



The impact of cohesion policy 2007-2013: model simulations with Quest III

FINAL REPORT

WORK PACKAGE 14a

Ex post evaluation of Cohesion Policy programmes
2007-2013, focusing on the European Regional
Development Fund (ERDF) and the
Cohesion Fund (CF)



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Work Package 14a: The impact of cohesion policy 2007-2013: model simulations with Quest III

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Ex post evaluation of Cohesion Policy programmes 2007-2013, focusing on the European Regional Development Fund (ERDF) and the Cohesion Fund (CF)

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The impact of cohesion policy: an ex-post evaluation of the 2007-2013 programming period based on QUEST III

1. Introduction

In its Article 174, the Treaty on European Union mandates the Union to "... develop and pursue its actions leading to the strengthening of its economic, social and territorial cohesion. In particular, the Union shall aim at reducing disparities between the levels of development of the various regions and the backwardness of the least favoured regions".

Cohesion policy is the Union's main instrument to achieve this objective, based on the European Regional Development Fund (ERDF), the European Social Fund (ESF), and the Cohesion Fund (CF). The policy aims at fostering sustainable growth, improving the well-being of EU citizens, and promoting the integration of EU economies. As such, the EU cohesion policy concentrates resources in the fields of R&D, competitiveness, education, or transport, telecommunication and environmental infrastructure.

Since its inception, the financial resources allocated to cohesion policy have steadily grown.¹ From 16% in 1988, its share in the community budget increased to about one third for the 2007-2013 multi-annual financial framework, corresponding to around 0.4 % EU GDP. While allocated to all Member States and regions across the EU, cohesion funding represents more than 3% of GDP in the less developed regions and Member States, financing a substantial part of their public investment.

EU interventions in the area of rural development are of similar nature as the one implemented under cohesion policy. The EU's rural development policy supports rural areas of the EU 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. The EU support for these objectives is channelled via the European Agricultural Fund for Rural Development (EAFRD).

For the 2007-2013 programming period, the EU allocated 337 billion euro for cohesion policy, and 96 billion euro 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 – 2015.²

In line with the regulation governing the implementation of the three cohesion instruments (ERDF, ESF, and CF)³, the Commission has carried out an ex post evaluation of the effectiveness and the socio-economic impacts of the policy interventions covering all the programmes of the 2007-2013 period. This report presents the results on the

¹ Note, however, that resources allocated to cohesion policy are less in real terms for the period 2014-2020.

² This rule is known as the 'N+2/'N+3' rule, with N being the start year when the money is allocated. Further details on EU budget for 2007-2013 at: http://ec.europa.eu/budget/figures/fin_fwk0713/fw0713_en.cfm.

³ Council Regulation (EC) No 1083/2006 of 11 July 2006 laying down general provisions on the European Regional Development Fund, the European Social Fund and the Cohesion Fund and repealing Regulation (EC) No 1260/1999.

overall effects of the cohesion policy at the macroeconomic level. Given the convergence in scope of cohesion policy and rural development programmes, and the fact that the two policies are closely linked, the analysis covers the interventions supported by the cohesion financial instruments together with those supported by the EAFRD.

Assessing the socio-economic impact of cohesion and rural development policies is particularly challenging. Monitoring data obtained from the programmes generally concern the output or at best the outcome of the interventions but they cannot provide information on net impacts. The programmes produce many direct and indirect effects on the economy which implies that, in order to assess their full impact, analytical instruments capable of capturing how the policy affects the allocation of resources in the EU economy are required.

In this paper, the potential impact of cohesion policy for the programming period 2007–2013 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 investment from the private sector. This type of approach allows us to examine the outcome of various policy scenarios 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.⁴

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 to name a few, we need first to differentiate between short-term (demand) effects and long-term (supply-side) effects.

The short-term effects occur during the implementation period while the programmes are being implemented in the form of projects on the ground (e.g. road construction, training schemes). Such interventions boost output and employment (e.g. construction workers, trainers), creating additional demand. As firms and people start earning more, they also invest and consume more (so called Keynesian multiplier effect).

The long-term effects arise due to the increased productivity in the economy and continue long after the implementation is over. 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, investments in cohesion policy do not only have direct impacts, but also indirect ones. For instance, projects in the field of transport will directly boost demand in the short run (e.g. public consumption) and improve the structure of the economy in the longer run, with a combined positive impact on GDP. At the same time, the same interventions will increase labour demand which will lead to higher wages and hence prices which will adversely affect GDP. These feedback effects are often difficult to pinpoint.

Cohesion policy is also likely to generate important spillover effects and externalities affecting economies other than the one receiving the funds. Examples include the

⁴ Note that the model focuses on the economic impact of the policies and that it cannot address all the issues relevant for the analysis of cohesion and rural development policies such as for instance their impact on social inclusion or on environment which affects the sustainability of growth generated by policies.

demand expansion in the beneficiary country leading to higher exports from other countries, or R&D innovations in one economy spreading into other economies and whose impact is again not straightforward to estimate.

Third, economic performance is typically affected by a wide range of internal policy actions and external developments in the economy which happen to coincide with cohesion policy interventions. The specific impact of the latter can therefore, again, not be identified by simply looking at the data contained in the national accounts. In order to capture the impact which can be attributed to the policy, one will have to compare a simulation of the economy as if cohesion policy was absent (the baseline scenario providing the counterfactual) with a scenario which includes the policy.

The use of macroeconomic models allows taking into account all these issues. First, models 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 allow also examining the impact in a context that includes spill-over effects and externalities for economies other than the beneficiary one. Finally, models help trace back the effects of cohesion policy spending, and shed light on the underlying channels through which the policy has an impact on the economy.

In the policy field, fiscal transfers and their economy-wide impacts and interactions at the aggregate level have often been assessed by macroeconomic models; Structural Funds are no exception to this. For years, the Directorate General for Regional and Urban Policy of the European Commission has assessed the impact of its cohesion policy programmes based on the QUEST model, and by using also other models such as the HERMIN for individual Member States (Bradley et al., 2003) and EcoMod (Bayar, 2007). Based on its multi-region model GIMF (Global Integrated Monetary and Fiscal), the IMF has also assessed the potential impact of the EU cohesion spending in the new Member States during the period 2004-2015 (Allard et al., 2008).

3. Cohesion policy: coverage and allocations

The EU funds simulated in this exercise include European Regional Development Fund (ERDF), Cohesion Fund (CF), European Social Fund (ESF), and European Agricultural Fund for Rural Development (EAFRD). The EU payments for cohesion and rural development have reached the level of almost 383 billion euro during 2007-2013, of which 76% are represented by the cohesion funds (ERDF, CF, and ESF). The data used for the simulation of cohesion policy with Quest is based on several sources as follows.

The EU expenditure for ERDF and CF is proxied by advance and interim annual payments reported in the REGIO database SFC over the period 2007 – October 2015, subject to two adjustments. First, given that these data are not reported at detailed level of types of expenditure (i.e. priority themes) within country, the distribution of the funds across types of expenditure is approximated by the breakdown of expenditure in 2014 provided by Work Package 13⁵ of the ex-post evaluation 2007-2013. Second, at the time of data collection, data on payments were available until early October 2015. In order to approximate total EU payments until end 2015, we used an additional assumption on the total level of payments until end of 2015. More precisely, we assumed that the countries which, by October 2015, had not reached a level of 95% of payments in total decided amounts could absorb in 2015 at most the same level as in year 2014.

Similarly, for the European Social Fund, total EU expenditure over the period 2007-2015 is proxied by the advance and interim annual payments, subject to the assumption on

⁵ Work Package 13 "Geography of Expenditure" provides an estimated breakdown of allocations and expenditure by priority themes at NUTS2 levels for years 2013 and 2014.

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 DG AGRI, refer to payment requests filed until August 2015, broken down by types of measures within country. For the rural development funds, no further assumption on absorption has been made.

Total actual payments and the resulting series for estimated absorption are presented by country in Table 1, columns (1) and (5).

Table 1 : EU advance and interim payments 2007-Oct 2015 (million euro)

Country	Total actual payments (all funds) 2007-Oct 2015 (mill euro)	Share in Total Payments (col. 1) (%)			Estimated payments (all funds) 2007-2015** (mill. 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 Aug 2015; ** Estimated Absorption until end-2015;

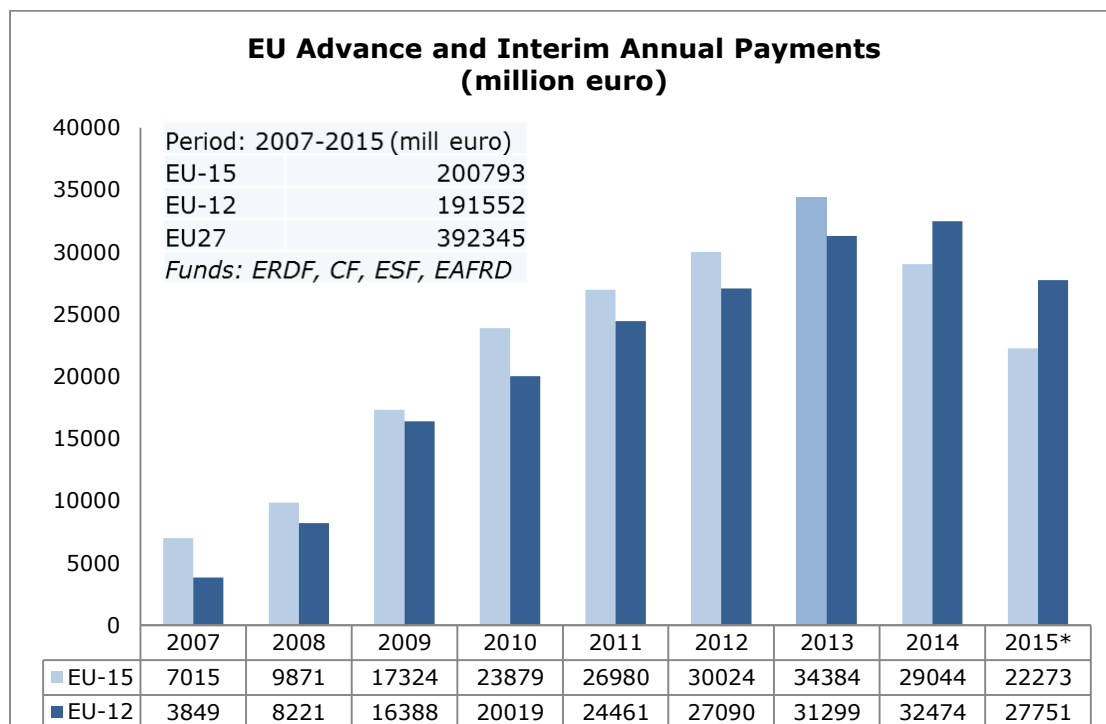
The assumption on absorption for the cohesion funds increases the level of payments especially for Germany, Hungary, and Romania. In effect, the effect of estimation on the total level of payments amounts to 2.5% of actual payments for the period October-December 2015.

The breakdown of total EU payments by funds reported in Table 1 illustrates different distributions across countries. First, shares higher than 50% for ERDF and CF in total payments are reported in the EU-12, and in Greece, Italy, and Portugal. Highest shares for ESF, on the other hand, are reported in Belgium and the Netherlands (36-40%). For EAFRD, highest shares are observed for Austria and Ireland (79%), followed by Luxembourg (67%) and Denmark (55%).

The time profile of EU payments for the four funds combined is illustrated in Figure 1. The graph presents the payment profile for two groups of countries: EU15 (including all EU members prior to accession in 2004), and EU12 (the EU new members beginning with 2004).⁶

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

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



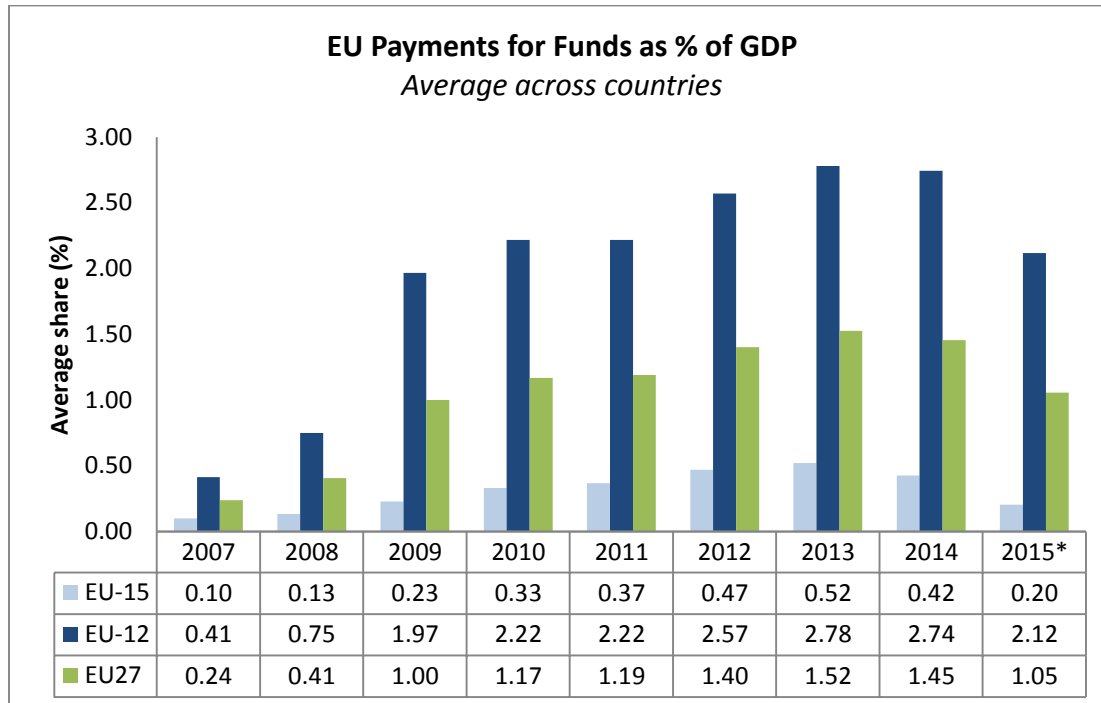
Source: DG REGIO. *Totals for ERDF, CF and ESF in 2015 are estimated until end-year; EAFRD payment requests data until Aug-2015

The importance of the funds for the economy at the country level, however, can be seen by looking at their share in country GDP. Figure 2 shows the shares of EU payments in country GDP, averaged for the two groups of countries, together with the shares of annual payments in EU GDP. The average share of EU cohesion and agricultural

⁶ Due to data availability, Croatia is not included in the analysis.

payments in GDP is in the range of 0.20-0.52% across years for EU-15, while for EU-12 the average share in GDP is in the range 0.41-2.78%. Overall, for the EU27, the share of EU payments for all funds combined is in the range of 0.08-0.49% of EU GDP across the period 2007-2015.

Figure 2 : Time patterns of EU payments as % of GDP, all funds



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

In sum, the data on EU payments for the four funds (ERDF, ESF, CF, and EARDF) combined illustrates the following broad patterns: 1) the amounts of total payments to EU-12 and EU-15 are roughly equal, 2) relative to EU-12, the EU-15 proved early starters in terms of advance and interim EU payments, and 3) the weight of EU structural funds is significantly higher in the economy of EU-12.

4. The QUEST model and its impact channels

The model used in this exercise 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 analysis of key fiscal and monetary policy scenarios, for assessing the impact of the structural reforms, or else for contributing to the economic projections of DG ECFIN. For the analysis of the Cohesion and Regional Funds, we adopted the R&D version of QUEST III (see Roeger et al., 2008 and Varga and in' t Veld, 2011) which is a semi-endogenous growth framework based on Jones (2005).

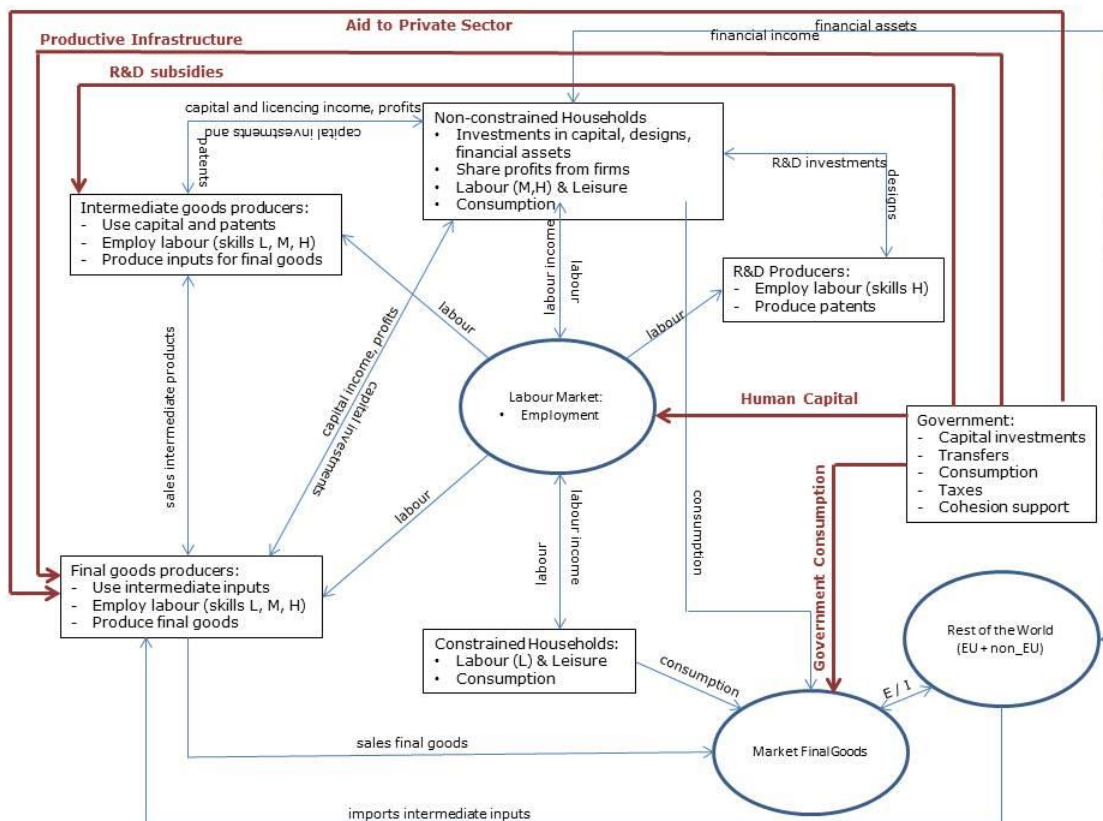
The model belongs to the class of New-Keynesian dynamic general equilibrium (DGE) models that are now widely used in economic policy institutions. It provides a fully micro-founded, integrated and optimization-based representation of the economies of the Member States.

The analysis based on the Quest model contributes to the understanding of the macroeconomic potential impacts of the cohesion and rural funds invested in 27 Member States during the period 2007-2015. The main question that the study addresses is the

following: given the size and the distribution of EU investments across Member States, fields of investment, and time, what are the likely net impacts of the policy, and which are the channels through which these effects operate? The model provides results simulated at the level of EU-27 Member States on a wide set of economic variables such as for instance GDP, employment, wages, investment or productivity.⁷

QUEST is structured around building blocks which represent the behaviour of fundamental economic agents and interactions. The model describes fully 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 through various market interactions.

Figure 3 : QUEST – Main building blocks



Source: DG REGIO.

The equations, assumptions and calibration of the model are provided in the papers cited above (see also the list of references in annex). The diagram in Figure 3 summarizes the main building blocks in the model and their interactions.

The model features two main types of firms: producers of intermediate and final goods and services, and R&D producers of patents. Firms produce goods and services by combining technology, physical capital and labour. The production technology is enhanced by acquiring new processes from the R&D sector which generates innovation by mobilising resources (primarily highly skilled labour). This in turn increases the productivity of producers of goods and services.

⁷ Nevertheless, it must be noted that it cannot address all the issues relevant for the analysis of cohesion and rural development policies such as for instance their impact on social inclusion, on environment or on specific territories (such as for instance rural or coastal areas). The model is also not meant to provide forecasts (i.e. making statements about future events based on existing data and various statistical methods) but rather simulations of policy scenario (i.e. replicating the operation of a real-world system over time).

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.

There are three types of labour skills (high, medium and low), and households can accumulate human capital by participating in education. During the time spent in schooling, individuals are not employed and, as a result, they are not included in the supply labour.⁸ Nevertheless, the accumulation of human capital increases labour productivity over time.

The model allows also 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 price paid for acquiring 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. Finally, public interventions can increase the efficiency of the education system in enhancing human capital which, by increasing labour productivity, contributes to increasing competitiveness and wages.

The model covers the 27 Member States and their trade links among each other and with 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 also be absorbed by non-innovative agents (e.g. through imitation). Support to R&D in one country will therefore have also 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. Finally, the model has been calibrated based on 2010 data and hence accounts for the particular conditions of the EU economies at that time.

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 features the policy interventions for cohesion and rural development and, by comparison with the baseline, it allows for the analysis of the impacts of the policy on the economy. For a given variable (say GDP), for instance, the difference between the values obtained under the two scenarios is interpreted as the impact attributable to the policy, and it is expressed as a percentage deviation from the baseline⁹.

⁸ The module of labour market in the Quest model relies on the simplified assumption that participation in the labour market is equivalent to employment. Therefore, the model is not amenable to an analysis of participation in the labour force.

⁹ The baseline is established on the basis of assumptions concerning the trends of key variables which is common practice in modelling exercise. The results, which correspond to the difference between the baseline and the 'with-policy' scenarios, are independent from the baseline.

5. Model simulation

Data on investments in cohesion policy are reported by 86 categories covering areas in which support is provided. Similarly, investments from the EARDF are reported by 46 categories (Annex 1 lists the categories of expenditure). For the purpose of the simulations, however, these investments are grouped into five fields of interventions: infrastructure, human capital, research and development (R&D), aid to private sector, and technical assistance and other investments.

In what follows, we present the main results of the analysis. Section 5.1 provides results by type of intervention, while section 5.2 includes the results obtained for the full policy package where all interventions are considered together. The results are reported either for the time horizon 2007-2013 (covering medium to long term), or for two points in time: 2015 and 2023. The year 2015 marks the end of the implementation period and, depending on the speed of the implementation, it constitutes a threshold for short to medium term. The full effects of the cohesion and rural policies, however, are likely to materialize with a policy lag on medium to long term. Therefore, results are reported also for year 2023 which, also depending on the timing of the investment, marks the medium to long term.

5.1 Model fields of interventions

We begin by presenting briefly the way in which each type of intervention is included in the Quest model and the simulation results for each of these interventions separately. The data on distributions of investments across these intervention fields for each Member States are presented later in the next section on policy mix.

5.1.1 Infrastructure

Infrastructure includes investments in transport, telecommunications, energy, environmental infrastructure and social infrastructure. These investments are modelled either as government investment (e.g. motorways, railways, infrastructure related to ICT, energy infrastructure, management and distribution of water, or education) 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.¹⁰

Government investment is part of final demand for goods and services and as such interventions in the fields of transport, telecommunications and energy infrastructure 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 run when the output enhancing effects of infrastructure investment become stronger. When investment is discontinued, the productivity effect slowly declines due to depreciation of public capital. On short term, government investment can also partly crowd-out private investment, although this effect proves rather modest (see Annex 2).

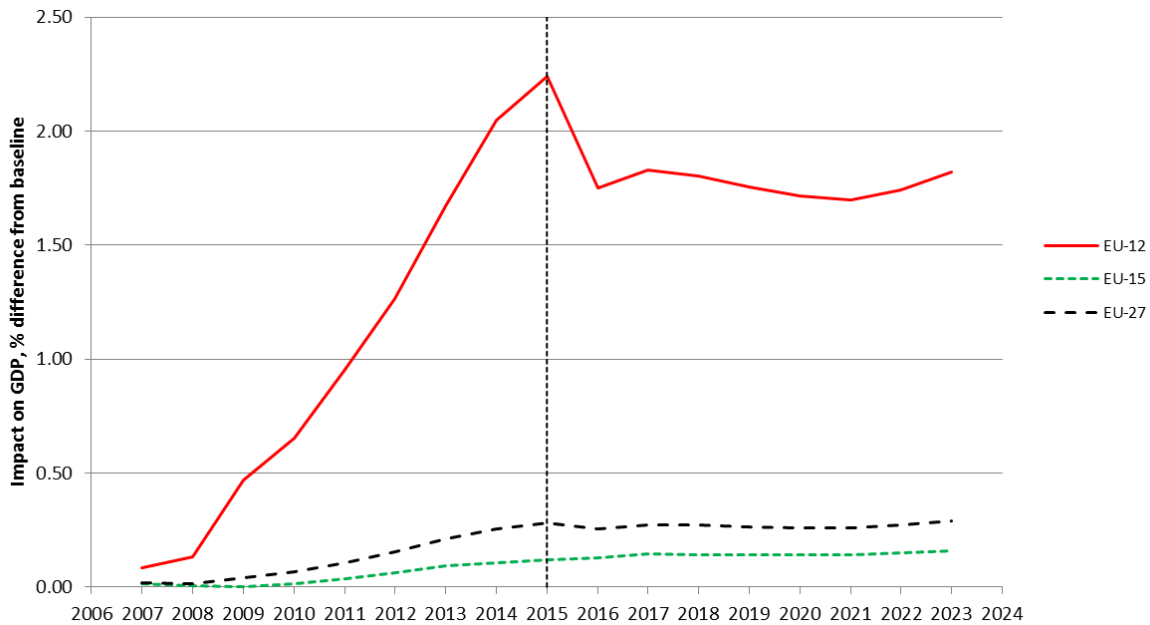
Accordingly, the impact of investment in this type of infrastructure materialises as soon as projects are implemented (due to the short run demand side effect of the interventions). They also have a long run effect linked to the increase in productivity they generate which continues to after the termination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

Government consumption is also a component of final demand but it is not expected to have a long-lasting effect on the structure of the economies. As such, interventions of

¹⁰ The classification of environmental infrastructure 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 the two simulations are quite similar in nature. The results of this alternative scenario are available upon request.

this type only have a short run demand impact which appears only during the implementation period.

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



Source: QUESTIII simulations.

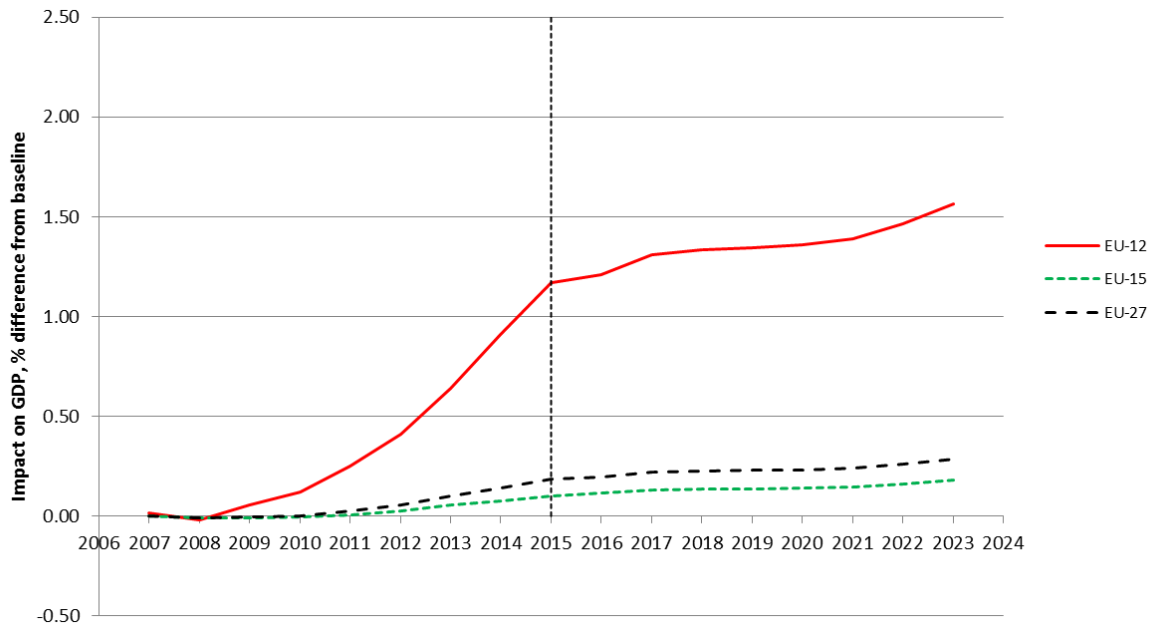
Figure 4 shows the time profile of the impact on EU-27 GDP of interventions in the fields of infrastructure, combining transport, telecommunications, energy environmental infrastructure and social infrastructure. The drop of the impact in 2015 corresponds to the completion of the programmes after which only the long-term supply side effects of the interventions are maintained.

5.1.2 Human capital

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 skills, and are assumed to increase labour productivity. This in turn leads to increasing real wages and hence consumption while stimulating investment (although this effect comes at a later stage, see Annex 2). These interventions also increase productivity in the R&D sector which fosters the production of patents and hence 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 medium term but they are significant and highly persistent (see Figure 5) due to the fact that they affect positively 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 eventually fades out according to the exit rate of working age population in the long run.

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



Source: QUESTIII simulations.

5.1.3 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 annex 3), boosts directly total factor productivity. Increases in R&D activities lead also to reallocate high skilled workers away from the production of final goods, having an initial negative impact on growth in the short run (see Figure 6).¹¹

Over time, however, the positive effects on output dominate. As they stimulate the endogenous growth mechanism at work in the model, the impacts of investments in R&D indeed tend to strengthen over time, long after the end of the programmes. Accordingly, the effects of such type of interventions take time to become apparent but the output gains are significant and continue to increase long after spending is discontinued.

5.1.4 Aid to private sector

Aid to private sector includes interventions such as advanced support to small and medium sized enterprises, facilitation to credit,¹² assistance to improve tourism services and cultural investments. It includes also various types of support to rural development based on EAFRD. Part of the interventions is modelled as reductions in fixed costs of final goods producers or in capital costs for tangible capital, while other interventions are included in government consumption.

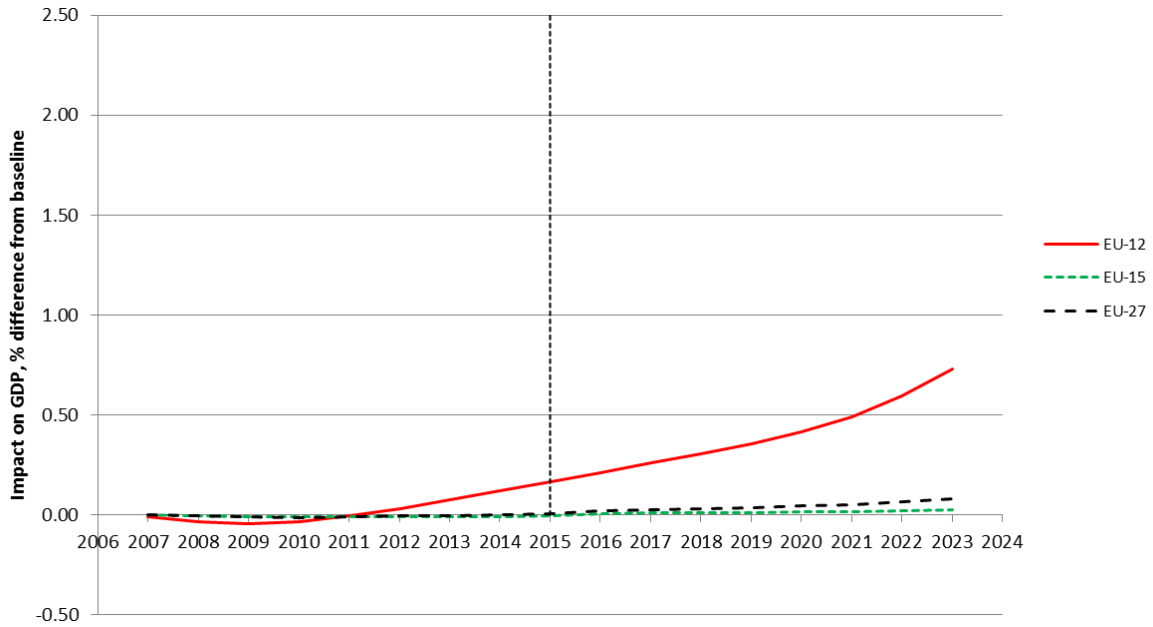
The impacts of aid to private sector on GDP over time are illustrated in Figure 7. Aid to private sector triggers increases in private investment (see Annex 2) and it accelerates the pace of capital accumulation which boosts growth. Other interventions, modelled as

¹¹ Note that this effect is likely to be tempered in times of crisis and high unemployment when labour (even high-skill) is available.

¹² Financial instruments are included into this field of intervention.

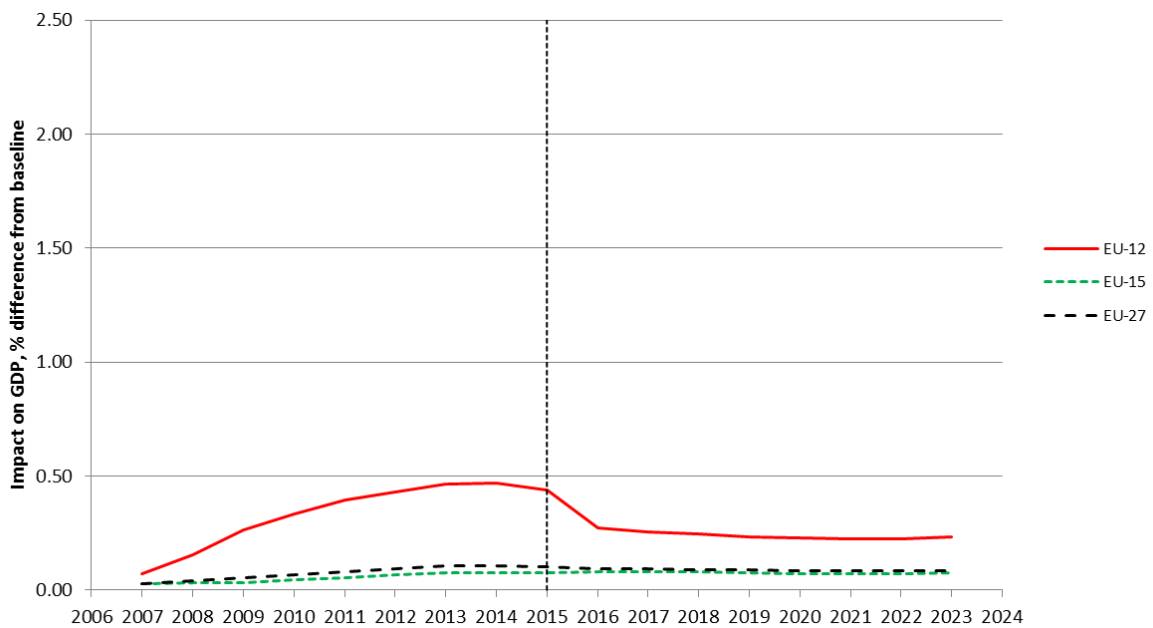
increasing government consumption (e.g. in the area of natural or cultural heritage), produce their impact mostly in the short run as they correspond to a subsidy provided during the implementation period.

Figure 6: Cohesion and rural development policies investment in R&D, impact on GDP, 2007-2023 (percentage deviation with respect to baseline)



Source: QUESTIII simulations.

Figure 7: Cohesion and rural development policies aid to private sector, impact on GDP, 2007-2023 (percentage deviation with respect to baseline)



Source: QUESTIII simulations.

5.1.5 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 on short-term. This category of intervention is generally modest (see Table 2 in the next section). As a result, even though these investments are included in the total volume of investments in Member States, their impact is not discussed further for the sake of conciseness.

5.2 Member States policy mix

In this section we analyse the net impacts of all EU interventions for cohesion and rural development during 2007-2013 on short, medium and long term across the 27 Member States. Annex 1 indicates 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.

Table 2 : Distribution of Funds per fields of intervention (% of the total allocation)

	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.

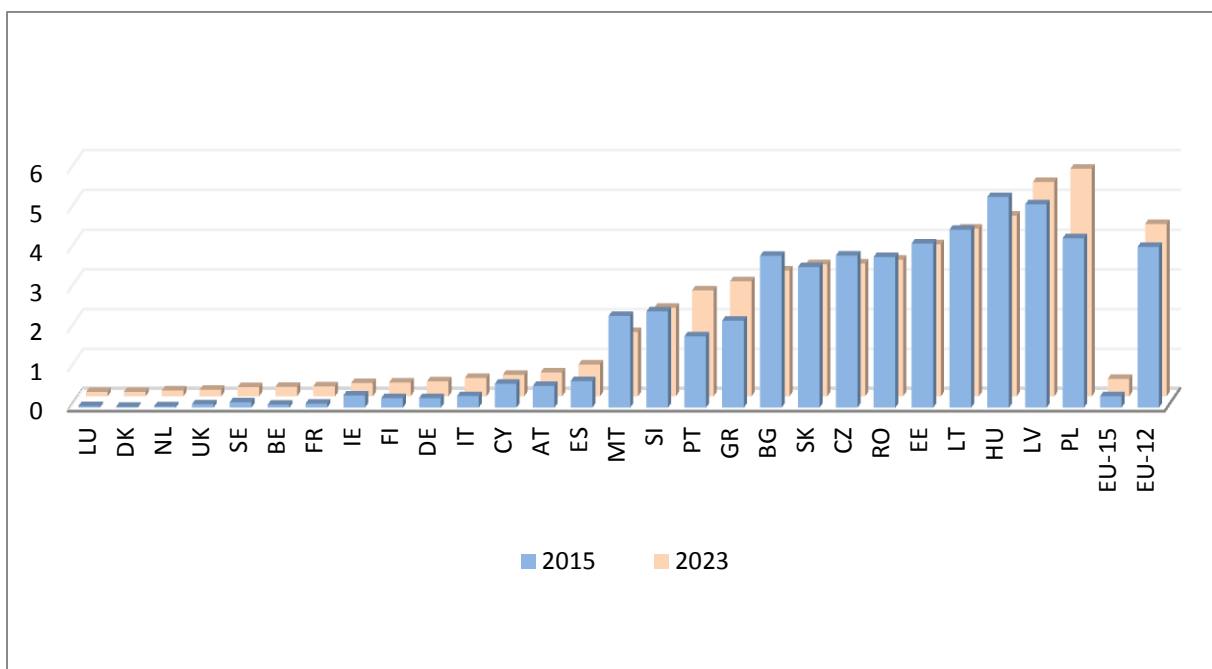
At the EU level, the highest share of payments goes to infrastructure (40%), followed by aid to the private sector and support for the development of human capital (respectively 28% and 20%). Within the EU, while highest relative to other categories of expenditures for both groups, the share for infrastructure is significantly higher for EU-12 compared with EU-15. Largest differences in EU-15 relative to EU-12 are reported for payments in support for human capital and for the private sector, with the EU-15 distributing the resources across infrastructure, aid to private sector and human capital more evenly.

Finally, the model also takes into account the fact that cohesion and rural development policies are financed by contributions of the Member States to the community budget. In the model, the contribution of each Member State is proportional to its GDP and it is financed by adapting VAT taxes. Taxes are distortionary and their increase affects adversely the economic performance, notably the GDP. This negative effect partly offsets the positive impact of the programmes.

5.2.1 Impact on GDP

The first set of results illustrates the net effects of EU cohesion and rural investments during the period 2007-2015 on GDP at country level for the Member States in the analysis. In Figure 8 we report these results for years 2015 and 2023 for all countries included in the analysis, and the aggregated effects for countries grouped into EU-15 (EU members prior to the 2004 accession), and EU-12 (EU new members beginning with 2004). The percentage deviation from the baseline for a given country indicates the additional GDP generated in the economy as a result of EU investments, once all model interdependencies and transmission channels are factored in fully.

Figure 8: Impacts on GDP of cohesion and rural development policies, 2015 and 2023 (percentage deviation with respect to baseline)



Source: QUESTIII simulations.

In the EU-12 countries, the impact of the interventions is significant both on medium and long term. In Hungary, for example, the impact by the end of the implementation period (2015) is more than 5% of GDP and slightly less (4.6%) in 2023.

For Poland, on the other hand, the impact strengthens between 2015 and 2023, increasing from 4.3% to 5.7%, most likely due to its stronger emphasis on investments

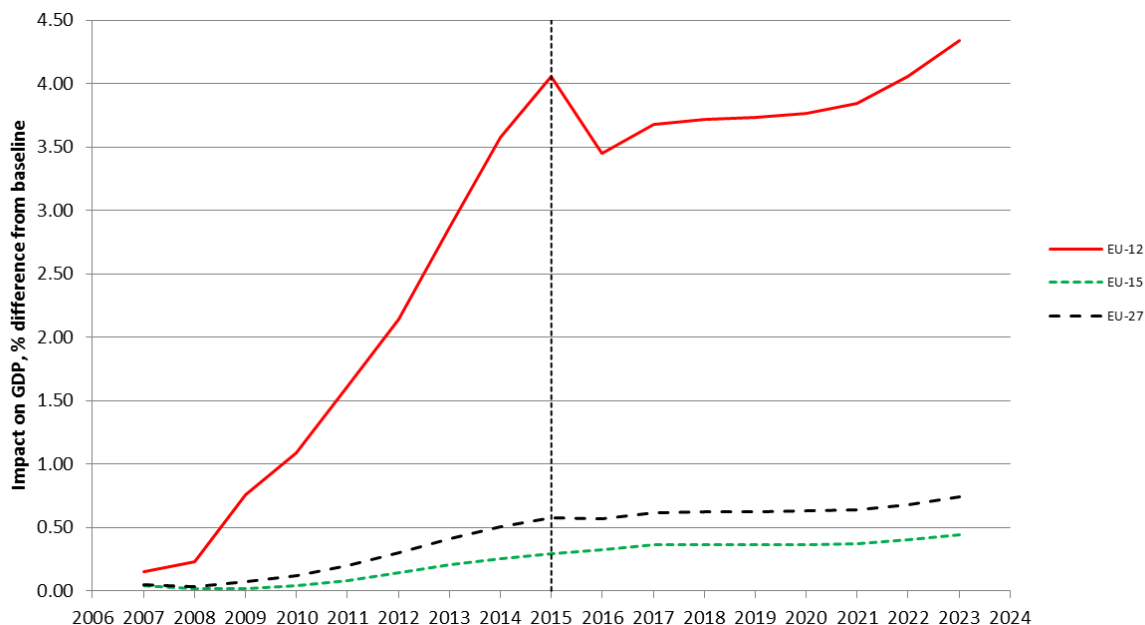
in R&D. For the EU-12 as a whole, the impact on GDP is around 4% above baseline both on medium and long term.

In the EU-15, the impact of cohesion policy and rural development policies, although more modest, strengthens over time. It is highest in the Member States which benefit from the Cohesion Fund and in particular for Greece (2.2% and 2.9%) and Portugal (1.8% and 2.6%).

The smaller magnitude of the impact in the EU-15 follows directly from the fact that, when compared with EU-12, the allocations accruing to these Member States are much lower relative to the size of their economies. In absolute terms, however, the gains are rather comparable. According to this analysis, the investments of 201 billion euro in cohesion and rural policies in EU-15, for example, have the potential to generate additional 135 billion euro by 2015, and a total of 548 billion euro by 2023. Similarly, for EU-12, the investments of 192 billion euro correspond to a gain of 173 billion euro by 2015, and 536 billion euro by 2023.

Therefore, given their orientation towards structural change, cohesion policy and rural development policies need time to generate sustainable gains. Sizeable impacts of the interventions materialise with a policy 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 medium run and long run, productivity enhancing effects of the policies' investment generate increases in GDP free of inflationary pressures. Figure 9 shows the time profile of the impact for the EU-27, EU-12 and EU-15 up to 2023.

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

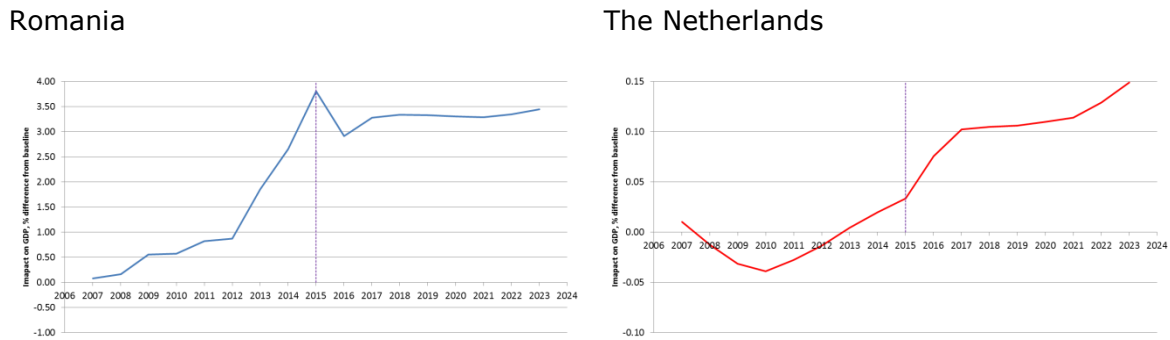


Source: QUESTIII simulations.

As the time profile of the impact changes significantly from one field of interventions to another (see Figures 4 to 7), the combined impacts of the policy, especially in the long run, will therefore not only depend on the magnitude of the resources injected in the economy but also on the distribution of expenditure among the various fields of interventions.

In particular, countries which invest heavily in R&D and human capital (such as the Netherlands) should see the impact of the interventions emerge in the long run while countries heavily investing in infrastructure (such as Romania) should benefit from the interventions already in the short run. As an illustration, Figure 10 shows the time profile of the policy impact on GDP for the Netherlands and Romania. In Romania, the positive effects of the policies already materialise at the beginning of the implementation period while in the Netherlands they only start to appear from 2013 onwards.

Figure 10 : Cohesion and rural development policies impact on GDP, 2007-2023 (percentage deviation with respect to baseline)

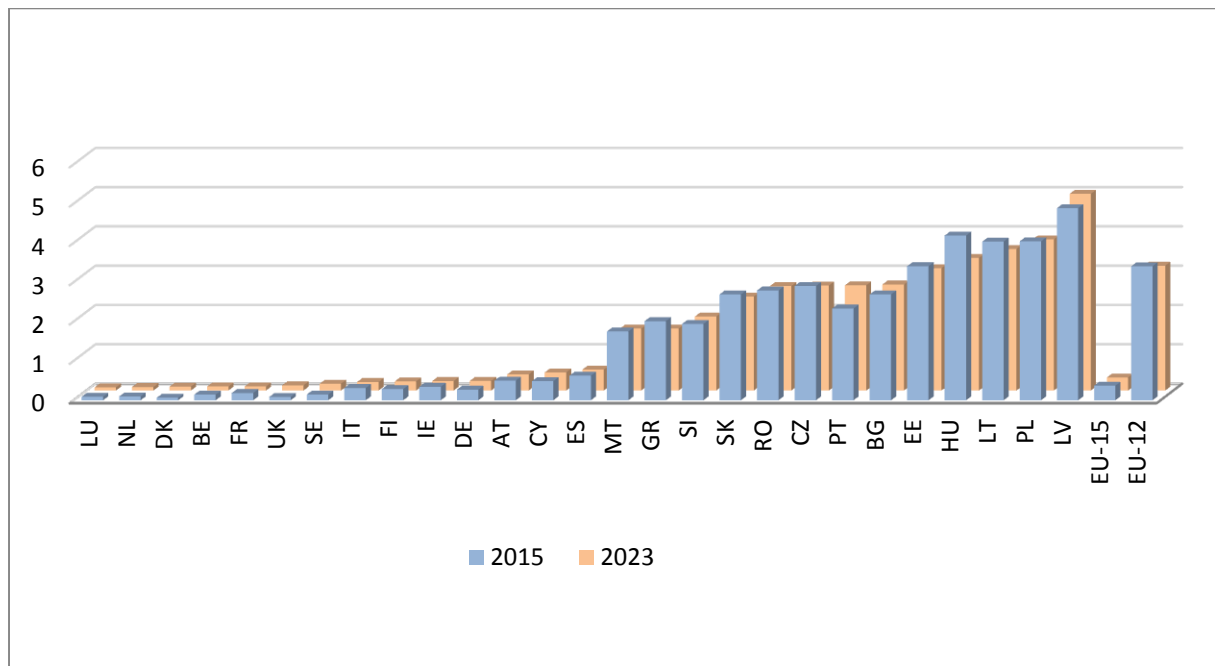


Source: QUESTIII simulations.

5.2.2 Impact on real wages

As mentioned earlier, in the Quest model, the impacts of cohesion and rural development investments on the labour market are reflected primarily through the effects on real wages and productivity. In Figure 11, we illustrate the net impacts of all investments on real wages for years 2015 and 2023. According to the simulations, the largest effects are generated for the EU-12 and Portugal. For all countries, however, the impacts on real wages persist at comparable levels between the two reference years. By 2023, real wages could increase by almost 3.2% in the EU-12, and by around 1.1% in the EU-27.

Figure 11 : Impacts on real wages of cohesion and rural development policies, 2015 and 2023 (percentage deviation with respect to baseline)



Source: QUESTIII simulations.

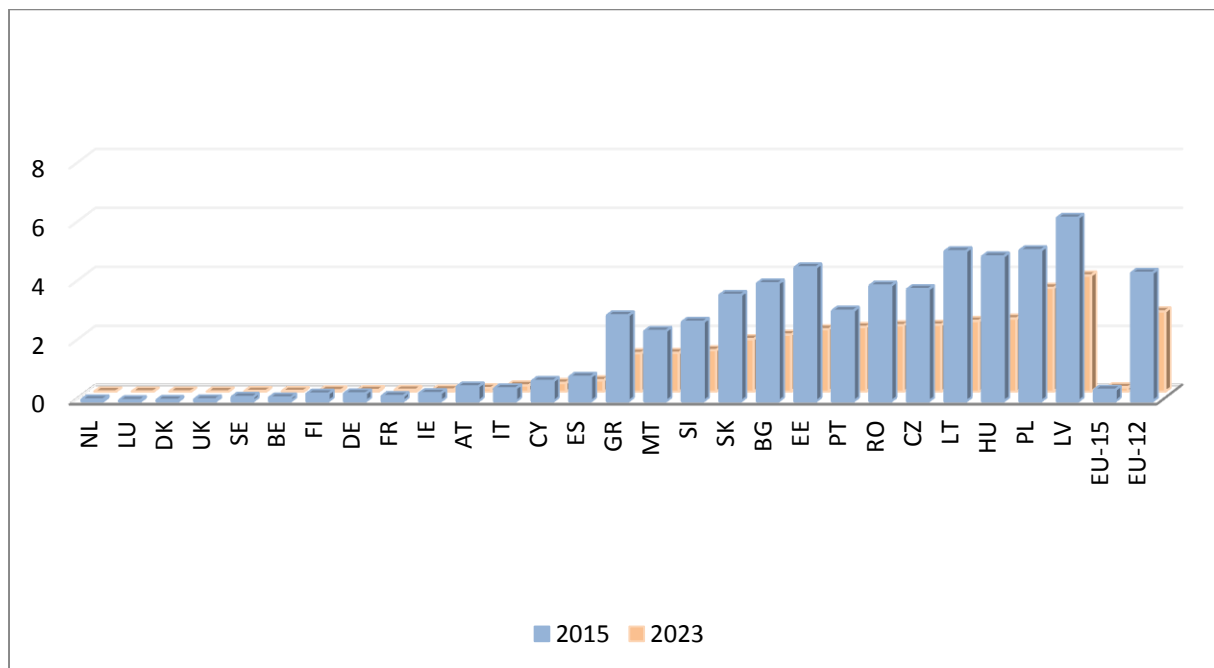
5.2.3 Impacts on total factor productivity and investment

The impact of cohesion and rural development policies is also apparent on other key macroeconomic variables such as the productivity of production factors (TFP) or private investment (Figures 12 and 13).

The contribution of cohesion and rural development policies to increases in total factor productivity is particularly high in the EU-12, reaching its highest level of 4.4% by 2015. By comparison, the average increase in TFP for EU-15 in the same year is around 0.4%. Subsequently, for all countries, the net impacts of investments on total factor productivity subside gradually.

The impact on private investment is to a large extent indirect as it captures mainly the improvement of the business environment due to 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. By 2023, for instance, the increase in private investments in the EU-12 reaches the level of 2.3%, while the increase in the EU-15 is 0.49%.

Figure 12 : Cohesion and rural development policies on total factor productivity, 2015 and 2023 (percentage deviation with respect to baseline)

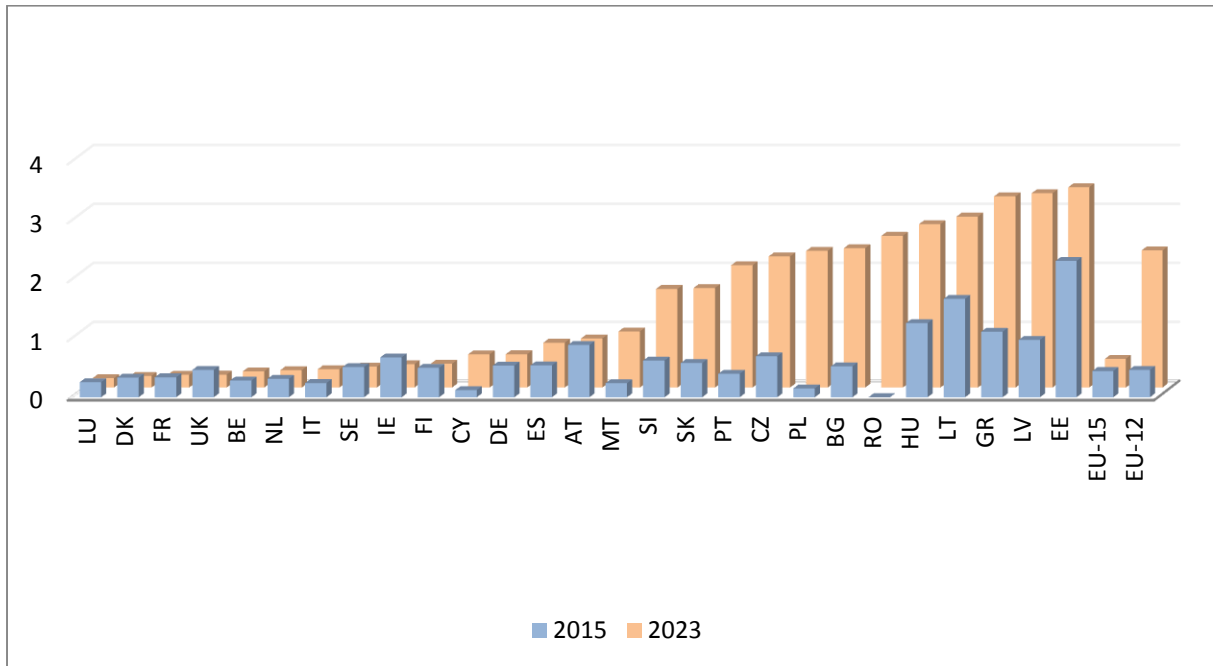


Source: QUESTIII simulations.

5.2.4 Impact on trade balance

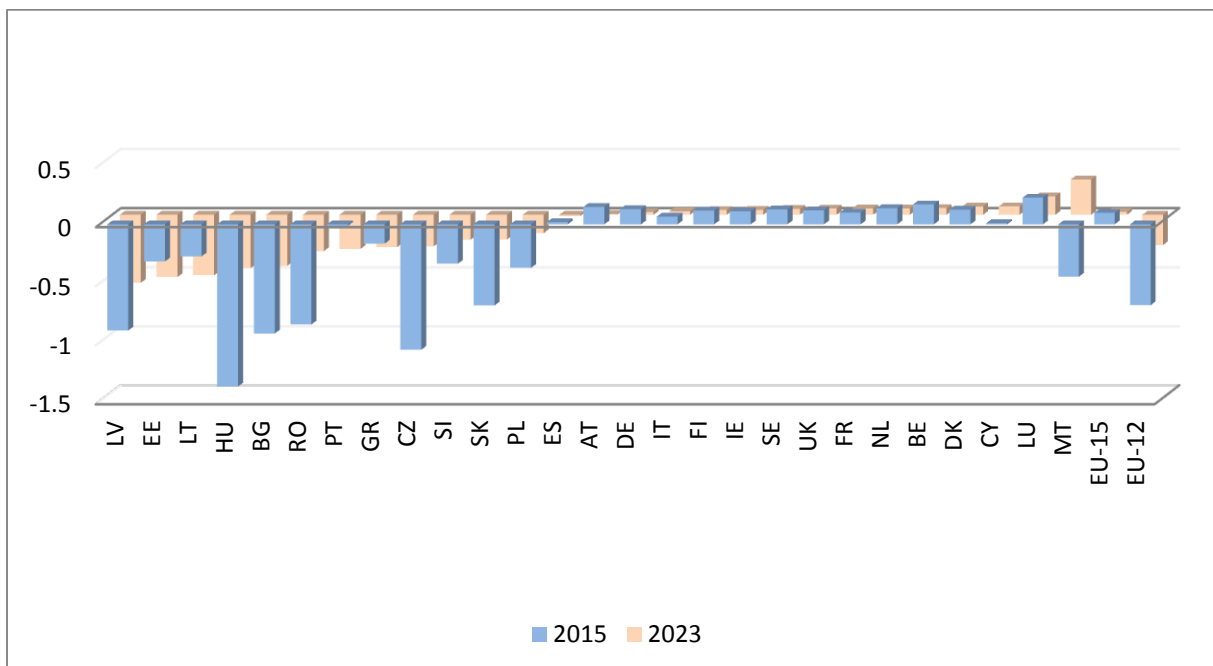
The impact on the country trade balance differs between the EU-12 and the EU-15. For most Member States in the first group, the programmes tend to deteriorate the trade balance due mainly to the fact that the increase in economic activity generated by the interventions is accompanied by an increase in imports. For other Member States, mostly located in the EU-15, the interventions have a positive effect on the trade balance. To a large extent, this reflects the fact that a significant part of the increases in imports in the EU-12 originates from the EU-15. These results indicate the trade spill-overs through which programmes implemented in one Member State generate positive impacts on other Member States.

Figure 13 : Cohesion and rural development policies impact on private investment, 2015 and 2023 (percentage deviation with respect to baseline)



Source: QUESTIII simulations.

Figure 14 : 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.

5.2.5 Impact per euro spent

As mentioned above, the impact in each Member State is directly related to the size of the financial support it receives from cohesion and rural development policies. In order to capture better the effectiveness of the interventions, the results of the simulation can be used to calculate a cumulative multiplier of the impact on GDP per euro spent. For a country, or group of countries, the cumulative multiplier is calculated as the ratio of the

cumulated change in GDP (relative to baseline) up to a given year and the cumulated amounts spent up to the same year, and it indicates the additional GDP generated by each euro invested by the policies.

In Table 3 we report the values of the cumulative multipliers on GDP for the two groups of countries and for EU-27 in years 2015 and 2023. Given the distribution and time patterns of investments, for example, one euro invested in the EU-27 during the period 2007-2015 corresponds to an increase of 0.78 euro in GDP by year 2015. Due to effects cumulated on medium to long term, however, the same euro invested corresponds to 2.74 euro additional GDP in EU-27 by 2023.

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.

The cumulative multipliers reflect in a synthetic manner the fact that, as expected for a policy aiming at structural changes in the economy, an important part of the impact of the interventions is to be expected in the medium to the long run when the supply-side effects, which persist long after the termination of the programmes, have emerged.

In sum, the results of the analysis based on Quest suggest that the Union efforts to allocate resources to cohesion and rural policies generate a common benefit for all the members of the EU especially in the medium to the long run.

6. Conclusions

This paper provides an assessment of the programmes implemented under the EU cohesion and rural development policies during the period 2007-2013. In particular, the analysis evaluates their impact on the European economy based on a set of simulations conducted with QUEST III. The results show that in general, the interventions brought significant gains and contributed to enhance the structure and the economic performance of the EU Member States.

Interventions substantially increased GDP, in particular in the Member States which are the main beneficiaries of the policies. The results suggest that in 2015, GDP was around 4.1% higher in the Member States which joined the Union after 2004 and which received a higher per capita allocation. 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 field of interventions, 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 are intended to improve the structure of the EU economies and hence their competitiveness. In the simulations, this is for instance captured by the impact of the interventions on the productivity of factors of production, as a result of investments in education and technology, of incentives investment in tangible and intangible assets, and of improved infrastructure.

Overall, cohesion and rural development policies yield high value for money. As expected from policies supporting investments, the impact on GDP per euro spent increases steadily over time, showing that these interventions fostering some key engines of growth benefit the whole Union even if they are concentrated in its less developed places.

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Annex 1 Mappings of QUEST fields of intervention

Table 1 - ERDF, CF and ESF: Mapping of 2007-2013 priority themes into Quest model 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 throughout 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

Table 2: EARDF: Mapping of measures into Quest model fields of intervention

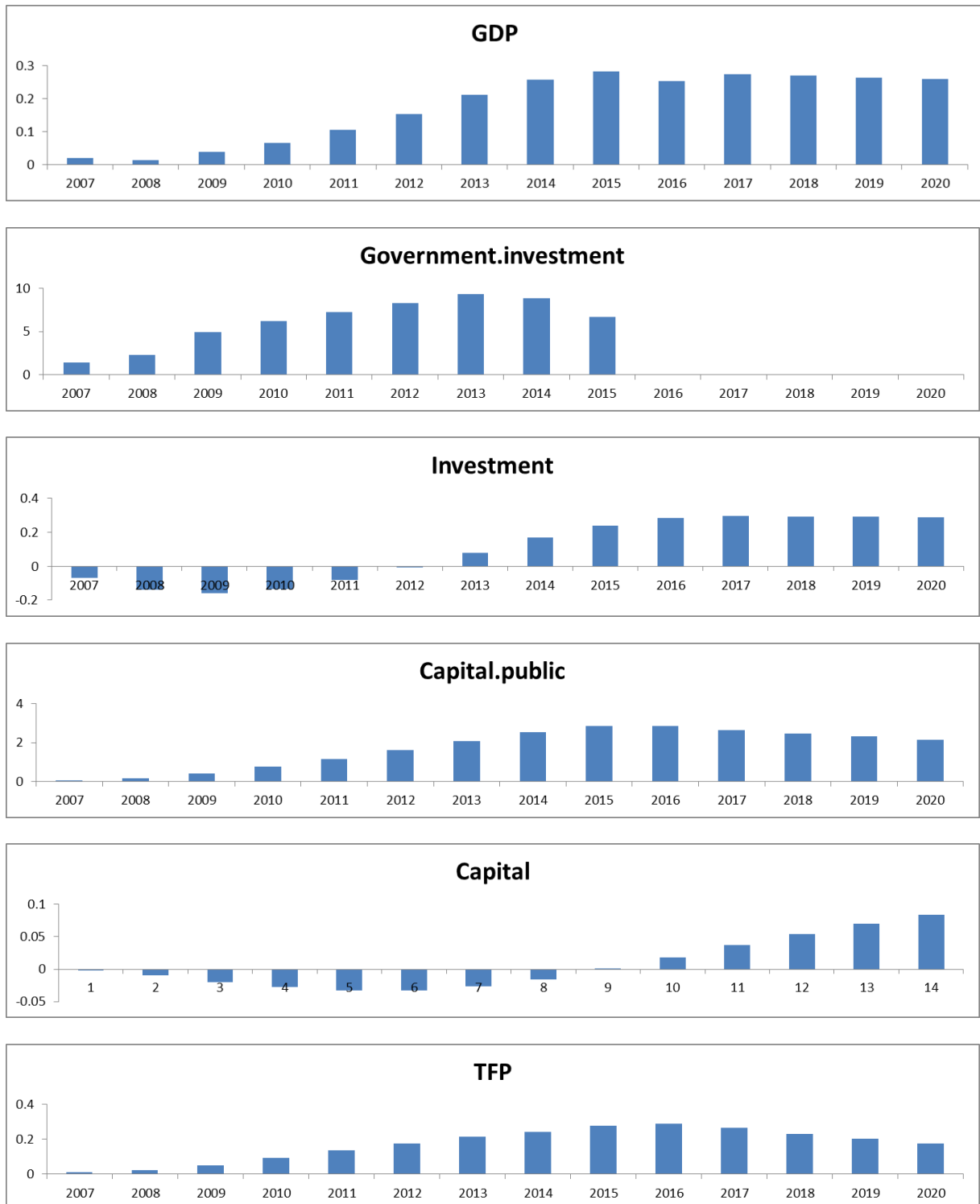
Category	FoI
111. Vocational training and information actions	HC
112. Setting up of young farmers	AIS
113. Early retirement	INFR
114. Use of advisory services	AIS
115. Setting up of management, relief and advisory services	AIS
121. Modernisation of agricultural holdings	AIS
122. Improvement of the economic 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	AIS
215. Animal welfare payments	AIS
216. Non-productive investments	AIS
221. First afforestation of agricultural land	AIS
222. First establishment of agro-forestry systems on agricultural land	AIS
223. First afforestation of non	AIS
224. Natura2000 payments	AIS
225. Forest environment payments agricultural land	AIS
226. Restoring forestry potential and introducing prevention actions	AIS
227. Non productive investments	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

Annex 2 Impacts per field of intervention and for policy mix EU27

Figure 1: INFRASTRUCTURE



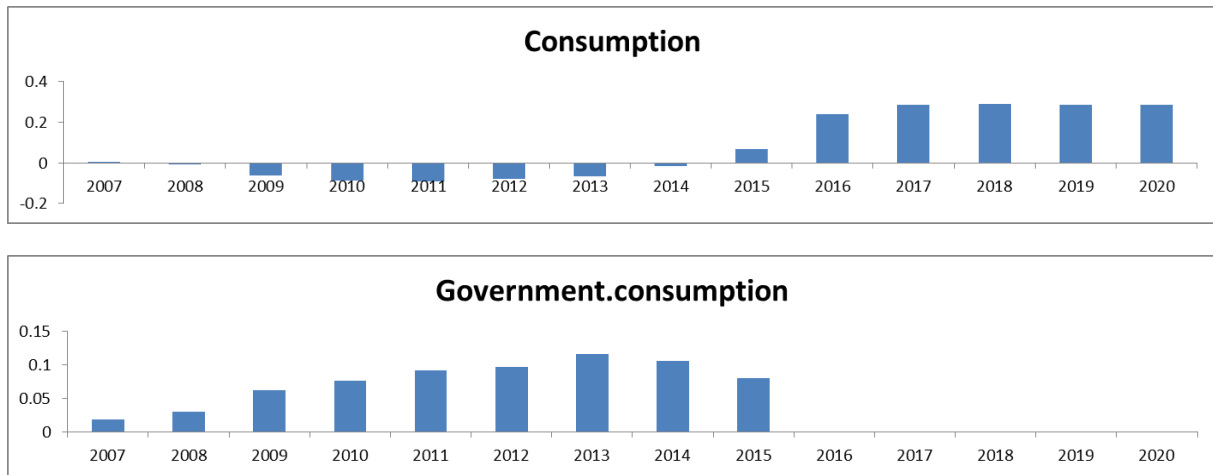
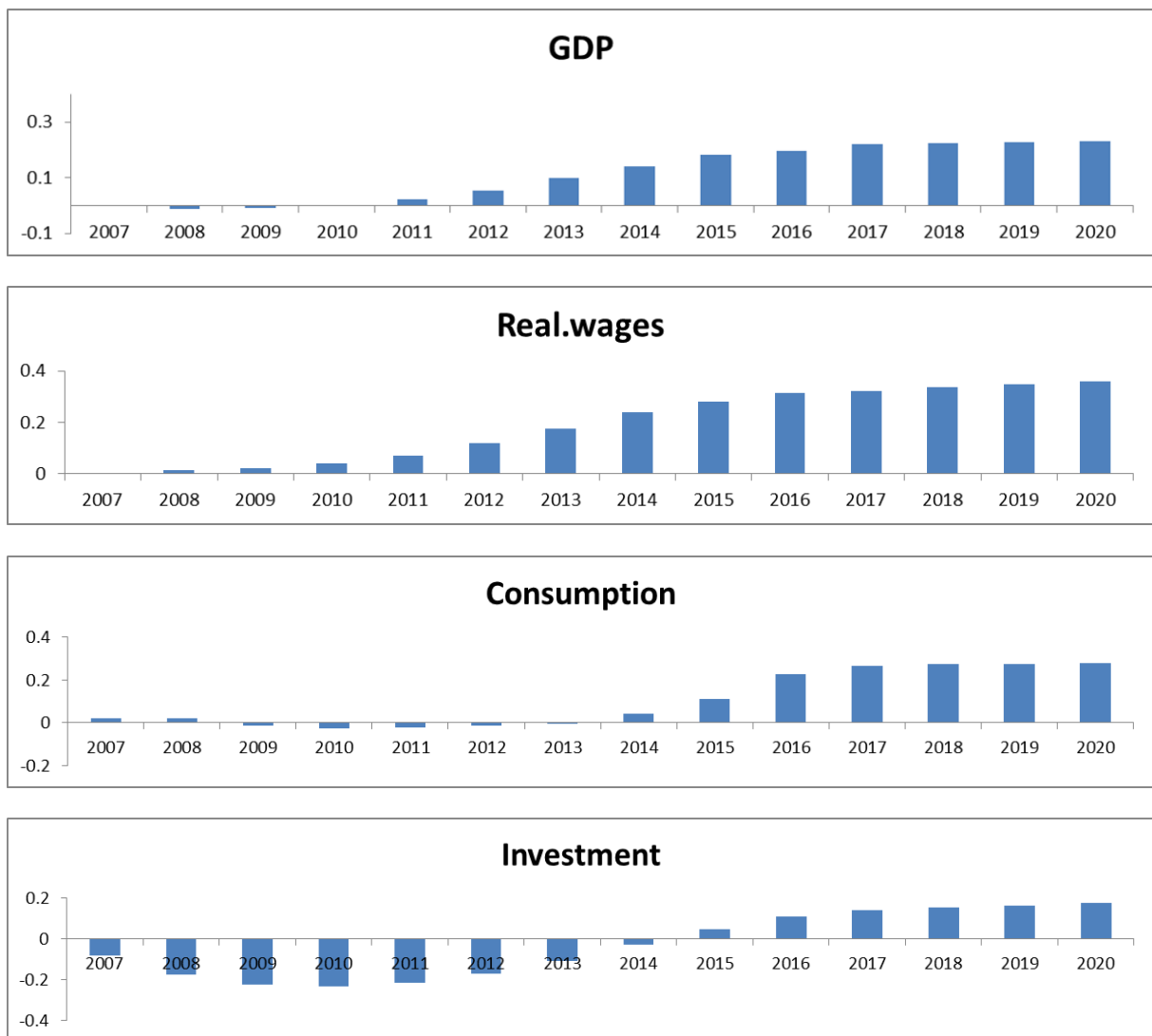


Figure 2: HUMAN CAPITAL



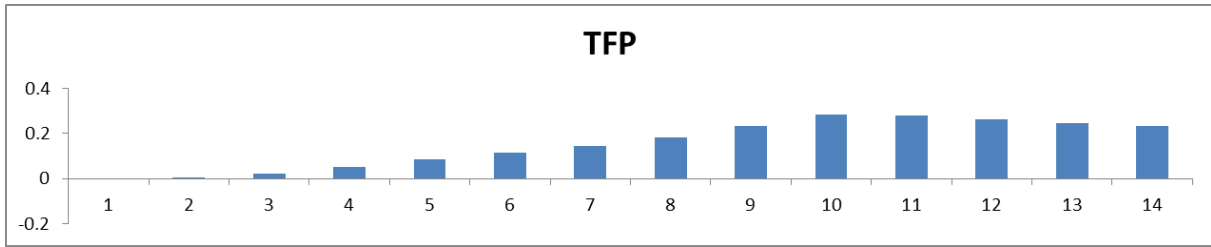


Figure 3: R&D SUPPORT

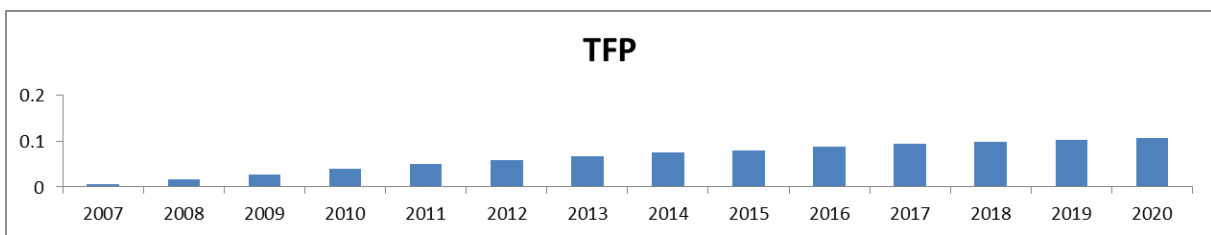
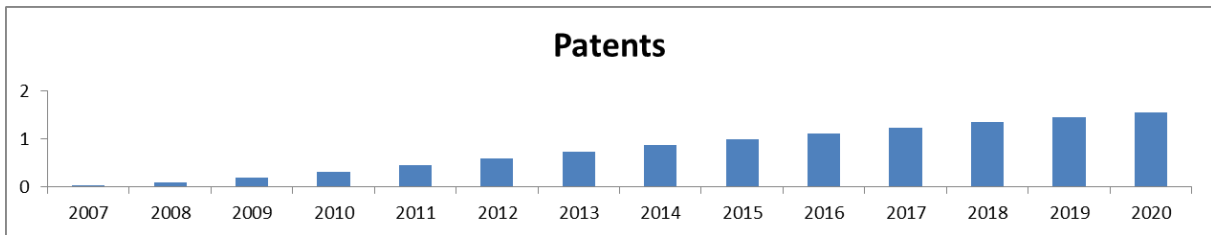
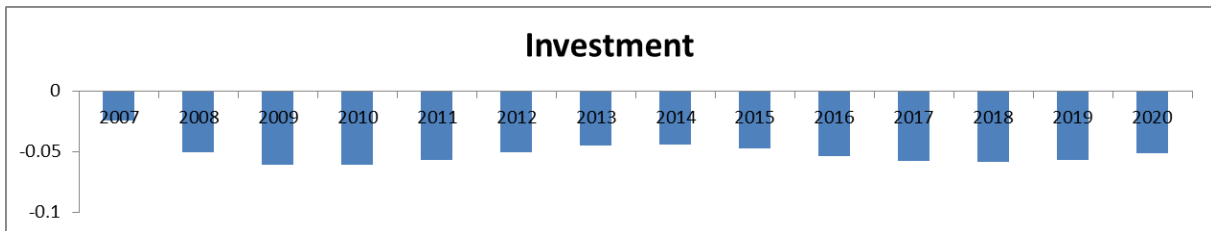
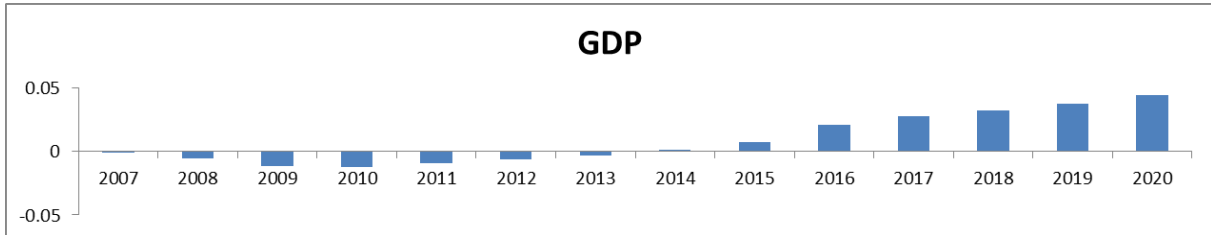


Figure 4: AID TO PRIVATE SECTOR

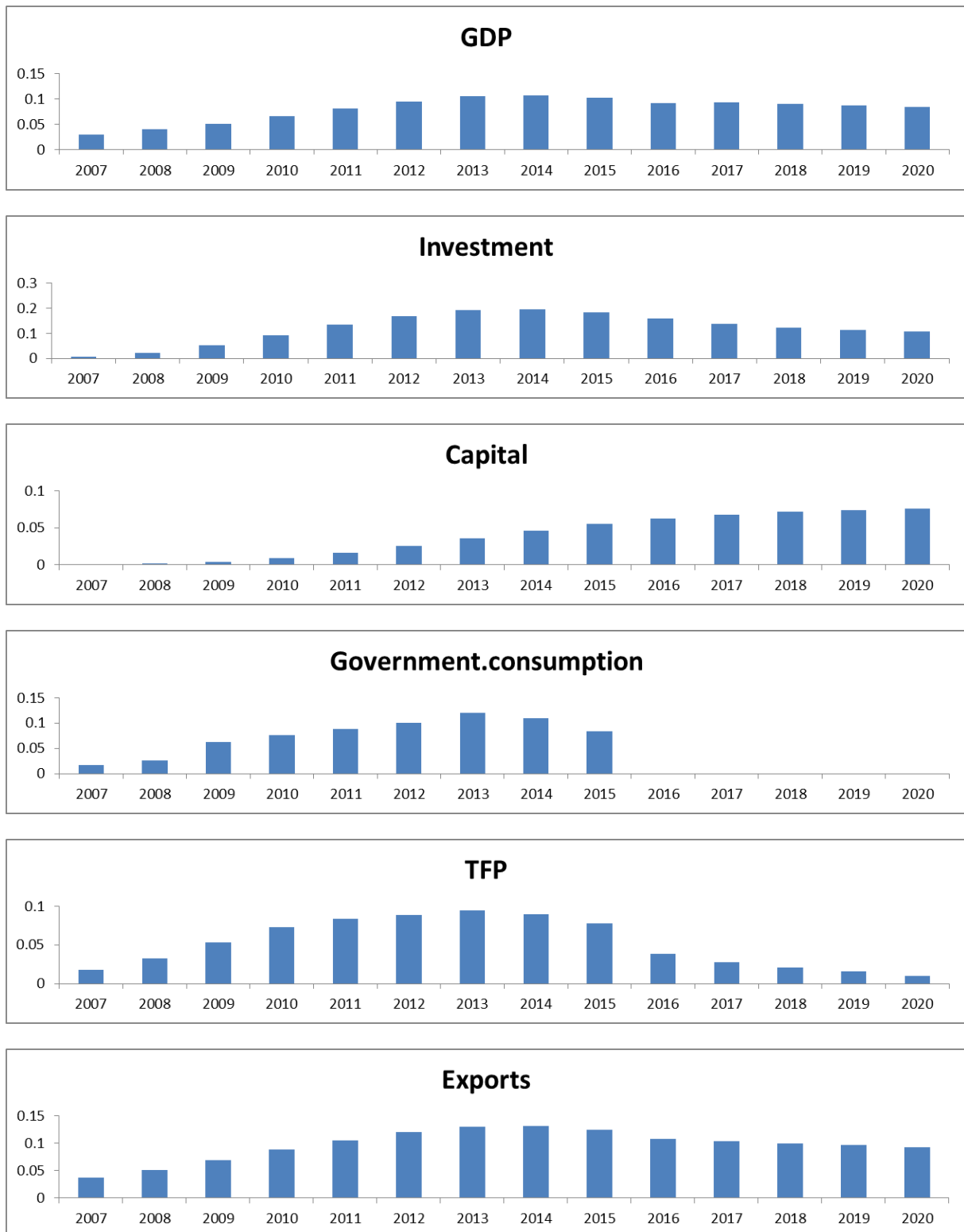
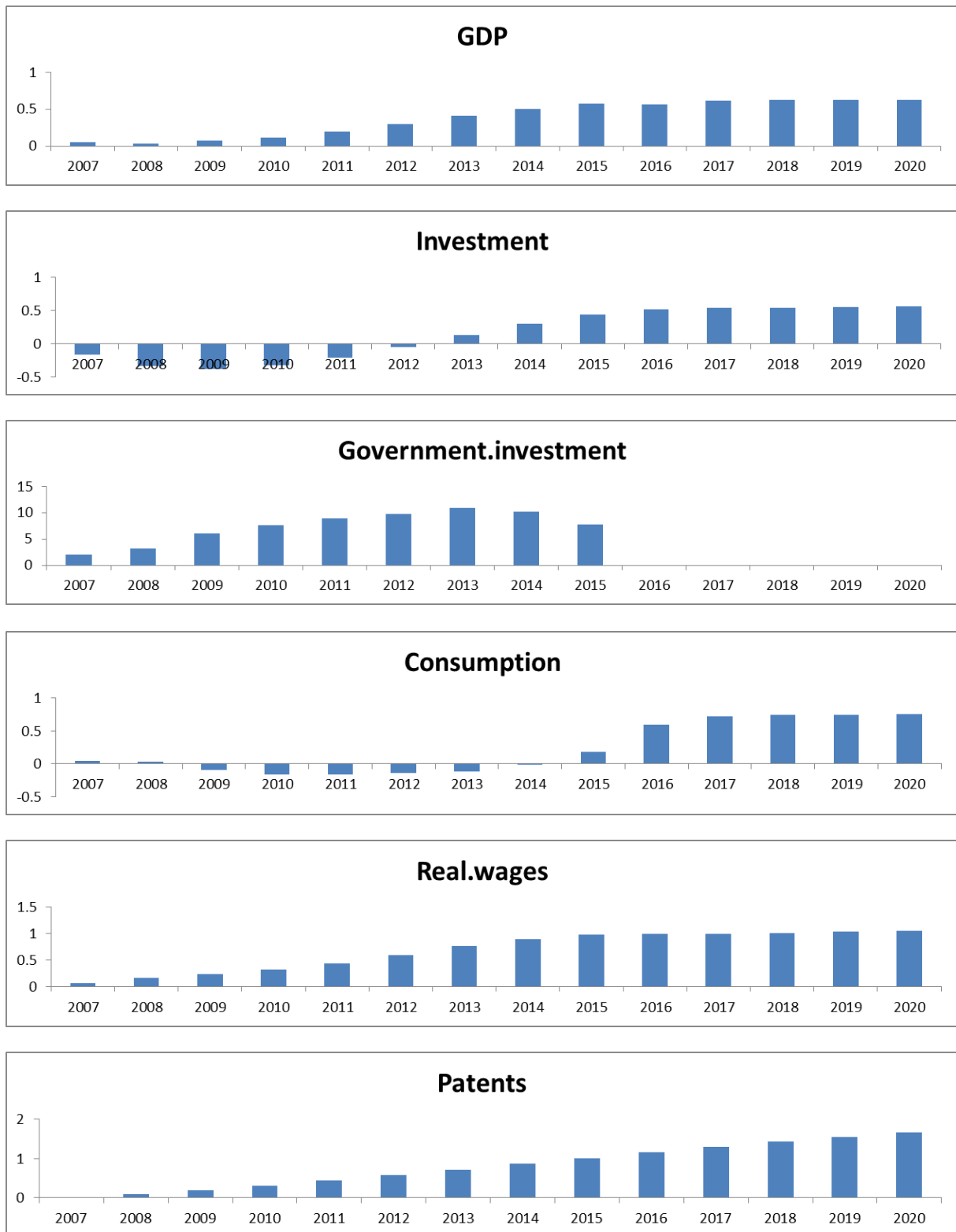
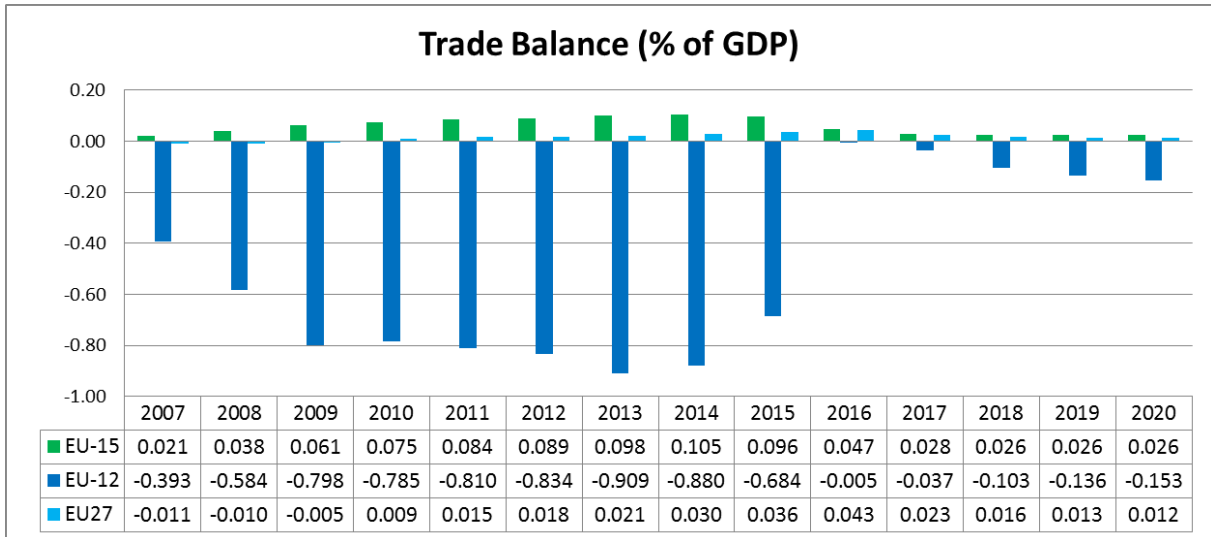
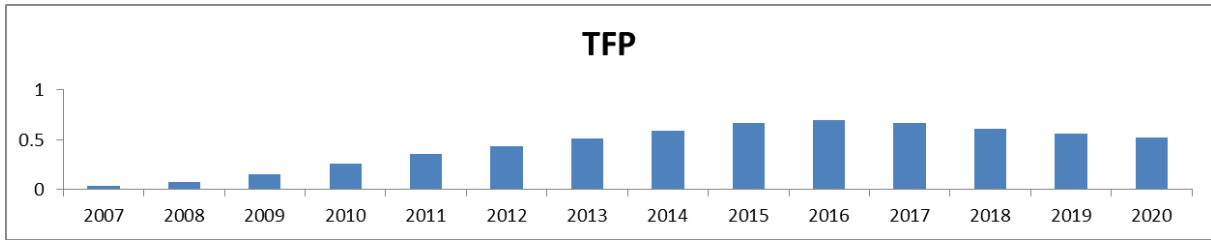


Figure 5: POLICY MIX





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