after 2004. The highest impact is found in Hungary (+ 5.3%) and Latvia (+ 5.1%) as well as in Poland (+4.3%). In the EU-15, the impact is more modest but it remains substantial for some Member States like Greece (+2.2%), Portugal (+1.8%) and Spain (+0.7%) which benefited from support of the Cohesion Fund.

For some fields of intervention, the impact takes time to materialise and continues to build up long after the termination of the programmes. This is particularly the case for interventions in the fields of R&D and human capital for which most of the effects come through in the long run when the productivity enhancing effects become gradually stronger.

Cohesion and rural development policies also affect many other key economic variables. Overall, the simulations shows that the interventions improve the structure of the EU economies and hence their competitiveness. In particular, they have a positive and significant impact on the productivity of factors of production, as result of direct investment in technology but also of enhanced business conditions encouraging investment in tangible and intangible assets.

Finally, cohesion and rural development policies yield high value for money. As expected from policies supporting investments in key engines of growth, a substantial part of their effects progressively increases over time and only emerge in the long run. However, once they produce their full impact, the interventions prove to benefit to the whole Union even if they are concentrated in its less developed places.

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## Appendix 1 - ERDF, CF and ESF Mapping of priority themes into fields of intervention

| Category | FoI |
|---|---|
| 1. R&TD activities in research centres | RTD |
| 2. R&TD infrastructure and centres of competence in a specific technology | RTD |
| 3. Technology transfer and improvement of cooperation networks | RTD |
| 4. Assistance to R&TD, particularly in SMEs (including access to R&TD services in research centres) | RTD |
| 5. Advanced support services for firms and groups of firms | AIS |
| 6. Assistance to SMEs for the promotion of environmentally-friendly products and production processes | AIS |
| 7. Investment in firms directly linked to research and innovation | RTD |
| 8. Other investment in firms | AIS |
| 9. Other measures to stimulate research and innovation and entrepreneurship in SMEs | RTD |
| 10. Telephone infrastructures (including broadband networks) | INFR |
| 11. Information and communication technologies | INFR |
| 12. Information and communication technologies (TEN-ICT) | INFR |
| 13. Services and applications for citizens (e-health, e-government, e-learning, e-inclusion, etc.) | INFR |
| 14. Services and applications for SMEs (e-commerce, education and training, networking, etc.) | INFR |
| 15. Other measures for improving access to and efficient use of ICT by SMEs | INFR |
| 16. Railways | INFR |
| 17. Railways (TEN-T) | INFR |
| 18. Mobile rail assets | INFR |
| 19. Mobile rail assets (TEN-T) | INFR |
| 20. Motorways | INFR |
| 21. Motorways (TEN-T) | INFR |
| 22. National roads | INFR |
| 23. Regional/local roads | INFR |
| 24. Cycle tracks | INFR |
| 25. Urban transport | INFR |
| 26. Multimodal transport | INFR |
| 27. Multimodal transport (TEN-T) | INFR |
| 28. Intelligent transport systems | INFR |
| 29. Airports | INFR |
| 30. Ports | INFR |
| 31. Inland waterways (regional and local) | INFR |
| 32. Inland waterways (TEN-T) | INFR |
| 33. Electricity | INFR |
| 34. Electricity (TEN-E) | INFR |
| 35. Natural gas | INFR |
| 36. Natural gas (TEN-E) | INFR |

| | |
|---|---|
| 37. Petroleum products | INFR |
| 38. Petroleum products (TEN-E) | INFR |
| 39. Renewable energy: wind | INFR |
| 40. Renewable energy: solar | INFR |
| 41. Renewable energy: biomass | INFR |
| 42. Renewable energy: hydroelectric, geothermal and other | INFR |
| 43. Energy efficiency, co-generation, energy management | INFR |
| 44. Management of household and industrial waste | INFR |
| 45. Management and distribution of water (drink water) | INFR |
| 46. Water treatment (waste water) | INFR |
| 47. Air quality | INFR |
| 48. Integrated prevention and pollution control | INFR |
| 49. Mitigation and adaption to climate change | INFR |
| 50. Rehabilitation of industrial sites and contaminated land | INFR |
| 51. Promotion of biodiversity and nature protection (including Natura 2000) | INFR |
| 52. Promotion of clean urban transport | INFR |
| 53. Risk prevention (...) | INFR |
| 54. Other measures to preserve the environment and prevent risks | INFR |
| 55. Promotion of natural assets | AIS |
| 56. Protection and development of natural heritage | AIS |
| 57. Other assistance to improve tourist services | AIS |
| 58. Protection and preservation of the cultural heritage | AIS |
| 59. Development of cultural infrastructure | AIS |
| 60. Other assistance to improve cultural services | AIS |
| 61. Integrated projects for urban and rural regeneration | AIS |
| 62. Development of life-long learning systems and strategies in firms; training and services for employees | HC |
| 63. Design and dissemination of innovative and more productive ways of organising work | HC |
| 64. Development of special services for employment, training in connection with restructuring of sectors | HC |
| 65. Modernisation and strengthening labour market institutions | HC |
| 66. Implementing active and preventive measures on the labour market | HC |
| 67. Measures encouraging active ageing and prolonging working lives | HC |
| 68. Support for self-employment and business start-up | HC |
| 69. Measures to improve access to employment and increase sustainable participation and progress of women | HC |
| 70. Specific action to increase migrants' participation in employment ... | HC |
| 71. Pathways to integration and re-entry into employment for disadvantaged people ... | HC |
| 72. Design, introduction and implementing of reforms in education and training systems ... | HC |

| | |
|---|---|
| 73. Measures to increase participation in education and training throughut the life-cycle ... | HC |
| 74. Developing human potential in the field of research and innovation, in particular through post-graduate studies | HC |
| 75. Education infrastructure | INFR |
| 76. Health infrastructure | INFR |
| 77. Childcare infrastructure | INFR |
| 78. Housing infrastructure | INFR |
| 79. Other social infrastructure | INFR |
| 80. Promoting the partnerships, pacts and initiatives through the networking of relevant stakeholders | TA |
| 81. Mechanisms for improving good policy and programme design, monitoring and evaluation ... | TA |
| 82. Compensation of any additional costs due to accessibility deficit and territorial fragmentation | TA |
| 83. Specific action addressed to compensate additional costs due to size market factors | TA |
| 84. Support to compensate additional costs due to climate conditions and relief difficulties | TA |
| 85. Preparation, implementation, monitoring and inspection | TA |
| 86. Evaluation and studies; information and communication | TA |

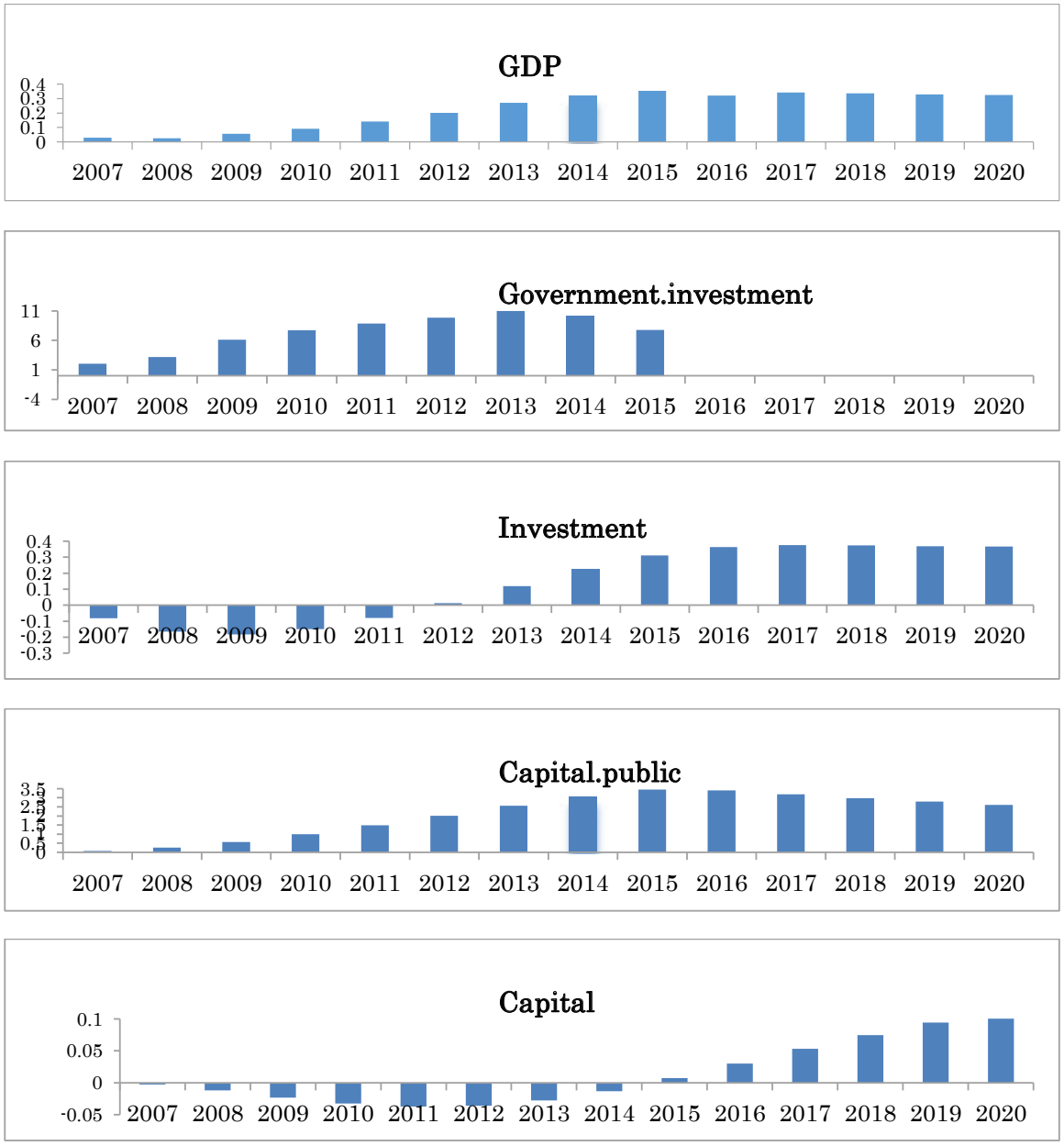
## Appendix 2 - EARDF Mapping of measures into fields of intervention

| Category | FoI |
|---|---|
| 111. Vocational training and information actions | HC |
| 112. Setting up of young farmers | AIS |
| 113. Early retirement | INFR |
| 114. Use of advisory services | AIS |
| 115. Setting up of management, relief and advisory services | AIS |
| 121. Modernisationof agricultural holdings | AIS |
| 122. Improvement of the economic value of forests | AIS |
| 123. Adding value to agricultural and forestry products | AIS |
| 124. Cooperation for development of new products, processes and technologies | RTD |
| 125. Infrastructure related to the development and adaptation of agriculture and forestry | INFR |
| 126. Restoring agricultural production potential | AIS |
| 131. Meeting standards based on EU legislation | AIS |
| 132. Participation of farmers in food quality schemes | AIS |
| 133. Information and promotion activities | AIS |
| 141. Semi subsistence farming | INFR |
| 142. Producer groups | AIS |
| 143. Providing farm advisory and extension services | AIS |
| 144. Holdings undergoing restructuring due to a reform of a common market organisation | AIS |
| 211. Natural handicap payments to farmers in mountain areas | AIS |
| 212. Payments to farmers in areas with handicaps, other than mountain areas | AIS |
| 213. Natura2000 payments and payments linked to Dir. 2000/60/EC | INFR |
| 214. Agri-environment payments | INFR |
| 215. Animal welfare payments | INFR |
| 216. Non-productive investments | TA |
| 221. First afforestation of agricultural land | INFR |
| 222. First establishment of agro-forestry systems on agricultural land | INFR |
| 223. First afforestation of non | INFR |
| 224. Natura2000 payments | INFR |
| 225. Forest environment payments agricultural land | INFR |
| 226. Restoring forestry potential and introducing prevention actions | INFR |
| 227. Non productive investments environment payments | INFR |
| 311. Diversification into non agricultural activities | AIS |
| 312. Support for business creation and development | AIS |
| 313. Encouragement of tourism activities | AIS |
| 321. Basic services for the economy and rural population | INFR |
| 322. Village renewal and development | INFR |

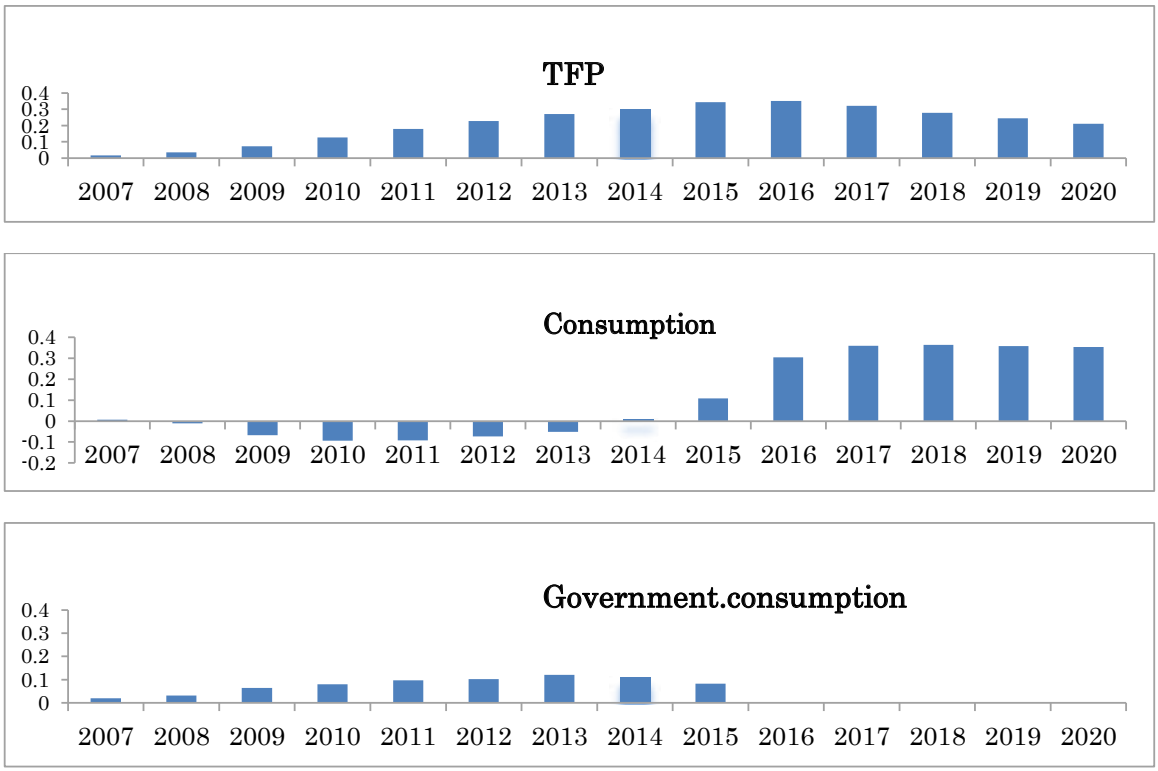
| | |
|---|---|
| 323. Conservation and upgrading of the rural heritage | INFR |
| 331. Training and information | TA |
| 341. Skills acquisition and animation measure for preparing and implementing a local development strategy | TA |
| 411. Competitiveness | AIS |
| 412. Environment/land management | INFR |
| 413. Quality of life/diversification | INFR |
| 421. Implementing cooperation projects | TA |
| 431. Running the LAG, skills acquisition, animation | TA |
| 511. Technical assistance | TA |
| 611. Complimentary direct payments | TA |

## Appendix 3 - Impact per field of intervention

*Figure A31: Infrastructure*

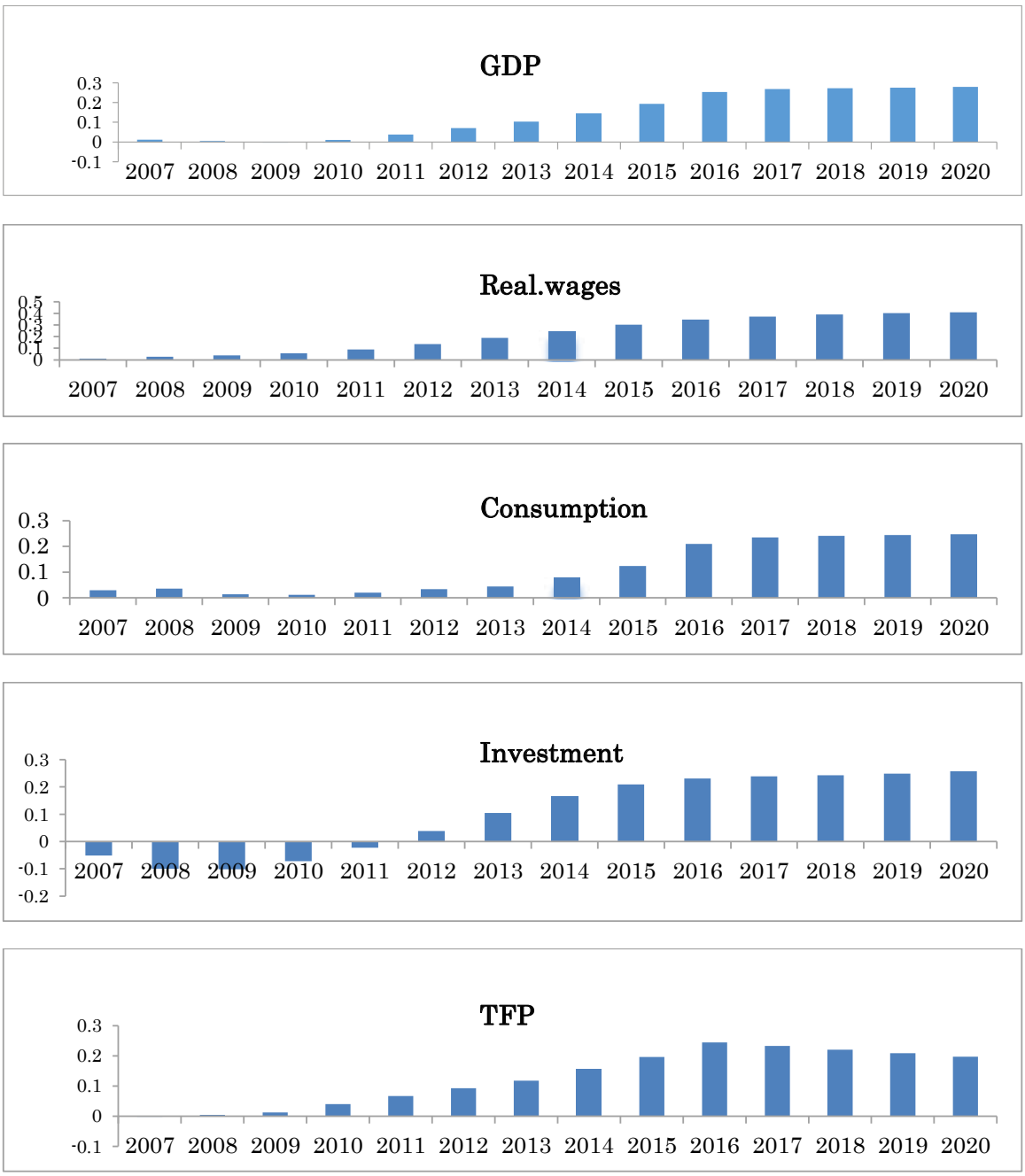



Source: QUESTIII simulations.



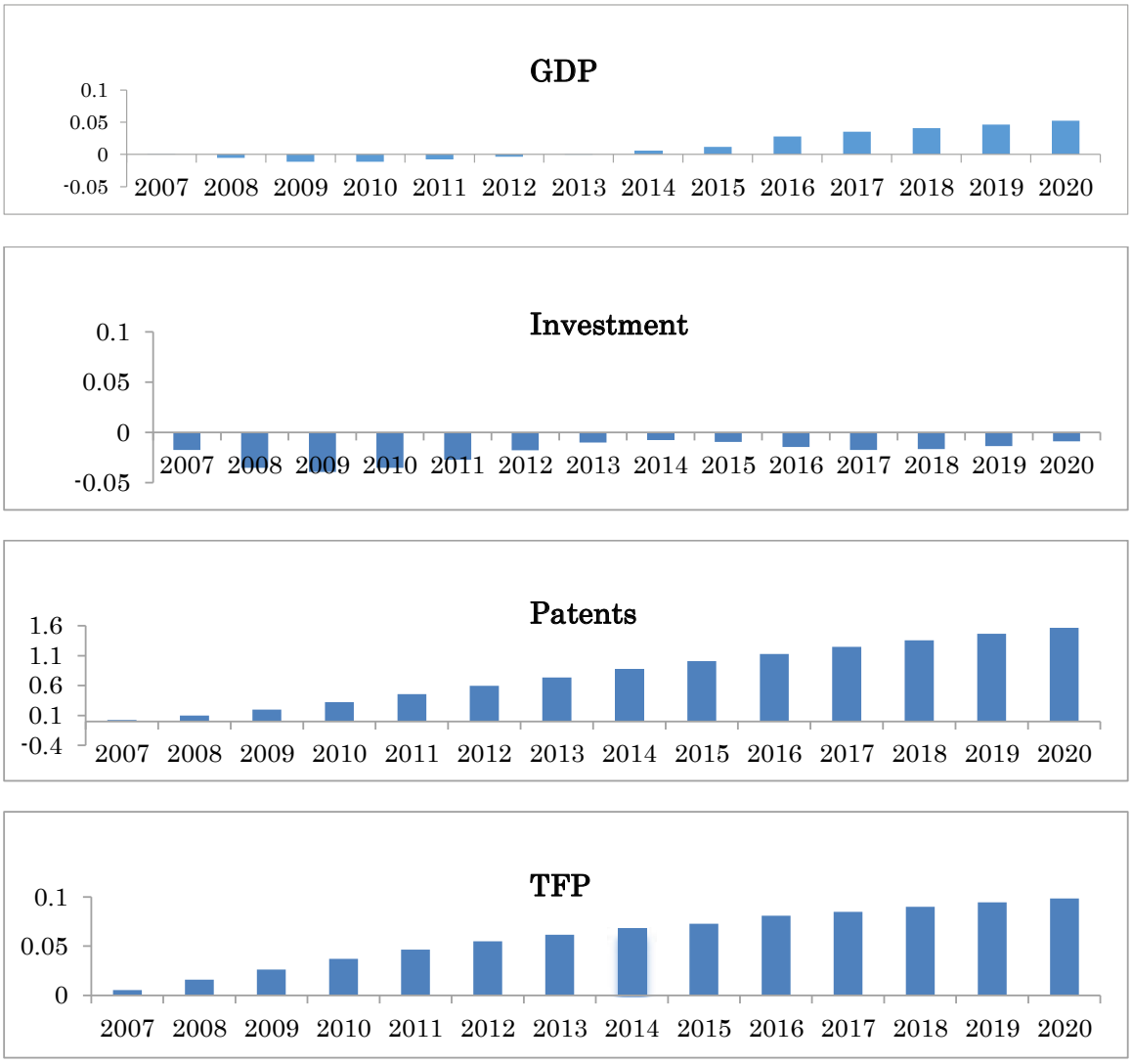

Source: QUESTIII simulations.

*Figure A32: Human capital*



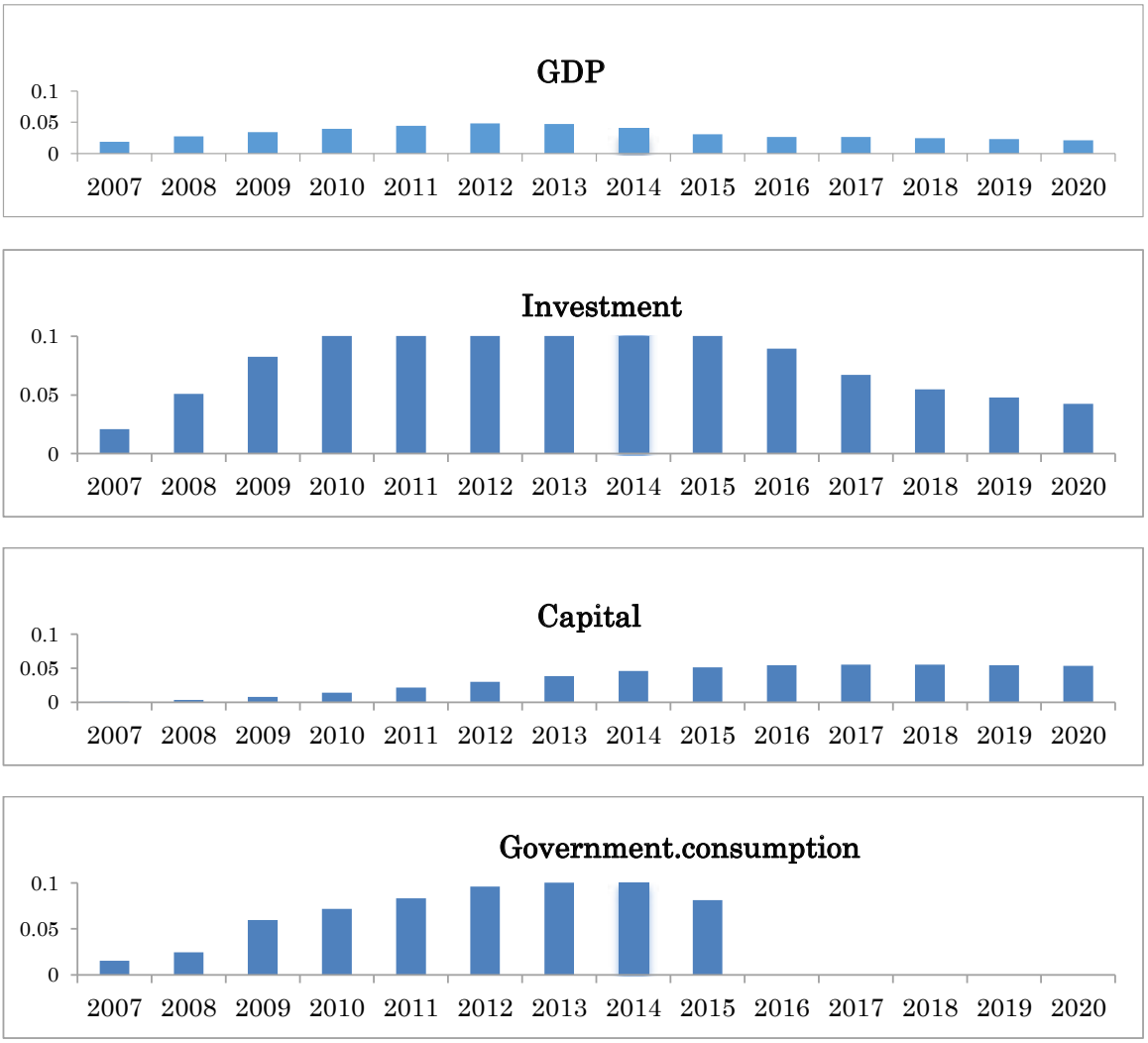

Source: QUESTIII simulations.

*Figure A33: R&D and innovation*

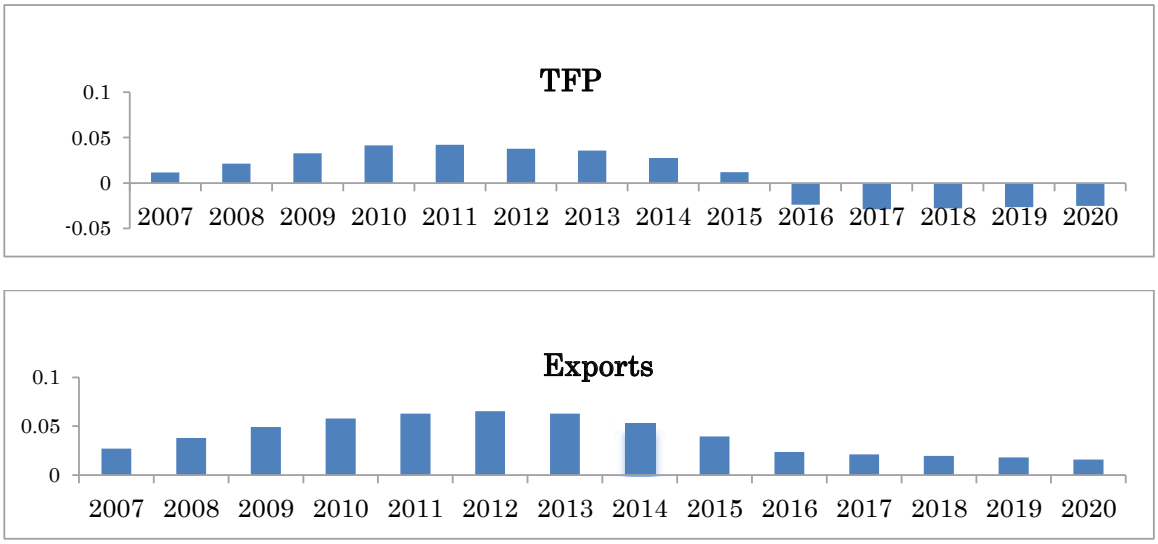



Source: QUESTIII simulations.

*Figure A34: Aid to private sector*

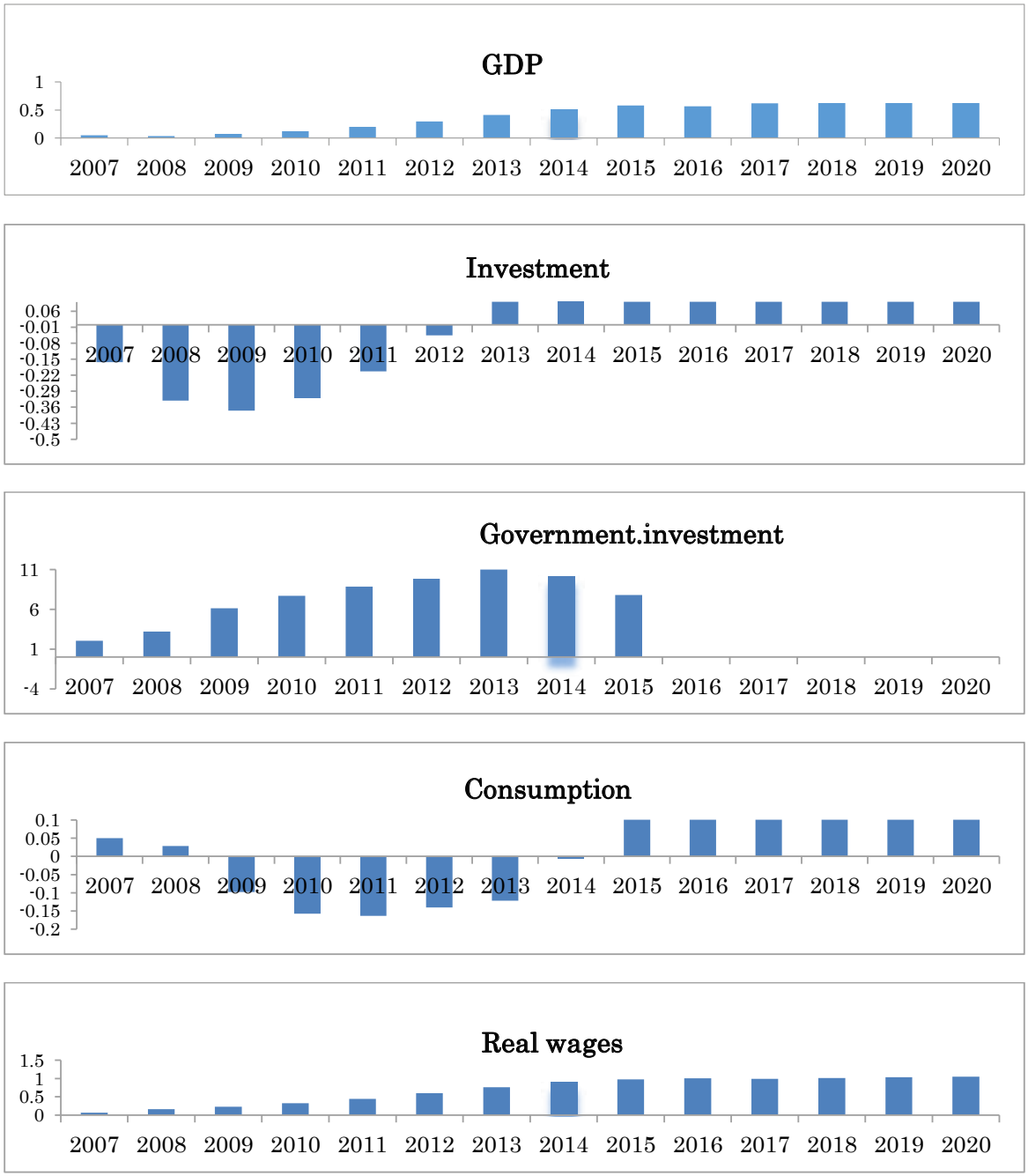



Source: QUESTIII simulations.

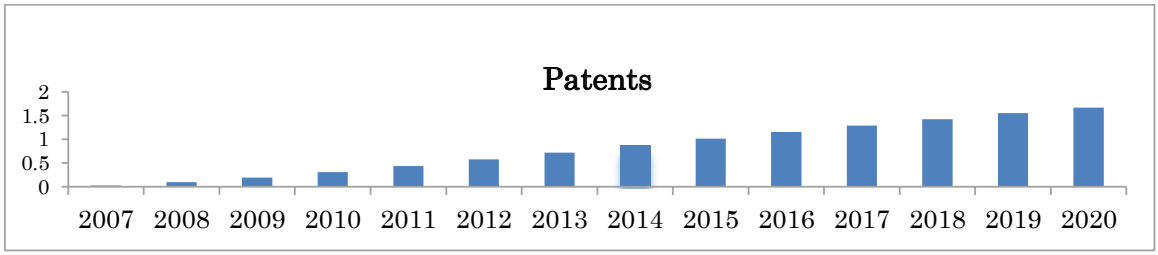


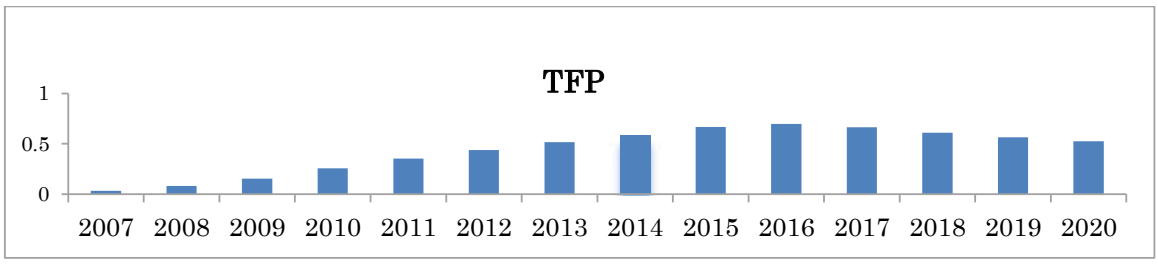

Source: QUESTIII simulations.

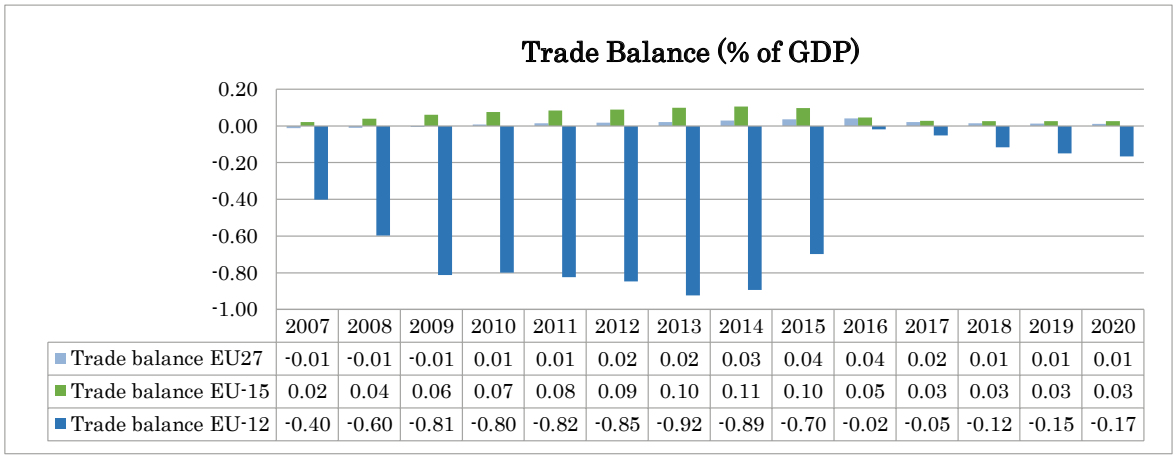
*Figure A35: Policy mix*




Source: QUESTIII simulations.




| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trade balance EU27 | -0.01 | -0.01 | -0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.03 | 0.04 | 0.04 | 0.02 | 0.01 | 0.01 | 0.01 |
| Trade balance EU-15 | 0.02 | 0.04 | 0.06 | 0.07 | 0.08 | 0.09 | 0.10 | 0.11 | 0.10 | 0.05 | 0.03 | 0.03 | 0.03 | 0.03 |
| Trade balance EU-12 | -0.40 | -0.60 | -0.81 | -0.80 | -0.82 | -0.85 | -0.92 | -0.89 | -0.70 | -0.02 | -0.05 | -0.12 | -0.15 | -0.17 |

Source: QUESTIII simulations.

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