ESPON

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Territorial Scenarios and Visions for Europe

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Economic Trends and Scenarios

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This report presents a more detailed overview of the analytical approach to be applied by the ET2050 ESPON project. This Applied Research Project is conducted within the framework of the ESPON 2013 Programme, partly financed by the European Regional Development Fund.

The partnership behind the ESPON Programme consists of the EU Commission and the Member States of the EU27, plus Iceland, Liechtenstein, Norway and Switzerland. Each partner is represented in the ESPON Monitoring Committee.

The approach presented in the report may not necessarily reflect the opinion of the members of the ESPON Monitoring Committee.

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This basic report exists only in an electronic version.

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Introduction to the Volume

This report presents the economic trends and scenarios as developed by ABC-Politecnico di Milano.

It is organizes as follows.

Part A] presents an introduction to the past and current trends of the European Economy, from official statistics and published sources.

Part B] introduces the structure of the MASST 3 model, the most recent version of the MASST model which was developed in order to simulate the impact of the project scenarios at NUTS2 level for all European regions.

Part C] presents how the qualitative assumptions of the baseline and exploratory scenarios are translated into inputs for the MASST3 model in order to produce quantitative results.

Part D] presents the results of the scenarios in terms of GDP and employment growth between 2010 and 2030. The baseline and the three exploratory will be presented, also with a specific attention to regional disparities.

Part E] presents a sensitivity analysis on the impact of model assumptions and variables on regional growth and disparities at European level.

Part A
Past economic trends at European level

1. Introduction

This part of the report describes the status of the economy of Europe as a starting point for the economic section of all scenarios.
The analysis is at European and country level in the first part, while the last part will depict patterns at regional level.

After the introduction, the part is organized into five main sections: first analyzed are income, employment and growth, then the European external economic relations (trade and FDI), followed by an analysis of monetary variable and public finance, by the analysis of disparities, regional growth and competitiveness, and, finally, by the main challenges which Europe will need to confront.
In each section of the part, first described the status, i.e. the current situation in order to build the starting point for scenarios and then the dynamic patterns, useful to know in which direction the European economy is currently moving

The report builds upon previously existing knowledge but relies only to a little extent on published sources and reports, and more on published statistics. This choice is in order to allow the report to be as updated as possible and in order to have a comprehensive analysis of the aspects which should be most important in the scenario building.

The level of analysis is the Espon space (31 countries), even if in some cases it is possible that some data for the Espon non-EU countries are missing, and in other cases data for other countries of the World are presented to act as benchmark.
When no larger aggregate data exist, or data are not comparative, data for the EU 27 will be presented, as this group represents a paramount share of the Espon space.

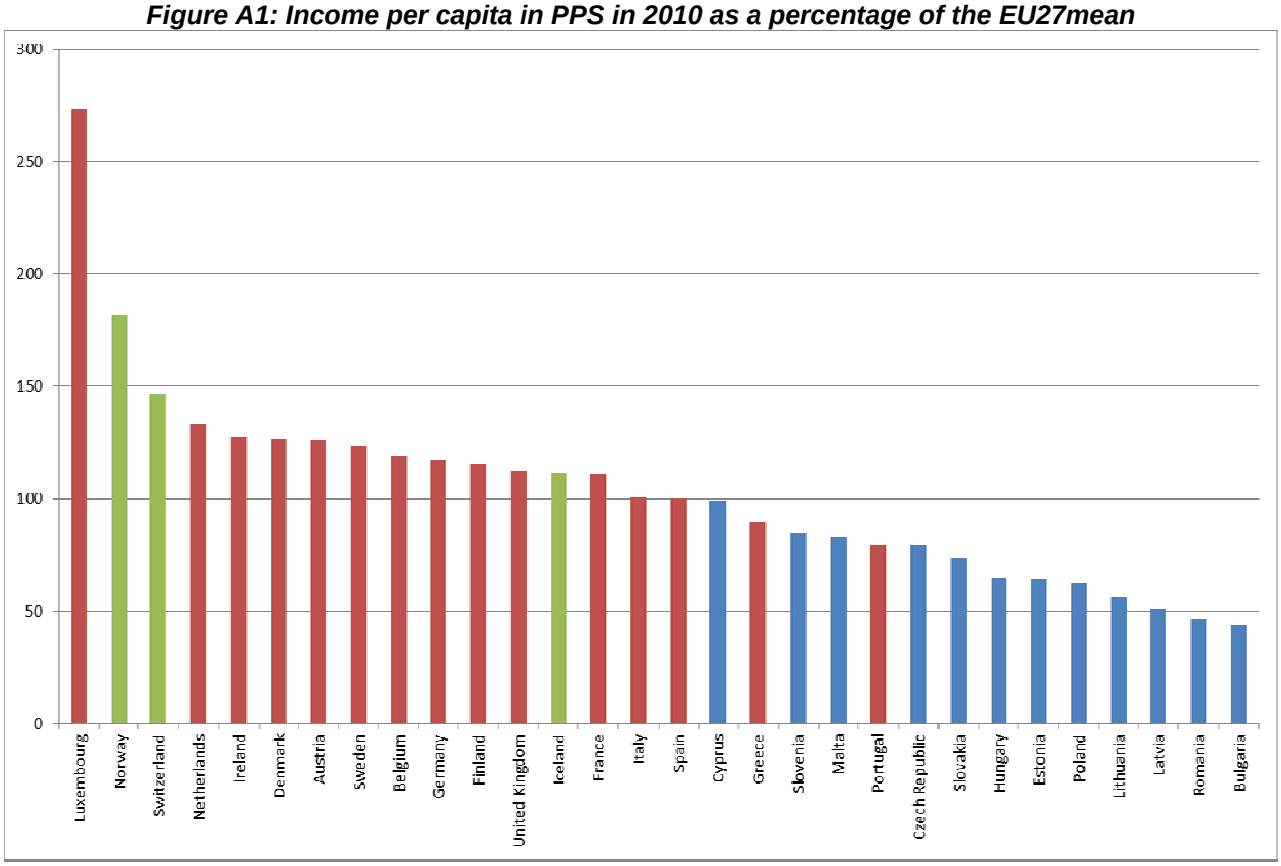
2. Income, employment and growth

2.1 The current situation of income, employment and growth

The most important and widespread quantitative measure of an economy is the income produced by its firms and citizens, since this income can then be used to buy goods and services, to save and invest and, through fiscal policy, to produce and supply public goods.
For this reason also the starting point of this report is the income produced by the citizens of European countries.
Figure A1 shows the level of income per capita in purchasing power parity for the European Espon countries, as a percentage of the European Union.
It is immediately evident that wide differences still exist among European countries, with the highest level in the Luxembourg at more than 270% and the lowest level in Bulgaria at less than 50%.
While the Luxembourg can be an outlier, the levels of countries such as Switzerland, Norway or the Netherlands are well above the European mean.

The most interesting feature emerging from Figure A1 is the fact that there is still a dualism between the old 15 member states of the European Union and the New 12 member countries which have joined the EU in 2004 or 2007. None of the New 12 countries reaches the average of the EU27, and only Greece and Portugal, among the old 15 countries, are below the mean, so that the 9 poorest European countries all belong to the New member countries.
This despite of the higher dynamics by these countries, which will be evidenced in Section 2.2.

Figure A1: Income per capita in PPS in 2010 as a percentage of the EU27mean

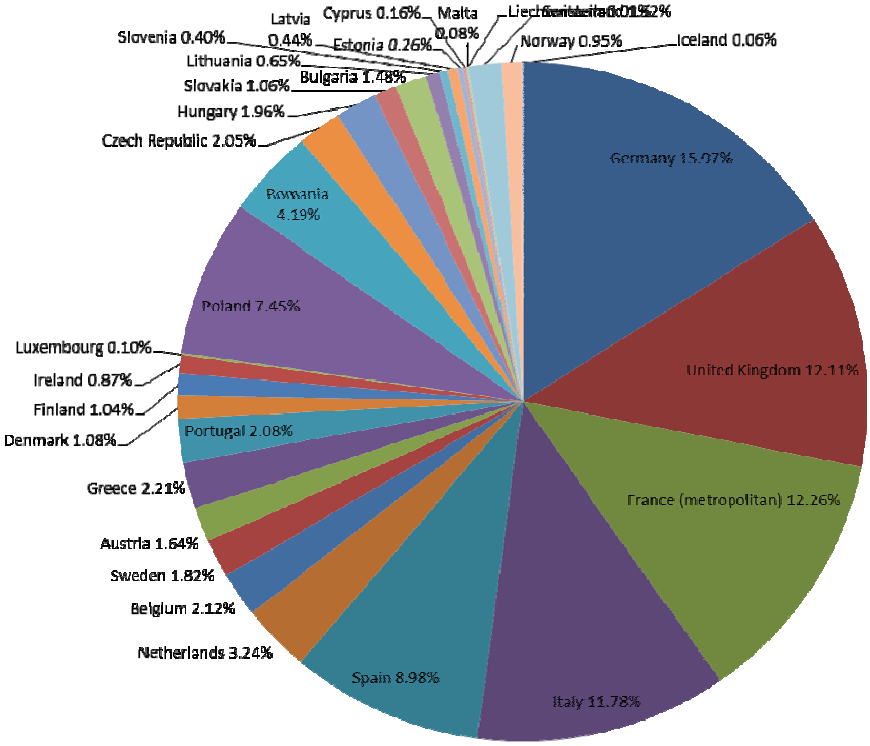


Source: Elaborations on Eurostat data

While there is a co-existence of richer and poorer countries, there is also a wider differentiation in terms of country size.

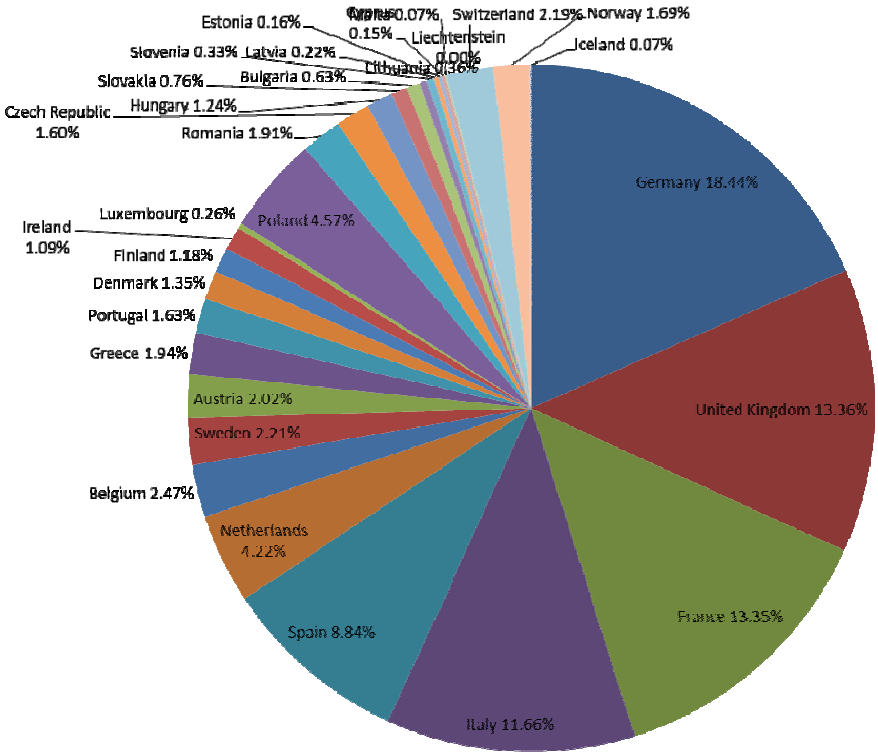
Leaving to the demographic report the discussion of population issues, it is however evident that much larger and much smaller countries co-exist within Europe, for example Germany accounts for almost 16% of European (Espon space) population while Ireland only for 0.87%. Within the new 12 member countries, Poland accounts for almost 7.5% of population, not much less than Spain, while Slovenia, Latvia, Estonia and Cyprus join the tiny Malta and Liechtenstein at less than 0.5% (Figure A2a).

Figure A2a. Share of Espon space total population by country at 1 January 2010



Source: Elaborations on Eurostat data

Figure A2b. Share of Espon space total gross domestic product at market prices by country in 2010.



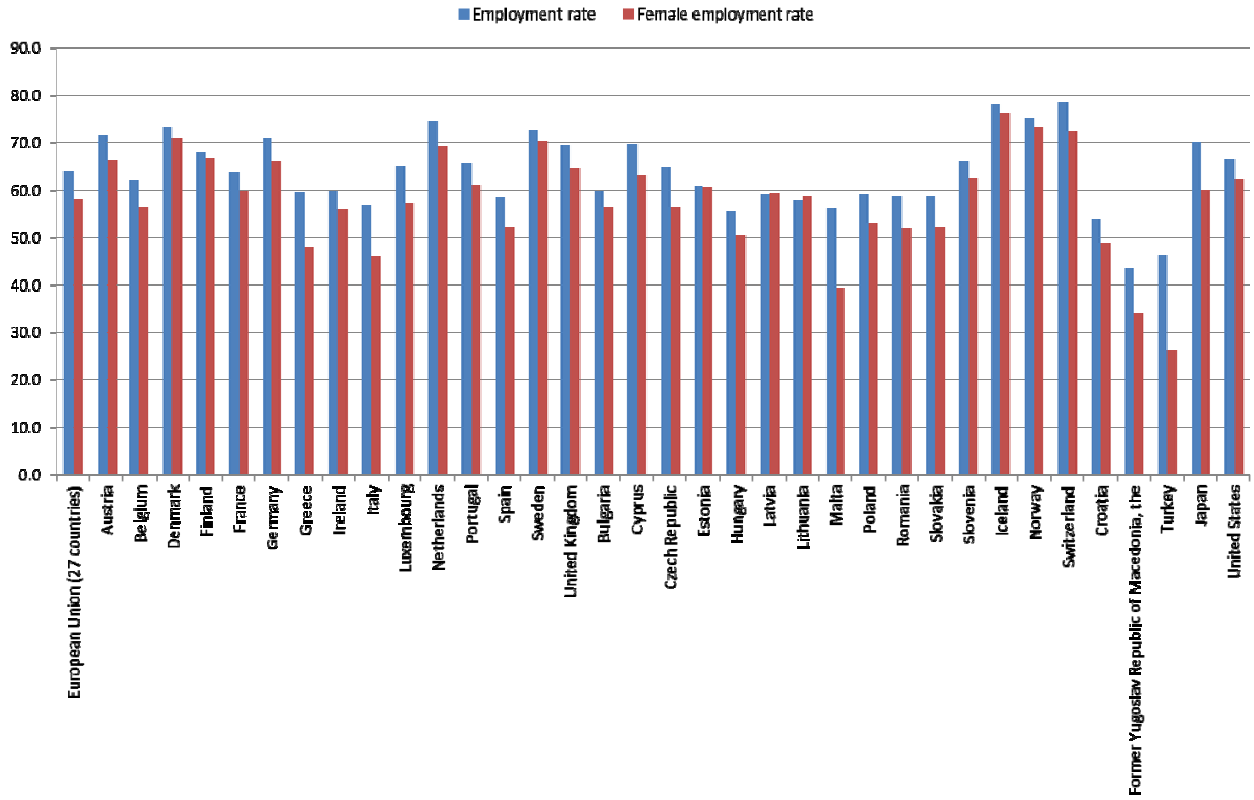
Source: Elaborations on Eurostat data

Considering the fact that the three biggest countries in terms of population are also above the European mean in terms of income per capita in PPS, it is clear why 3 countries account for 45% of total GDP in PPS, and 6 countries account for 70% of GDP, which also explains the different weight of countries in political terms.
The 12 new member countries of the EU, being smaller and relatively poorer, still account for only 12% of the total, with Poland, the 6th economy of Europe at 4.57%, just above the Netherlands.

The European economy is also very different for what concerns employment rates, which are around 65% of the relevant population on average in the European Union, a level very similar to the one of the United States (Figure A3).
In the case of employment, the New 12 member countries are below the EU 27 mean, but not significantly.
Differences between countries, however, are more significant. In particular, employment levels are high in the non-EU Espon countries of Iceland, Norway and Switzerland, not far from 80%, while the lowest employment levels are in Hungary, Malta, Italy and Spain, all well below 60%.

Female employment rates are lower in Europe, about 5% less than the male counterpart, with a difference more marked than in the United States.
Latvia and Lithuania are an exception as the only countries with higher female than male employment rates, while Greece, Italy and Malta are countries in which more female tend to be out of employment (Figure A3).

Figure A3. Employment rate by country in 2010

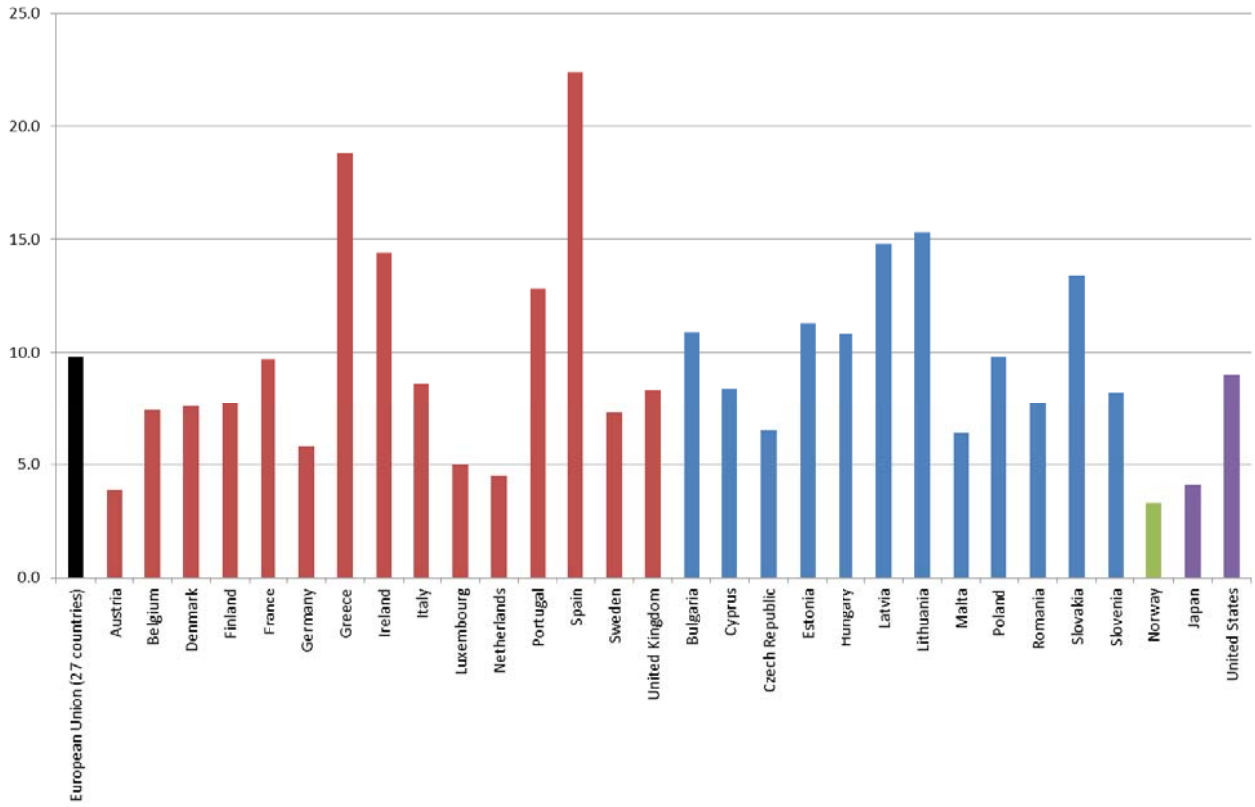


Source: Elaborations on Eurostat data

The unemployment rate reflects the fact that, among those people who are actively willing to work, not all are able to find a job.
The problem of unemployment has been made much more important by the economic crisis, as it will be shown in Section 2.2, but the different European countries have labour markets differently able to produce jobs.

At the EU 27 level the unemployment rate is close to 10%, higher but not by a large extent with respect to the United States, but in any case *significantly higher with respect to a structural/frictional level*.
The country where the unemployment rate is higher is Spain, characterized by a dual labour market, followed by Greece, Lithuania, Latvia, Ireland and Portugal, so that the old Cohesion countries are now those with higher problems of unemployment.
Norway, at 3.3%, and Austria, at 4.1% are the countries with lowest unemployment rates.

Figure A4. Unemployment rate by country in September 2011
(latest month with data available for all countries)

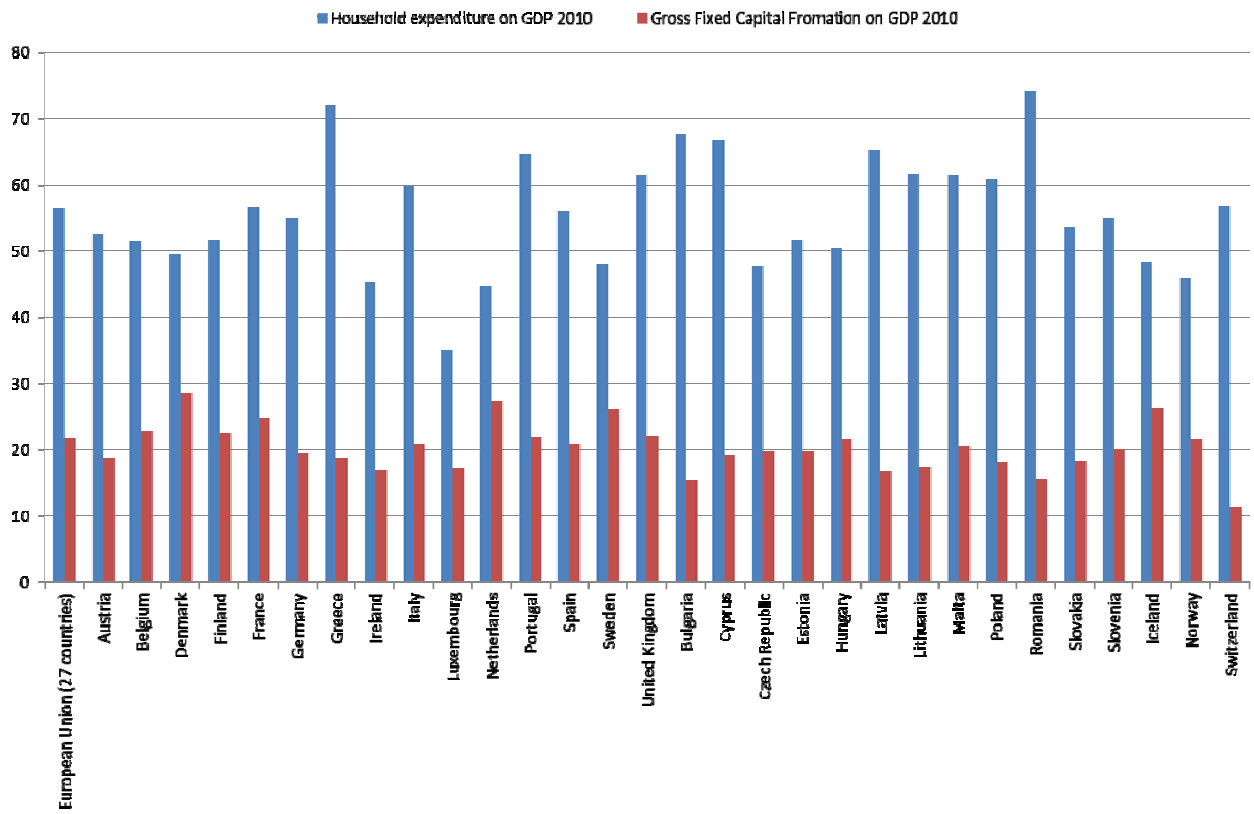


Source: Elaborations on Eurostat data

On average 55% of European GDP is accounted by household expenditure, but the various countries show different attitudes to savings and spending, as it is shown in Figure A5.
In particular, the ratio of household expenditure on GDP is high in Greece and Romania, above 70%, while the Luxembourg is by far the country where it is lower at less than 35% (even if this datum can be partly due to the small size of the country), but is also low in Ireland and the Netherlands.

Gross fixed capital formation, expressed as ratio on GDP, is slightly less than 22% on average across Europe, but is higher in some countries, especially in the Netherlands and in the Nordic countries of Denmark, Sweden and Iceland.
Interestingly, the countries which are investing less are first Switzerland, followed by Bulgaria and Romania in the East and Ireland and Luxembourg in the West.

Figure A5. Household expenditure and gross fixed capital formation on GDP in 2010, by country.



Source: Elaborations on Eurostat data

2.2 The dynamics of income, employment and growth

This section of the report analyzes the dynamics of the main macroeconomic variables.
In Table A1, the dynamics of GDP is shown for the Espon countries, for the 12 years prior to the crisis, i.e. from 1995 to 2007, and for the first three years of economic crisis.
By looking at the long term pattern, it can be observed that the European Union has been growing around 2.5% a year, which is less than the 3.17% of the dynamic US and more than the 1.17% of the stuck Japan.
Within Europe, the new 12 member countries have significantly outperformed the old 15 members, by almost 2 percentage points, which is a very significant different but still insufficient to fill the gap between the two groups (see Section 2.1 for the disparities still existing).

Among the European countries, some countries have had a significantly better growth performance. With regard to the old 15 member countries, there has been a significantly better performance by Finland, Greece, Ireland, Luxembourg, Spain, Sweden, the United Kingdom.
Other countries have had significant problems of growth, namely Italy but also Germany.

With regard to the new 12 member countries, outstanding is the performance of the three Baltic republics of Estonia, Latvia and Lithuania, while only Malta is below 2% and only Romania below 3%.

Table A1. Real annual GDP growth rate by country

Country	1995-2007	2008	2009	2010
European Union (15 old countries)	2.43	0.03	-4.30	1.98
European Union (12 new countries)	4.29	4.14	-3.70	2.33
European Union (27 countries)	2.53	0.32	-4.26	1.99
Austria	2.62	1.40	-3.81	2.31
Belgium	2.32	0.96	-2.84	2.27
Denmark	2.12	-0.78	-5.83	1.30
Finland	3.90	0.29	-8.35	3.73
France	2.20	-0.08	-2.73	1.48
Germany	1.60	1.08	-5.13	3.69
Greece	3.75	-0.16	-3.25	-3.52
Ireland	7.00	-2.97	-6.99	-0.43
Italy	1.53	-1.16	-5.05	1.54
Luxembourg	5.01	0.75	-5.30	2.68
Netherlands	2.84	1.80	-3.54	1.69
Portugal	2.42	-0.01	-2.91	1.38
Spain	3.70	0.89	-3.74	-0.07
Sweden	3.22	-0.61	-5.17	5.61
United Kingdom	3.22	-1.10	-4.37	2.09
Bulgaria	3.17	6.19	-5.48	0.15
Cyprus	3.68	3.59	-1.86	1.14
Czech Republic	3.52	3.10	-4.70	2.74
Estonia	7.55	-3.67	-14.26	2.26
Hungary	3.29	0.89	-6.80	1.26
Latvia	7.31	-3.28	-17.73	-0.34
Lithuania	7.30	2.91	-14.84	1.44
Malta	1.64	4.33	-2.62	2.89
Poland	4.62	5.13	1.61	3.94
Romania	2.64	7.35	-6.58	-1.65
Slovakia	5.01	5.89	-4.91	4.24
Slovenia	4.37	3.59	-8.01	1.38
Iceland	4.70	1.27	-6.67	-4.00
Norway	2.87	0.04	-1.67	0.68
Switzerland	2.00	2.10	-1.88	2.71
Japan	1.17	-1.04	-5.53	4.43
United States	3.17	-0.34	-3.49	3.03

Source: Elaborations on Eurostat data

The economic crisis has hit Europe even more than the United States, and has also hit all countries of Europe but in very differentiated ways.
First of all the old 15 member countries of the EU have been hit significantly more than the new 12 member countries. In fact, the crisis has arrived in the old 15 countries one year before (the growth rate of new 12 countries in 2008 is in line with the long term average), has hit more in 2009 and is less keen to leave room for recovery in 2010.
The growth rates of 2008 show the fact that while some countries had entered the recession, for other countries the recession is still a slowdown.
In 2009, all countries but one have had negative growth rates, and it is interesting to observe that the same countries with outstanding growth prior to the crisis, Estonia, Latvia, Lithuania, have also been hit more than the others

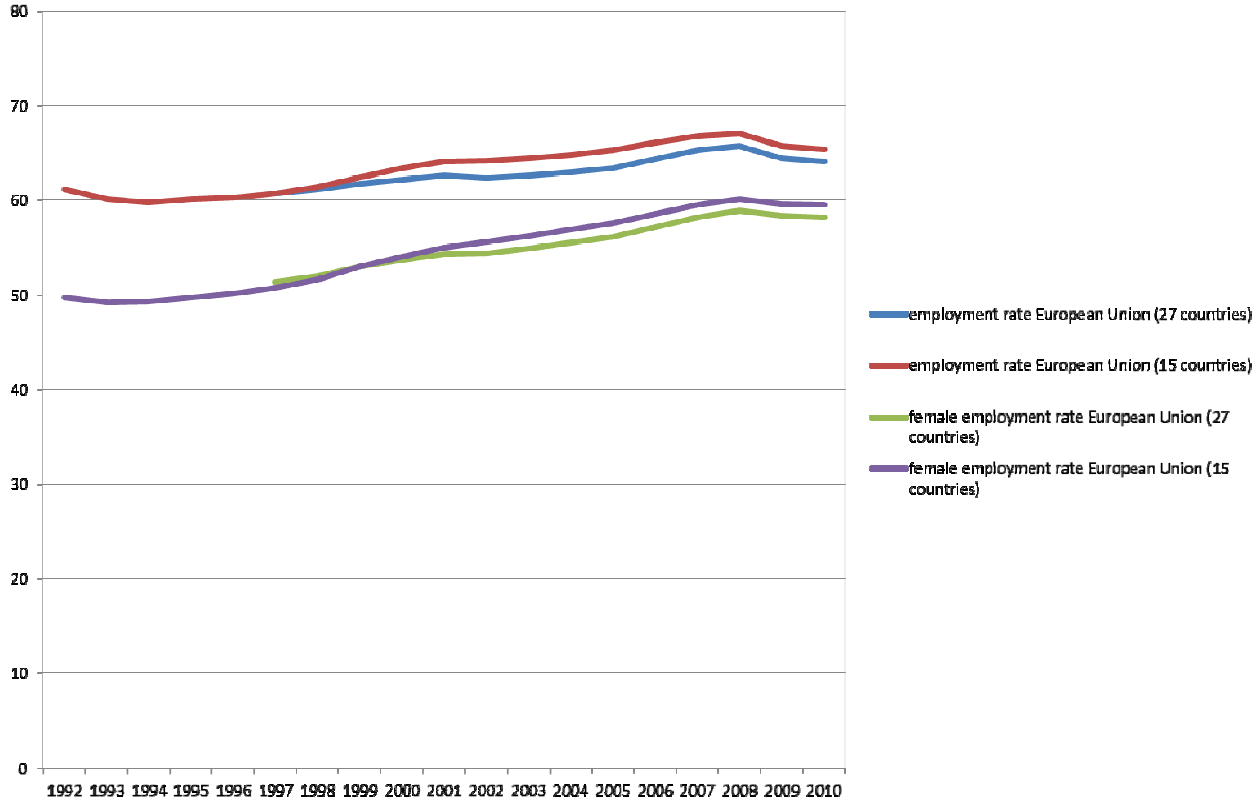
A notable exception is Poland, the only European country with no sign of crisis in 2008 and positive growth in 2009. Poland is also among those countries recovering faster in 2010.
Among the largest countries, it is also notable the recovery of Germany, which is considerably faster than the one of the UK, France or Italy.

The dynamics of employment rates, reported in Figure A6 for the European Union, and for the Old 15 member countries in order to have a longer time series, is a structural indicator on which the Union has put large emphasis in recent times in order to foster competitiveness though a larger workforce and to foster societies through larger participation to the labour market.

It can be observed that the long term pattern is in this case quite stably increasing until the start of the economic crisis, from around 60% to 66%, while with the economic crisis, the growth of unemployment and the increase of discouraged people who renounce to seek for a job, it bounced back to 64%.
The difference between males and females is still striking: the employment rate of females is 6% lower than the total one.
However, there has been partial convergence, as the difference was of more than 10% in the early nineties and the economic crisis has not halted this convergence process since before the crisis the difference was of around 7%, i.e. about 1% more than it is now (figure A6).

The dynamics of unemployment is another very important indicator of economic cycles.
Using monthly data from the European Labour Force Survey, the long term patterns of total unemployment rate and of young and female unemployment rates have been traced (Figure A7).
Young people and female are two categories of citizens which historically record higher unemployment rates, in the first case because of the difficulties entering the labour market, in the second because in some countries it is more difficult to make work and children care co-exist.

Figure A6. Employment and female employment patterns at the EU level



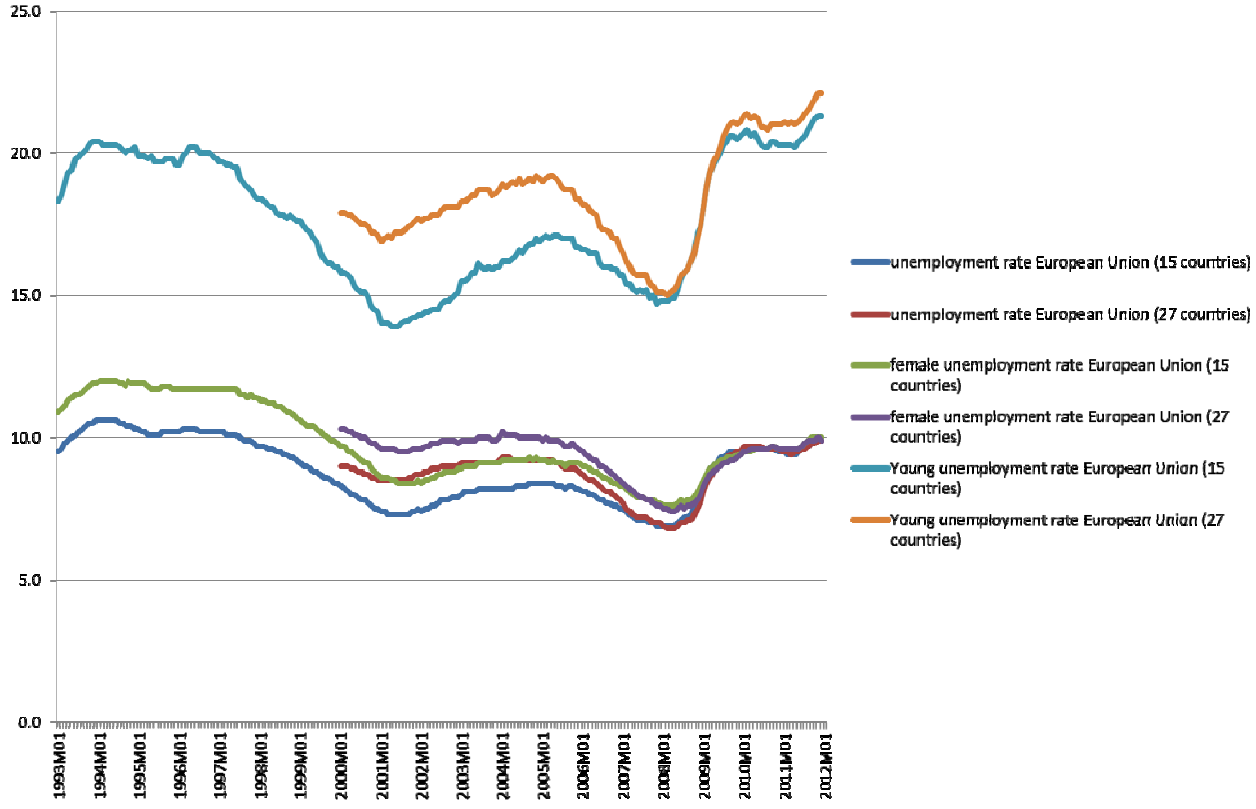
Source: Elaborations on Eurostat data

First of all it can be observed that the total unemployment rate of the European Union and, in order to have a longer time-span, of the 15 old member countries, starting at above 10% had been declining in the late nineties, then increasing slightly in the early 2000s and then significantly declining to about to around 7% before growing steeply with the current economic crisis to values close to 10% again.
The economic crisis has hence been able to cancel the progresses of the previous 15 years (Figure A7).

The pattern of female unemployment is interesting, because it started about 1.3% higher than the total male+female, but it has slowly converged to the one of males so that today the two are the same. The economic crisis has helped fill definitively the gap.

The pattern of young unemployment rate is exactly the opposite (Figure A7).
It started around 10 percentage points higher than the total unemployment rate, at more than 20%, and then converged only partly, to less than 7 percentage points higher (at 14%) in 2001, then it increased in the early nineties and decreased again in the late nineties before the crisis, when the value was slightly less than 15%, i.e. 8 percentage points higher than the total rate.
The last big economic crisis affected young people significantly more than the others, so that the young unemployment rate is now as high as 21.3%, with a difference with respect to the total rate of more than 11%, i.e. the largest recorded in the time series.

Figure A7. Total unemployment rate, female unemployment rate and young unemployment in the *European Union*



Source: Elaborations on Eurostat data

3. European external economic relations: trade and FDI

3.1 European trade and balance accounts

The synthesis of balance accounts of European countries are presented in Table A2, where it can be seen that, on average, exports and imports account for around 40% of GDP. This makes European countries much more open with respect to the US or Japan, which are at about 15% of GDP.
The new 12 member countries of the EU are significantly more open with respect to the old 15 members, with exports and imports at around 60% of GDP.
Switzerland is significantly more open with respect to the European union, while Iceland and Norway export as much as the EU and import less.

The overall trade balance of the EU is positive, with a figure of about 1,33% of GDP. This is the result of the positive trade balance of the old 15 member countries and the negative trade balance of the 12 new members. Iceland, Switzerland and Norway all have a significantly positive trade balance, at around 10% of GDP.

In relative terms the countries with the largest positive trade-balance are the Luxembourg and Ireland, while in absolute terms the countries with the highest difference between exports and imports are Germany and the Netherlands.

A number of European countries have a negative trade-balance, most notably Romania, Greece and Portugal, while in absolute terms the two countries which import more than they export are France and the United Kingdom.
The trade deficit of the US, however, is 10 times as large the one of these two countries.

The most important markets for the European Union's countries are Asia and America, but also European non-EU-27 countries. Together, these three markets of comparable size account for 86% of exports (Table A3a).
Other export markets are the Mediterranean Basin Countries and the Organisation of Petroleum Exporting Countries.
Among the individual countries, by far the most important customer for European exports are the United States of America, at around 18% of total exports, followed at distance by China, Switzerland and Russia.
It is interesting to notice that Switzerland is almost as important as China as an export market, despite being infinitely smaller.

The main producers of European Union's imports are Asia and the European non-EU-27 countries, at 43 and 27% respectively.
In particular, large is the share of China, at almost 19%, while North America and the United States in particular play an important but lesser role, at 11% (table A3b).

Table A2. External trade: Balance accounts in 2010 by country in million Euro at 2005 prices

Country	*Exports 2010*	*Imports 2010*	*Trade Balance*	*Exports on GDP*	*Imports on GDP*	*Trade balance on GDP*
European Union (15 old countries)	*4'253'411.2*	*4'097'075.0*	*156'336.2*	*39.49*	*38.03*	*1.45*
European Union (12 new countries)	*468'929.5*	*471'773.6*	*-2'844.1*	*59.93*	*60.29*	*-0.36*
European Union (27 countries)	*4'722'340.7*	*4'568'848.6*	*153'492.1*	*40.87*	*39.54*	*1.33*
Austria	*145'659.2*	*128'178.3*	*17'480.9*	*55.36*	*48.72*	*6.64*
Belgium	*262'849.6*	*251'169.9*	*11'679.7*	*81.74*	*78.10*	*3.63*
Denmark	*109'494.2*	*102'175.4*	*7'318.8*	*53.12*	*49.57*	*3.55*
Finland	*71'420.3*	*66'225.0*	*5'195.3*	*43.26*	*40.12*	*3.15*
France	*466'996.3*	*503'160.3*	*-36'164.0*	*26.29*	*28.33*	*-2.04*
Germany	*1'131'926.6*	*992'044.7*	*139'881.9*	*47.79*	*41.88*	*5.91*
Greece	*42'695.2*	*59'528.4*	*-16'833.2*	*21.83*	*30.44*	*-8.61*
Ireland	*152'010.3*	*118'299.3*	*33'711.0*	*93.43*	*72.71*	*20.72*
Italy	*385'176.1*	*400'617.4*	*-15'441.3*	*27.08*	*28.16*	*-1.09*
Luxembourg	*55'411.2*	*47'258.9*	*8'152.3*	*166.85*	*142.30*	*24.55*
Netherlands	*423'877.0*	*375'337.0*	*48'540.0*	*76.94*	*68.13*	*8.81*
Portugal	*49'573.6*	*62'760.3*	*-13'186.7*	*31.44*	*39.80*	*-8.36*
Spain	*267'343.5*	*286'002.3*	*-18'658.8*	*28.13*	*30.09*	*-1.96*
Sweden	*163'246.0*	*144'660.0*	*18'586.0*	*51.02*	*45.21*	*5.81*
United Kingdom	*525'236.2*	*562'061.0*	*-36'824.8*	*27.94*	*29.89*	*-1.96*
Bulgaria	*16'026.1*	*18'030.1*	*-2'004.0*	*60.46*	*68.02*	*-7.56*
Cyprus	*6'855.4*	*7'816.9*	*-961.5*	*44.80*	*51.09*	*-6.28*
Czech Republic	*92'950.7*	*84'923.3*	*8'027.4*	*77.77*	*71.05*	*6.72*
Estonia	*9'587.5*	*8'711.6*	*875.9*	*85.78*	*77.94*	*7.84*
Hungary	*86'868.6*	*79'548.5*	*7'320.1*	*98.81*	*90.48*	*8.33*
Latvia	*7'128.7*	*7'447.4*	*-318.7*	*57.07*	*59.62*	*-2.55*
Lithuania	*15'929.7*	*15'740.3*	*189.4*	*72.19*	*71.33*	*0.86*
Malta	*5'130.9*	*4'861.1*	*269.8*	*95.18*	*90.18*	*5.01*
Poland	*126'792.6*	*132'847.0*	*-6'054.4*	*41.19*	*43.16*	*-1.97*
Romania	*36'330.0*	*51'694.5*	*-15'364.5*	*40.24*	*57.26*	*-17.02*
Slovakia	*40'997.0*	*39'347.2*	*1'649.8*	*84.77*	*81.36*	*3.41*
Slovenia	*21'343.5*	*21'012.8*	*330.7*	*67.98*	*66.92*	*1.05*
Iceland	*5'354.1*	*4'078.7*	*1'275.4*	*40.55*	*30.89*	*9.66*
Norway	*105'803.5*	*81'653.2*	*24'150.3*	*41.53*	*32.05*	*9.48*
Switzerland	*181'380.2*	*145'614.0*	*35'766.2*	*54.79*	*43.98*	*10.80*
Japan	*601'449.0*	*477'384.7*	*124'064.3*	*16.10*	*12.78*	*3.32*
United States	*1'336'870.0*	*1'675'910.3*	*-339'040.3*	*12.71*	*15.93*	*-3.22*

Source: Elaborations on Eurostat data

Commodity exporting countries and areas are also very relevant in European Imports, in particular Russia, Mediterranean Basin Countries and the Organisation of Petroleum Exporting Countries (which includes some countries of the Mediterranean Basin).
Switzerland and Norway each account for more than 5% of the European Union's imports, i.e. more than Japan and not far from the total of Latin America.

Table A3a. The most important trade partners for the European Union in terms of exports, 2010

Partner	Exports 2010	% of Exports
Asia	447'984	33.23
America	362'014	26.86
European non-EU-27 countries	355'754	26.39
North American Free Trade Agreement	290'124	21.52
United States	242'173	17.97
Mediterranean Basin Countries	180'992	13.43
European Free Trade Association	150'002	11.13
Africa	125'528	9.31
Organisation of Petroleum Exporting Countries	117'651	8.73
China (except Hong Kong)	113'251	8.40
Switzerland	105'375	7.82
Latin American countries	86'668	6.43
Russia	86'133	6.39
Candidate countries	76'110	5.65

Source: Elaborations on Eurostat data

Table A3b. The most important trade partners for the European Union in terms of imports, 2010

Partner	Imports 2010	% of Imports
Asia	655'084	43.47
European non-EU-27 countries	397'451	26.37
America	287'134	19.05
China (except Hong Kong)	282'508	18.75
North American Free Trade Agreement	203'453	13.50
United States	170'111	11.29
European Free Trade Association	167'256	11.10
Russia	158'553	10.52
Mediterranean Basin Countries	145'950	9.69
Africa	133'804	8.88
Organisation of Petroleum Exporting Countries	129'185	8.57
Latin American countries	91'326	6.06
Switzerland	84'307	5.59
Norway	79'229	5.26
Japan	65'766	4.36

Source: Elaborations on Eurostat data

As a consequence of the different importance of the same markets for imports and exports, the European Union countries hold a positive trade balance with some parts of the world and a negative with other parts (Table A4).
The most positive trade balance is with NAFTA (North American Free Trade Agreement) countries, and in particular the United states of America. The Mediterranean Basin Countries are the second area with largest trade surplus, followed by the candidate countries to the EU, including Turkey.
The European Union holds a positive trade balance also towards a number of oil exporting countries, most notably the United Arab Emirates and Saudi Arabia, and to Oceania and Australia in particular. Also Switzerland, which has overall a positive trade balance, has however a notable trade-deficit with respect to the European Union.

The area to which the European Union holds the largest trade-deficits is Asia, and firstly China, but also Japan and South Korea. Smaller but significant trade deficits are also present to a number of commodity exporting countries, first of all Russia, but also Norway, Libia, the Organisation of Petroleum Exporting Countries in general and Kazakhstan (Table A4).

Table A4. The most important trade partners for the European Union in terms of trade-balance, 2010

Partner	Trade balance in 2010
North American Free Trade Agreement	86'671
United States	72'062
Mediterranean Basin Countries	35'042
Candidate countries	24'431
United Arab Emirates	21'921
Switzerland	21'069
Turkey	18'912
Oceania and southern polar regions	17'779
Australia	16'979
Hong Kong	16'266
WBC - Western Balkan Countries	12'617
Mexico	8'181
Egypt	7'637
Saudi Arabia	6'950
Canada	6'427
Morocco	5'907
Ukraine	5'883
Singapore	5'663
…	…
Kazakhstan	-10'709
South Korea	-11'135
Organisation of Petroleum Exporting Countries	-11'534
European Free Trade Association	-17'254
Japan	-21'914
Libya	-22'097
Association of Southeast Asian Nations	-25'858
Norway	-37'347
European non-EU-27 countries	-41'697
Russia	-72'420
Extra EU-27	-158'986
China (except Hong Kong)	-169'257
Asia	-207'101

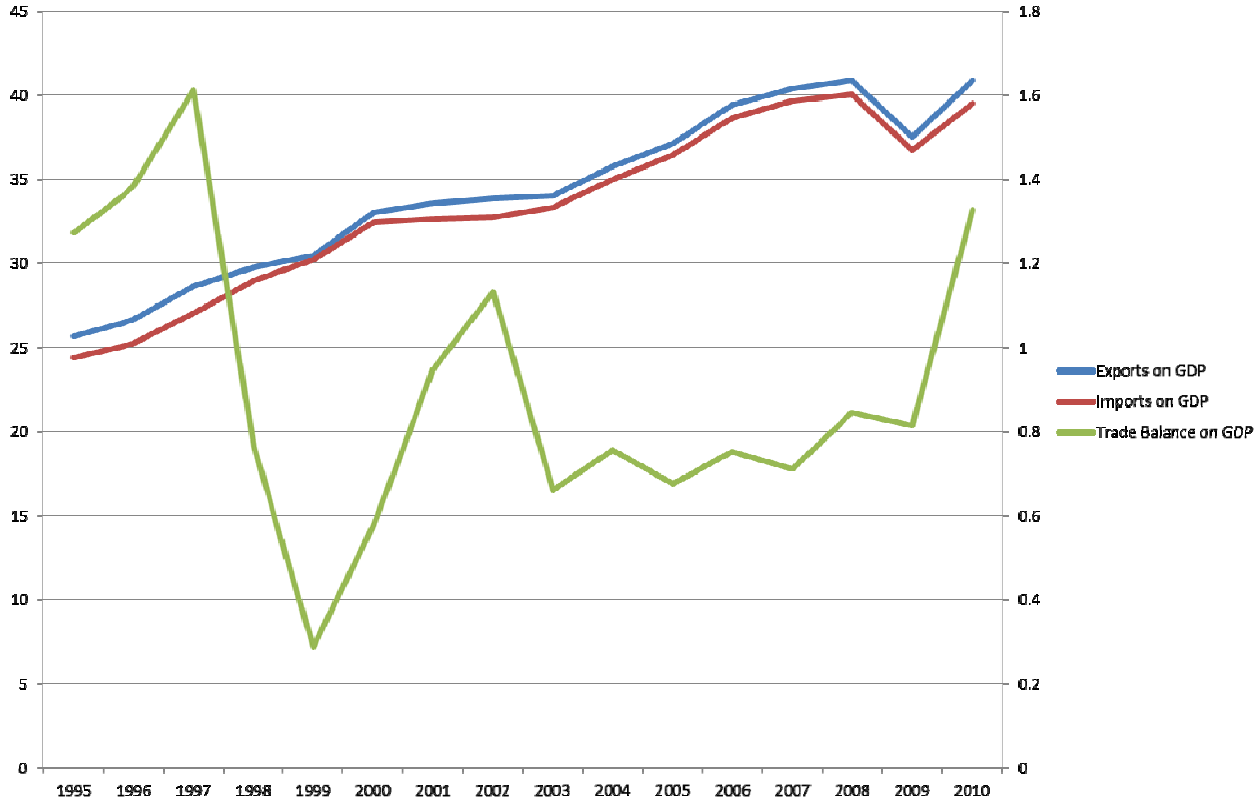
Source: Elaborations on Eurostat data

3.2 The dynamics of European trade

The European countries have developed an increasingly open economy in time.
As it can be observed in Figure A8, Exports and imports accounted for about one quarter of GDP in 1995, and have risen steadily afterwards, to about 40% in 2008.
The economic crisis has hit this process, with countries increasingly, so that openness has decreased in 2009, but it has recovered in 2010.

The trade balance has been fluctuating around 1% of GDP and remained positive throughout the period, with peaks in 1996 and 2002, a through in 1999 and a new peak in 2010, meaning that, maybe, the exit from the crisis passes through increased exports and contained imports (Figure A8).

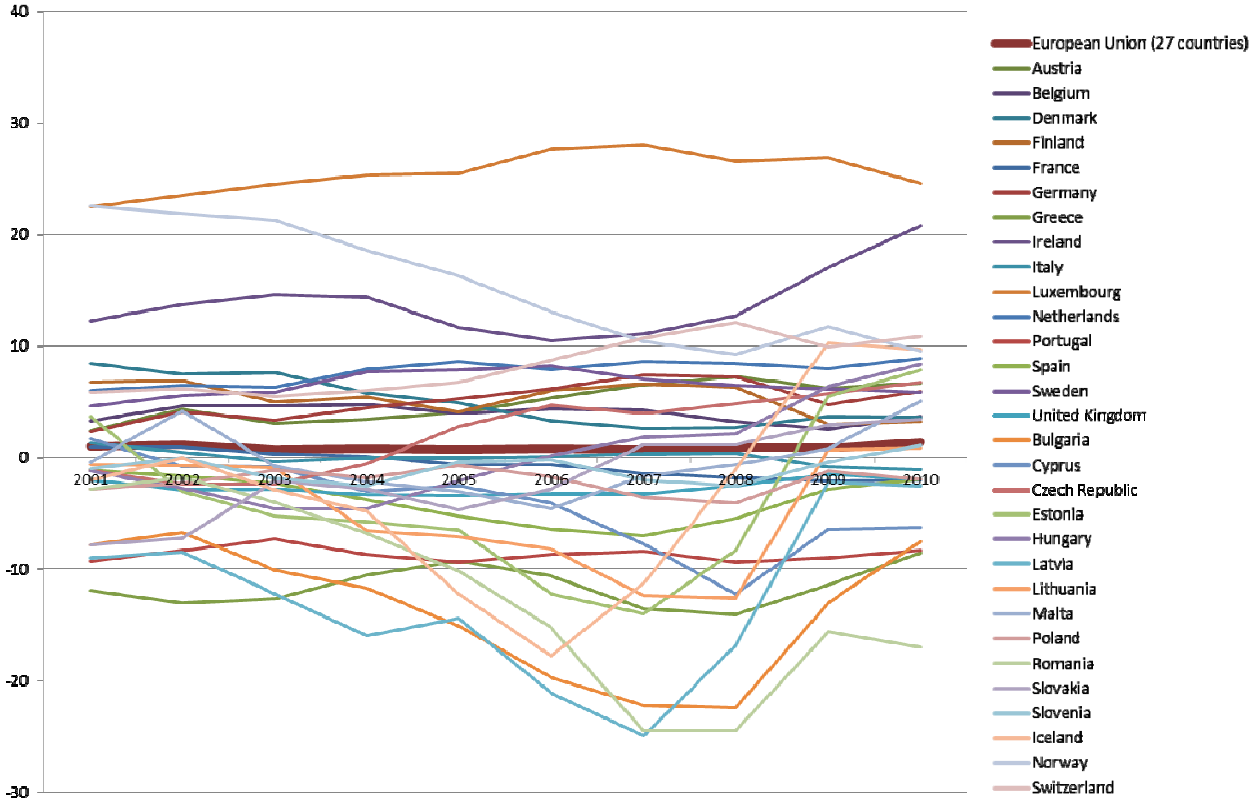
Figure A8. Exports on GDP, Imports of GDP and Trade Balance on GDP of the European Union



Source: Elaborations on Eurostat data

The trade balance is differentiated across countries, and from Figure A9 it can be observed that in general there co-exist in Europe countries with structural trade surpluses, such as Luxembourg, Ireland, Norway, Switzerland, Netherlands, Sweden and Germany, and other countries with structural trade deficit, such as Romania, Bulgaria, Latvia, Greece and Cyprus.
Only a few countries, such as Estonia and Iceland, have been able to convert from trade deficit to trade surplus in the latest years.

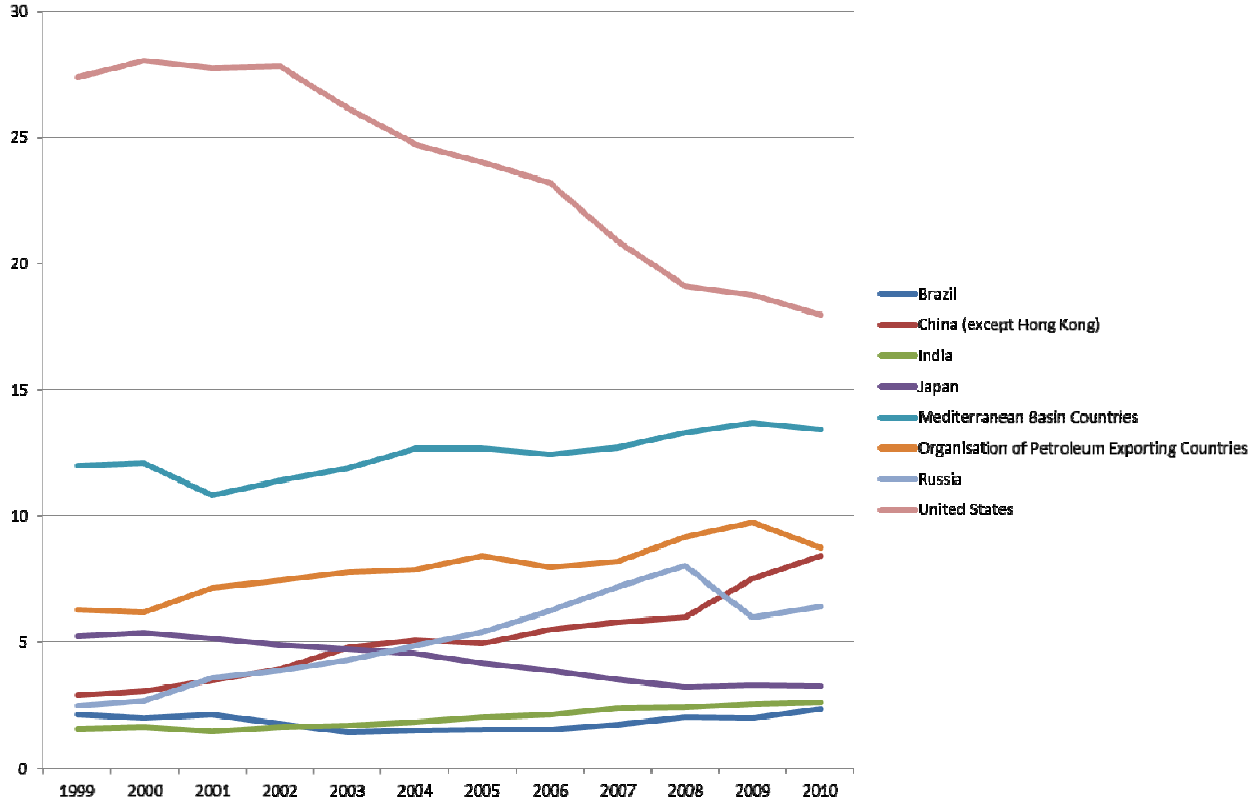
Figure A9. Trade balance on GDP of European Countries



Source: Elaborations on Eurostat data

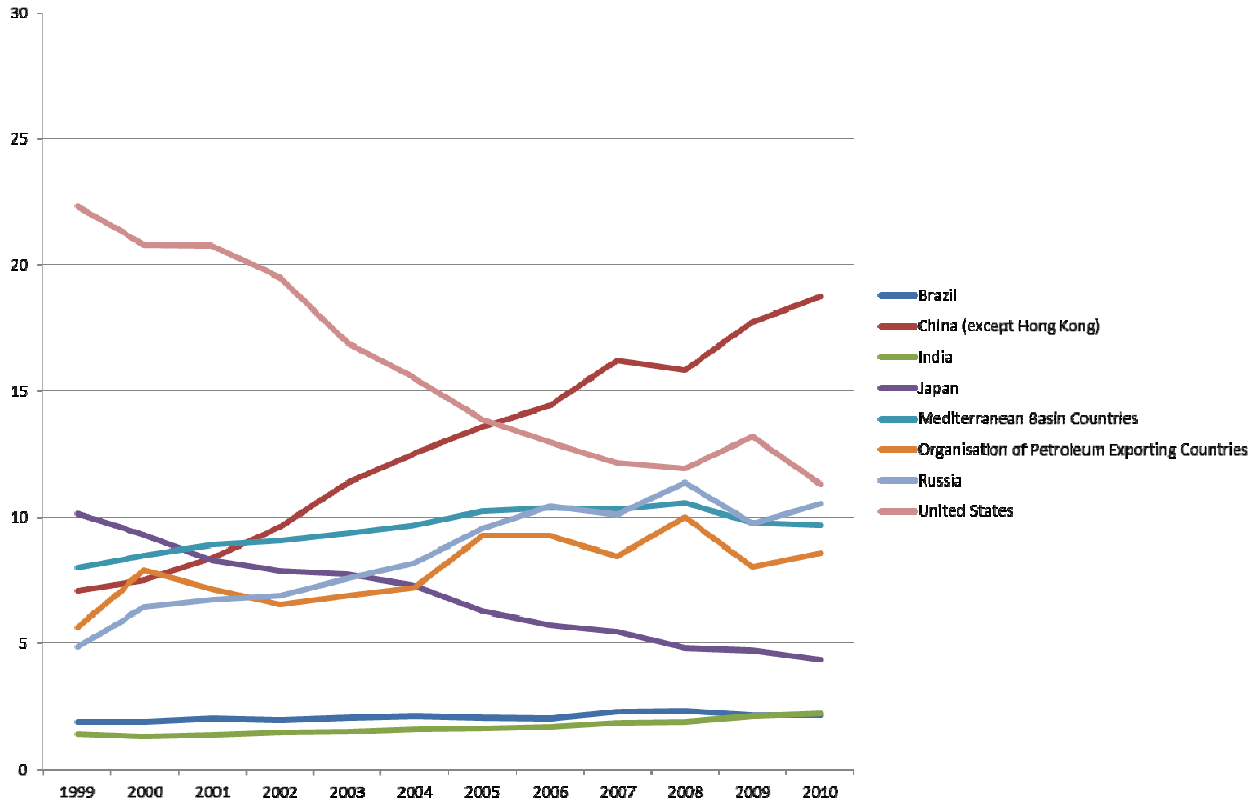
The trade partners of the European Union have been significantly changing in time (Figures A10a & A10b).
Although the United States still represent the largest export markets for the European Union, their weight has decreased from almost 28% to around 18% in just 10 years.
Mediterranean basin countries have increased slightly, as the Organization of Petroleum Exporting countries.
Exports towards Russia and China have also increased, while those towards Brazil and India, the last two BRIC countries have remained substantially stable.

Figure A10a. Trade partners of EU27 (exports)



Source: Elaborations on Eurostat data

Figure A10b. Trade partners of EU27 (imports)



Source: Elaborations on Eurostat data

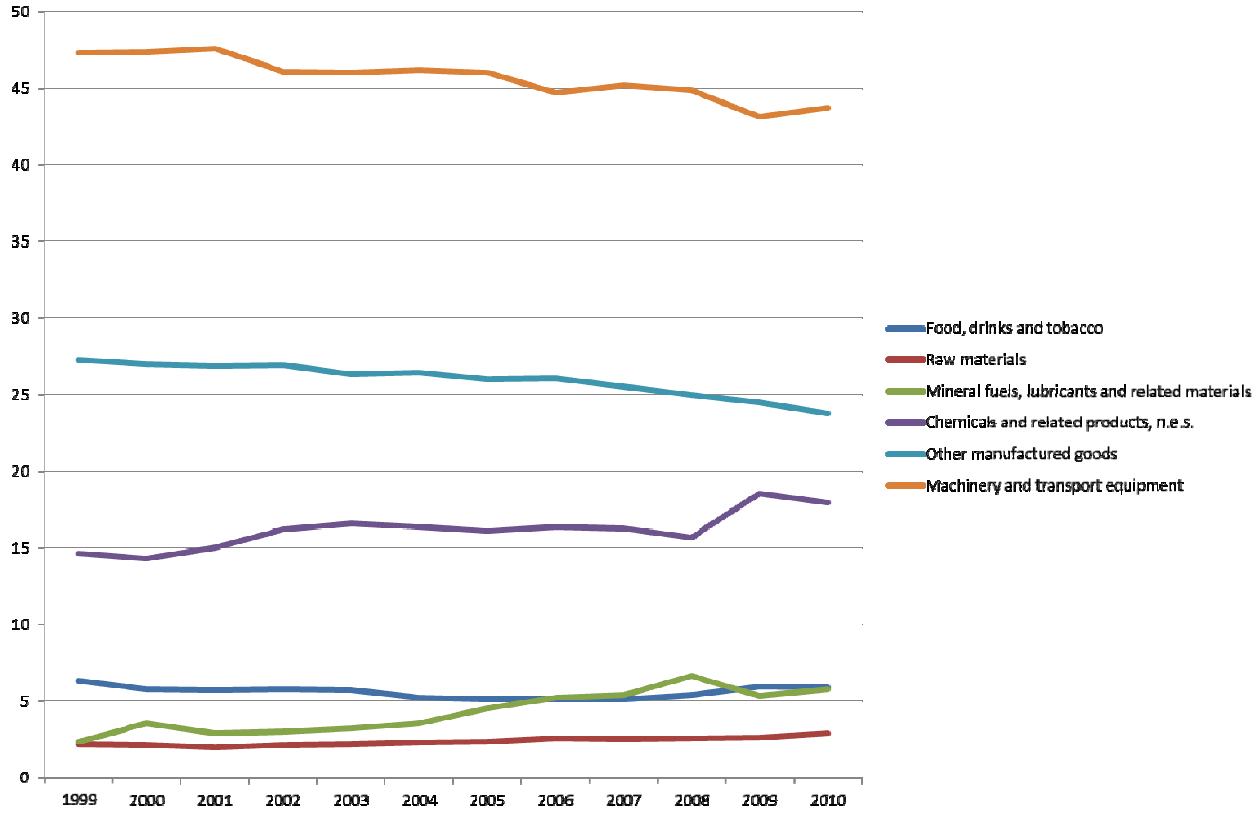
The main trade partners in terms of imports have changed even more markedly with respect to exports (Figure A10b).
Most notably, the share of the United States has declined rapidly from 22% to 11% in 11 years, and its role as the main exporter towards Europe has been taken by China, which in the same period has increased its share from 7% to 19% of the total.
The second country which used to account for much more EU imports than now is Japan, which has decreased from 10% to 4% of the total.
Russia on the other hand has increased its role, from 5% to 11%, while the Mediterranean Basin Countries and the Organisation of Petroleum Exporting Countries have had a more mixed pattern.
Finally, the role of Brazil and India still remains marginal.

The trade specialization of the European Union (largest aggregate for which data are available) in terms of goods can be observed in Figure A11a and A11b.
While the European specialization in terms of exports has remained quite stable, the one of imports has changed more markedly.

As far as exports are concerned, the European Union remains specialized in Machinery and transport equipment, though with a share decreasing from 47% to 44%, followed by Other manufactured goods, this one also with a decreasing share from 27% to 24%.
Chemicals and related products, n.e.s. has risen from about 15% to 18%, and also Mineral fuels, lubricants and related materials has risen from 2.5 to almost 6%
Food, drinks and tobacco has remained stable to about 6% and Raw materials have increased but still represent less than 3% (Figure A11a).

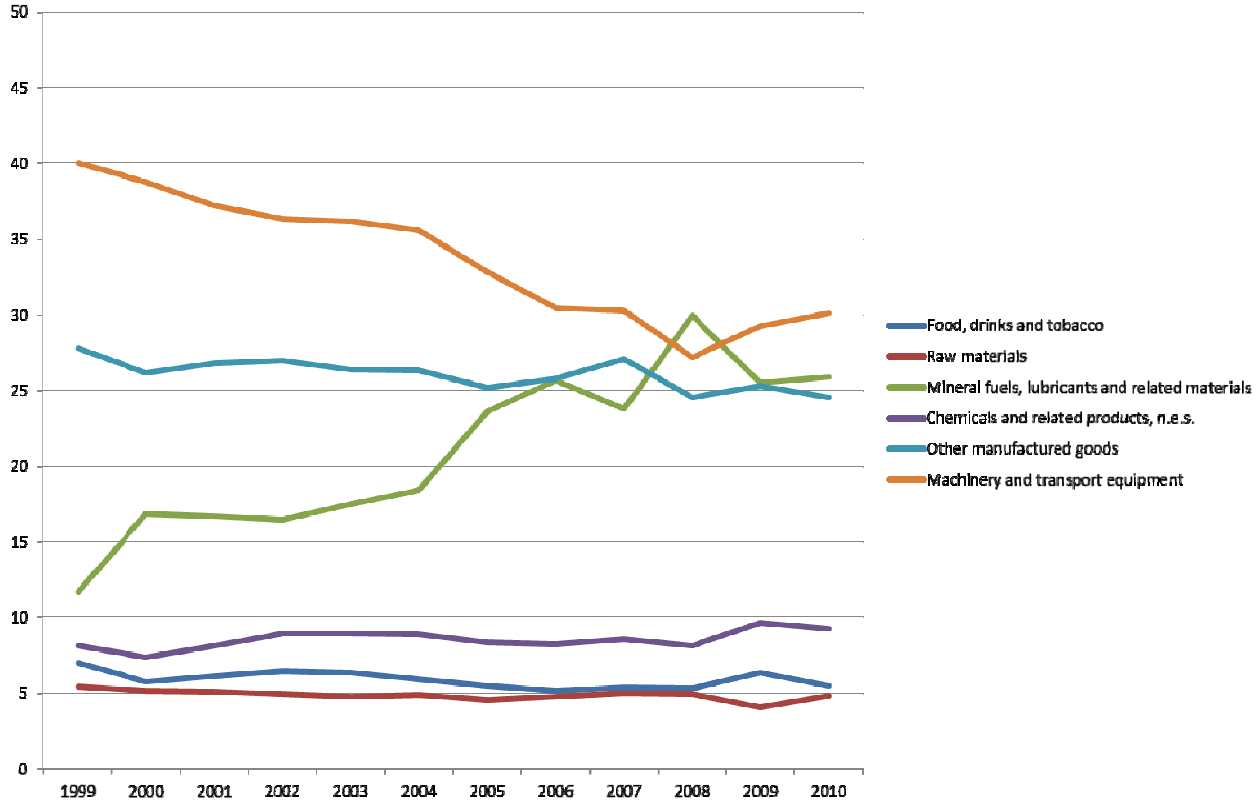
Import specialization has evolved more rapidly. Consistently with an intra-sectoral trade model, the first import item is again Machinery and transport equipment, but this time it has decreased from 40% to 27%, and only with the crisis it has increased again to 30%.
Other manufactured goods has decreased less, from 28% to slightly less than 25%, while Mineral fuels, lubricants and related materials, which represented less than 12% in 1999, now represent almost 26% of the total, with a peak in 2008 at almost 30%.
Chemicals and related products are stable at around 9%, and also Food, drinks and tobacco and Raw materials have remained quite stable at about 5% (Figure A11b).

Figure A11a. The evolution of EU27 Trade specialization (exports)



Source: Elaborations on Eurostat data

Figure A11b. The evolution of EU27 Trade specialization (imports)



Source: Elaborations on Eurostat data

3.3 The patterns of European and World FDI

The ability to attract FDI, or to make good FDI investments abroad is one key competitiveness factor for Europe as for the other countries of the World.
The dynamics of FDI is presented in Table A5, where again the choice has been to start from year 2000 and then present data for 2007 (i.e. at the outset of the crisis) and for 2010, latest available year[1].

First of all, it can be observed that the flows of FDI, both inward and outward, have increased in the early nineties, and reached a peak in 2007, just at the start of the economic crisis. The crisis itself brought a decrease of investment and increased protectionism in many cases, so that FDI have thereafter decreased markedly.

By looking at the shares, the share of inward investments towards developed economies has decreased from more than 80% to less than 50%, even more rapidly with the crisis, which has affected the developed economies more than the rest of the World.
Europe is not an exception to this trend, and probably a forerunner in it, and has decreased its share, larger than 50% in 2000, to 45% before the crisis and to 25% now, while the United states of America, which had lost a lot in relative terms before the crisis, are now recovering.
As expected, the relative growth in inwards FDI is concentrated in Asia, but not only in China.

The share of advanced economies in outward investments has decreased less rapidly with respect to the one of inward investments, but also this drop has accentuated with the crisis.
In particular, it is European outwards FDI which has decreased, while those of developing economies and also those of the United States have increased in relative terms.

By looking at the European countries, the countries which appear to have maintained their attractiveness are Belgium and Ireland, while the United Kingdom is the one which used to be a very large FDI attractor and is now sees it role significantly reduced because of the crisis. It is also interesting to observe that Germany used to attract significantly more FDI in 2000 than in 2007, while its FDI attractiveness has not been affected too much by the crisis.
The shares of FDI attracted by the new 12 member countries of the EU remain significantly lower with respect to the ones of the old 15 member states.

By looking at country outflows, France halved its contribution already before the crisis, while Germany in the same period increased it and the two countries appear to maintain their – similar – levels in the period of crisis.
The United Kingdom, which used to be a very important investor abroad, had decreased its share in the early nineties and has afterwards decreased it even more, to very tiny levels.
Among the largest European economies, it is noticeable the closeness of Italy, which is marginal in both inflows and outflows.
The United states of America and the developing economies, and Asia in particular, are those which are taking the space left empty by retiring European investors.

[1] The total of inflows and outflows are not coinciding because of different countries reporting them.

Table A5. The patterns of European and World FDI (in millions of Dollars)

Region / economy	Inflows 2000	Inflows 2007	Inflows 2010	Share 2000	Share 2007	Share 2010	Outflows 2000	Outflows 2007	Outflows 2010	Share 2000	Share 2007	Share 2010
World	1 402 680	1 970 940	1 243 671	100.00	100.00	100.00	1 232 117	2 174 803	1 323 337	100.00	100.00	100.00
Developed economies	1 138 040	1 306 818	601 906	81.13	66.30	48.40	1 094 728	1 829 044	935 190	88.85	84.10	70.67
Europe	724 932	895 753	313 100	51.68	45.45	25.18	867 687	1 274 118	475 763	70.42	58.59	35.95
European Union	698 278	850 528	304 689	49.78	43.15	24.50	813 119	1 199 325	407 251	65.99	55.15	30.77
Austria	8 840	31 154	6 613	0.63	1.58	0.53	5 740	39 025	10 854	0.47	1.79	0.82
Belgium	-	93 429	61 714	-	4.74	4.96	-	80 127	37 735	-	3.68	2.85
Belgium and Luxembourg	88 739	-	-	6.33	-	-	86 362	-	-	7.01	-	-
Denmark	33 823	11 812	- 1 814	2.41	0.60	-0.15	26 549	20 574	3 183	2.15	0.95	0.24
Finland	8 834	12 451	4 314	0.63	0.63	0.35	24 030	7 203	8 385	1.95	0.33	0.63
France	43 250	96 221	33 905	3.08	4.88	2.73	177 449	164 310	84 112	14.40	7.56	6.36
Germany	198 277	80 208	46 134	14.14	4.07	3.71	56 557	170 617	104 857	4.59	7.85	7.92
Greece	1 108	2 111	2 188	0.08	0.11	0.18	2 137	5 246	1 269	0.17	0.24	0.10
Ireland	25 779	24 707	26 330	1.84	1.25	2.12	4 629	21 146	17 802	0.38	0.97	1.35
Italy	13 375	40 202	9 498	0.95	2.04	0.76	12 316	90 778	21 005	1.00	4.17	1.59
Luxembourg	-	- 28 260	20 350	-	-1.43	1.64	-	73 350	18 293	-	3.37	1.38
Netherlands	63 854	119 383	- 16 141	4.55	6.06	-1.30	75 635	55 608	31 904	6.14	2.56	2.41
Portugal	6 635	3 055	1 452	0.47	0.16	0.12	8 132	5 490	- 8 608	0.66	0.25	-0.65
Spain	39 575	64 264	24 547	2.82	3.26	1.97	58 213	137 052	21 598	4.72	6.30	1.63
Sweden	23 430	27 737	5 328	1.67	1.41	0.43	40 964	38 836	30 399	3.32	1.79	2.30
United Kingdom	118 764	196 390	45 908	8.47	9.96	3.69	233 371	272 384	11 020	18.94	12.52	0.83
Bulgaria	1 016	12 389	2 170	0.07	0.63	0.17	3	282	238	0.00	0.01	0.02
Cyprus	855	2 234	4 860	0.06	0.11	0.39	172	1 245	4 220	0.01	0.06	0.32
Czech Republic	4 985	10 444	6 781	0.36	0.53	0.55	43	1 620	1 702	0.00	0.07	0.13
Estonia	392	2 725	1 539	0.03	0.14	0.12	61	1 746	133	0.00	0.08	0.01
Hungary	2 764	3 951	2 377	0.20	0.20	0.19	620	3 621	1 546	0.05	0.17	0.12
Latvia	413	2 322	349	0.03	0.12	0.03	12	369	16	0.00	0.02	0.00
Lithuania	379	2 015	629	0.03	0.10	0.05	4	597	128	0.00	0.03	0.01
Malta	618	1 006	1 041	0.04	0.05	0.08	21	14	87	0.00	0.00	0.01

Poland	9 445	23 561	9 681	0.67	1.20	0.78	17	5 405	4 701	0.00	0.25	0.36
Romania	1 057	9 921	3 573	0.08	0.50	0.29	- 13	279	193	-0.00	0.01	0.01
Slovakia	1 932	3 581	526	0.14	0.18	0.04	29	600	328	0.00	0.03	0.02
Slovenia	137	1 514	834	0.01	0.08	0.07	66	1 802	151	0.01	0.08	0.01
Other developed Europe	26 655	45 225	8 411	1.90	2.29	0.68	54 568	74 793	68 512	4.43	3.44	5.18
Iceland	171	6 824	2 950	0.01	0.35	0.24	390	10 186	- 1 935	0.03	0.47	-0.15
Norway	7 090	5 800	11 857	0.51	0.29	0.95	9 505	13 588	12 195	0.77	0.62	0.92
Switzerland	19 255	32 435	- 6 561	1.37	1.65	-0.53	44 673	51 020	58 253	3.63	2.35	4.40
North America	380 802	330 604	251 662	27.15	16.77	20.24	187 304	451 244	367 490	15.20	20.75	27.77
United States	314 007	215 952	228 249	22.39	10.96	18.35	142 626	393 518	328 905	11.58	18.09	24.85
Other developed countries	32 306	80 460	37 144	2.30	4.08	2.99	39 737	103 682	91 937	3.23	4.77	6.95
Japan	8 323	22 550	- 1 251	0.59	1.14	-0.10	31 557	73 548	56 263	2.56	3.38	4.25
Developing economies	257 617	573 032	573 568	18.37	29.07	46.12	134 194	294 177	327 564	10.89	13.53	24.75
Africa	10 967	63 132	55 040	0.78	3.20	4.43	1 495	10 719	6 636	0.12	0.49	0.50
North Africa	3 250	24 775	16 926	0.23	1.26	1.36	223	5 545	3 384	0.02	0.25	0.26
Algeria	280	1 662	2 291	0.02	0.08	0.18	14	295	226	0.00	0.01	0.02
Egypt	1 235	11 578	6 386	0.09	0.59	0.51	51	665	1 176	0.00	0.03	0.09
Libyan Arab Jamahiriya	141	4 689	3 833	0.01	0.24	0.31	98	3 933	1 282	0.01	0.18	0.10
Morocco	422	2 805	1 304	0.03	0.14	0.10	59	622	576	0.00	0.03	0.04
Sudan	392	2 426	1 600	0.03	0.12	0.13	-	11	51	-	0.00	0.00
Tunisia	779	1 616	1 513	0.06	0.08	0.12	2	20	74	0.00	0.00	0.01
Other Africa	7 717	38 357	38 114	0.55	1.95	3.06	1 272	5 173	3 252	0.10	0.24	0.25
Latin America and the Caribbean	97 680	169 514	159 171	6.96	8.60	12.80	49 723	61 731	76 273	4.04	2.84	5.76
Asia	148 747	339 252	357 846	10.60	17.21	28.77	82 964	221 688	244 585	6.73	10.19	18.48
China	40 715	83 521	105 735	2.90	4.24	8.50	916	22 469	68 000	0.07	1.03	5.14
Hong Kong, China	61 938	54 341	68 904	4.42	2.76	5.54	59 374	61 081	76 077	4.82	2.81	5.75
India	3 588	25 350	24 640	0.26	1.29	1.98	514	17 234	14 626	0.04	0.79	1.11
Oceania	223	1 134	1 511	0.02	0.06	0.12	12	39	71	0.00	0.00	0.01
South-East Europe and CIS	7 023	91 090	68 197	0.50	4.62	5.48	3 195	51 581	60 584	0.26	2.37	4.58
South-East Europe	1 608	12 837	4 125	0.11	0.65	0.33	6	1 448	52	0.00	0.07	0.00

Albania	144	656	1 097	0.01	0.03	0.09	-	28	- 12	-	0.00	-0.00
Bosnia and Herzegovina	146	2 080	63	0.01	0.11	0.01	-	28	47	-	0.00	0.00
Croatia	1 051	5 035	583	0.07	0.26	0.05	5	289	- 203	0.00	0.01	-0.02
Montenegro	-	934	760	-	0.05	0.06	-	157	29	-	0.01	0.00
Serbia	52	3 439	1 329	0.00	0.17	0.11	2	947	189	0.00	0.04	0.01
The FYR of Macedonia	215	693	293	0.02	0.04	0.02	- 1	- 1	2	-0.00	-0.00	0.00
CIS	5 415	78 252	64 072	0.39	3.97	5.15	3 189	50 134	60 532	0.26	2.31	4.57
Armenia	104	699	577	0.01	0.04	0.05	- 1	- 2	8	-0.00	-0.00	0.00
Azerbaijan	130	- 4 749	563	0.01	-0.24	0.05	1	286	232	0.00	0.01	0.02
Belarus	104	1 805	1 350	0.01	0.09	0.11	0	15	43	0.00	0.00	0.00
Georgia	131	1 750	549	0.01	0.09	0.04	3	76	6	0.00	0.00	0.00
Kazakhstan	1 283	11 119	9 961	0.09	0.56	0.80	4	3 153	7 806	0.00	0.14	0.59
Kyrgyzstan	- 2	209	234	-0.00	0.01	0.02	5	- 0	0	0.00	-0.00	0.00
Moldova, Republic of	128	534	199	0.01	0.03	0.02	0	17	4	0.00	0.00	0.00
Russian Federation	2 714	55 073	41 194	0.19	2.79	3.31	3 177	45 916	51 697	0.26	2.11	3.91
Ukraine	595	9 891	6 495	0.04	0.50	0.52	1	673	736	0.00	0.03	0.06

Source: UNCTAD, FDI/TNC database (www.unctad.org/fdistatistics).

4. Monetary variables and public finance

4.1 Inflation and exchange rates

The first economic indicator which will be descried in this section of the report is inflation, measured by the increase of consumer price index.
In the last 15 years, inflation has not been a problem as it used to be in the 70s, on the contrary it has had a declining pattern to around 2%, and then a small peak at little less than 4% immediately before the crisis.
With the crisis inflation has first decreased and then recovered to values of more than 3% in just two years (Figures A12a & A12b).

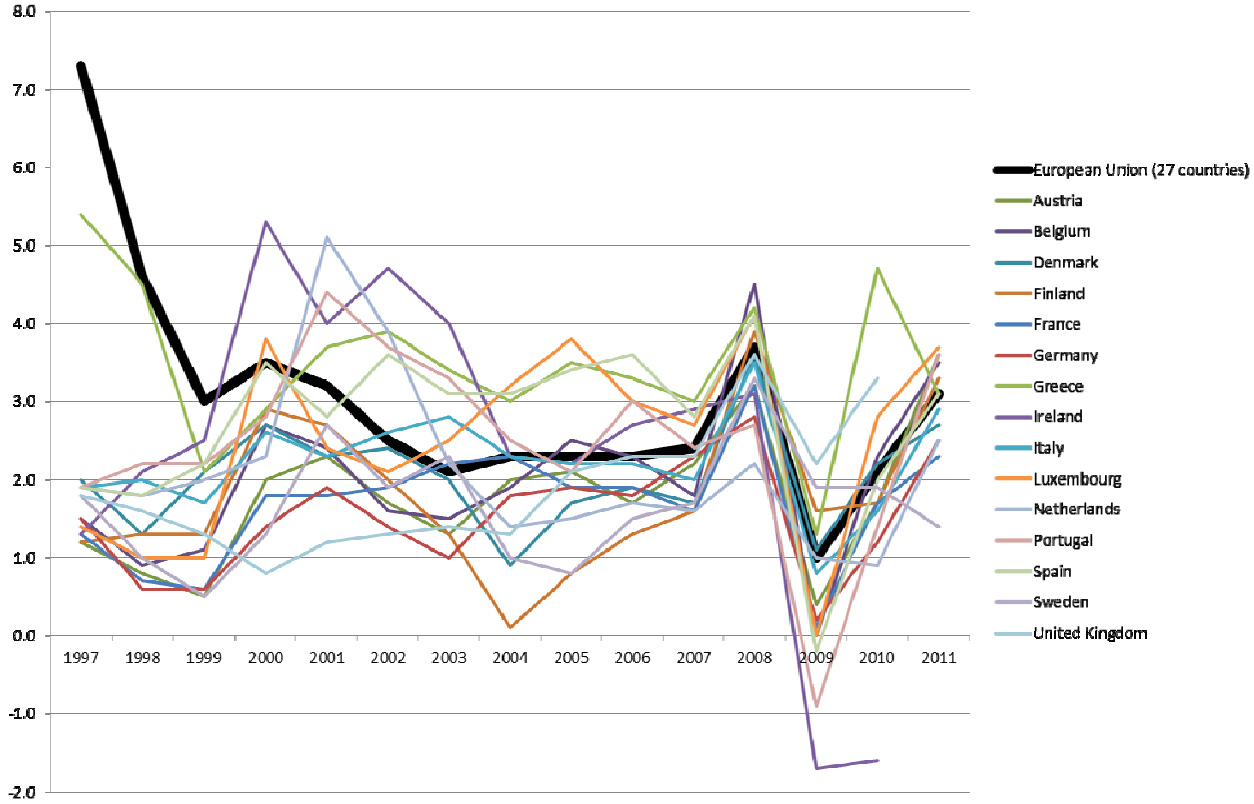
The country patterns are highly differentiated, especially before the crisis, and for this reason Figure A12 has been split into two groups of countries.
Not all western countries follow clearly the pattern of the EU 27 before the crisis, for example Finland had a through in 2004 and the Netherlands a peak in 2001.
The pattern of the old 15 member countries in the years of crisis, on the contrary, are more coherent, with almost all countries experiencing relatively high inflation in 2008, outset of the crisis, and very low inflation in 2009 (Figure A12a).

The patterns of the new 12 member countries are much more differentiated and, often, higher.
Peculiar is the path of inflation in Romania, which has had a gradual normalization after years of hyper-inflation.
Althogh many countries have an inflation peak in 2008, the through of 2009 is much less evident and not present in many countries (Figure A12b).

As far as financial variables are concerned, the exchange rate is an important parameter which measures the capability of countries to buy foreign goods and services.
Many European countries belong to the Euro area and share the same currency, while others have their exchange rate more or less pegged to the Euro.
For this reason, the value of the Euro is an indicator of the economic path of Europe, in particular the one against the US Dollar, which is the main currency used for international transactions and international reserves, above the Euro.

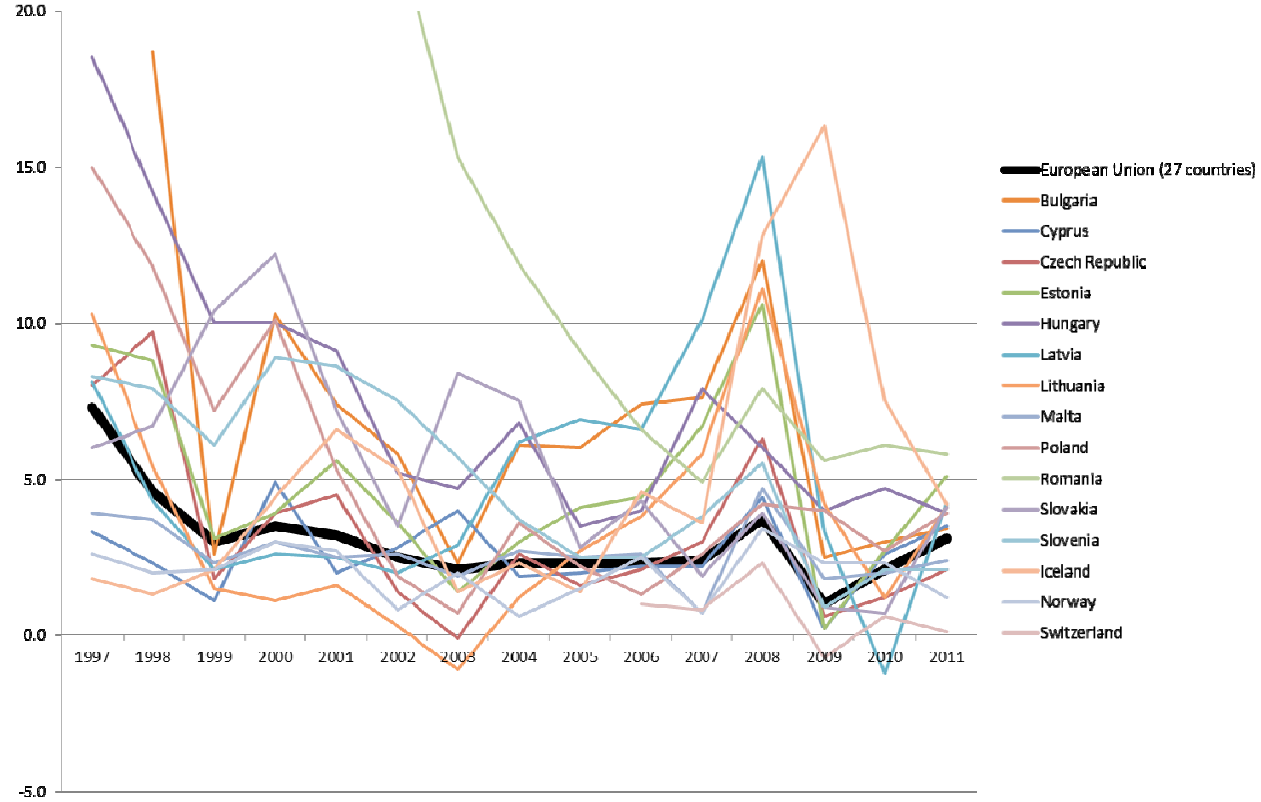
The exchange rate of the Euro against the dollar is traced in Figure A13. It can be seen that, in the first years the Euro depreciated, but then revaluated consistently until reaching the maximum of 1.59 in mid 2008, in the early period of the crisis, which hit the US with some time advance with respect to Europe.
After that peak, the Euro de-valued and fluctuated consistently, and is now around 1.3, i.e. still higher than the starting exchange rate.

Figure A12a. Inflation: change in consumer price index (note: data for 2011 are still provisional)



Source: Elaborations on Eurostat data

Figure A12b. Inflation: change in consumer price index (note: data for 2011 are still provisional)



Source: Elaborations on Eurostat data

Figure A13. Nominal exchange rate between Euro and the Dollar

Source: European Central Bank

The European economy, however, is composed by different countries and even those sharing the same currency have a different real effective exchange rate, which is calculated taking into account the nominal exchange rate and the pattern of nominal prices within the same countries, this against a basket of trading partner countries.

The table with real effective exchange rates for European countries is presented in Table 6, where the index is 100 in 1999.
It is evident that, in the period between 1999 and 2007 (i.e. prior to the crisis) the Euro area has revaluated, and so has the wider European Union, even to a larger extent, in particular the new 12 member countries.
In the same period, Japan, the United States and also China devalued in real terms.

With the crisis, both the Euro area and the wide European Union devalued, especially the latter since the nominal exchange rate of the Euro remained high.
Particularly strong has been the real devaluation of the United Kingdom after 2007, due to the devaluation of the Pound.
Due to the different dynamics of prices, also Germany devaluated in real terms after 2007, to values lower than in 1999, while most countries remained above the values of 1999, especially the new 12 member countries of the EU, whose real effective exchange rates are generally well above those of 2004, which makes them enjoying a lower price competitiveness advantage with respect to the EU enlargement.
Among the non-EU Espon countries, both Norway and Switzerland revaluated in real terms with the crisis, while among the largest trading partners of European countries, there has been a revaluation of Japan, Brazil, China and Russia, and again a devaluation of the United States. (Table 6)

Table A6. Real Effective Exchange Rate (deflator: consumer price indices - 36 trading partners) Index, 1999=100

Country	1999	2004	2007	2010	2011
Euro area (17 countries)	100	107.70	109.90	106.61	:
European Union (27 countries)	100	109.85	117.22	103.43	:
Austria	100	100.24	99.92	98.60	99.45
Belgium	100	102.78	104.28	105.63	106.71
Denmark	100	103.82	103.98	104.96	104.60
Finland	100	102.82	101.34	101.61	102.26
France	100	102.62	102.78	101.33	101.10
Germany	100	99.71	100.32	97.36	97.28
Greece	100	103.16	105.10	109.25	110.17
Ireland	100	117.17	121.95	115.82	114.69
Italy	100	105.59	106.37	105.32	105.88
Luxembourg	100	105.21	108.64	110.71	111.91
Netherlands	100	107.61	106.58	105.53	105.47
Portugal	100	108.20	109.87	107.20	108.27
Spain	100	108.18	112.74	113.37	114.03
Sweden	100	99.56	97.07	94.62	98.95
United Kingdom	100	96.57	97.99	78.66	79.59
Bulgaria	100	123.57	138.49	152.93	155.42
Cyprus	100	107.11	107.38	108.28	109.11
Czech Republic	100	118.24	134.75	151.84	155.05
Estonia	100	109.04	119.40	126.48	128.92
Hungary	100	129.33	139.74	139.08	138.36
Latvia	100	100.96	112.10	121.67	123.87
Lithuania	100	116.83	122.05	133.14	135.31
Malta	100	107.63	111.01	110.37	110.35
Poland	100	104.44	124.18	123.58	120.94
Romania	100	113.56	156.30	140.10	144.18
Slovakia	100	143.34	171.33	192.02	194.75
Slovenia	100	102.90	103.92	106.28	105.54
Norway	100	101.62	105.44	112.01	113.35
Switzerland	100	102.25	95.05	107.35	117.67
Japan	100	84.10	67.25	86.21	88.56
United States	100	93.85	89.60	87.66	83.68
Brazil	100	78.88	121.92	148.10	:
China (except Hong Kong)	100	90.88	98.12	109.79	:
Russia	100	142.83	184.50	202.03	:

Source: Elaborations on Eurostat data

4.3 Public finance in Europe

Public finances are an important issue in Europe as well as elsewhere in the World, especially with the economic crisis which has increased the need for support policies while at the same time decreasing the tax base for government tax imposition.

Table A7 presents four main indicators of the wealth of public finances over three time periods, i.e. 2000, as a starting point, 2007, i.e. just before the crisis, and 2010, the last year with complete data.
The three indicators, all expressed in terms of percentage of GDP, are the Government consolidated gross debt, the primary balance, i.e. excluding the expenditure for interest rate payment, interest rates payments and, finally, the balance, which is a net lending if positive or a net borrowing if negative.

Government gross debt of European countries, which slightly decreased between 2000 and 2007 and went below 60% of GDP, has afterwards increased to more than 80% in 2010.
This increase concerns almost all countries, including those considered more virtuous as the Germany.
The highest gross debt is the one of Greece, followed by Italy, Belgium and Portugal. The new 12 member countries are generally less indebted, even if in many of them the debt is increasing fast.

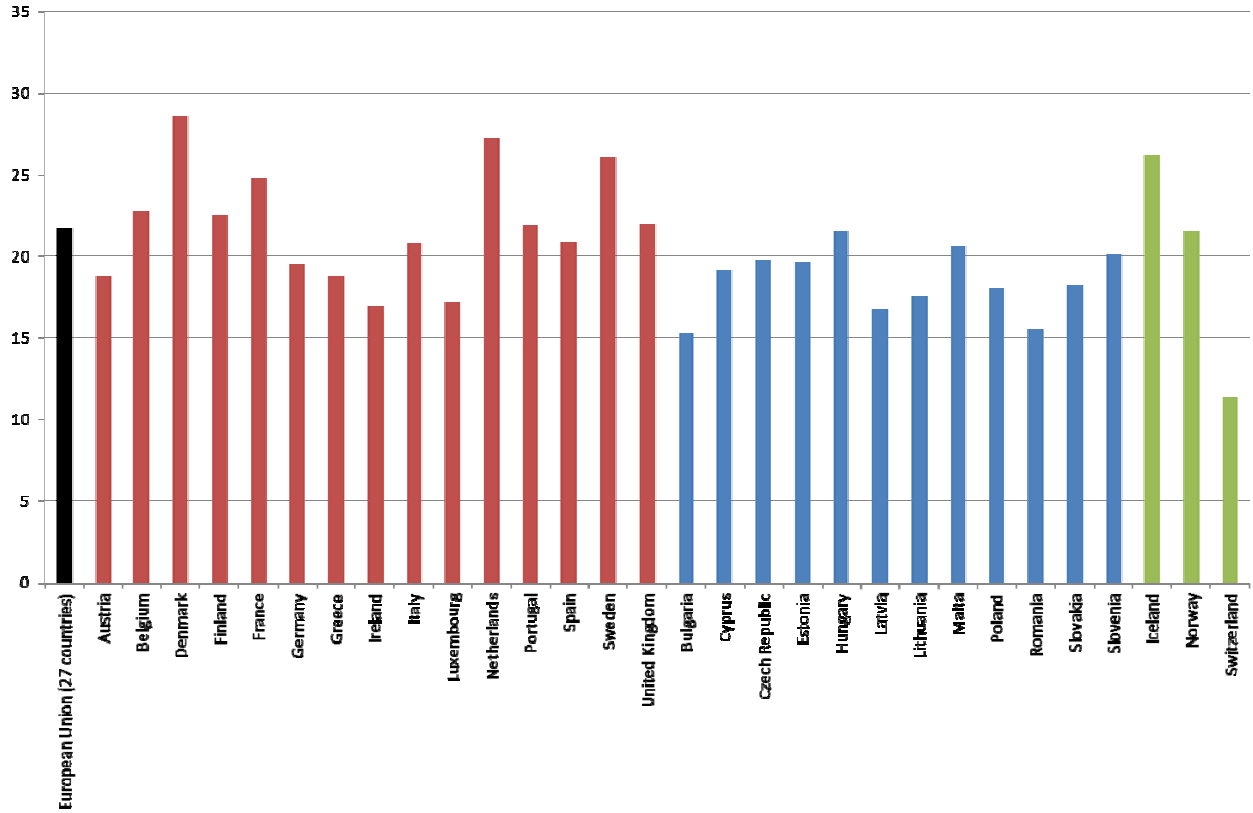
The government expenditure represents on average slightly less than 22% of GDP in Europe (Figure 14).
In some countries, where traditionally the tax rates and the welfare system are higher, this ratio is significantly higher, for instance in the Nordic countries of Denmark, Sweden, Iceland and the Netherlands it is well above 25%. Switzerland is by far the Espon country with lower government expenditure, at 11%, while Romania and Bulgaria are the European Union's countries with the lowest ratio at about 15%. Among Western countries, Ireland and Italy are those with lower values.

Table A7. Synthesis of main government finance indicators

Country	Government consolidated gross debt			Primary balance			Interest			Net lending (+)/Net borrowing (-)		
	2000	2007	2010	2000	2007	2010	2000	2007	2010	2000	2007	2010
European Union (27 countries)	61.9	59.0	80.1	4.2	1.8	-3.9	3.6	2.7	2.7	0.6	-0.9	-6.6
Austria	66.2	60.2	71.8	1.8	1.9	-1.7	3.6	2.9	2.6	-1.7	-0.9	-4.4
Belgium	107.8	84.1	96.2	6.5	3.5	-0.7	6.6	3.9	3.5	0.0	-0.3	-4.1
Denmark	52.4	27.5	43.7	5.9	6.4	-0.9	3.7	1.6	1.9	2.3	4.8	-2.6
Finland	43.8	35.2	48.3	9.7	6.8	-1.5	2.8	1.5	1.4	6.9	5.3	-2.5
France	57.3	64.2	82.3	1.4	0.0	-4.6	2.9	2.7	2.4	-1.5	-2.7	-7.1
Germany	60.2	65.2	83.2	4.3	3.0	-1.8	3.2	2.8	2.5	1.1	0.2	-4.3
Greece	103.4	107.4	144.9	3.6	-2.0	-5.0	7.4	4.8	5.8	-3.7	-6.5	-10.6
Ireland	37.5	24.8	92.5	6.7	1.1	-28.2	2.0	1.0	3.1	4.7	0.1	-31.3
Italy	108.5	103.1	118.4	5.4	3.4	-0.1	6.3	4.9	4.4	-0.8	-1.6	-4.6
Luxembourg	6.2	6.7	19.1	6.3	3.9	-0.7	0.3	0.2	0.4	6.0	3.7	-1.1
Netherlands	53.8	45.3	62.9	5.6	2.4	-3.1	3.7	2.2	1.9	2.0	0.2	-5.1
Portugal	48.5	68.3	93.3	0.0	-0.2	-6.8	2.9	3.0	3.0	-2.9	-3.1	-9.8
Spain	59.4	36.2	61.0	2.3	3.5	-7.4	3.2	1.6	1.9	-0.9	1.9	-9.3
Sweden	53.9	40.2	39.7	7.1	5.3	1.0	3.5	1.8	1.0	3.6	3.6	0.2
United Kingdom	41.0	44.4	79.9	6.3	-0.5	-7.4	2.7	2.2	2.9	3.6	-2.7	-10.3
Bulgaria	72.5	17.2	16.3	3.6	2.3	-2.5	4.2	1.2	0.6	-0.5	1.2	-3.1
Cyprus	59.6	58.8	61.5	1.1	6.5	-3.1	3.4	3.0	2.3	-2.3	3.5	-5.3
Czech Republic	17.8	27.9	37.6	-2.8	0.4	-3.4	0.8	1.1	1.4	-3.6	-0.7	-4.8
Estonia	5.1	3.7	6.7	0.0	2.6	0.4	0.2	0.2	0.1	-0.2	2.4	0.2
Hungary	56.1	67.0	81.3	2.3	-0.9	-0.1	5.4	4.1	4.2	-3.0	-5.1	-4.2
Latvia	12.4	9.0	44.7	-1.8	0.0	-6.8	1.0	0.3	1.4	-2.8	-0.4	-8.3
Lithuania	23.6	16.8	38.0	-1.5	-0.3	-5.3	1.7	0.7	1.8	-3.2	-1.0	-7.0
Malta	54.9	62.1	69.0	-2.0	1.0	-0.6	3.8	3.3	3.0	-5.8	-2.4	-3.6
Poland	36.8	45.0	54.9	0.0	0.4	-5.2	3.0	2.3	2.7	-3.0	-1.9	-7.8
Romania	22.5	12.8	31.0	-0.7	-2.2	-5.4	3.9	0.7	1.6	-4.7	-2.9	-6.9
Slovakia	50.3	29.6	41.0	-8.2	-0.4	-6.3	4.1	1.4	1.3	-12.3	-1.8	-7.7
Slovenia	26.3	23.1	38.8	-1.3	1.2	-4.2	2.4	1.3	1.6	-3.7	0.0	-5.8
Iceland	:	28.5	92.9	:	8.0	-4.5	:	2.6	5.5	:	5.4	-10.1
Norway	:	51.5	44.0	:	18.8	11.9	:	1.3	:	:	17.5	10.6

Source: Elaborations on Eurostat data

Figure A14. Government Expenditure on GDP in 2010.



Source: Elaborations on Eurostat data

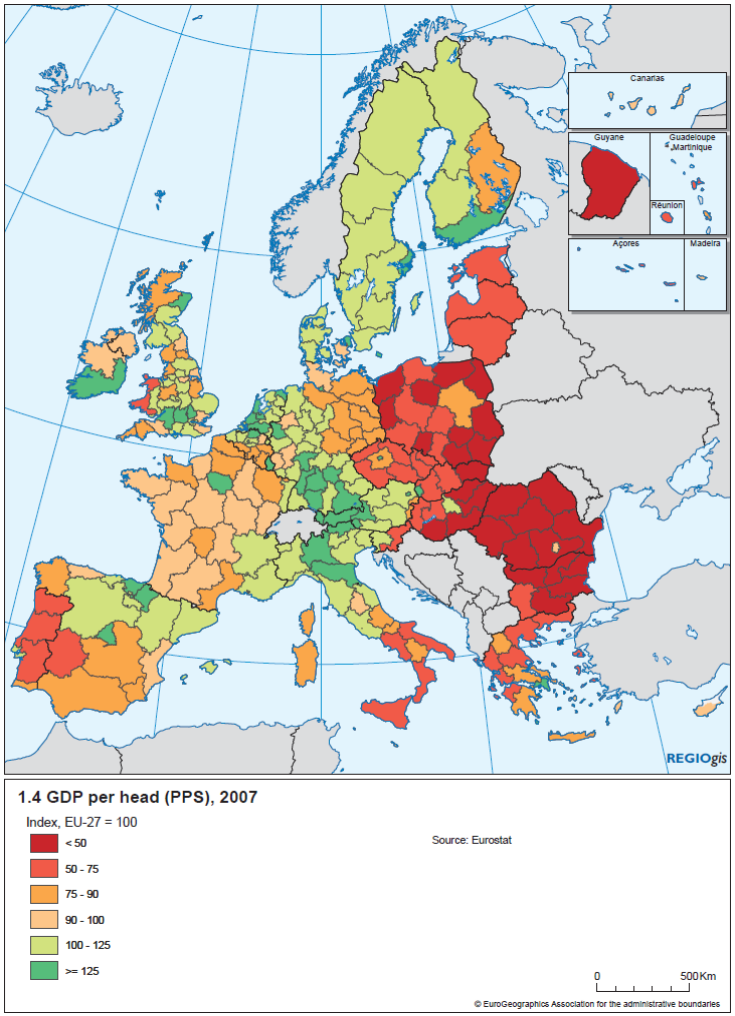
5. Regional disparities, growth and competitiveness

The European economy is not only composed by countries with different features and levels, but also at regional level there are wide differences.
For instance, if we show in Map 1a the GDP per head in PPS as a percentage of the EU27 mean (it is the same value which is represented in Figure A1, but for an earlier year due to the delay of regional statistics) we see that disparities within countries are highly relevant.
For instance, in almost all countries, being then old or new members of the EU, the regions with the capital normally have a level of GDP per person higher than the rest of the country.
Also the non-capital metropolitan areas have GDP per capita higher than the country average, including Munich, Frankfurt, Milan and Rotterdam.

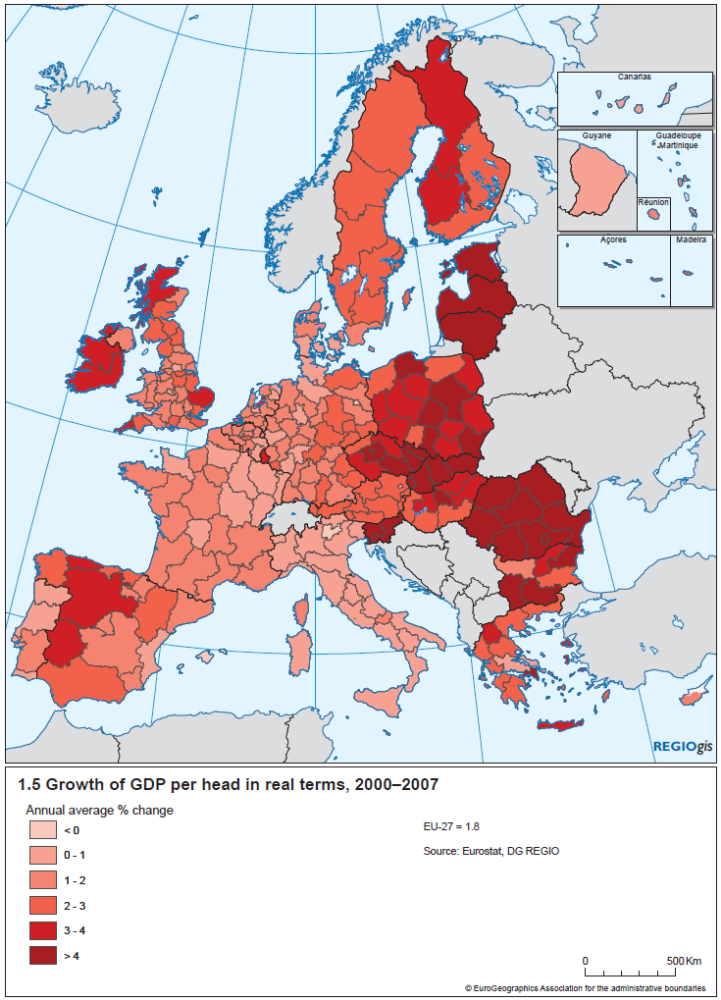
Many countries exhibit a marked dualism, for example in Germany between the former DDR and the western landers, in France between Paris and the rest of the country, in Italy between the North and the South.
Most Eastern countries now have capital regions above or around the EU average, while the rest of these countries are well below the European levels.

The differences between regions are evident also in terms of growth rates, as shown in Map 1b.
In particular, the new 12 member countries hold many high growing regions, but their growth rates have been differentiated and central and capital regions have normally outperformed the rest of their countries.
As a result, this process has brought at European level divergence within countries despite convergence between countries, with a decrease in total disparities due to the fact that the poorer new member states of the EU have significantly out-performed the others.

Map A1a . GDP per head in PPS of European regions in 2007 (source of map: 5th Cohesion report, 2010)



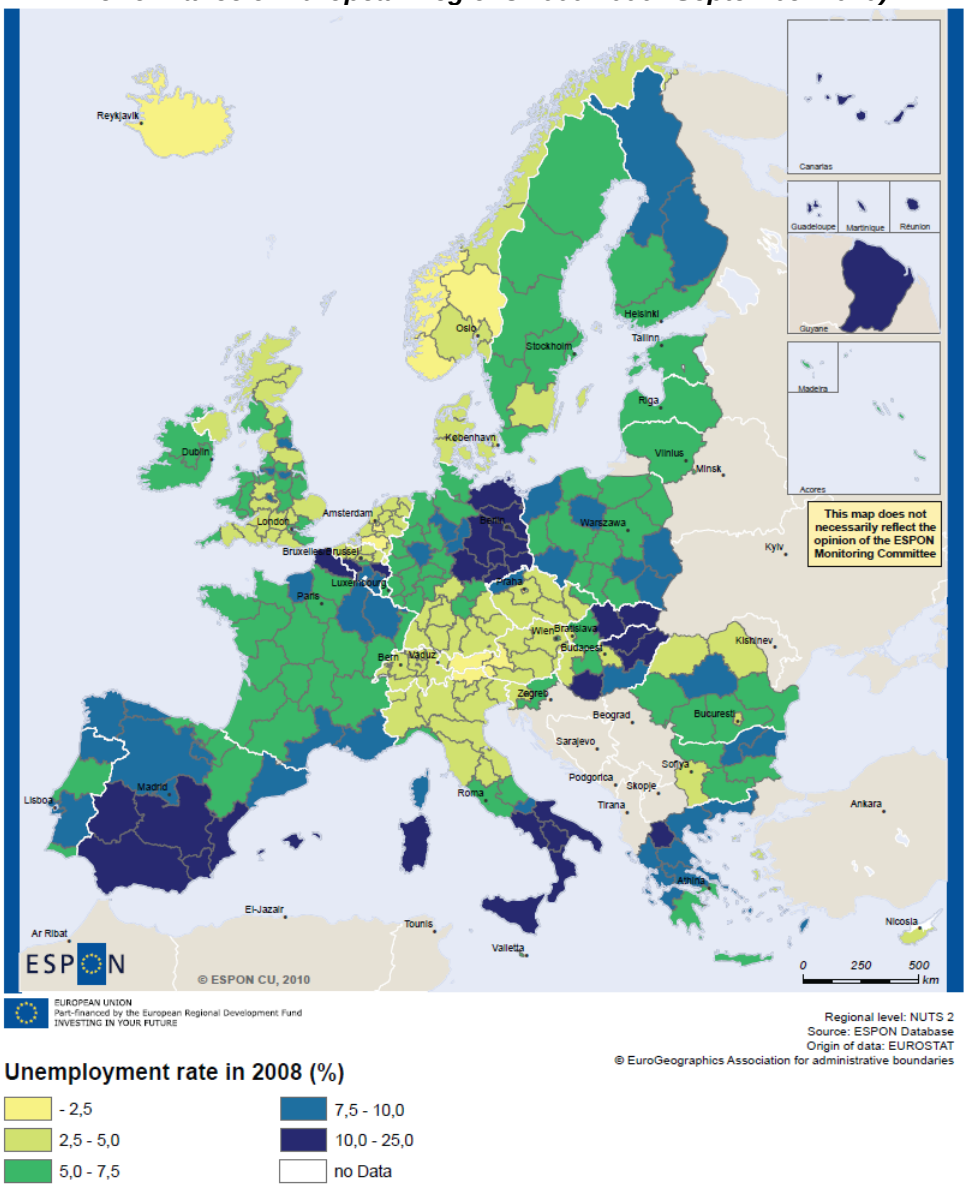
Map A1b. growth of real GDP per head of European regions between 2000 and 2007 (source of map: 5th Cohesion report, 2010)



The differences between European regions are also very marked in terms of unemployment rates, which are shown in map 2.
It is evident that the more peripheral regions are also generally characterized by higher unemployment rates, and this trend is valid within countries (see the cases of Germany, Hungary and the Slovak Republic) but also at European level, as evident by the case of the Southern Mediterranean regions.

The country patterns, which were evidenced in Figure 4, are still evident, for instance the high values of Spain and the low values of Austria and Norway.
As for GDP per person, also in the case of unemployment rates Germany and Italy are the most dual countries, with very low levels in Southern Germany and Northern Italy and very high levels in Eastern Germany and Southern Italy.

Map A2. Regional Unemployment rate in 2008 (source of data: ESPON TO "Trends in Economic Performance of European Regions 2000-2006" September 2010)



The differences in income per capita and in unemployment are mainly due to the economic specificities of European regions, which were synthesized in Map A3, coming from Espon Project 3.4.2 "Economy".
It is evident that the financial and business services are concentrated in core regions, most of them located within the so called 'Pentagon', and in the main metropolitan areas in particular.

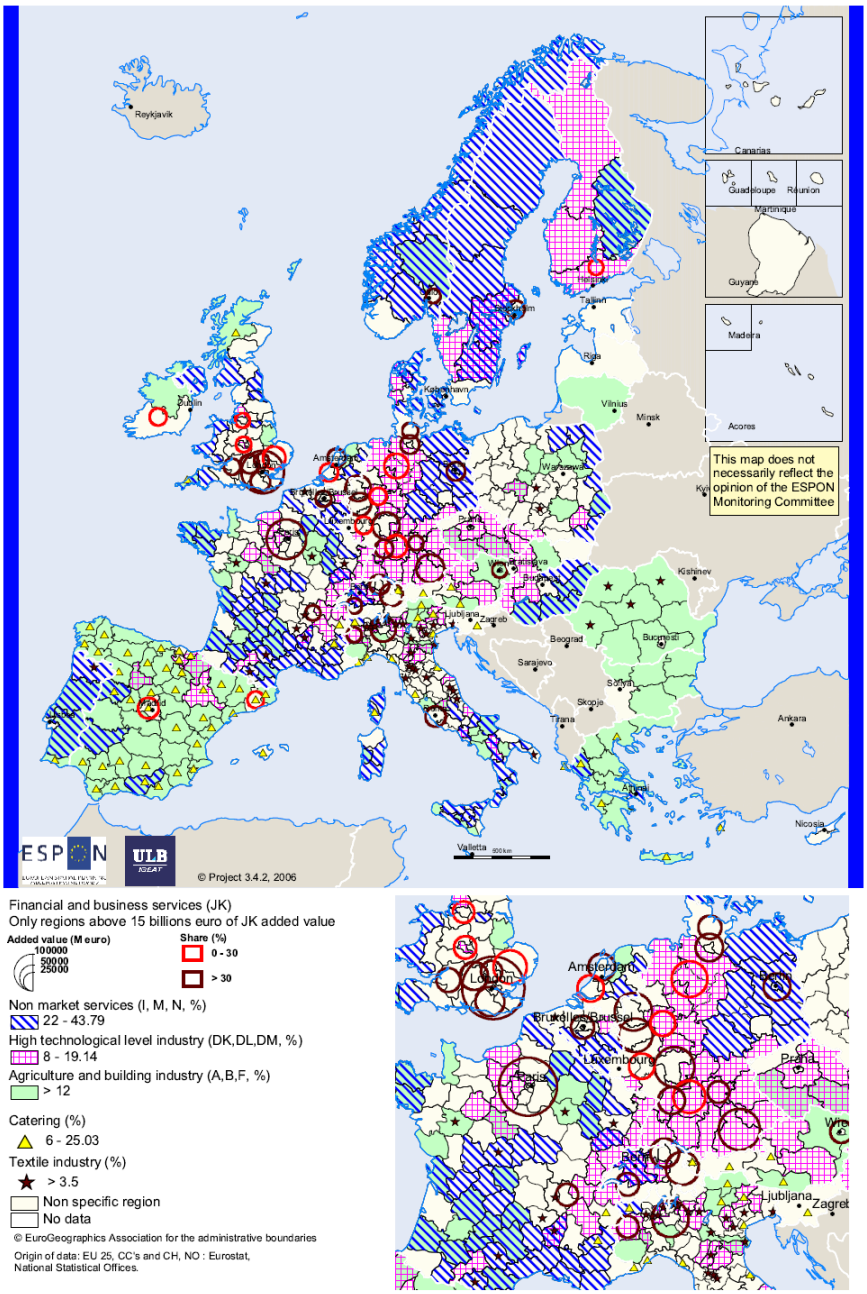
Other regions are mainly specialized in non-market services, and are hence more relying on the public sector in order to produce gross value added. These regions are generally peripheral with respect to their own countries and also with respect to the EU.
Finally, other regions are specialized in agriculture and building industry, and are located in eastern Europe and in other peripheries of Western countries, and especially in Bulgaria, Romania, Spain and Greece.

The economic core of Europe, however, is represented by regions specialized in high-tech industry, and these regions tend to locate in and around the regions specialized in financial services, so that they are also predominantly present in the Pentagon plus Finland and the Czech Republic (Map A3).

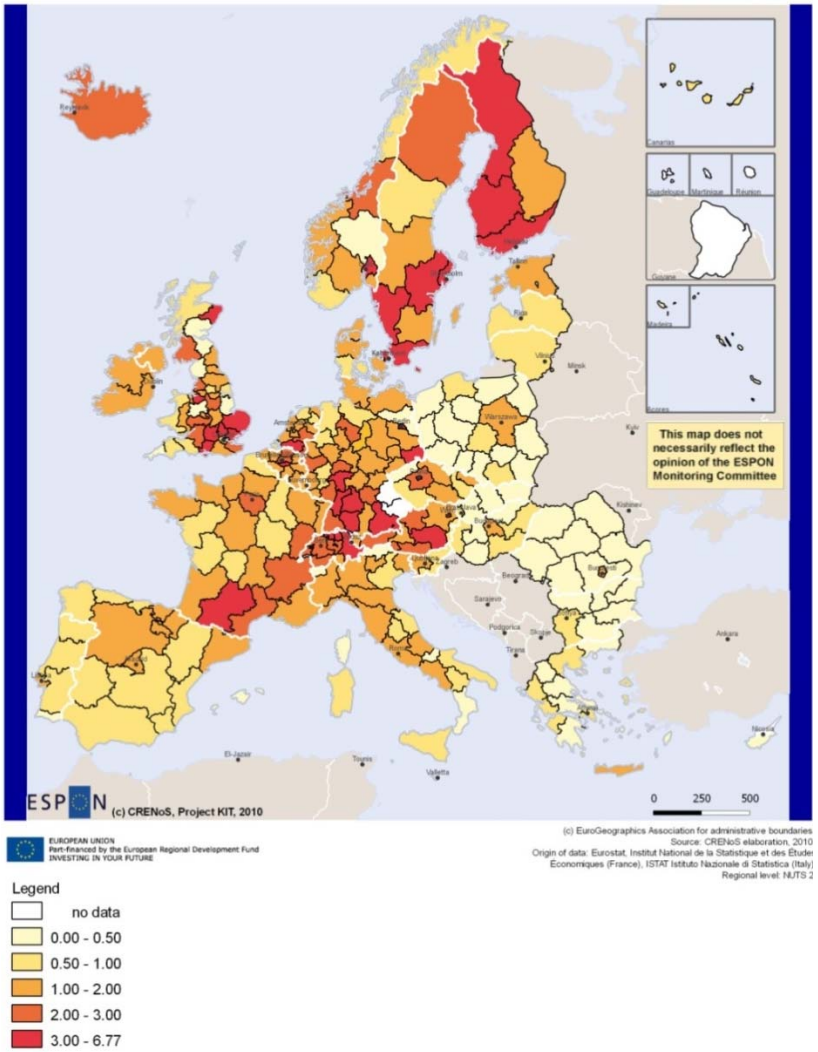
The possibility to have high tech industries, and also in general the possibility to innovate and be competitive in a knowledge economy, heavily depends on the capability of regions to invest in R&D and produce innovations with it.
Maps A4a and A4b, coming from the Espon project KIT (Knowledge, Innovation and Territory) show that R&D is highly concentrated in Europe and only very few regions are above the 3% threshold in terms of the ration between R&D expenditure and GDP.
In particular, R&D concentrates in Southern Germany, Southern Britain, Austria, Switzerland, Scandinavia and Southern France (Toulouse) (Map A4a).

The patterns of patenting are clearly related but concentrated in wider areas, and also appear to follow very evident country specificities (Map A4b).
In particular, patenting appear so be a diffused habit in Germany, Switzerland and the Nordic countries, and also in France and Britain.
Eastern countries, as well as Mediterranean ones, appear to be much less keen on patenting, as shown by the very low levels of Greece, Spain and Portugal. Italy, again, has a very dual pattern, with patenting concentrated in the North, while for most new 12 member countries patenting is still not customary, and also those regions with high R&D expenditure on GDP do not patent as much.

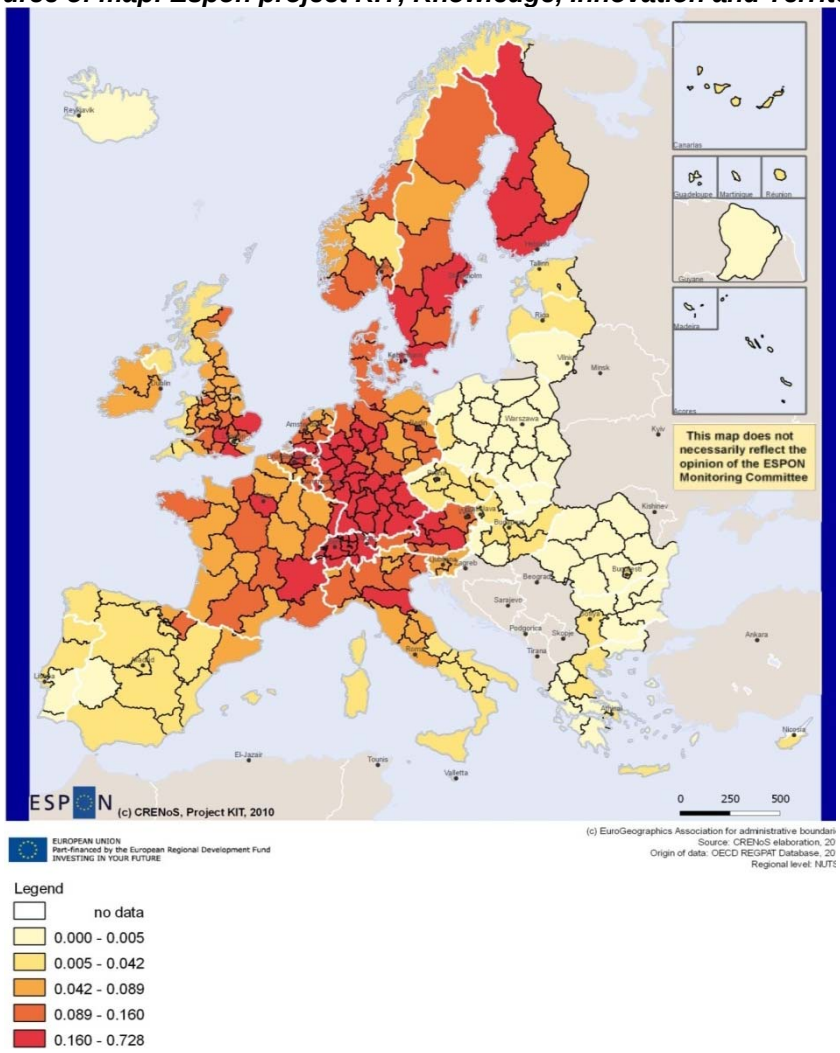
Map A3. Economic specificities of European regions in 2002 (source of Data: Espon Project 3.4.2)



Map A4a. R&D Expenditures on GDP, average 2006-2007 (source of map: Espon project KIT, Knowledge, Innovation and Territory)

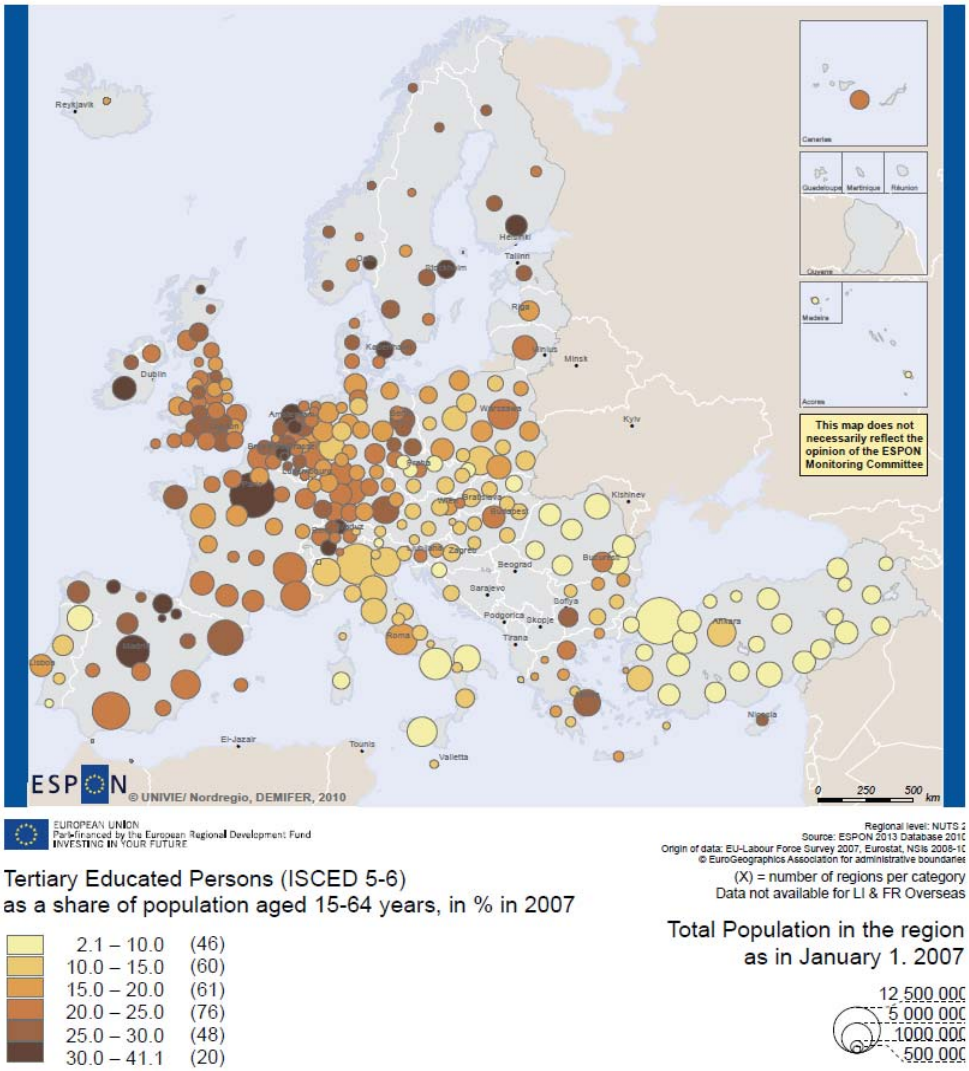


Map A4b. Number of patents per 1000 inhabitants, average 2005-2006 (source of map: Espon project KIT, Knowledge, Innovation and Territory)



The patterns of innovation and of high-tech sectors heavily depend on the availability of skilled and educated workforce.
As evident from Map A5, coming from Espon project Demifer, North-Central Europe concentrates most of population but also people with higher educational attainments.
Educated workforce is particularly numerous and dense in the metropolitan areas of Paris, Madrid and in the Netherlands, Switzerland and Southern Britain.
In general, all capital regions have a higher share of tertiary educated people with respect to their respective countries, and in general regions belonging the old 15 member countries of the European Union have more educated people with respect to regions in the new 12 member countries, with the notable exceptions of Southern Italy and Northern and Southern Portugal.

Map A5. Tertiary Educated People in Labour Force, 2007 (source of data: ESPON TO "Trends in Economic Performance of European Regions 2000-2006" September 2010)



6. Building Blocks for the Baseline scenario

1. **European growth**. The European Union has been growing around 2.5% a year before the crisis, less than the 3.17% of the US but more than the 1.17% of Japan. Within Europe, the new 12 member countries have significantly outperformed the old 15 members, by almost 2 percentage points, a very significant difference but still insufficient to fill the gap between the two groups in terms of income per capita. The economic crisis has hit Europe even more than the United States, and has also hit all countries of Europe but in very differentiated ways. The old 15 member countries of the EU have been hit significantly more than the new 12 member countries and one year before.
2. **Regional disparities**. wide differences still exist among European countries in purchasing power parity, with the highest level in the Luxembourg at more than 270% and the lowest level in Bulgaria at less than 50%. There is still a dualism between the old 15 member states of the European Union and the New 12 member countries which have joined the EU in 2004 or 2007. None of the New 12 countries reaches the EU average.
3. **Employment rates**. They are around 65% of the relevant population on average in the European Union, a level very similar to the one of the United States. Differences between countries, however, are significant. Female employment rates are lower in Europe, about 5% less than the male counterpart, with a difference more marked than in the United States. The long term pattern of employment rates was stably increasing until the start of the economic crisis while with the economic crisis it bounced back. The employment rate of females is still 6% lower than the total one but there has been partial convergence.
4. **Unemployment.** The problem of unemployment has been made much more important by the economic crisis but the different European countries have labour markets differently able to produce jobs. At the EU 27 level the unemployment rate is now close to 10%, significantly higher with respect to a structural/frictional level. The total unemployment rate had been declining in the late nineties, then increasing slightly in the early 2000s and then significantly declining to about to around 7%, before growing steeply with the current economic crisis to values close to 10%. The economic crisis has hence been able to cancel the progresses of the previous 15 years. Female unemployment has slowly converged to the one of males while the economic crisis affected young people significantly more than the others, so that the difference with respect to the total rate is now the largest recorded in the time series.
5. **Productivity**. In average, between 1998 and 2011 productivity per capita grew 0.5% in the euro zone, against 2.5% in USA and 3.0% in Sweden. The average working time in Europe is not significantly smaller than in USA or Japan (despite the fact that the number of hours worked per week has dropped some 15% since 1980, the total labour input has remained stable), but the level of investment on research and development, the training and professional qualification of the population or the economic structure of many European countries with sectors providing low productivity, such as construction, distribution or tourism. In countries, like Spain, large part of the GDP growth was mostly due to the increase on the number of workers, mostly emigrants, working on sectors with low productivity.
6. **Research and Development**. Expenses on Research and Development are about 1.9% in the euro zone, against 2.6% in USA and 3.7% in Sweden. The relevance of sectors related new technologies is smaller in Europe than in USA (7% of GDP against 10%). The fragmented investments in Defense and Military-related fields by European countries, compared to the Chinese and USA integrated military programs, explain to a large extend the difference in publically financed research.
7. **North-South Structural Disequilibrium**. Still the Northern and Southern European regions have large differences on terms of their economic structures. After decades of transfers from northern to southern countries linked to Structural and Cohesion Funds, the North remains industrialised and technologically-oriented, while the South is even in

a faster process of deindustrialisation. Employment in the industrial sector in Germany was reduced 10% in the latest ten years (mostly transferred to industrial-related business activities) while it was reduced by 25% in Spain (mostly due to the industrial delocalisation process; industries coming in the late eighties and nineties leaving to Eastern European countries such as Poland and Hungary, or to China, and to a some extend also to Morocco). Salaries in the industry use to be higher than in the low service sectors (e.g. tourism) and therefore also the consumption level in Southern countries tends to be reduced, or compensated by a higher level of private debt that recently achieved unsustainable levels. Economic gaps among more developed and less developed regions may remain, because of the likely reduction of financial transfers and solidarity between regions and countries at EU level, as well as Cohesion Policies, due to the financial shortage of National administrations.

8. **Public Debt.** The level of public debts in European economies has rapidly grown after the 2008 crisis, largely due to the need to guarantee the stability of the financial systems and cover unemployment expenses. Optimising the size of Public Administrations and improving their efficiency delivering added-value services remains as a key challenge for many countries.

9. **Private Debt.** Because salaries loose purchase power, consumption tend to be reduced for the majority of the population, except for the highest income group. The private debt accumulated during the latest years will tend to be reduced slowly. After the introduction of the euro, private debt grew from 120% of GDP to 225% in Spain, from 170% to 250% in Portugal, from 150% to 330% in Ireland, from 55% to 120% in Greece.

10. **Real Estate speculative bubble** have increased private debt two/three times faster that GDP. The ratio of loans that fail increased by 12 in Ireland from 2007 to 2010, creating an in-depth crisis in the financial system. The number of Real Estate properties in the hands of banks have increased exponentially in the previous three years, and in many cases still their market values have not been reduced according to the crisis. The speculative Real Estate Bubble (e.g. Japan in 1993, USA and Europe in 2008) result from periods of fast growth, and very low interest rates, in contexts with relaxed land regulations. In Spain, 2012, there are approximately 1.300.000 new houses and apartments, many in the hands of banks, along the coast, to be sold.

11. **Stable inflation.** In the last decade, inflation has not been a problem for the European Economy, after the creation of the euro and the Central Bank. In the near future a small inflation may be even beneficial to finance debts and stimulate exports sensitive to the rate change. A strong value for the euro together with austerity measures reinforces the recession.

12. **Trade**. Global trade has increased by 2.000% since 1950. EU trade in 2010 is six times greater than in 1980. EU trade in 1980 was already six times greater than in 1970. Exports and imports account for around 40% of EU GDP in average. Most important trade partners are USA (18% of exports), China (8.4%) and Switzerland (7.8%). There has been a replacement of the USA with China as the main exporter towards Europe, while European exports are still mainly towards the USA and The comparison of Chinese figures against USA and, specially, Switzerland, clearly indicates the growth potential for trade growth.

13. **Trade by sector.** With the increasing demand from emerging economies, the demand and price of raw materials and fuels have been high and growing. Because raw materials and mineral fuels have considerably increased their share on European imports and represent 5% of GDP approximately, if the pattern of increasing prices continues, thismay result in a lost of growth in EU GDP. On the other hand, energy efficiency could limit the impact of these increases.

14. **Global Finances**. Global finances have grown much faster than trade, in an unregulated process, often creating unstable dynamics (e.g. crisis in Asia in early nineties, crisis related to subprime in 2008). Paradoxically, developing countries such

as China, that have strict regulations for the use of international private funds to finance their growth, used to transfer public savings to finance Western public debts; at the same time, private savings and private direct investments in Western countries have been increasingly transferred to developing countries were more business opportunities exist in the coming years.

15. **Reindustrialisation**. Reindustrialisation will mostly be limited to traditionally industrial zones, but EU27 industry will be indispensable to generate economic growth, and will largely contribute to employment creation through generation of increased demand for business related services, transport industry, food processing and design niches remain competitive, but in other strategic sectors European industries may not be global leaders (microelectronics and computers, software, genetics, nanotechnology…). In 2010, the weight of industry in the European economy is of 18.8%, while in 2000 it was of 22.4%.

16. **Knowledge-based activities**. There are more than 250 million daily Internet users in Europe and virtually all Europeans own mobile phones has changed lifestyle. It will be challenging for business and other organizations to find new ways of work-life integration. The increasingly free production and access to information content will challenge the traditional business model in many sectors, particularly in the creation of added value.

17. **Education**. The education system remains to be adapted in many European countries to the requirements of the emerging economy, favouring more pro-active and collaborative, creative and entrepreneurial competences in students.

18. **Service-oriented jobs**. European countries' economy is more and more dependent on services and advanced tourism. Advanced personal services in health and education represent an increasingly important economic activity. In 2010, the weight of services in the European economy is 79.5%, while in 2000 it was of 75.3%. The weight of services may still increase in the future.

19. **Intelligent and regional agriculture**. Within the food sector, the most influential trend is that the global food prices are growing in real terms, , as a result of growing world population, rising affluence, and the shift to Western dietary preference. This can place more pressure on water for agriculture The strongest effect of high food prices is that the poorest countries will not be able to afford decent food or the minimum to maintain its basic needs for survival. New technologies applied to agriculture will allow from precision robot tractors to vertical farming inside urban areas, closely monitoring weather evolution.
    One important trend is the increase of local markets for agricultural products sensitive to ecological higher quality. This brings higher level of self-sufficiency at local and regional level.

7. Considerations regarding alternative future scenarios for the economy

In order to build coherent scenarios, we have to keep separate the exogenous (cause) and the endogenous (effects) elements (variables).

In the economy part the endogenous variables are:
- European GDP growth;
- Territorial effects of the assumptions on the worldwide economy.

In the economy part the exogenous variables are:
- World GDP growth, and GDP growth of blocks of countries;
- Energy;
- Transport;
- Technology;
- Demography;
- Land use regulation;
- Economic governance and institutions;
- Other public policies.

According to the authors of this report future economic scenarios have to be built by making assumptions on the following challenges:

Dealing with the economic crisis and raising the growth rate.
The economic crisis has significantly decreased the income of most European countries and increased unemployment. To recover, it will be necessary at least some years of sustained growth, which will require structural transformations.
Whether or not national economies will be able to adjust to these structural transformations represents a possible bifurcation.

Dealing with World-wide competition without abjuring the European labour market model and welfare state
The European society is characterized by higher levels of public welfare with respect to almost all the rest of the world, which means higher services but also higher expenditure for health care and pensions.
These costs translate into higher taxes on labour and capital.
At the same time, the European labour market model is in many cases little flexible, with workers which either do the same job until the retirement age or fall into unemployment. Young people, in particular, find it difficult to find a regular job to enter this protected labour market.
In order to be able to sustain its welfare system and labour protection, Europe will need to foster labour productivity, otherwise production and services will be off-shored.
Whether or not Europe will be able to sustain their welfare represents a possible bifurcation.

Building a more innovative economy
The only way to foster productivity for advanced economies passes through innovation, but despite the efforts by the individual countries and the EU, innovation is still not high enough. Moreover, the competition for the most qualified human capital has become global too, which makes it important for Europe to be able to retain and attract the highest skilled workers and researchers, by offering them not only good quality of life but also job satisfaction opportunities.
Whether or not Europe will be able to put in place a "smart growth" as suggested by the Agenda 2020 represents a possible bifurcation.

Dealing with an aging population and workforce
The European population is aging very fast, second only to Japan.
This implies that the workforce is increasingly old, and that workers in their 50s or even 60s will need to be re-trained and qualified for new economic tasks.
Moreover, due to the demographic structure, the dependency ratio will worsen, so that it will become important to maintain workers into the labour market until older ages.
Whether or not Europe will be able to re-qualify its aging labour force represents a possible bifurcation.

Dealing with stretched public finances
The expensive welfare state already made Europe a relatively indebted continent, but this situation has worsened with the economic crisis, so that now almost all countries have a significantly larger burden of public debt on GDP.
Some countries are already experiencing difficulties in re-financing maturing debt.
For this reason tight public finances, increased growth and coordination between countries will be needed in order to maintain the debt sustainable.
Whether or not Europe (and its single countries) will be able to find ways to finance its public debt represents a possible bifurcation.

Dealing with lower demand
The US, which is still the largest buyer of European goods and services, will probably remain in a situation of weak demand for the years to come, so that the European economy, which cannot rely on the public sector to create demand, will need to find other demand sources. This should be found in the same emerging economies which have increased their exports towards Europe in the last two decades. These emerging economies, in fact, have already started increasing the disposable income of their citizens, and European firms have to try and find a way into these rapidly expanding markets.
Whether or not Europe will be able to create and take advantage of a demand from emerging countries represents a possible bifurcation.

Dealing with a different competition from rising powers
The European economy used to compete with their products against the firms of other OECD countries such as the US or Japan. The earlier competition from China and the Asian tigers but also from Brazil and India, was on the contrary based on cost competitiveness on lower value added products.
This pattern has already changed. Emerging economies are increasingly active in high-tech sectors and products, and this will increase in the future so that European economies will need to compete against younger countries also in these sectors, by trying to maintain and renew the technological advantage they still have.
Whether or not Europe will be able to compete with emerging countries also in high-value sectors represents a possible bifurcation.

Establishing an energy efficient economy
The price of energy will not decrease due to the rising of other, emerging, economies which will compete for the same resources and commodities, hence energy efficiency will be needed also for pure economic reasons.
Whether or not Europe will be able to put in place and take advantage of renewable resources and energy efficiency represents a possible bifurcation.

Dealing with the challenges of global warming
Reducing emissions will probably entail higher costs for European firms, which will make them less competitive, ceteris paribus, with respect to countries where regulations are less ecologic.
At the same time, this challenge could bring opportunities if Europe could establish itself as a forerunner in green technology.
Whether or not Europe will be able to take the lead in the green economy sector represents a possible bifurcation.

Dealing with internal income disparities
Income disparities between countries and even more between regions are still an issue in Europe. The resources devoted to the compensation of these differentials will be scarce in the foreseeable future, and will also need to achieve a competitiveness objective at the same time.
For this reason Europe will need to find a way to enhance the endogenous potential of its regions if it has to achieve overall growth.
Whether or not Europe will be able to tap the untapped potential of its regional diversity richness represents a possible bifurcation.

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Part B
The structure of the MASST3 model

1. Introduction to the MASST model

The MASST model was developed in a number of past projects, and was updated and upgraded for this project to its third generation.

Academic publications with the previous versions of the MASST model include:

- Capello R (2007) A forecasting territorial model of regional growth: the MASST model. Ann Reg Sci 41(4):753–787.

- Capello, R., Camagni, R., Chizzolini, B. and Fratesi, U. (2008) *Modelling Regional Scenarios for the Enlarged Europe: European Competitiveness and Global Strategies*, Springer-Verlag, Berlin, ISBN 978-3-540-74736-9.

- Capello R., Fratesi U. and Resmini L. (2011), *Globalisation and Regional Growth in Europe: Past Trends and Scenario*s, Springer Verlag, Berlin, ISBN: 978-3-642-19250-0.

- Capello R. and Fratesi U. (2012), "Modelling Regional Growth: an Advanced MASST Model", *Spatial Economic Analysis*, vol. 7, n. 3, pp. 293-318

2. Methodological characteristics of the MASST Model

The decision to build a new version of the MASST model and the choice of the methodological characteristics to be used in it stem from the purposes which the model is intended to fulfil.

Regarding the MASST model, its purpose is to produce *conditional scenarios for all European regions in the medium-long run*, in order to use these scenarios as tools with which to study the impact of the possible forthcoming major bifurcations in European regional economies. With this purpose, it is clear that the MASST model is not expected to produce a forecast, but to produce a number of different scenario simulations, each depending on the actual fulfilment of some external and internal conditions. The model, therefore, is in this case not a tool which shows what the world will look like, but a tool which makes it possible to tell with scientific coherence what the world will look like *if* some conditions come about.

The fact that the MASST model must be run for all European NUTS2 regions imposes some significant limitations, due to data availability and comparability, on the variables which can be used. On the other hand, the fact that the model has to produce conditional scenarios in the medium-long run is what determines the decision to make it a partial equilibrium one. The characteristics of the long run make it impossible to handle with the normal short-run instruments. First of all because, in the long run, no variable and factor endowment, nor technology can be assumed to be fixed. Moreover, because forecasts are for a greater number of years, uncertainty tends to grow as noise and errors add to those of the previous periods. Even more importantly, in the long run there is a greater likelihood of radical, catastrophic, changes or events. For instance, when we began to produce the new version of the MASST model, nobody and no model was able to predict the present global economic crisis, and all forecasts produced by prediction models at that time thereafter proved wrong. Since so many things may happen in the long run, therefore, it is better to consider any effect as a conditional effect; and it is more sound scientifically to present results in the form of "should these assumptions be borne out, this would be the economic landscape of Europe", rather than producing forecasts.

Rather than using internally produced estimations for all its variables, the MASST model chooses to maintain some important levers exogenous, because forecasts tend to be based on the past, whereas, since almost everything is bound to change in the long run, the conditions in which regional development takes place are unstable and cannot be easily forecasted. The fact is that models normally tend to see the future as some sort of extrapolation from the past, whereas the judgement of experts can enable the conception of alternative and even extreme future patterns, to which the MASST model must provide internal quantitative coherence.

Although a general equilibrium approach has sounder internal coherence, a partial equilibrium approach is better able to leave room for the envisaging of various possible distant futures, whereas when all variables are linked in a general equilibrium model, there is less room for the researcher to model future challenges. For this reason, in the short run, where there is a lesser likelihood of unpredictable patterns, a general equilibrium approach produces more reliable forecasts; for the same reasons, when modelling the longer run, a partial equilibrium is preferable (Fratesi, 2009).

Moreover, inter-regional relationships are more important in the medium-long run than in the short one because there is more time for indirect effects and spillovers to be produced.

The other characteristic of the MASST model, which was an important new advantage in its first version and which has been reinforced in this new one, is that it has been designed to be simultaneously a top-down and a bottom-up model, i.e. a model in which regional growth is at the same time distributive and generative *à la* Richardson (Richardson, 1967). This is coherent with the theories which will be presented in the next section, and it is made possible by the use of a multi-regional and regional-national approach whereby regions compete for slices of national GDP but, at the same time, the competitiveness of regions is at the basis of national growth.

Last, but not least, as a result of the recent economic crisis, the role of macroeconomic elements in forecasting regional growth has come to the fore. In Europe, national economies entered the crisis with different levels of sovereign debt, different public deficits, different taxation levels, different productivity growth trends, and therefore different chances of recovery and growth. Austerity measures “suggested” by the Union to diverging countries set limitations on some national economies, conditioning the way out of the crisis especially in those countries where the stability and growth pact exerts strong pressures on national debts and deficits. Moreover, the impact of the ongoing financial crisis on the service of public debt for the five largest EU economies has been severe. While the positive GDP growth rates registered in the late 1990s and early 2000s allowed a progressive reduction of the outstanding stock of debt ratio, the recent economic downturn has imposed a halt on this process, boosting public deficits and justifying severe cuts to public expenditure and investments. After the decade of financial stability brought about by the inception of the common currency, with all EU countries servicing their debt at very low prices, international markets have recently begun associating a higher probability of default with certain government debts, with a consequent rise in the risk premia requested with respect to riskless bonds, typically German ones.

All these macro conditions exert an influence not only on national growth patterns but also on regional ones, and consequently on the overall European convergence process. In fact, despite the lack of analysis in the literature, macroeconomic trends and policies have differentiated regional impacts, and they therefore exert different pressures on regional growth. The aim of this paper is to explain the importance of macroeconomic trends (and policies) for regional growth. One of the main results of the conceptual reasoning presented in the paper is that it is impossible to deduce conceptually which territory is more resilient to the macroeconomic trends that accompany a period of economic downturn. For this reason the importance of building forecasting regional growth models for understanding the spatially differentiated effects of the crisis increases.

Macroeconomic constraints on deficits and debts are very powerful, and they may jeopardise the convergence process of many lagging countries in spite of their cost advantage (as in the case of Greece, Portugal, and most of the southern European countries). This consideration highlights the need to endogenize the public expenditure growth rate, and its mechanisms, in a regional growth forecasting model.

3. Growth theories behind the structure of MASST and the model features

When applied to the study of regional economic growth, econometric model specifications have always been grounded on the main economic growth theories developed at regional level. Regional econometric models began as further elaborations of macroeconomic models dealing with such variables as production, investment, consumption, and exports (Nijkamp et al, 1986). In these approaches, important attempts were made to translate econometric models interpreting economic growth of national systems into regional econometric models (Glickman, 1977 and 1982; Cappellin, 1975 and 1976). These models reflected the Keynesian approach to growth based on the theoretical assumption that local development is a demand-driven process supported by increases in the internal or external consumption of locally produced goods which, via multiplier effects, generate increases in local employment and income. These models are based on macroeconomic theories of the 1950s; among them, export-base theory in particular.

The need to emphasize supply elements to explain growth induced regional econometric models to use different specifications. Interregional flows of resources (capital and labour) were the main modelling elements, given their prime role in neoclassical growth models (Moody and Puffer, 1969). During the 1980s, supply regional econometric growth models developed in two directions. The first was a more heterodox neoclassical approach to growth characterised by specification of a production function containing production factors (infrastructure and accessibility) other than the mere traditional capital and labour factors, as put forward by the micro-territorial and behavioural theories of the 1970s and 1980s (Biehl, 1986). The second direction was a focus on endogenous growth elements resulting from the success of the neoclassical (macroeconomic) endogenous growth theory of the 1990s (Barro and Sala-i-Martin, 1991).

These specifications seem inappropriate when the new theoretical bases for regional economic growth must be taken into account. In particular, none of these specifications envisage that the factors determining regional performance have two main sources (Camagni, 2002).

In fact, the causes of regional success and failure – especially in periods of global economies - comprise, on the one hand, certain pervasive characteristics of the national economy and, on the other, regional dynamics. National factors are: i) institutional features like the efficiency of the legislative, judicial and governmental functions of the nation state; ii) organisational factors like the quality of services of general interest like education, transport, communication, health, and security services; iii) economic factors like general fiscal pressure, effectiveness of public expenditure, pervasiveness of environmental regulations, the efficiency of contract enforcement procedures, and general price-competitiveness in the case of less advanced countries. Moreover, national economic dynamics are linked to the overall performance of regional economies through close inter-regional, within-country integration, in terms of the exchange of goods, services and production factors, due to proximity effects and the absence of institutional or linguistic barriers.

Besides the national component, a crucial role in explaining regional performance is played by each region's internal development capability, and its endogenous capacity to turn threats stemming from higher competition into growth opportunities.

Starting from these considerations, regional growth is the result of two intertwined effects in the MASST model (Fig. 1). On the one hand, national growth explains much of regional growth: when a national system is competitive in terms of institutional features (e.g. efficiency of governmental functions), organisational factors (e.g. good accessibility through transport infrastructure endowment) and economic factors (general price competitiveness), its capacity to conquer new international markets and to achieve a distinct role in the international division of labour guarantees higher penetration of national products in the world economy. In a global economy, world demand for (both intermediate and final) national goods explains much of the national growth through a typical aggregate Keynesian demand approach. On the other hand, the capacity of a region to grow more or less within its national frame is largely a supply-side phenomenon based on the internal entrepreneurial capabilities of regions and places and on the capacity of local economic actors and policy makers to cumulate existing local assets

and use them efficiently, as today widely accepted by the most advanced scientific and institutional literature on regional growth (Camagni, 2009; EC, 2005).

For this reason, the MASST model is built around two sub-models: a national model, in which growth is mostly dependent on demand-side aspects, and a regional model, where the regional differential growth is dependent on supply-side elements. Regional growth is the result of the sum of the national component and of the differential growth component.

The national model has largely a traditional Keynesian structure. Each component of the aggregate demand depends on the conventional elements. Consumption growth depends on income growth; investments growth depends on changes in interest rates; import growth depends on exchange rate variations, while export growth is influenced by exchange rate adjustments and world demand volatility. Public expenditure growth rates are exogenous to the model. However, with respect to the Keynesian approach, some supply-side elements concerning the competitiveness of the national economy are added in the model specification in order to take account of the strong competitive environment that the global economy generates for national economies. In particular, global competition strongly affects investments, and import and export growth; national efficiency certainly plays a role in dealing with the high level of competition. New investments depend on productivity gains furnished by the national economic system and on the capacity of the national economy to attract foreign direct investments; import growth also depends on the capacity of national economies to attract foreign direct investments representing strong importers of intermediate goods.[2] Finally, the capacity of a national economic system depends not only on world demand but also, once there is an increasing international market, on the capacity of the economic system to conquer a position in the international division of labour. Export growth is therefore strongly influenced by productivity gains capturing the efficiency of institutional elements (legislative, judicial and governmental functions of the nation state) and organizational elements, (e.g. the quality of services of general interest like education). All these aspects are taken into full account in the model specification (Fig. 1).

Once national effects have been controlled for, regional competitiveness is explained by supply-side elements, and it is in the specification of the supply elements that the advanced MASST model differs substantially from the first version of the model (Capello, 2007). In the new version, the sectoral dimension is taken into account in the model's structure, and the regional growth differential is made dependent on four blocks of elements: i) the sectoral composition of the region (typically the MIX component of the shift-share analysis), ii) inter-sectoral productivity elements that explain how sectors in a region can be more productive than the same sectors in another region (the DIF component of the shift-share, conceptualised at an inter-sectoral level), iii) demography dynamics; and iv) technological interdependence among regions (Fig. 1).

The four blocks of elements refer to different growth theories. The sectoral component of growth relates to a traditional theory that links regional differential growth to its sector endowment and sector dynamics (Perloff, 1957; Perloff et al., 1960). The new value added from the conceptual point of view is that the sectoral employment dynamics does not merely depend on the presence of specific sectors, but on the high/low value added functions present in the region (Fig. 1). This is all the more true in the present period of globalization characterised by the relocation of low-level functions, and even single tasks, in cost-competitive areas (Baldwin, 2006).

The second block of elements that characterise regional growth differentials in the MASST model derive from local development theories. Since the mid-1970s, regional development has been interpreted as an *endogenous* process fundamentally dependent on a concentrated organization of the territory, embedded in which is a socio-economic and cultural system whose components determine the success of the local economy: entrepreneurial ability, local production factors (labour and capital), relational skills of local actors generating cumulative knowledge-acquisition (Camagni, 1991) – and, moreover, a decision-making capacity which enables local economic and social actors to guide the development process, support it when undergoing change and innovation (Asheim, 1996; Lundvall,

[2] There is much debate in the literature on the FDI and trade substitution/complementarity relationship. See Forte, 2004 for a review of the issue. We assume in the model specification that complementarity exists, and see in the empirical results whether this assumption is verified.

1992; Lundval and Johnson, 1994; Maskell and Malmberg, 1999), and enriching it with the external information and knowledge required to harness it to the general process of growth (Nijkamp et al, 1998), and to the social, technological and cultural transformation of the world economy (Cappellin, 2003; Stimson et al., 2005). More recently, the importance of intangible aspects has been emphasized in the literature as additional important elements explaining growth. This concerns the role of trust (Glaeser et al., 2000; McCloskey and Klamer, 1995), social capital (Glaeser et al., 2002; Knack and Keefer, 1997; La Porta et al., 1997; Beugelsdijk and van Schaik, 2005; Putnam, 2000), sense of belonging to a society (Bowles et al., 2001; Lazear, 1999; Alesina and La Ferrara, 2000) in national and regional economic dynamics. At regional level, a successful stream of studies, spanning from sociology to economics, from anthropology to business (Bourdieu 1983; Coleman 1988; Putnam 2000; Fukuyama 1995), has substantially demonstrated that a wealth of social capital feeds economic interactions (Beugelsdijk and van Schaik 2005; Beugelsdijk et al. 2004; Guiso et al. 2006; Knack and Keefer 1997). An effort is made in MASST to measure these effects by adding a measure of trust to the inter-sectoral elements explaining growth (Fig. 1).

The third group of theories to which we refer is the one linked to endogenous growth. The theoretical contribution made by endogenous growth theories useful for this model is that they highlight an endogenous law of accumulation of a resource to explain cumulative growth (see among others Aghion and Howitt, 1992; Lucas, 1988; Romer, 1986). In MASST, the endogenous law of accumulation refers to the population, expressed in a long-term neoclassical view as a resource for production development which should not be wasted on emigration (Fig. 1).

The last group of theories on which the regional differential component specification relies consists of the recent neoclassical growth models *à la* Makin-Ertur and Kock (Mankiw et al. 1992; Ertur and Koch 2007). The theoretical jump made by these models is the implicit assumption that technological progress is characterized by a worldwide global interdependence among economies which depends on their geographical connection with other economies (Lòpez-Bazo et al. 2004; Ertur and Koch 2007). In fact, technological interdependence is not homogenous across economies (countries or regions) and depends closely on their geographical interconnection with other economies.[3] With this idea, the MASST model specification entails "growth spillovers" capturing the capacity of a region to grow by virtue of resources, technological capacity and knowledge coming from other regions. This mechanism is recursive in the model, and guarantees a cumulative and self-reinforcing local growth process *à la* Myrdal-Kaldor-Krugman (Myrdal, 1957; Kaldor, 1970; Krugman, 1991).

Because it is a "territorial model", MASST includes the role of agglomeration economies in a cumulative growth process: regions more endowed with large cities, where agglomeration forces are present, are expected to have a higher endogenous growth potential than rural regions. In a very simple way, MASST captures this aspect with the introduction of a settlement structure typology to explain differential growth.

With this structure, the present MASST model has some *distinct features that differentiate it from other forecasting models*. It contains an interesting mixture of demand and supply side elements that explain regional growth at national and regional level: whilst, in fact, national growth is mostly explained by aggregate demand elements, the model is also intended to capture price competitiveness effects at national level. At regional level, while differential regional growth is mostly explained by territorial capital elements, in line with the most advanced regional growth theory, demand elements are captured by the mix of sectors present in the region.

These aims are achieved without losing the most attractive aspect of MASST, as explained in section 2: its nature, to use Richardson's (1967) terminology, as a "distributive" and a "generative" model at the same time, i.e. a top-down and a bottom-up model. In fact, the model allows for endogenous differentiated regional feedbacks on national policies and trends and distributes them differently among regions according to their capacity to capture national growth potentialities, following a distributive logic. In their turn, regional shocks, and regional feedbacks, propagate on regional GDP growth because of of

[3] Very recently, Ertur and Koch (2011) have also proposed an extension of the multi-country endogenous (Schumpeterian) growth model which includes technological interdependence among economies in order to take account of the neighborhood effects on growth and convergence processes.

structural elements explaining regional capacity to react to shocks. Regional shocks propagate to the national level through the sum of the regional GDP levels, thus giving the model a generative nature.

Another important feature of MASST is that it makes it possible to model competition and cooperation among regions at the same time: competition is related to the generative part of the model, which guarantees higher regional growth rates to more competitive regions; cooperation is assured by interregional linkages inserted in the form of regional growth spillovers in the regional differential shift equation and by the generative effect of regional competitiveness on national growth, which is kept from the first version of the model (see Capello et al., 2008).

A final feature of MASST is that it is a purely territorial model in which not only are regional growth spillovers modelled but the effects of variables are differentiated with respect to the settlement structure of regions.

The next section presents the analytical structure of the model in detail.

4. The new conceptual and analytical structure of MASST 3

4.1. The conceptual structure of the model

As has been traditionally the case in previous versions of the model, also MASST3 is structured around its two main sub-components, the national growth and the regional growth sub-models, which add up their output to provide the final economic effect of regional growth at regional Nuts2 level. National growth is mostly dependent on aggregate demand-side aspects, while regional differential growth is mostly dependent on supply-side elements.

Regional growth is therefore the result of the sum of the national component and of the differential growth component:

$$\Delta GDP_{rt} = \Delta GDP_{nt} + diff_{rt} \qquad (1)$$

where ΔGPD_r is the growth of regional GDP, ΔGPD_n the growth of national GDP, and $diff_r$ the growth differential shift of the region compared to its nation.

As we will see later on, although both sub-models were present in the previous versions of MASST, their structure has been improved and expanded to achieve the aims of this latest version as specified in Section 3.

The model diagram, presented in Figure B3, reflects the two sub-model structure, and shows the national sub-model on the left and the regional sub-model on the right. This structure relates to the theoretical approach on which the model rests. National growth explains much of regional growth: when a national system is competitive in terms of institutional features (e.g. efficiency of governmental functions), organisational factors (e.g. good accessibility through transport infrastructure endowment) and economic factors (general price competitiveness), its capacity to conquer new international markets and to achieve a distinct role in the international division of labour guarantees higher penetration of national products in the world economy. In a global economy, world demand for (both intermediate and final) national goods explains much of the national growth through a typical aggregate Keynesian demand approach.

Instead, the capacity of a region to grow more or less than the national level is a supply-side phenomenon, mostly dependent on the local endowment of specific tangible and intangible assets, like entrepreneurial capabilities, knowledge, creativity, trust and sense of belonging, and on the capacity of local economic actors and policy makers to make use of these assets in an efficient way, as today

strongly suggested by the most advanced scientific and institutional literature on regional growth (Camagni, 2009; EC, 2005).

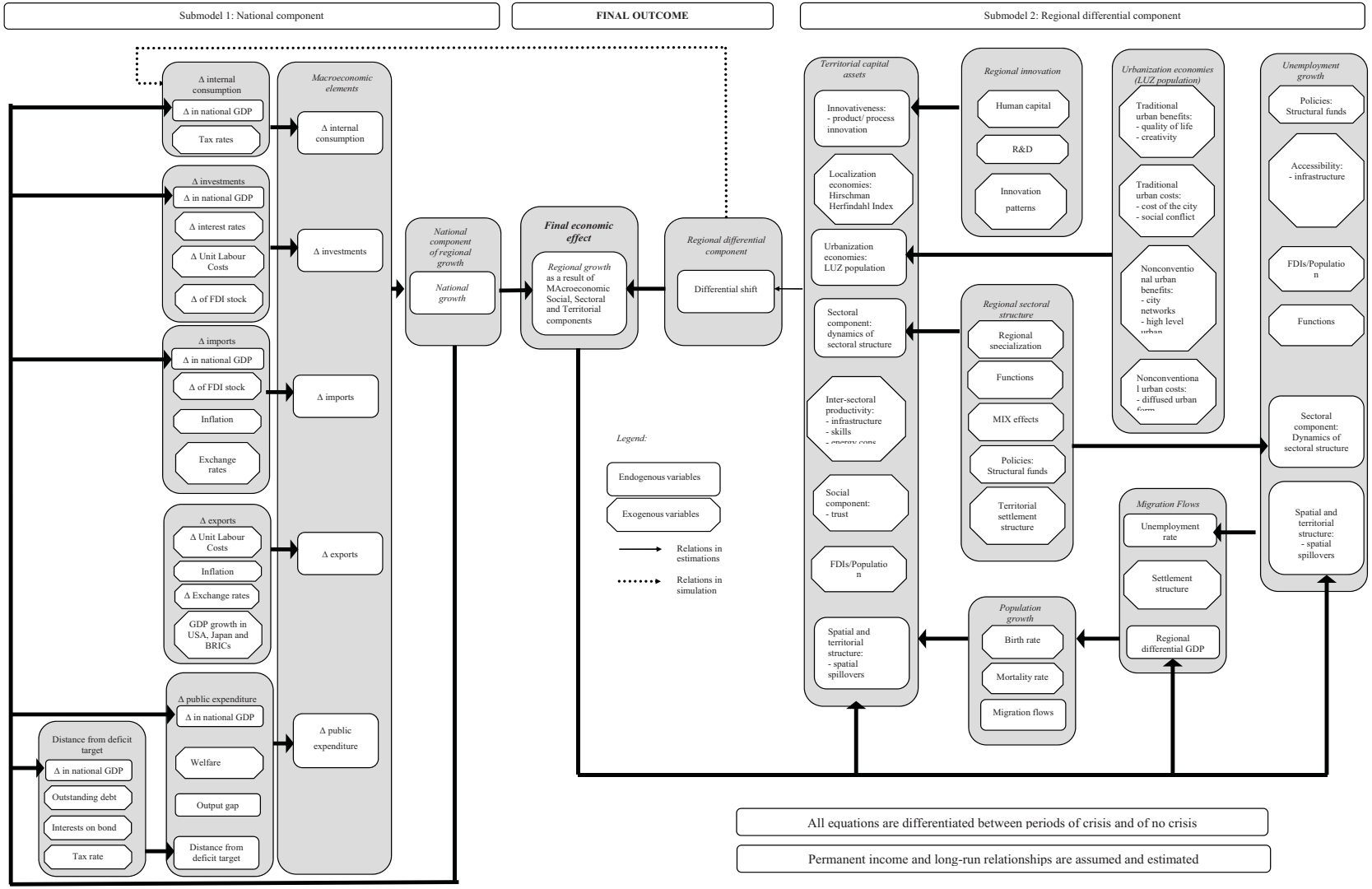
In the scheme of Figure B1, each grey rectangle represents an equation, where the components of equations are either endogenous (white rectangles with rounded corners), or exogenous (white octagons). The endogenous components are determined by other equations of the model, those denoted by an arrow, while the exogenous ones have to be assumed by the modeller according to the scenarios, with a mechanism of targets. This mechanism is such as the modeller has to enter the long-term values of variables, and then the model adjusts to those values with a speed which is dependent on the type of variable, since structural variables need more time to adjust with respect to conjunctural ones (see Capello et al., 2008 for details). Targets can be set for each single region or nation or for groups of regions/nations which belong to the same typology and can hence be thought to share the same long-term value.

In the model, each equation provides feed-back to at least another equation, as illustrated by the thick arrows in Figure B3. One of these feed-backs, however, is different since this is not a relation in estimation but a relation in simulation, due to a specific theoretical assumption, and is hence represented with a dotted arrow. This is the feed-back from regional growth to national growth. In the MASST3 model, in fact, the regional component of growth is also a generative one, in addition to a distributive one, and this is practically made possible by the fact that the sum of the regional components of MASST also determines the national potential income, which is the reference variable to which national behavioral equations (most notably internal consumption) depend.

The choice of the regressors in the estimations of the model is made accordingly three necessities:

- the theory: all the estimated equations follow a theoretical approach as coming from the literature, and the choice of regressors starts from what the theory states influences the dependent variable;
- the availability of data: since the MASST3 model is estimated for all the European Union at the same time, data are needed for all its Nuts2 regions, and while some random missing values for some regions are acceptable, estimating without groups of countries or specific types of regions can make estimations biased. For this reason, the choice of proxies is strongly constrained by data availability;
- the scenario requirements: a particular effort has been made, since in order to produce scenarios it is important to have all required levers, representing policies or bifurcations, in the model, even if in rare occasions at the expense of econometric significance.

Figure B1. Diagrammatic structure of the MASST3 model



4.2. The national sub-model

The national model has largely a traditional Keynesian structure. Each component of the aggregate demand depends on the conventional elements. Consumption growth depends on income growth; investments growth depends on changes in interest rates; import growth depends on exchange rate variations, while export growth is influenced by exchange rate adjustments and world demand volatility. With respect to the Keynesian approach, some supply-side elements concerning the competitiveness of the national economy are added in the model specification in order to take account of the strong competitive environment that the global economy generates for national economies. In particular, global competition strongly affects investments, and import and export growth; national efficiency certainly plays a role in dealing with the high level of competition. New investments depend on productivity gains furnished by the national economic system and on the capacity of the national economy to attract foreign direct investments; import growth also depends on the capacity of national economies to attract foreign direct investments representing strong importers of intermediate goods. Finally, the capacity of a national economic system depends not only on world demand but also, once there is an increasing international market, on the capacity of the economic system to conquer a position in the international division of labour. Export growth is therefore strongly influenced by productivity gains capturing the efficiency of institutional elements (legislative, judicial and governmental functions of the nation state) and organizational elements, (e.g. the quality of services of general interest like education).

The structure of the national sub-model is relatively easier with respect to the regional model: each component of the standard Keynesian national account identity is estimated in one single equation, which feeds the national growth equation. Four of these components were already endogenous in the previous editions of MASST, while a public expenditure growth reaction function has been added and a major improvement has been introduced: the consumption, investment, and import equations include Error Correction Mechanisms (henceforth, ECM), that measure the speed of convergence of each variable to its long-run trend (Davidson et al., 1978; Alogoskoufis and Smith, 1991). In fact, as the data set used for the estimation of the model encompasses a long time series (1990-2011, see the Annex for details), each of these variables present relevant time trends and tend to oscillate around such trend, at least in the short run. The evidence suggests the existence of positive and comparable long run equilibria of the three variables corrected with the ECM component. The small adjustment coefficients display a relatively weak tendency to converge to such long run equilibria, with the imports showing the slowest mean convergence. This result, in turn, implies that consumption, investment and imports may remain far away from a long run trend, when a shock (either positive or negative) determines a deviation from such trend. A major example of such shock would be the ongoing financial crisis, which thus reinforces the case for using such advanced modeling tools in the process of regional forecasting.

More in detail:

- the growth of internal consumption depends on the growth of total national GDP and, due to the fact that people can only consume their disposable income, on the tax rate in the country (*t*). The ECM in this equation links the long run path of consumption to disposable income, $\left[C_{nt-1} - \beta_3 GDP_{nt-1}\left(1 - t_{nt}\right)\right]$, and we assume that such long run path is not affected by the crisis, that is by the recent sluggish economic performance. The crisis however affects both the speed of adjustment of consumption to its long run equilibrium and the average consumption growth rate: see the significant coefficients of the dummy variable (d_{crisis}), which takes on value 1 after 2008, and of the ECM multiplied by the crisis dummy. Country fixed effects have been added. Consumption growth is thus formalized as in eq. (2):

$$\begin{aligned}\Delta C_{nt} &= const + \beta_1 \Delta\left[GDP_{nt-1}\left(1 - t_{nt)}\right)\right] + \beta_2\left[C_{nt-1} - \beta_3 GDP_{nt-1}\left(1 - t_{nt}\right)\right] + \\ &+ \beta_4 d_{crisis,t} + \beta_5 * d_{crisis,t} * \Delta\left[GDP_{nt-1}\left(1 - t_{nt)}\right)\right] + \beta_6 * d_{crisis,t} * \left[C_{nt-1} - \beta_3 GDP_{nt-1}\left(1 - t_{nt}\right)\right] + \\ &+ FE + \varepsilon\end{aligned} \tag{2}$$

- the growth rate of investments depends on the real interest rates, reflecting the cost of capital, on the unit labour costs (ULC), reflecting the cost of labour, and the FDI, which reflect the ability of the country to attract investments from abroad. Because of the structural break imposed on long-run investment in the current economic crisis, investments depend also on the crisis dummy above described, while the ECM that links investments to GDP in the long run, is only significant in the pre-crisis period. Country fixed effects have been added. Investments growth is therefore summarized by eq. (3):

$$\Delta I_{nt} = const + \beta_1 r_{nt} + \beta_2 \Delta FDI_{nt} + \beta_3 \Delta ULC_{nt-1} + \beta_4 d_{crisis,t} + \\ + \beta_5 * \left(1 - d_{crisis,t}\right) * \left[I_{nt-1} - \beta_6 GDP_{nt-1}\left(1 - t_{nt}\right)\right] + FE + \varepsilon \quad (3)$$

- the growth in imports depends on the growth of FDI (some of the inputs needed by foreign firms have to be imported), on the Euro/USD (€/USD) exchange rate, as a proxy for the shadow price of importing, on the GDP deflator (used to control for changing price levels) and on the fact that the country is located in NMS, where trade has faced massive growth rates in the first half of the 2000s. As with the consumption and investment equations, the ECM that links Imports to GDP is included. No country fixed effects were needed because the significant difference among Imports growth rates were between the two blocks of core EU versus NMS rather than among countries within each block. This is formalized in eq. (4):

$$\Delta M_{nt} = const + \beta_1 \Delta FDI_{nt} + \beta_2 * \left(1 - d_{crisis,t}\right) * \left(€/US\$\right)_t + \beta_3 deflator_{nt} + \beta_4 * d_{east} * time \\ + \beta_5 \left[M_{nt-1} - \beta_6 GDP_{nt-1}\left(1 - t_{nt}\right)\right] + \varepsilon \quad (4)$$

- the growth of exports depends on demand aspects and on the competitiveness of the country. The demand aspects are captured by the demand coming from the key extra-European players, i.e. USA & Japan (the largest OECD countries) and the emerging countries, in particular the BRICs (Brazil, Russia, India and China). The Country's competitiveness is measured by Unit Labour Costs. As for Imports, country fixed effects do not enter the equation, and the significant difference between growth rates of Core EU versus NMS is modeled by the dummy NMS (d_{east}) multiplied by the time trend. Export growth is formalized in eq. (5).

$$\Delta X_{nt} = const + \beta_1 \Delta ULC_{nt-1} + \beta_2 \left(€/US\$\right)_{t-1} + \beta_3 \left(\Delta GDP_{US,t} + \Delta GDP_{JP,t}\right) \\ + \beta_4 \Delta GDP_{BRICS,t} + \beta_5 deflator_{nt-1} + \beta_6 * d_{east} * time + \varepsilon \quad (5)$$

A last component of the national sub-model is the growth of public expenditure, which was exogenous in the previous version of MASST and which now depends on a set of equations of public policy, in order to allow the modeling of the impact of the economic crisis on public finances. In MASST3, public expenditure growth rate equation reads as:

$$\Delta G_{nt} = const + \beta_1 (deficit_{nt} / GDP_{nt} - target) + \beta_2 outgap_{nt} + \beta_3 \Delta GDP_{nt-1} + \varepsilon \quad (6)$$

and it is specified as a government reaction function to, first of all the difference between the real deficit over GDP and the policy target (exogenously defined): the higher is the difference between actual and target deficit GDP ratio, the stricter Fiscal Policy, hence public expenditure growth rate, will be. In particular, tax revenues and interest payments, calculated within the model (as tax rate * GDP and interest rates * debts, respectively), enter the explanation of the public deficit, calculated as the difference between public expenditures and public revenues, the former obtained as the sum of public expenditure and public interests and the latter as public income:

$$deficit_{nt} = (G_{nt} + \text{int}onbund_{nt} * debt / GDP_{nt} * GDP_{nt}) - taxrates_{nt} * GDP_{nt} \quad (7)$$

Moreover, public expenditure growth rate is made dependent on an output gap, conceptually measured as the difference between a potential and a real GDP, expected to be positive since in periods of recession (when potential GDP is higher than real GDP), public expenditure growth rate increases to absorb unutilized production capacity.

The output gap is defined as the difference between potential and actual GDP (these can be respectively defined as Y^* and Y). Thus, the output gap is formally defined as $Y^*–Y$. Measuring the output gap is subject to a degree of inference, since the potential output is not observable and can only be estimated (Bank of Canada, 2010). In the third generation of the MASST model, potential output is assumed to reflect a supply-side definition. Thus, potential output is the sum of regional GDPs forecasted by the model. Formally, if we label $GDP_{pot,nt}$ as the potential output at the national level at time t, and $\overline{GDP_{it}}$ the GDP of region i at time t forecasted by the model, we can state the following equation:

$$GDP_{pot,nt} = \sum_{i=1}^{270} \overline{GDP_{it}} \tag{8}$$

and the output gap in the MASST3 model as

$$outgap_{nt} = GDP_{pot,nt} - GDP_{nt} = GDP_{nt}^{*} - GDP_{nt} \tag{9}$$

Positive values for this measure suggest unfulfilled production capacity: this implies that the growth of aggregate supply is outpacing the growth of aggregate demand.

These five equations enter then the Pseudo-Identity (the national account identity in dynamic terms). The five estimated equations (2 through 6, which can be found in Columns 1 through 5) are shown in Table B1 below, whilst the Pseudo-Identity is for ease of read reported below the Table. All the estimated coefficients meet the expectations formed in the related literature.

Table B1. National estimations of the MASST3 model

Dep. variable	*Consumption growth*	*Investment growth*	*Import growth*	*Export growth*	*Growth of public expenditure*
Model	(1)	(2)	(3)	(4)	(5)
Constant term	0.40***	0.11	0.07**	-0.01*	0.01***
	(0.00)	(0.22)	(0.03)	(0.06)	(0.00)
Lagged growth of disposable income	0.34***	-	-	-	0.22***
	(0.00)				(0.00)
Variation in Unit Labour Costs	-	-0.05	-	-0.13***	
		(0.54)		(0.00)	
Dummy crisis	-0.06***	-0.16*	-	-	-
	(0.00)	(0.09)			
Real interest rate	-	-0.01***	-	-	-
		(0.00)			
Adjustment coefficient (ECM)	-0.18***	-0.13***	-0.03***	-	-
	(0.00)	(0.00)	(0.01)		
Long-run coefficient	-0.84***	-0.83***	-0.81***	-	-
	(0.00)	(0.00)	(0.00)		
Adjustment coefficient * Dummy crisis	0.02***	-	-	-	-
	(0.00)				
Lagged growth of disposible income * Dummy crisis	-0.30***	-	-	-	-
	(0.00)				
Lagged growth of FDI	-	0.01***	0.01***	-	-
		(0.00)	(0.00)		
Inflation	-	-	0.45***	-	-
			(0.00)		
Price level	-	-	-	-0.04***	-
				(0.00)	
Exchange rate Euro/USD (not in crisis)	-	-	0.10***	-0.26***	-
			(0.00)	(0.00)	
GDP growth in US and Japan	-	-	-	1.19***	-
				(0.00)	
GDP growth in BRIC countries	-	-	-	0.35***	-
				(0.00)	
Deviation from the deficit target (Public deficit/GDP-3%)	-	-	-	-	-0.002***
					(0.00)
Output gap	-	-	-	-	0.004***
					(0.00)
Dummy East* Time trend	-	-	0.01*	0.002***	-
			(0.08)	(0.00)	
R^2	0.53	0.33	0.23	0.69	0.20
Estimation technique	Fixed effects	Fixed effects	OLS	Random effects (Estimated GLS)	OLS

*Notes: ***,**,*: significance at the 10, 5 and one per cent, respectively. P-values in brackets.*
Estimated Pseudo-Identity:

$$\Delta Y_{nt} = 0.51 * \Delta C_{nt-1} + 0.01 * \Delta I_{nt-1} + 0.03 * \Delta G_{nt-1} + 0.17 * \Delta X_{nt-1} - 0.09 * \Delta M_{nt-1}$$

4.3 The regional sub-model

4.3.1 The regional differential shift

The regional sub-model is more complex and recursive with respect to the national one. As in the previous versions of MASST, the basis of the regional component is the equation of differential shift, whose structure has been improved and enriched in order to take into account the urban agglomeration and innovation aspects.

The regional differential component depends on a large number of structural assets, recently called territorial capital assets (Camagni, 2009) some of them endogenous to the model through second-order equations, and some exogenous through the scenario assumptions.

As in the previous version of the model, the structural elements are separated into two conceptually different groups of variables. The first group is intended to measure sectoral dynamics, through both manufacturing (ΔMan) and service (ΔSer) employment growth rates. The second part seeks to measure the effects of inter-industry productivity through the presence of innovation capacity (*inno*), regional localization economies (*HHI*), accessibility (*access*), relative geographical position vis-à-vis other regions (*spill*), relational capital (*trust*), an equilibrated urban system (*LUZ pop*), and regional attractiveness of FDI (*FDI*) as follows:

$$dif_{rt} = const + \beta_1 \Delta man_{rt-1} + \beta_2 \Delta ser_{rt-1} + \beta_3 inno_{rt-1} + \beta_4 LUZpop_{rt-1} + \beta_5 spill_{rt-1} + \beta_6$$
$$+ \beta_7 access_{rt-1} + \beta_8 encons_{rt-1} + \beta_9 trust_{rt-1} + \beta_{10} FDI_{rt-1} + \varepsilon \qquad (10)$$

In particular, the endogenous regressors are the following:

- regional innovation, represented by the share of firms which introduced product or process innovations, obtained by an ancillary innovation production equation, where innovation is made dependent on R&D expenditure, presence of human capital and dummies representing the way a region combines innovation and knowledge thanks to the presence/absence of some local preconditions for creating knowledge and turning it into innovation, called in a recent work regional innovation patterns (Capello and Lenzi, 2013a);
- urbanization economies, measured by the share of regional population living in a LUZ, produced in the ancillary equation equating marginal urban benefits and marginal urban costs, thus obtaining the size that guarantees maximum net advantages (Camagni et al., 2013);
- the spatial structure, and in particular the growth spillovers. These are weighted spillovers and appear to be more relevant for regions with an urban settlement structure;[4]
- the dynamics of employment, measured by the growth rates of manufacturing and service employment, which is the intra-industry factor since it is differentiate by macro-sectors. In this case, it also appears that the impact of manufacturing employment on GDP growth rate is different for rural regions, and specifically lower since these regions are not attracting advanced manufacturing but rather the lowest

[4] Urban regions are defined as regions with a centre between 150.000 and 300.000 inhabitants and a population density 150 – 300 inhabitants / km sq. (or a smaller population density – 100-150 inh. /km with a bigger centre (>300.000) or a population density between 100 – 150 inh./km sq.

levels, so that maintaining manufacturing employment for them is detrimental since it precludes more advanced activities.

Included in the explanation of regional differential growth are also exogenous regressors, which are either bifurcation levers or policy variables, not produced by the MASST model elsewhere:

- localization economies, measured by the Hirschman-Herfindahl index, which however is only significant for the an urban region.
- accessibility of regions, which is a comprehensive measure of infrastructure availability, and is a complex index (Spiekermann and Wegener, 2006). As general accessibility to people is also a signal of congestion, as many people crowd in or close to the region, the sign of its estimated coefficient can be negative. However, the increase of accessibility is expected to be positive as it is a signal of increase of agglomeration and decrease of congestion bottlenecks.
- availability of energy, and cheap energy, in the region, proxied by the energy consumption. This is expected to be positive for agglomerated regions, where more energy means more production, while it is in general negative since more energy consumption means more costs and less efficiency.
- social characteristics of the region, and in particular it appears from our data to be important to have a high level of trust in the region, which is measured by the percentage of people in the region who trust the others.
- regional attractiveness of the regions for investors, which measured by the share of FDI on population.

All regional estimations are with a panel of three periods, with lagged dependent variables to reduce endogeneity (which implies two estimation periods, one before crisis and one in crisis years). Each of the three periods is actually a weighted average over three years, in order to reduce the short term volatility and estimate longer term relationships needed for a long-run foresight model. Moreover, this allows to use as determinants those structural or conjunctural variables which are now available yearly, but either as points in time or as three year averages, as infrastructure, FDI, trust, etc.

Since the estimation sample covers two very different economic periods, the pre-crisis one and the crisis one, in the estimations a dummy for the crisis (post 2007) years is included; sometimes the crisis dummy is significant in terms of a different intercept, and more often able to change the estimated parameters of explanatory variables, meaning that the impact on the dependent variable is not the same in ordinary periods or in crisis periods. In addition to improving estimations, this is also helpful because it allows the model to produce scenarios in which some years are of crisis and others are not.

The estimation results for the differential equation are presented in Table 2: all coefficients have the expected sign and most of them are significant, while insignificant but close to significant are the coefficients of regional innovation, of differential growth spillovers in urban regions, of energy consumption in not agglomerated regions and total accessibility, which is slightly negative.

4.3.2 Regional innovation

The first regional second order equation that is estimated in the MASST3 model is the innovation one:

$$Inn_r = const + \beta_1 R\&D_r * pattern1 + \beta_2 R\&D_r * pattern2 + \beta_3 R\&D_r * pattern3 + \\ + \beta_4 R\&D_r * pattern4 + \beta_5 R\&D_r * pattern5 + \beta_6 humcap + \varepsilon \quad (11)$$

where *R&D* are the expenditures in research and development over GDP, *humcap* represents the quality of human capital and patterns 1-5 are dummy variables assuming value 1 if regions are characterized by that particular pattern of innovation and 0 otherwise. In fact, regions innovate according to different combinations of internal knowledge, external knowledge and innovation, depending on the presence/absence of preconditions for creating knowledge, turning knowledge into innovation. In particular, five different territorial patterns of innovation have been identified, namely (Capello and Lenzi, 2013a):

- pattern 1 is characterized by regions with a strong knowledge base and fast innovation processes, specialized in general purpose technology, with a high generality and originality of local science-based knowledge and a high degree of knowledge inputs coming from regions with a similar knowledge base. R&D activity is high. This pattern is called a European science-based area;
- pattern 2 is made up of strong knowledge producing regions characterized by applied science, with a high degree of knowledge coming from regions with a similar knowledge base. Its label is an applied science area;
- pattern 3 is characterized by a high product innovation rate is registered, with a limited degree of local applied science and high creativity and receptivity which allow to translate external basic science and applied science into innovation. R&D endowment is much lower than in the previous two cases. The apparent target of this group of regions is to achieve specialized diversification across related technologies in diversified technological fields of competence The label for this pattern is a smart technological application area;
  pattern 4, labeled a smart and creative diversification area, is characterized by a low degree of local applied knowledge, some internal innovation capacity, high degree of local competences, which suggest that the not negligible innovation activities carried out in the area mainly rely upon tacit knowledge embedded into human capital;

Table B2. Estimation results for the DIF (regional differential growth)

Dep. variable: regional diff	*Coefficient*	*p-value*	*Sig.*
Constant term	-1.67	0.45	***
Intra-sectoral component			
Growth rate of manufacturing employment	0.03	0.01	***
Growth rate of manufacturing employment * Dummy rural	-0.04	0.02	**
Growth rate of service employment	0.03	0.02	*
Inter-sectoral component			
Energy costs	-0.05	0.03	
Energy costs * Dummy agglomerated	0.11	0.04	***
Regional FDIs	0.001	0.00	**
Sectoral specialisation * Dummy urban	1.52	0.85	**
Multimodal accessibility	0.00	0.00	
Growth of multimodal accessibility	0.04	0.02	**
Social component			
Regional trust	1.99	1.03	*
Regional innovation			
Innovation (product and/or process innovation)	0.008	0.005	
Urban component			
Share of regional population living in metro areas	0.69	0.31	**
Spatial and territorial structure			
Spatial growth spillovers (weighted by GDP)	0.19	0.08	**
Spatial growth spillovers (weighted by GDP)* Dummy urban	0.79	0.52	
Number of obs.	474		
Joint F-statistic	4.69		***
R^2	0.17		
Robust standard errors	Yes		

- pattern 5 shows a low knowledge and innovation intensity, low entrepreneurship and creativity, a high attractiveness of FDI and a good innovation potential. This is called an imitative innovation area.

The estimations are presented in Table B3.

Table B3. Estimation results of regional innovation

Dep. variable: product and/or process innovation	*Coefficient*	*p-value*	*Sig.*
Constant term	0.25	0.02	***
Human capital			
Share of workforce aged 15-64 with ISCED 5-6 degrees	0.61	0.18	***
Research intensity			
Gross expenditure on R&D in:			
European Research Area regions	6.29	0.85	***
Applied science area regions	1.76	0.63	***
Smart technological application regions	1.90	0.46	***
Smart and creative diversification regions	-1.85	0.75	**
Imitative innovation regions	-12.69	2.65	***
Number of obs.	262		
R^2	0.84		
Robust standard errors	Yes		
Lagrange multiplier (spatial error)	0.547		
Lagrange multiplier (spatial lag)	1.571		

Empirical results suggest that the performance of the European Research Area stands out in terms of R&D elasticity. The Smart and creative diversification area shows instead a statistically lower elasticity of GDP growth to R&D with respect to the other groups; thus, investment in knowledge creation in this area seems less growth-enhancing than in the other groups of regions.

4.3.3. Urbanization economies

The advantages of urbanization economies within a region is treated in an original and new way in MASST3. Instead of inserting indicators of urbanization economies, a more sophisticated conceptual approach has been used to capture the urban advantages stemming from a previous study of the authors (Camagni et al., 2013). This approach allows to endogeneize urbanization economies.

The efficiency of regional growth depends in fact not only on the presence of cities per se, but of cities able to achieve the maximum return from their size. In a neoclassical setting whereby each individual maximizes a utility function, urban location benefits and costs can be equalized to find the city-specific size that gives rational individuals no incentive to deviate from the preferred location, therefore assuming spatial equilibrium in an urban

system. Such equilibrium city size varies across cities on the basis of city-specific benefit and cost determinants, as formalized in eq. 12:[5]

$$\ln(size)_u = const + \beta_1 \ln(amenities)_u + \beta_2 \ln(diversity)_u + \beta_3 \ln(functions)_u + \\ + \beta_4 \ln(networks)_u - \beta_5 \ln(rent)_u - \beta_6 \ln(malaise)_u - \beta_7 \ln(sprawl)_u + \varepsilon \quad (12)$$

The results of estimating eq. (13) are shown in Table B4, based on robust OLS estimates on a sample of 59 European Functional Urban Areas, encompassing a large share of EU's GDP and population. The results corroborate the theoretical expectations deriving from the model in eq. (12): positive and significant correlations exist between traditional and unconventional urban benefits and equilibrium city size, and negative and significant relations are identified between traditional and unconventional urban costs and equilibrium city size. The equilibrium city size forecasted by the model presents remarkable adherence with real data. Deviations from the real city size never exceed the 10 per cent threshold.[6]

The equilibrium city size forecasted by the model is divided by the total regional population; the share of regional population living in an equilibrated urban system becomes, therefore, a factor of regional performance, as also underlined in recent policy measures at both the EU and national level.

4.3.4 Sectoral specialization

Along the inter-sectoral productivity factors, demand aspects are very important for regional growth, and those factors are different for different sectors, since they afford different conjunctures (for example the economic crisis hit the construction sector more than the others). This means that the regional specialization is important, as already noticed by Perloff in 1957.

[5] For details on the derivation of eq. 12, see Camagni et al. (2013).

[6] In Camagni et al. (2013), causality issues are also taken into account by instrumenting the cost and benefit variables most likely to be mutually influencing equilibrium city size. This exercise confirms the baseline OLS estimates.

Table B4. Estimation results of urban equilibrium size

Dep. variable: equilibrium city population	*Coefficient*	*p-value*	*Sig.*
Constant term	9.93	2.01	***
Traditional urban benefits			
Urban amenities (log tourist inflows in metro area)	0.32	0.07	***
Urban sectoral diversity	0.83	0.46	*
Traditional urban costs			
Land rent (prices of av. quality apartments per sqm.)	-0.35	0.14	**
Urban malaise (crime rate)	-0.10	0.05	*
Unconventional urban benefits			
Urban functions	0.20	0.09	**
City networks	0.12	0.05	**
Unconventional urban costs			
Urban sprawl	-0.30	0.08	***
Location dummies			
Dummy small Country	-0.25	0.13	*
Dummy financial capital	0.60	0.17	***
Number of obs.	59		
Joint F-test	21.01		***
R^2	0.78		
Robust standard errors	Yes		

*Standard errors in parentheses. ***, **, and * indicate significance at 10, 5 and 1 %, respectively.*

The dynamics of employment structure is hence estimated separately for manufacturing and for services, even if the two equations follow the same theoretical logic, which is similar to the previous version of MASST. However, in this present version of the model the onset of the economic crisis has made evident that the same assets which help regional employment growth in ordinary times are not necessarily the same which help regions better resist the hard times of crisis. For this reason for most regressors two coefficients are estimated, one for the period of crisis and another for ordinary times, and this is allowed by the fact that now the MASST3 model is estimated as a panel also at regional level, thanks to better data availability.

The total employment growth in each region *r* and macro-sector *j* ($\Delta empl_{rt}^{j}$) is modelled as follows:

$$\Delta empl_{rt}^{j} = cons_{r}^{j} + \sum_{i \in j} \beta_{i}^{norm} LQ_{irt-1} + \sum_{i} \beta_{i}^{crisi} LQ(crisis)_{ir(t-1)} + \beta_{2} pol_{r(t-1)} + \\ + \beta_{3} prof_{r(t-1)} + \beta_{4} char_{r(t-1)} + \varepsilon \quad (13)$$

where LQ_{ir} is the location quotient of sector *i* in region *r*, *pol* is the policy support in the regions, *prof* is the functional specialisation and *char* are the regional characteristics in terms of settlement structure or belonging to new member countries.

Eq. (13) measures intra-sectoral productivity effects. The increasing/decreasing returns to scale within a certain sector, or intra-sectoral productivity effects, may derive from particularly efficient performance by that sector. This is captured by the link between the degree of specialisation in each sector and industrial employment growth; a certain industrial specialisation provides advantages/disadvantages for absolute industrial employment growth[7]. However, due to the economic crisis, the specialization in certain sectors, which was positive/negative in ordinary times can become no longer significant in crisis times, and at the same times there are sectors which allow to better/worse resist the crisis, and this is now captured in the MASST3 model estimations.

In the simulation part of the model, for both industrial and service growth rates, the constant term allows to capture the standard MIX effects due to assumptions which favour/hamper certain sectors in certain scenarios, and as a consequence favour/hamper those regions specialized in those favoured/hampered sectors. The constant terms in simulations is hence calculated as a decomposition as follows:

$$cons_{r} = cons_{r}^{est} + \sum_{i} (E_{i} / E_{EU}) LQ_{ir} \Delta E_{iEU} \quad (14)$$

where $cons_{r}^{est}$ is the estimated constant, E_{i} is the employment in sector *i* at European level and E_{EU} is total employment in the EU.

The estimation of manufacturing employment growth equation is presented in Table B5, first column.
Among the structural factors, the level of functions performed in the region has a positive and significant impact, as shown by the coefficient of the share of corporate managers, proxy for high level functions. This holds in crisis and non-crisis alike. Also, the settlement structure of regions is important and significant. Ceteris paribus, manufacturing employment tends to grow more in intermediate urban regions and in rural regions, and in regions belonging to the new member countries. Finally, the support of policies, in particular those devoted to SMEs has a positive and almost significant sign.

[7] Specialisation is measured by a location quotient traditionally calculated as the share of employment (or value added) in industry *i* in region *r* on total employment with respect to the share of employment (or value added) in the same industry at the European level

Table B5. Estimation results for regional employment growth and regional unemployment growth

Dependent variable	*Manufacturing employment growth*		*Service employment growth*		*Unemployment growth*	
Time period	*Before crisis*	*During the crisis*	*Before crisis*	*During the crisis*	*Before crisis*	*During the crisis*
Constant term	-4.81*** (1.24)		2.31*** (0.60)		0.95*** (0.15)	
Dummy urban	1.52*** (0.47)				-	
Dummy rural	2.86** (1.29)				-	
Dummy New Member States	2.31** (0.91)		-		-	
Total stock of FDIs * Dummy New Member States	-		-		-.0003*** '(0.00)	
Time lag of unemployment rate	-		-		-0.09*** '(0.02)	
Structural funds supporting SMEs per 1,000 inhabitants	0.003 (0.002)				-	
Structural funds supporting employment per 1,000 inhabitants			-0.02** (0.01)		-0.01 (0.005)	0.02 (0.01)
Structural funds supporting employment per 1,000 inhabitants in agglomerated regions	-			.06** (.02)	-	
Structural funds supporting employment per 1,000 inhabitants in intermediate urban regions			0.02* (0.01)	0.03 (0.02)	-	
Structural funds supporting employment per 1,000 inhabitants in rural regions			-0.001 (0.03)	0.04 (0.05)	-	
GDP growth spillovers	-		-		-0.17*** '(0.05)	
Growth of multimodal accessibility	-		-		-0.003 '(0.004)	
Share of legislators, senior officials and managers over total employment	-		-		-2.56*** '(0.004)	
Share of corporate managers over total employment	58.88** (25.40)		-		-	
Share of legislators and senior officials over total employment	-		-111.82** (52.55)	175.80* (96.75)	-	

To be continued...

Continued...

Dependent variable	*Manufacturing employment growth*		*Service employment growth*		*Unemployment growth*	
Time period	*Before crisis*	*During the crisis*	*Before crisis*	*During the crisis*	*Before crisis*	*During the crisis*
Share of customer services clerks over total employment	-		-23.23*** '(6.96)		-	
Lagged growth of manufacturing employment	-		-		-0.02* '(0.01)	
Location quotient Rubber and plastic industry (DH)	-1.03*** (0.09)		-		-	
Location quotient non-metal products (DI)	0.87 (0.59)	-1.78 (1.15)	-		-	
Location quotient machinery (DK)	-1.18* (0.68)	2.31* (1.29)	-		-	
Location quotient electronic and optical instruments (DL)	-1.82 (1.10)	2.46 (2.15)	-		-	
Location quotient other manufacturing industries (DN)	2.63 (1.93)	-4.88 (4.17)	-		-	
Location quotient wholesale and retail trade (G)	-		12.94*** (3.48)	-25.80*** (7.72)	-	
Location quotient hotels and restaurants (H)	-		-1.03* (0.61)	1.85 (1.23)	-	
Location quotient transport, storage and communication (I)	-		-2.64 (1.69)	4.99 (3.36)	-	
Location quotient transport, financial intermediation (J)	-		-2.05* (1.18)	4.19* (2.35)	-	
Location quotient real estate, renting and business activities (K)	-		-5.12** (2.11)	11.38** (4.37)	-	
Location quotient public administration (L)	-		2.21** (1.06)	-5.19** (2.32)	-	
Location quotient education (M)	-		-1.96 (1.36)	4.21* (2.61)	-	
Location quotient healthcare and other public services (N)	-		-3.90*** (1.13)	10.03*** (3.40)	-	
Location quotient other public services (O-P)	-		4.40** (1.67)	-7.27** (2.96)	-	
Country dummies	Included and significant		Included and significant		Included and significant	
Robust standard errors	Yes		Yes		Yes	
Number of observations	489		489		482	
R^2	0.44		0.84		0.56	
Fixed effects	Yes		Yes		Yes	

In order to capture demand effects on the various sub-sectors, the location quotients in the different sub-sectors have been added to the estimations when significant or almost significant. The choice here is not driven by a theoretical a-priori, but by the empirics, since

some sectors are growing more than others, or have more links with other sectors and are able to trigger more growth. The sectors were introduced as regressors for the whole estimation period, and when the coefficient turned out to be significant and not different in times of crisis, kept as pure regressors. For other sectors, however, the coefficient resulted to be different in times of crisis and in this case both coefficients were kept. In some cases, some coefficients that turned out to be slightly insignificant with robust standard errors, have been kept because strategic as levers of the model.

Apart from the specialization in sub-sector DH (Manufacture of rubber and plastic products), which is negative throughout, there are other sub-sectors whose impact on regional manufacturing employment growth has opposite signs in crisis periods, among these ones: non-metal products (DI); quotient machinery (DK); electronic and optical instruments (DL); other manufacturing industries (DN).

Since the patterns of employment are very different between countries, the estimations also include country dummies, which are significant and which are also useful in simulations since they allow to make scenarios in which the various countries tend to homogenize and scenarios in which they rather remain different.

Table B5, in the second column, presents the estimations for the service employment growth equation. Very interesting are the results with structural variables. In particular, the specialization in low-level service activities (proxied by the share of customer services clerks) is always detrimental to the growth of service employment. Moreover, the specialization in public services (proxied by the share of public managers), is negative in ordinary periods, since these are less dynamic, but positive in periods of crisis, as public service jobs are less likely to be shed with respect to private ones.

The impact of policies is in this case highly varied: the most relevant policy proxy variable is the total expenditure of Structural Funds (any fund) in support to employment creation, and the impact of this variable is differentiated by settlement structure and by ordinary or crisis period. In ordinary times, there appears to be a positive and significant impact of structural fund expenditure only on urban regions, while the one on rural regions is highly insignificant and the one on agglomerated regions is even negative, signalling that assistance is normally associated with problems and restructuring in these regions. However, in periods of crisis, the coefficient for policy support becomes positive in all regions, highly significant in agglomerated regions (and compensating the negative overall sign), almost significant and still positive (so adding to the general coefficient) in urban regions, insignificant but positive and clearly offsetting the negligible general coefficient for rural regions.

Also in this case, the country dummies are included because highly significant, signalling that the service employment growth models are very different across EU countries. Moreover, also here the specialization in a number of service sub-sectors has significant impact on the growth of service employment, always different between periods of crisis and periods without crisis. For example, a specialization in education and in healthcare has a negative sign in ordinary times but, being public sectors, a positive sign in times of crisis, while a specialization in wholesale and retail trade (G) was positive before the crisis but has a negative impact in times of crisis.

4.3.5 Regional unemployment

Since the MASST3 model aims at analysing the crisis, unemployment has been endogenized, rather than being an exogenous variable as it was in the previous version of the model. In order to do so, the choice of the explicative variables has been based on the

main theoretical reference contained in a survey (Elhorst, 2003), adapted to the availability of data and significance of variables.

The unemployment rate, which feeds into the migration equation, is hence determined by an equation in which endogenous and exogenous components mix. In particular, the dynamics of unemployment growth is dependent in the model on a number of exogenous assumptions including the ones on the amount of policy support received by the region, on the evolution of regional accessibility, on incoming FDI and on the functions that the region performs in the labour market. Two other components of unemployment changes are endogenous. First of all the growth of employment in the region, and second the spatial and territorial structure of the region, captured by the regional spillovers which are determined by the GDP growth in the region and the neighboring ones as calculated by the model.

Accordingly, the equation of unemployment growth is the following one:

$$\begin{aligned}\Delta unempl_{rt} &= cons_r + \beta_1 unempl_{rt-1} + \beta_7 \Delta empl_{rt-1} + \\ &+ \beta_3 prof_{rt-1} + \beta_4 access_{rt-1} + \beta_5 spill_{rt-1} + \beta_6 FDI_{rt-1} + \beta_2 pol_{rt-1} + \varepsilon\end{aligned} \tag{15}$$

where *empl* is employment growth, *prof* is the level of functions performed in the region, *access* is the level of accessibility of the region, *spill* is the growth spillovers received by the region, *FDI* is the level of investments attracted by the region and *pol* is the level of policy support.

The results of the unemployment growth estimations are presented in the third column of Table B5, and include highly significant country dummies since the labour markets are very different in the various EU countries.

The first notable result is that there is some sort of convergence of regional unemployment rates towards natural levels, since regions with higher starting unemployment tend to decrease their unemployment rate towards more standard values, as this mechanism may reflect on the one hand the movement of population towards better job opportunities, and a downward pressure on salaries which should attract economic activities.

Employment growth, as expected, acts as a reducer of unemployment rates. In particular, it turns significant the manufacturing employment growth, which tends to be related to higher level products, while service employment growth is not significant and not included in the final form of the equation. This is probably due to the fact that export-oriented manufacturing employment tends to pull total employment while service employment is still often locally oriented.

The level of activities performed in the region is an important determinant of unemployment, as the presence of managers (public and private), i.e. of high-level functions, tends to significantly reduce unemployment. The level of accessibility is not significant, but is kept in the model because it can help implement scenario assumptions and has the expected negative sign, i.e. it tends to reduce unemployment.

The growth performance of the neighbouring regions, measured by growth spillovers, also significantly reduces unemployment rates, either because activities can spill or because commuting flows can take place. As expected, an effect of reducing unemployment is also coming from the attraction of capital, as shown by the negative sign of incoming FDI in Eastern regions.

Finally, the impact of policies is not clearly determined. In fact, support policies should reduce unemployment, but at the same time they might impact on the regional attitude

towards shifting towards higher segments in the value chain, or impact on the participation rate through the requalification of discouraged worker. As a result, although both slightly insignificant, the impact of policies on unemployment is a reducing one, as expected, in ordinary times, but appears to be not effective in periods of crisis; for scenarial simulation reasons, both coefficient are kept.

4.3.6 Regional population growth and migrations

Finally, although the MASST3 model is not a demographic model, the dynamics of population is endogenized in order to produce the population growth associated with the socio-economic processes. This population growth is also helpful because it allows to compute levels of variables per capita consistent with the scenarios.

Population growth, whose estimation is presented in Table B6, depends on crude birth and death rates, both with the expected sign and a coefficient very close to the expectation (which is 100). Moreover, population growth depends on the number of immigrants arriving; in this case immigration rates are available for three age classes, and all three have a positive coefficient, while the ones of younger people, more likely to have children, are more significant.

Table B6. Estimation results for the population growth equations

Dep. Variable	*Populazion growth*		
	Coefficient	Std. Error	Sig.
Constant term	0.01	0.22	
Megas regions in Old 15 Countries	0.30	0.07	***
Rural regions in NMS	-0.33	0.04	***
Birth rate (lagged 1 year)	120.08	12.54	***
Death rate (lagged 1 year)	-97.13	13.92	***
Net immigration flows (people between 17-27 years). Average value in the period 1995-2000	0.00	0.00	***
Net immigration flows (people between 32-42). Average value in the period 1995-2000	0.03	0.01	***
Net immigration flows (people between 52-67 years). Average value in the period 1995-2000	0.01	0.01	
Number of observations	255		
Robust standard errors	Yes		
Joint F test	73.80		***
R^2	0.58		

Finally and very interesting for regional scholars, the settlement structure of regions is also statistically significant. This is due to the fact that some regions, due to their settlement, are attractive of people from outside Europe and people in all age classes[8], while other regions tend to lose population. It hence turns out that, ceteris paribus, regions with Megas in

[8] Data are available only for three age classes, namely 17-27, 32-42 and 52-67, thanks to an ESPON project.

Old 15 countries have a higher population growth, while rural regions in New Member countries have a lower one.

The ancillary equations of migrations in three age classes have not been re-estimated in MASST3, due to the fact that no new data, nor new theoretical needs were present for these equations, and are the same of the MASST2 model (Capello and Fratesi, 2012). Migrations in the three age classes still depend on differential GDP, on unemployment rates and on the settlement structure of regions (Table B7) and could not be estimated as a panel as the rest of the regional model due to data availability.

Table. B7 Estimation results for the migration equations

Dep. variable	*Net immigration flows (people between 17-27 years)*			*Net immigration flows (people between 32-42 years)*			*Net immigration flows (people between 52-67 years)*		
	Coefficient	p-value	Sig.	Coefficient	p-value	Sig.	Coefficient	p-value	Sig.
Constant term	-0.76	0.94		7.64	0.00	* * *	6.38	0.00	***
Regional differential GDP (with the EU) (lagged 1 year)	0.94	0.00	***						
Regional differential GDP (with the EU) (lagged 1 year) in NMS				0.21	0.00	***	0.17	0.00	***
Regional differential GDP (with the EU) (lagged 1 year) in Old 15 countries				-0.37	0.00	***	-0.38	0.00	***
Unemployment rate (lagged 1 year)	-0.25	0.09	*	-0.41	0.00	***	-0.25	0.00	***
Dummy NMS	12.98	0.00	***						
Dummy agglomerated regions	6.96	0.00	***	-2.10	0.00	***	-2.64	0.00	***
λ	0.94	0.00	***		-		0.82	0.00	***
Number of observations	249			249			249		
Robust Lagrange multiplier test for spatial lag error[1]	46.98	0.00	***				20.09	0.00	***
Estimation method	Spatial error			OLS			Spatial error		
Robust standard errors	Yes			Yes			Yes		
R^2	0.33			0.32			0.37		

1: results of the spatial lag model LM test are not reported, being uniformly less significant than the LM tests for the spatial error model.

Part C
Scenario assumptions in the MASST3 model

1. Introduction and methodology

This part of the report presents the quantitative target values imputed in the MASST model to simulate the baseline and the three exploratory scenarios.

The scenarios are those presented in the main section of the report, and this section explains how they were translated into quantitative assumptions.

The MASST model has been described in detail in the previous part of this report. The interest in this part is not to present the MASST model in detail, but to underline how scenarial assumptions are translated in MASST.

This section describes the link between the qualitative and quantitative assumptions. In particular, it states the quantitative assumptions behind each scenario that represent the levers of the model. Technically speaking, these represent the target variables to which the model tends in 2030, i.e. long-term values of the exogenous variables to which each initial regional and national variable will tend on the basis of the following formula:

$$x_t = x_{t-1} + s(T - x_{t-1}) \qquad (1)$$

where x is the value of the exogenous territorial variable for a given region/country, T is the long run (target) value to which the variable converges, and s is the speed of adjustment. A value of 1 in the speed of adjustment implies an immediate adjustment (in one year) of the variable to its target.

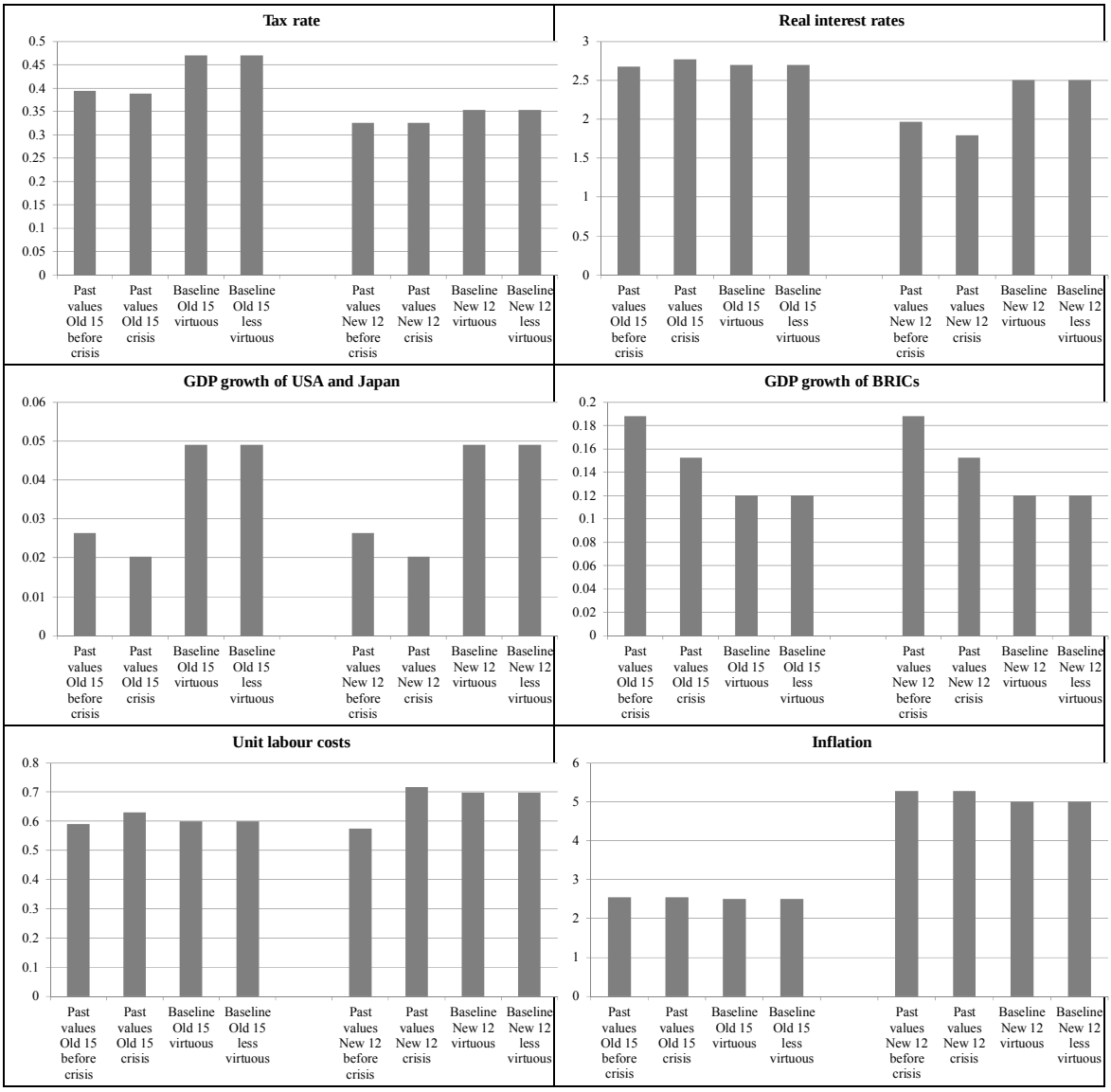
The target values can be the same for all geographical units (for example, at national level, the growth rate of public expenditure in our first scenario), or they can be different for each geographical unit and entered as a vector (for example, at regional level), or they can be differentiated by regional/country typologies.

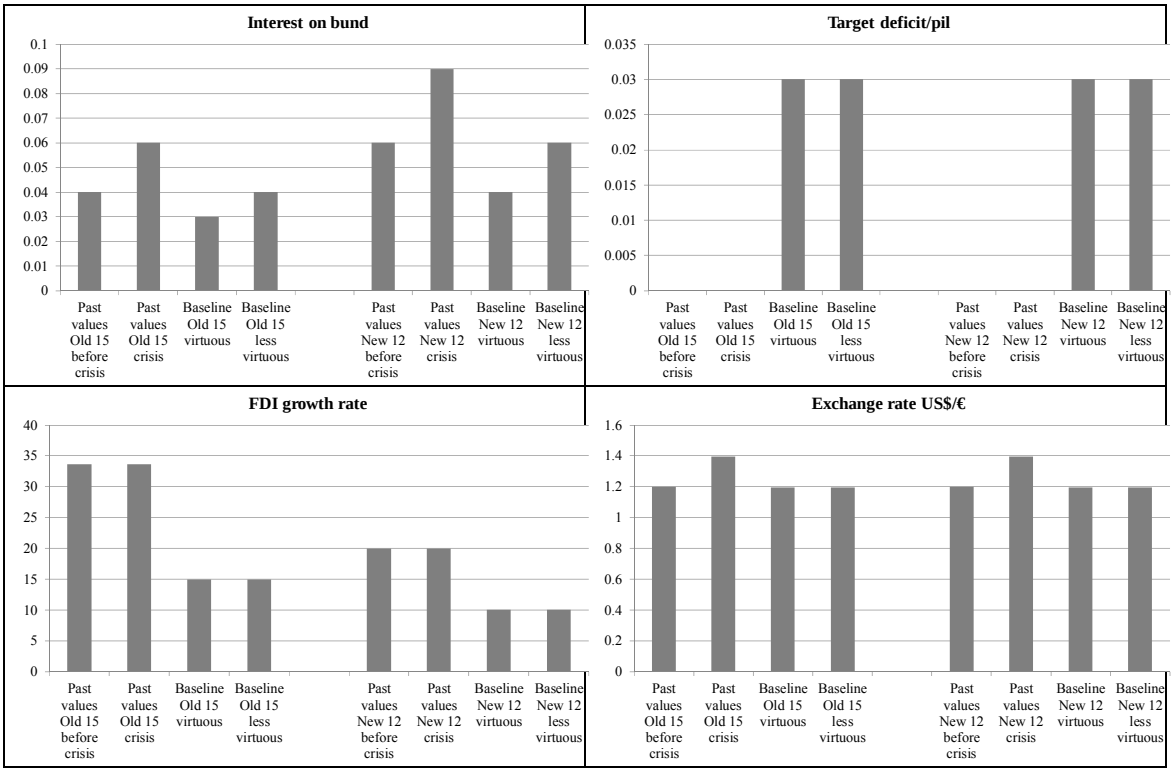
Although the targets are mechanisms with implicit convergence, the structure of the MASST model ensures that the pattern of variables is different for each region and each country at the beginning of the simulation period as well as at its end.

Although the quantitative assumptions on the target values of the exogenous variables of the model are defined subjectively, they respond to a very strict logic and to solid constraints. General consistency is required – and pursued – in the entire logical chain linking the general characteristics of each scenario to the potential trend in the main macroeconomic, technological and social variables – our so-called ‘driving forces’.

2. National targets in the Baseline scenario and recent values

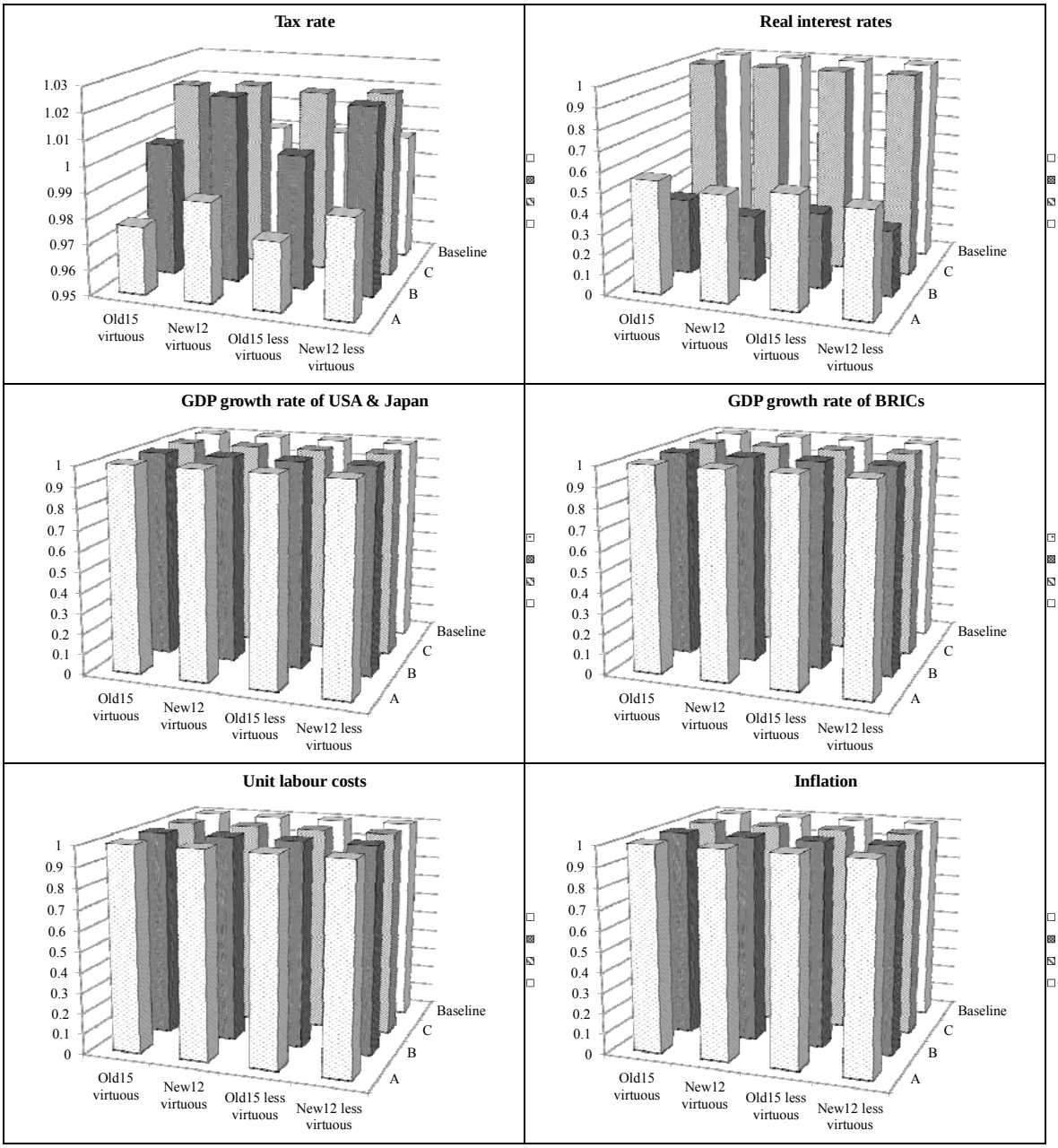
This section presents one histogram graph per group of macroeconomic assumptions in the baseline scenario.
In each graph, the past values of the variable are presented on the left and, on the right, the quantitative assumptions are illustrated. Past values and scenarial assumptions are differentiated by group of countries.

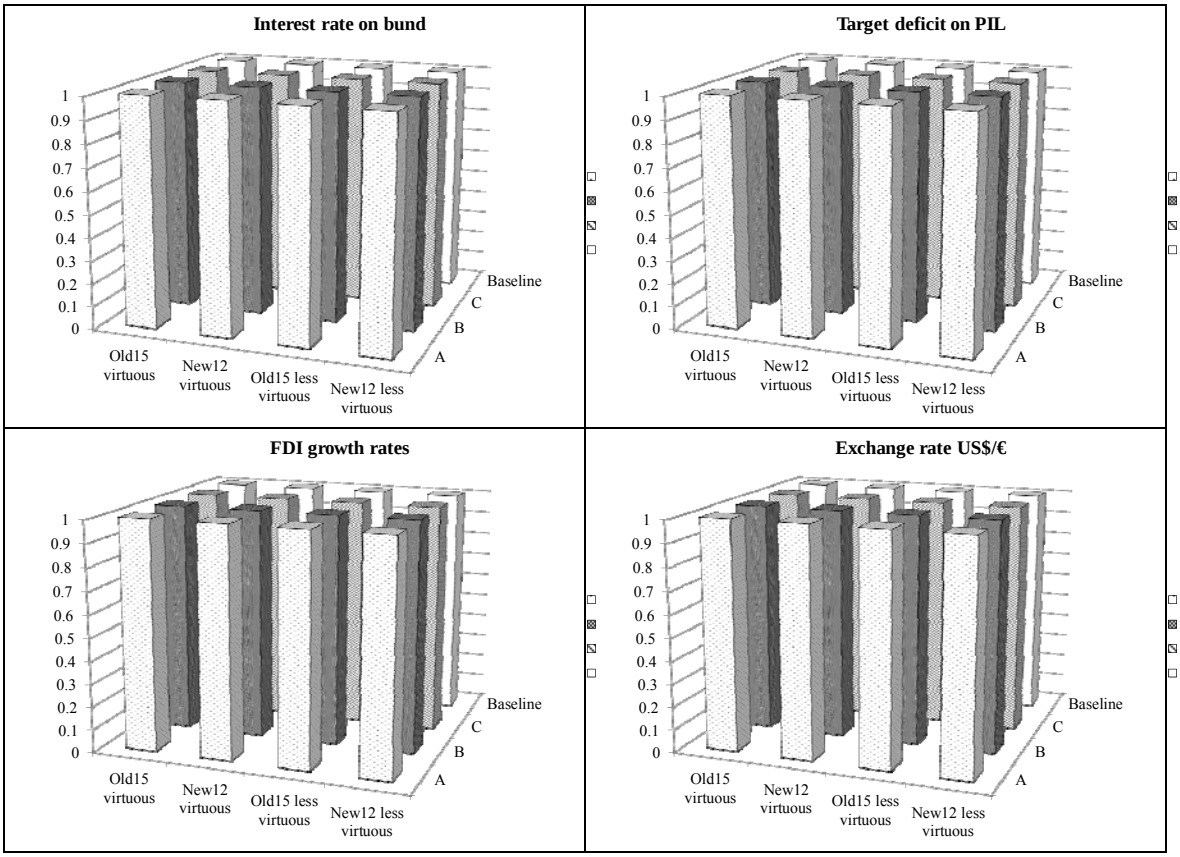



Interest on bund
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Past values Old 15 before crisis
Past values Old 15 crisis
Baseline Old 15 virtuous
Baseline Old 15 less virtuous
Past values New 12 before crisis
Past values New 12 crisis
Baseline New 12 virtuous
Baseline New 12 less virtuous
Target deficit/pil
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Past values Old 15 before crisis
Past values Old 15 crisis
Baseline Old 15 virtuous
Baseline Old 15 less virtuous
Past values New 12 before crisis
Past values New 12 crisis
Baseline New 12 virtuous
Baseline New 12 less virtuous
FDI growth rate
40
35
30
25
20
15
10
5
0
Past values Old 15 before crisis
Past values Old 15 crisis
Baseline Old 15 virtuous
Baseline Old 15 less virtuous
Past values New 12 before crisis
Past values New 12 crisis
Baseline New 12 virtuous
Baseline New 12 less virtuous
Exchange rate US$/€
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
Past values Old 15 before crisis
Past values Old 15 crisis
Baseline Old 15 virtuous
Baseline Old 15 less virtuous
Past values New 12 before crisis
Past values New 12 crisis
Baseline New 12 virtuous
Baseline New 12 less virtuous

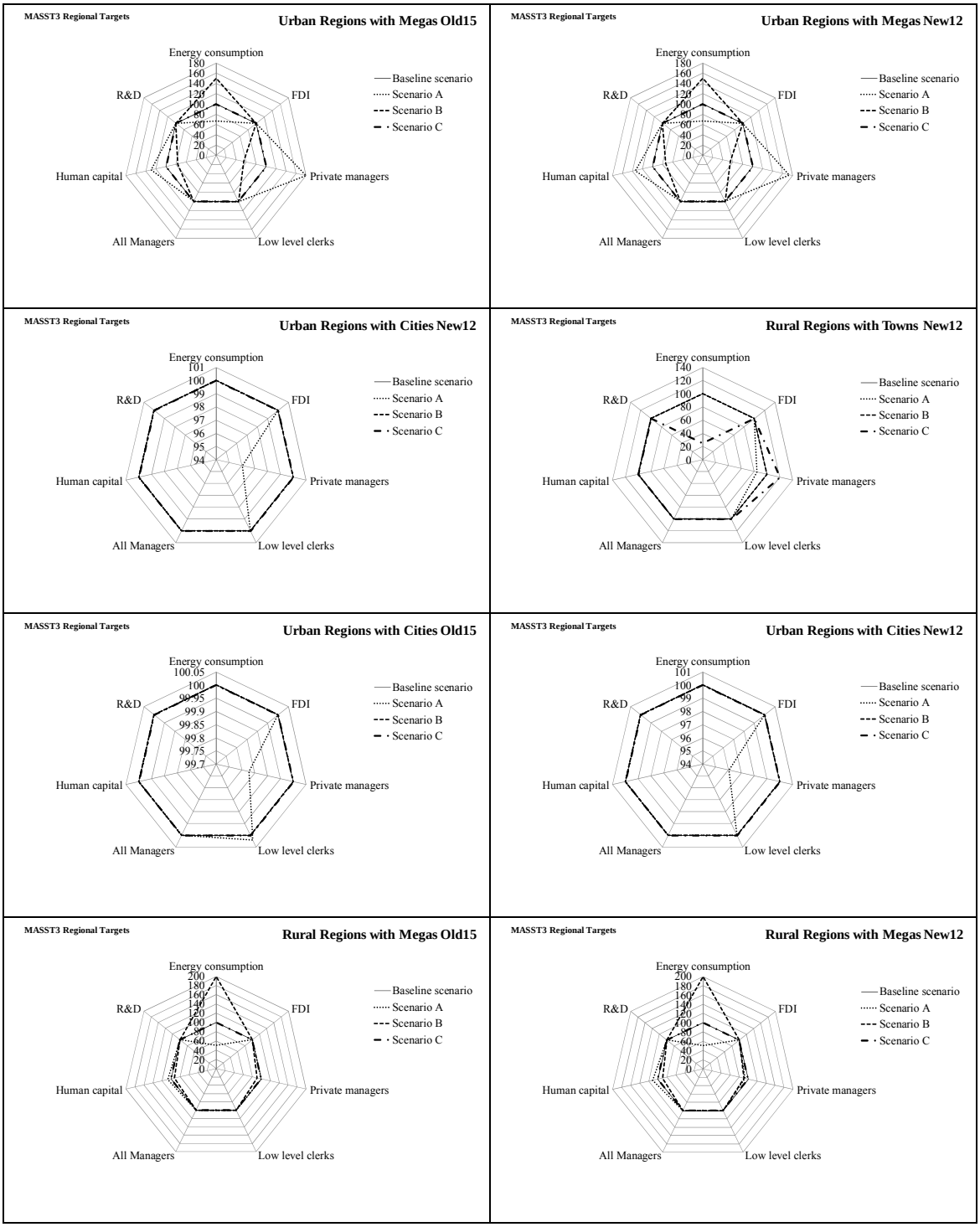
3. National targets in the exploratory scenarios. Baseline = 1

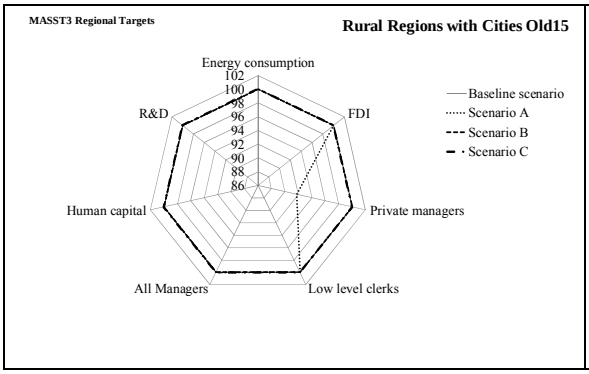
The graphs of this section present the quantitative assumptions of the three thematic scenarios with respect to the baseline for the national part of the Masst3 model.
For each variable and each group of countries, the target in each scenario is presented with respect to the one of the baseline scenario, normalized to 1.
(Notice that exploratory scenarios are mostly territorial scenarios and as such are not different regarding a number of external macroeconomic conditions).

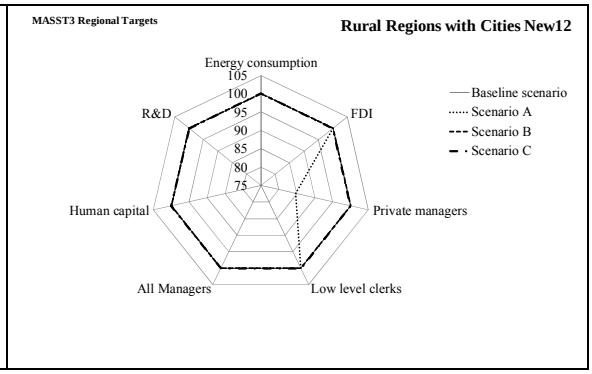



Interest rate on bund
Target deficit on PIL
FDI growth rates
Exchange rate US$/€
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
Old15 virtuous
New12 virtuous
Old15 less virtuous
New12 less virtuous
Baseline
C
B
A

4. Regional targets in the exploratory scenarios, by regional typology. Baseline = 100




MASST3 Regional Targets
Rural Regions with Cities Old15
Energy consumption
FDI
Private managers
Low level clerks
All Managers
Human capital
R&D
102
100
98
96
94
92
90
88
86
Baseline scenario
Scenario A
Scenario B
Scenario C


MASST3 Regional Targets
Rural Regions with Cities New12
Energy consumption
FDI
Private managers
Low level clerks
All Managers
Human capital
R&D
105
100
95
90
85
80
75
Baseline scenario
Scenario A
Scenario B
Scenario C

Part D
MASST3 model results for the Baseline and the three exploratory scenarios

1. Introduction

This part of the report contains the final results of the quantitative scenarios obtained by running the MASST3 model with the assumptions of the Baseline scenario and of the three exploratory scenarios presented in the main report. The purpose of the MASST3 model is in fact to create territorial scenarios under different assumptions about the main socio-economic driving forces of change that will act in the future.

A word of attention is needed to interpret the results in the right way. The model is not created (and therefore not able) to produce economic forecasts; the quantitative results of the model are therefore not precise values of specific economic variables in the future, on the basis of extrapolations of a system of past socio-economic relations, but depict the ***tendencies and relative behavioural paths*** of regional GDP growth (and regional employment growth) in each individual region under certain conditions, i.e. probable states of the system that may become real under certain conditions that are exogenously assumed. In a scenario-building of this kind, the existence of the MASST model guarantees that the results are neutral vis-à-vis the assumptions, since they are based on the structural relationships that hold together the economic system in an objective way (estimates). Used with such a purpose, it is not a short-term forecasting tool, but a long-term quantitative foresight model.

The MASST3 results for the four scenarios are calculated for the ESPON space (31 countries)[9] as an aggregate and at NUTS2 level; ***for the period 2011 – 2030*** MASST3 produces:

- the annual average GDP growth rates;
- the annual average total employment growth rates;
- the annual average industrial employment growth rates;
- the annual average service employment growth rates.

[9] The MASST3 model produces results for the 27 EU Member Countries. The four EFTA countries (Switzerland, Liechtenstein, Norway and Iceland) have been introduced in the quantitative foresights on the basis of a simplified, extrapolative / comparative sub-model. Complete results, integrating the MASST3 outcome with extensions to the four countries sub-model outcome, are provided in this report.

2. Aggregate results of the Baseline scenario

Table D1 presents the aggregate results of the average annual growth rates between 2011 and 2030 of GDP, total employment, industrial and service employment, and population, for the 31 ESPON countries as a whole. The same results are presented for two groups of countries:

- the old (EU15), plus the four ESPON countries that do not belong to the EU, namely Switzerland, Norway, Liechtenstein (from now on mentioned as western countries);
- the new member states countries, those that joined the EU in recent times (from now on mentioned as New 12 countries).

Table D1. Aggregate annual average growth rates between 2011 and 2030 Baseline scenario

	GDP	Total employment	Manufacturing employment	Service employment
31 ESPON countries	1.89	1.58	1.38	1.63
Western countries*	1.88	1.53	1.48	1.54
New 12	1.93	1.90	0.98	2.33

** Old 15 member countries plus Switzerland, Iceland, Norway and Liechtenstein*

The aggregate results already depict interesting messages:

- the *baseline scenario registers an average GDP growth rate of 1.89%*, which is slightly lower than the long run trend for Europe, because of the slow coming out of the crisis;
- *the New 12 countries register a slightly higher annual average GDP growth with respect to the western countries* (1.93%,), but the moderate increase signals that convergence rate toward western countries will decrease;
- *employment grows at a sustained rate in Europe, meaning that large part of the recovery from the crisis comes from job creation*. Part of the recovery, however, also comes from productivity gains, as signalled by the larger increase of GDP with respect to employment;
- *productivity gains are particularly present in western countries with respect to the New12 countries, where GDP growth mostly takes place through employment creation*. Despite the negative population growth rates in this part of Europe, labour force is made available from employees leaving the agricultural sector (if Eastern countries' contribution of agriculture to total GDP decreased from 11% in the 1990 to 6% in the 2008, it is still higher than western countries' one, which is around 2.4% in 2008) and from unemployed people returning to work;
- *productivity gains are limited in New 12 countries* mainly for two main reasons: i) the traditional reconversion from agriculture to manufacturing activities that has characterised these countries since the fall of the Iron curtain is now more contained (the share of agriculture reached 6% of total GDP, and therefore the more contained shifts to industrial activities generate more limited productivity gains than before); ii) New 12 countries are characterised by a shift of employment from manufacturing to services, evidencing a clear new stage of development from industry to services; however, this industrial reconversion does not bring with it

gains in productivity, being the new services low-value added services, like commerce;

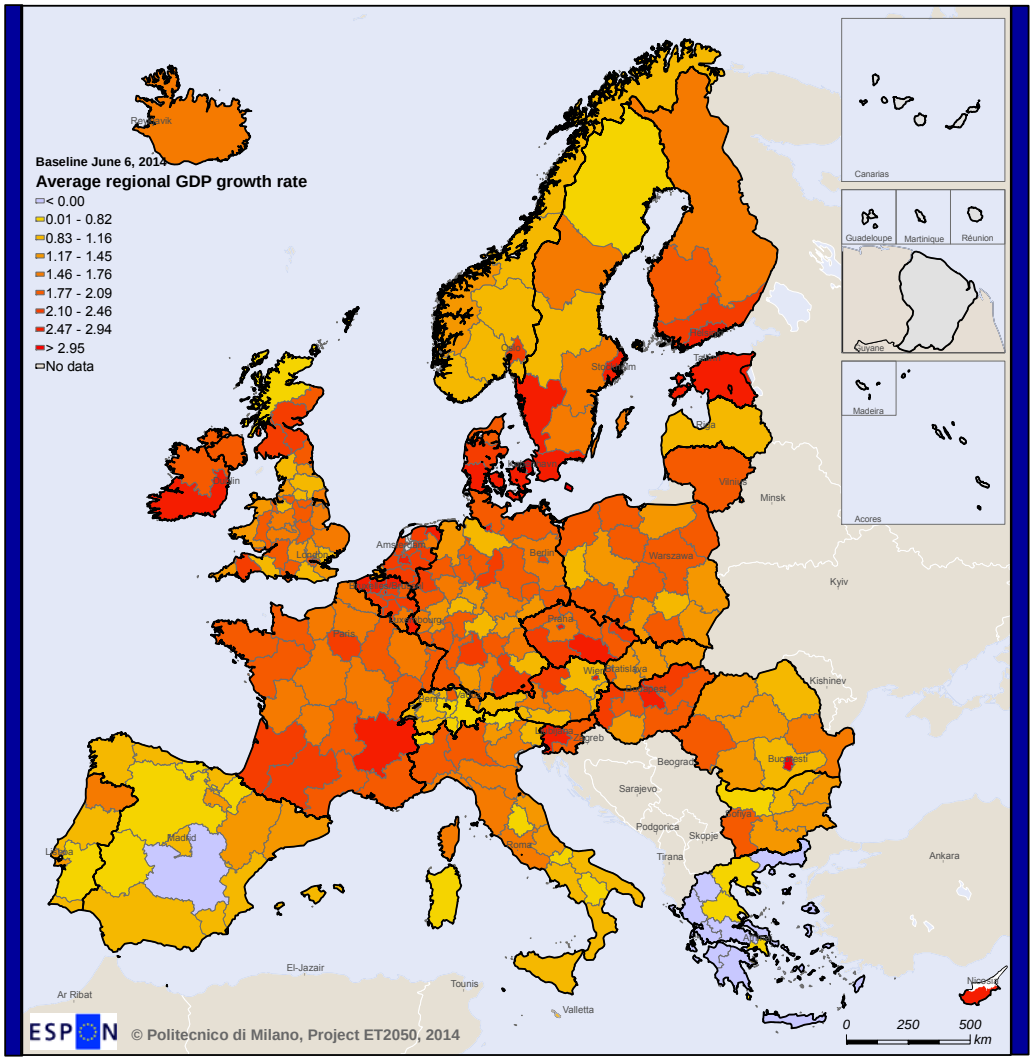
- *a more contained positive trend in employment growth accompanies growth in western countries*. In these countries, contrary to the New 12, an increase in productivity is evident, showing a higher GDP growth rate than the one in employment;
- *an equilibrated increase of both manufacturing and service activities characterises western countries*. This suggests that a process of reindustrialization will take place in these countries, a process that can find explanations in lower salaries as a result of the long crisis the crisis, and a slowing down in off-shoring processes, especially towards Eastern countries, the latter will more and more suffer from the constant erosion of their relative advantage in low labour cost;
- *in western countries manufacturing increases mostly in traditional manufacturing industries, re-launching entrepreneurship of high quality*, as the productivity gains suggest.

3. Regional results of the Baseline scenario

All the results described above are spatially differentiated at Nuts2-2010 level, and reported in Maps D1 and D2. Map D1 depicts the annual average regional GDP growth rate in the baseline scenario, showing that:

- *GDP growth is positive in all European regions*, with the exception of a very limited number regions in southern Europe, where the recovery after the crisis is not able to overcome the negative effects of the crisis in the first years of the period 2011-2030. These regions are the rural areas of Greece and Castilla-La-Mancha in Spain;
- in terms of GDP growth rate, there is a *two speed Europe*, since regions belonging to southern peripheral countries grow in general significantly less than northern countries. Southern European countries discount the difficult present conditions on their future evolutionary trajectories and their post-crisis growth is insufficient to recover with respect to other countries where the crisis is felt mildly;
- the *convergence process by New12 countries is incomplete* – since these countries are only slightly outperforming the Western ones – and is uneven, since also within the New12 countries GDP growth rates are differentiated. Eastern European countries still grow more than the others, but this is not enough to catch up with the GDP per capita levels of the Western countries by 2030;
- *intra-national regional disparities increase* in all countries, in New 12 and in Western ones. The regions with the capitals, the regions with the largest cities, and the more central regions at national level generally outperform the regions which are more rural and peripheral at national level. This is especially evident in Bulgaria and Romania, where Sofia, Bucharest and, to a lower extent, Timisoara are winners at the national level; France, where the highest rates are in Paris, Lyon, Toulouse and Bordeaux; Italy, where the differential between the richer North and the poorer Mezzogiorno increases; Greece, where the three regions with positive growth rates are Attiki, Thessalia and Kentriki Makedonia.

Map D1: Annual average GDP growth rate in the Baseline scenario



EUROPEAN UNION
Part-financed by the European Regional Development Fund
INVESTING IN YOUR FUTURE

Regional level: NUTS2
Source: Politecnico di Milano, 2014
Origin of data: - MASST3 model
© EuroGeographics Association for administrative boundaries

As a result of these trends, total disparities increase, as the effect of very small decrease of disparities between countries and a significant increase of disparities within countries, although the former remain bigger than the latter in absolute terms (Fig. D1).

Maps D2a, D2b and D2c depict the annual average regional employment growth rates in the baseline scenario, distinguishing between total employment, manufacturing employment and service employment. Total employment growth map (Map D2a) evidences the following trends:

Map D2: Annual average total employment, manufacturing employment and service employment growth rate in the Baseline scenario

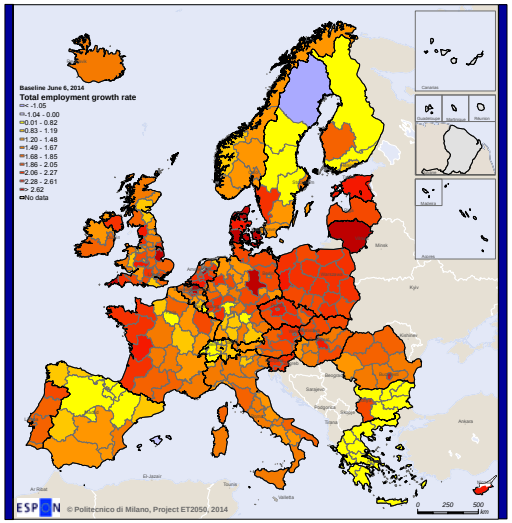
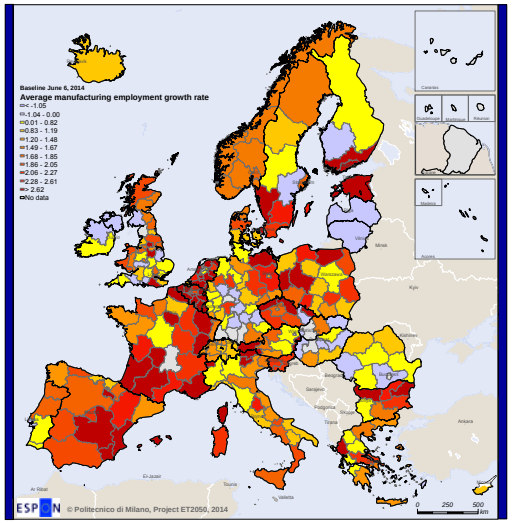
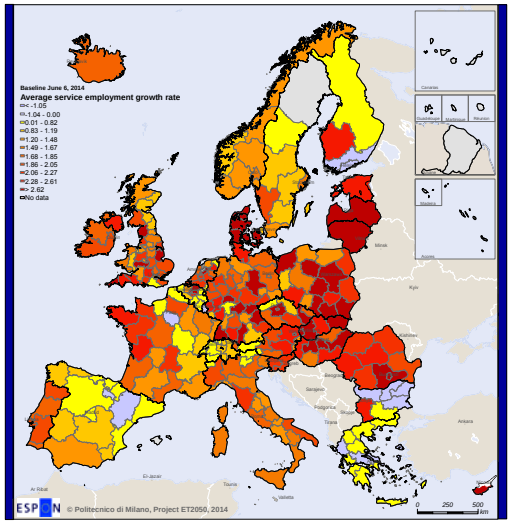
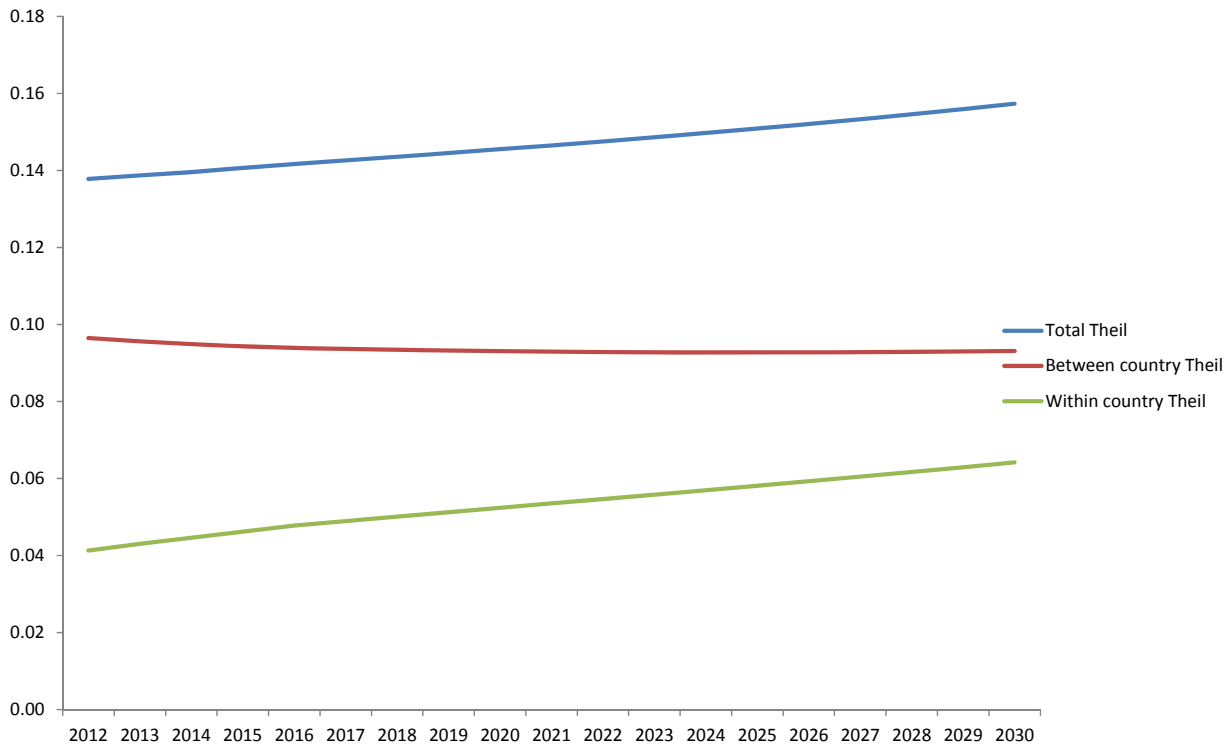
D2a	D2b	D2c
 Regional level: NUTS2 Source: Politecnico di Milano, 2014 Origin of data: - MASST3 model © EuroGeographics Association for administrative boundaries	 Regional level: NUTS2 Source: Politecnico di Milano, 2014 Origin of data: - MASST3 model © EuroGeographics Association for administrative boundaries	 Regional level: NUTS2 Source: Politecnico di Milano, 2014 Origin of data: - MASST3 model © EuroGeographics Association for administrative boundaries

Figure D1: Theil index in the Baseline scenario



- *employment growth is substantially positive* in all Europe, with just two exceptions in Övre Norrland and the Baleares, confirming the general result which interprets employment creation as the major channel for exiting the crisis;
- *employment creation is especially strong in New 12 countries*, with the exception of the rural areas of Bulgaria. Regions in these countries grow thanks to the creation of new jobs, because, having already almost completed the restructuring of their manufacturing systems, they will tend to create jobs, especially in the service sector, including jobs in low value added services to people;
- also *in the regions of Southern Europe there is positive employment growth*, although lower than in the rest of Europe. This contributes to reducing the unemployment generated by the crisis, and, being accompanied by weak productivity growth, it rarely takes the form of high employment. Prolonging the present trend, salary flexibility substitutes exchange rate flexibility;
- *within the countries of western Europe, employment grows most in second rank city areas*, and generally grows little in core areas with the highest GDP growth. In the latter, in fact, growth is driven by productivity, while in non-core areas lower level employment can be the result to ease the problems of unemployment generated by the crisis;
- *within the New 12 countries, core and capital regions have higher employment growth rates* in addition to higher GDP growth, but the *growth of employment is less concentrated* with respect to the one of GDP, meaning that productivity growth is higher in the core regions.

Additional insights on the Baseline scenario are obtained by looking at the results on manufacturing and service growth rates presented in Map 2b and 2c, namely:

- *manufacturing employment growth is positive in most regions of Europe*, due to the re-industrialization of most countries and the in-shoring of manufacturing activities;
- manufacturing employment growth is higher in Western countries than in New 12 countries, where the benefits of attractiveness in manufacturing mostly have already been exploited in the past and the growth shifts towards services in the scenario;
- *in western countries, many core areas are able to create manufacturing employment*, including Paris, London, Frankfurt, Munich, Brussels, Helsinki. However, this pattern has some exceptions, such as Lisbon, Wien and Berlin;
- *in New 12 countries, manufacturing growth is especially weak in core and capital regions*, which grow through a reconversion to services of their economy, while it remains positive and significant in lower order regions, which can still exploit their lower labour costs;
- *service employment growth is high in almost all regions of Europe*, and especially high in the regions of New 12 countries, which shift towards services after having attracted manufacturing activities before the years of crisis;
- southern European countries, especially Spain and Greece, are among those less able to create service employment. For Greece especially, this signals the limited re-launch in its sector of specialization, tourism, a trend that contributes to explain their weak performance in terms of GDP;
- particularly *high is service employment growth in the core and capital regions of New 12* countries, since these areas are upgrading their service sector, while the rest of their countries creates service jobs with lower value added;
- in Western countries, service employment growth is high in second rank regions and cities, which are able to attract low value added services, and lower in most core regions, which externalize the same low value added services.

4. Aggregate results of the three exploratory scenarios

In this part of the report we present the results for the three exploratory scenarios, namely the "Megas/Flows", the "Cities" and the "Regions" scenarios. In Box 1 we briefly sketch the assumptions on which they are based.[10]

Box D1. Sketch of assumptions for the three exploratory scenarios

"Megas/Flows" scenario
Market driven scenario; welfare system fully privatized; financial debt repaid in 2030; budget reduced for cohesion policies; concentration of investments in European large cities.

"Cities" scenario
Public policies mostly at national level; actual welfare system reinforced through increased taxation; financial debt not fully repaid in 2050; budget maintained for cohesion policies; concentration of investments in second rank cities.

"Regions" scenario
Social policies; strong public welfare system; financial debt repaid in 2050; budget significantly increased for cohesion policies; concentration of investments in rural and cohesion areas.

As developed for the Baseline scenario, aggregate results for the ESPON space and for the western and New12 countries are presented before moving to the regional results. Table D2 presents the annual average GDP growth rate, both in absolute terms and with respect to the baseline, of the three exploratory scenarios, while Table D3 presents the annual average growth rates with respect to the baseline of the three scenarios for what concerns total employment, and its subdivision between manufacturing and service.

Table D2. Annual average GDP growth rates – 2011-2030

Aggregates	Baseline	Megas	Cities	Regions	Megas vs. baseline	Cities vs. Baseline	Regions vs. Baseline
Espon 31 countries	1.89	2.22	2.31	1.82	0.33	0.42	-0.06
Western countries	1.88	2.22	2.31	1.81	0.34	0.43	-0.07
New 12 countries	1.93	2.22	2.23	1.98	0.30	0.30	0.05

The "Cities" scenario is the most expansionary scenario in terms of GDP, followed by the "Megas" scenario and then by the "Regions" scenario, and this holds particularly for western countries, although also the New 12 countries show a strong similarity between the "Megas" and the "Cities" scenarios. The higher expansion of growth in the "Cities" scenario can be explained by the higher and more efficient exploitation in this scenario of territorial capital elements, of local specificities, present in both large and second rank cities that allows local economies to achieve higher competitiveness. Development based also on second rank cities implies the existence of an integrated and equilibrated urban system, made of efficient second rank cities working with first rank cities in providing quality

[10] For an in-depth description of the three exploratory scenario assumptions, see the first annex to the interim report (October 2012), entitled "Structuring of Exploratory Scenarios, Territorialisation and Use of Wild Cards", pp. 201-202.

services and allowing the latter to avoid strong diseconomies of scale that can be of detriment to growth. The weak presence of equilibrated and efficient urban systems in the Eastern countries may explain why these nations register very similar growth rates between the “Megas” and the “Cities” scenarios, being both the result of growth based on efficient first rank cities. With respect to the baseline, New12 countries gain the same from a “Megas” and a “Cities” scenario, while the western countries have a clear higher advantage from the “Cities” scenario than from a “Megas” scenarios when compared to the Baseline.

The “Regions” scenario tells a different story: ESPON space countries as a whole gain less from this scenario than from the Baseline scenario. When the average growth rate is divided between western and New 12 countries, the advantage that the latter countries achieve with respect to the baseline emerges, confirming that when cohesion policies are reinforced, their effect is visible. However, the “Regions” scenario is not the one from which the New 12 countries gain the most compared to the Baseline; both the “Megas” and the “Cities” scenarios register higher growth rates than the “Regions” also for the New 12 countries. This result underlines the importance of a “competitiveness” driven attitude, and at the same time reminds the relatively lower effect of cohesion policies when they are not accompanied by an endogenous effort in moving towards competitiveness. The two combined aspects, cohesion policies from one side, and local competitiveness from the other, can probably be the best recipe for growth.

When trends in employment are analysed with respect to the Baseline (Table D3), other interesting messages emerge, namely:

- the “Megas” scenario registers a higher manufacturing than service employment growth rate, and this is particularly true for western countries;
- in the “Cities” scenario, service employment is more expansionary than manufacturing, and this is particularly true for the New 12;
- the “Regions” scenario is characterised by a higher manufacturing employment growth rate than the other two scenarios in the New 12 countries, while western countries register a higher service employment growth rate than the manufacturing one.

These results suggest that each scenario is accompanied by a relative increase of a specific industrial profile in each block of countries. The most competitive scenario, namely the “Megas” scenario, is in favour of a reindustrialization process all over, and especially in the western countries, being a scenario based on a re-launch of new technological paradigms, higher rhythm of innovation, higher productivity linked to an increased share of high-level functions. The “Cities” scenario registers a higher expansion of service employment with respect to the baseline; being a more spatially diffused scenario, both population and business services are required all over Europe. In the “Regions” scenario, the trends in the sectoral profile are different between western and Eastern countries; the high social welfare requirements call for additional population services in western and eastern countries, but the latter benefit from additional cohesion funds for the re-launch of industrial activities.

Table D3. Annual average growth rate (2011-2030) with respect to the baseline of GDP, total employment, manufacturing and service employment

Aggregates	GDP	Total employment	Manufacturing employment	Service employment
		"Megas" scenario		
Espon 31 countries	0.33	0.34	0.74	0.23
Western countries	0.34	0.35	0.82	0.24
New 12 countries	0.29	0.25	0.41	0.19
		"Cities" scenario		
Espon 31 countries	0.42	0.38	0.28	0.41
Western countries	0.43	0.38	0.31	0.40
New 12 countries	0.30	0.37	0.12	0.46
		"Regions" scenario		
Espon 31 countries	-0.06	-0.03	-0.30	0.04
Western countries	-0.07	-0.03	-0.40	0.04
New 12 countries	0.05	0.00	0.09	0.05

5. Regional results of the "Megas" scenario

The Megas scenario is more expansionary with respect to the baseline, with a GDP growth rate which is 0.33% higher. This differential growth is higher for the Western countries (+0.34%) with respect to the New 12 countries (+0.29%).

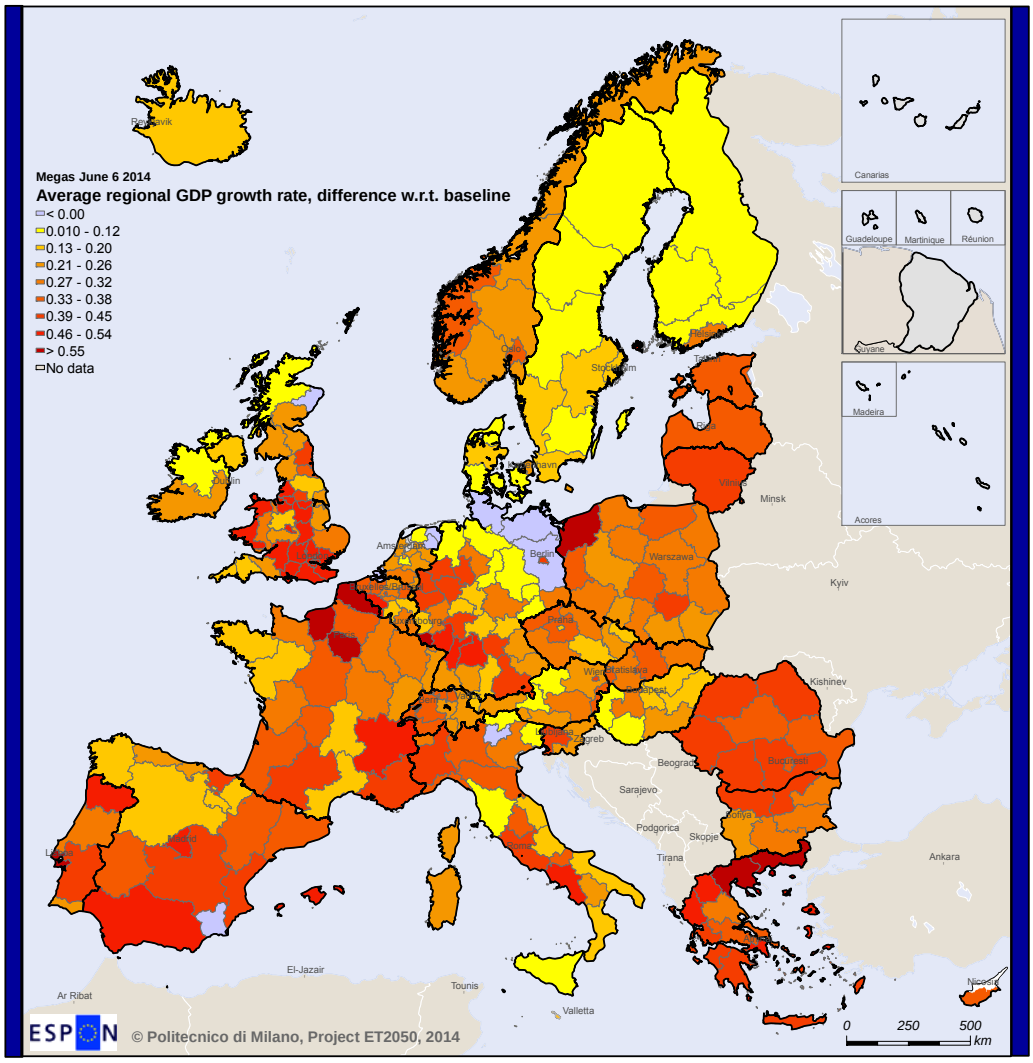
The difference in employment growth is similar to the one of GDP in the two groups of countries, meaning that, on aggregate, this scenario has the same productivity growth than in the baseline, but is able to create more employment.

The difference in employment creation is higher in manufacturing (+0.74%) with respect to services (+0.23%), and this effect is stronger for the Western countries with respect to the New 12 countries. Market oriented policies are hence able to produce results more for the countries which currently hold higher functions at European level.

At regional level, the average annual GDP growth rate is differentiated and presented in Map D3. The map evidences that:

- *GDP growth is higher with respect to the baseline scenario in all countries of Europe, but not necessarily in all regions*. In fact, there are some peripheral areas of western countries, such as North Eastern Scotland, Murcia, Drente, Groningen, Schleswig-Holstein, Mecklenburg-Vorpommern, Brandenburg and Trento, where GDP growth is lower than in the baseline due to the fact that these regions are just crossed by the major corridors without being nodes;
- at national level, *some countries appear to gain more than the others*. In particular, gain is lower in Nordic countries (Sweden, Finland and Denmark), while, unexpectedly, southern countries, including Portugal, Spain and especially Greece are not particularly damaged by a competitiveness scenario like the "Megas". These countries appear to take advantage of a re-launch of the European economy, increasing their demand for exports, able to overcome the still weak internal market;
- as expected by a scenario of policy concentration, within western countries *the highest gains in GDP growth rate are experienced in the most important urban poles*, including London, Manchester, Paris, Lyon, Madrid, Lisbon, Porto;
- however, the gain in GDP growth is also high, and in some cases even higher, in some urban second rank areas, such Karlsruhe, Rheinhessen-Pfalz, Hampshire, Berkshire, Buckinghamshire and Oxfordshire, Campania, Piedmont. This means that *the Megas scenario favours the drivers, but not only;* thanks to growth spillovers, input-output linkages, increased demand, *development spreads to the rest of the regions*;
- *in New 12 member countries* the gain in GDP growth rate is more evenly distributed than in western countries, and *core and capital regions are indeed winners but not more than their respective countries*. This is due to the fact that growth in these countries has been concentric in the past and continues to be concentric in the Baseline scenario, so that an increase of demand and production as the one of the Megas scenario cannot be confined within the core areas but needs to be spread elsewhere.

Map D3: Annual average GDP growth rate in the Megas scenario: difference with respect to the baseline



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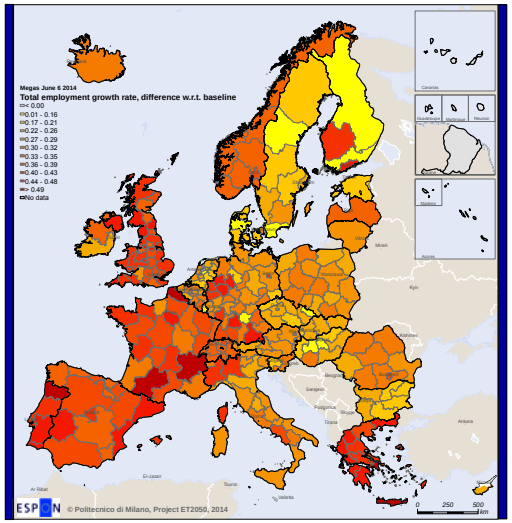
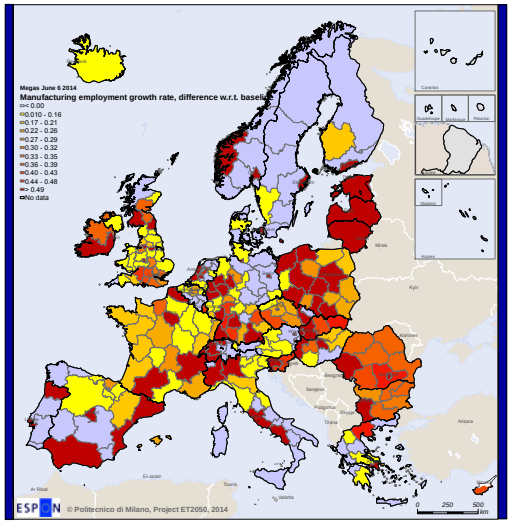
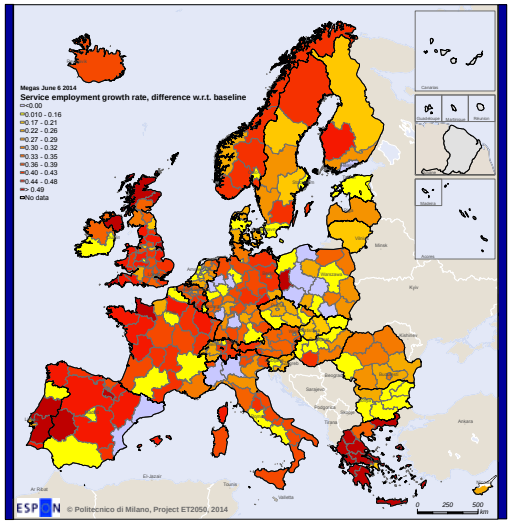
Maps D4a, D4b and D4c depict the differential of annual average regional employment growth rates between the Megas and the Baseline scenario, distinguishing between total employment, manufacturing employment and service employment.

Map D4: Annual average total employment, manufacturing employment and service employment growth rate in the Megas scenario

D4a	D4b	D4c
		

Map D4a presents the difference in total employment growth and evidences some interesting trends:

- *the differential of employment growth is larger in western with respect to New 12 countries*. The latter do not have the same high differential GDP in the first instance, but also appear to have more productivity gains;
- as with GDP, Nordic countries are relatively lesser winners, and southern countries are among the major winners, thanks to increased external demand;
- at regional level, *the gains of employment growth in western countries are diffused*, and all regions are positive, but the regions with the largest increases are generally regions hosting large urban areas, although not necessarily the largest of their countries, such as Lyon, Toulouse, Lille, Munich, Stuttgart, Hannover, Helsinki, Barcelona and Porto;
- *in New 12 countries, the gains of employment growth are even more diffused* than in the western countries, and regional differentials are weak, with core and capital regions performing similarly to the rest of the country. This confirms the spread effect of GDP growth.

Maps D4b and D4c are able to separate the differences of employment growth (between the Megas and the Baseline scenario) in manufacturing and service employment, highlighting some interesting trends:

- *manufacturing employment growth is highly concentrated, especially at regional level, in the regions with the most important areas of their respective countries*. Dublin, London, Birmingham, Manchester, Liverpool, Glasgow, Paris, Lille, Lyon, Toulouse and Bordeaux, Amsterdam, Rotterdam, Munich, Stuttgart, Köln, Copenhagen, Stockholm, Helsinki, Wien, Milan, Turin, Rome, Naples, Athens, Madrid, Barcelona, Lisbon are all the best performers of their respective countries. This is due to the fact that manufacturing is more advanced in this scenario with respect to the past and to the Baseline scenario, it involves a larger use of innovation and hence involves an increased share of high-level functions;
- the same pattern also applies *in New 12 countries,* where *manufacturing employment growth is concentrating in core and capital regions*, as evident in Prague, Bratislava, Budapest, Bucharest, Sofia, Warsaw, Lodz, Cracow;
- *rural and peripheral regions have a lower manufacturing employment growth*, as it concentrates elsewhere. This is true in the sparsely populated regions or Nordic countries, in Eastern Germany (with the obvious exception of Berlin), Highlands and Islands, Cornwall, Namur, Tyrol, Centro, Extremadura, the Italian Mezzogiorno, Dytiki Ellada;
- the gains of service employment growth are very different from those of manufacture. First of all, this indicator is less spatially concentrated, with gains more evenly spread and losses which are in a smaller number of regions;
- *a number of the metropolitan regions which gain high-level manufacturing-related functions, also expel low-level services*, and have in this way a negative differential of service employment growth. This is the case of Milan, Turing, Barcelona, Seville, Dublin, Stuttgart, Dortmund, Helsinki;
- however, *other metropolitan areas are able to also maintain their service employment*, although with lower differential growth rates if compared with the rest of the country. This happens in Madrid, Rome, Athens, Paris, London, Stockholm, Copenhagen, and all the capitals of New 12 countries;
- *service employment growth is high in third order regions, not necessarily peripheral, belonging to Western countries*: Central and Eastern France, all non-metropolitan Britain, Småland, Vali-Suomi, Centro (PT) and Alentejo. These regions appear to be hosting the low level services which are ejected from metropolitan and capital regions;

- *service employment growth is especially strong in Greece*, where the increased demand makes it possible an upsurge of tourism, fulfilling its potential in this sector. This is also one main reason behind the higher GDP growth with respect to the Baseline scenario;
- finally, *a small number of areas show a good balance between service and manufacturing employment growth rates, with positive gains in both*. This happens for example in the case of Auvergne, the English South-East, Freiburg and Tubingen.

6. Regional results of the "Cities" scenario

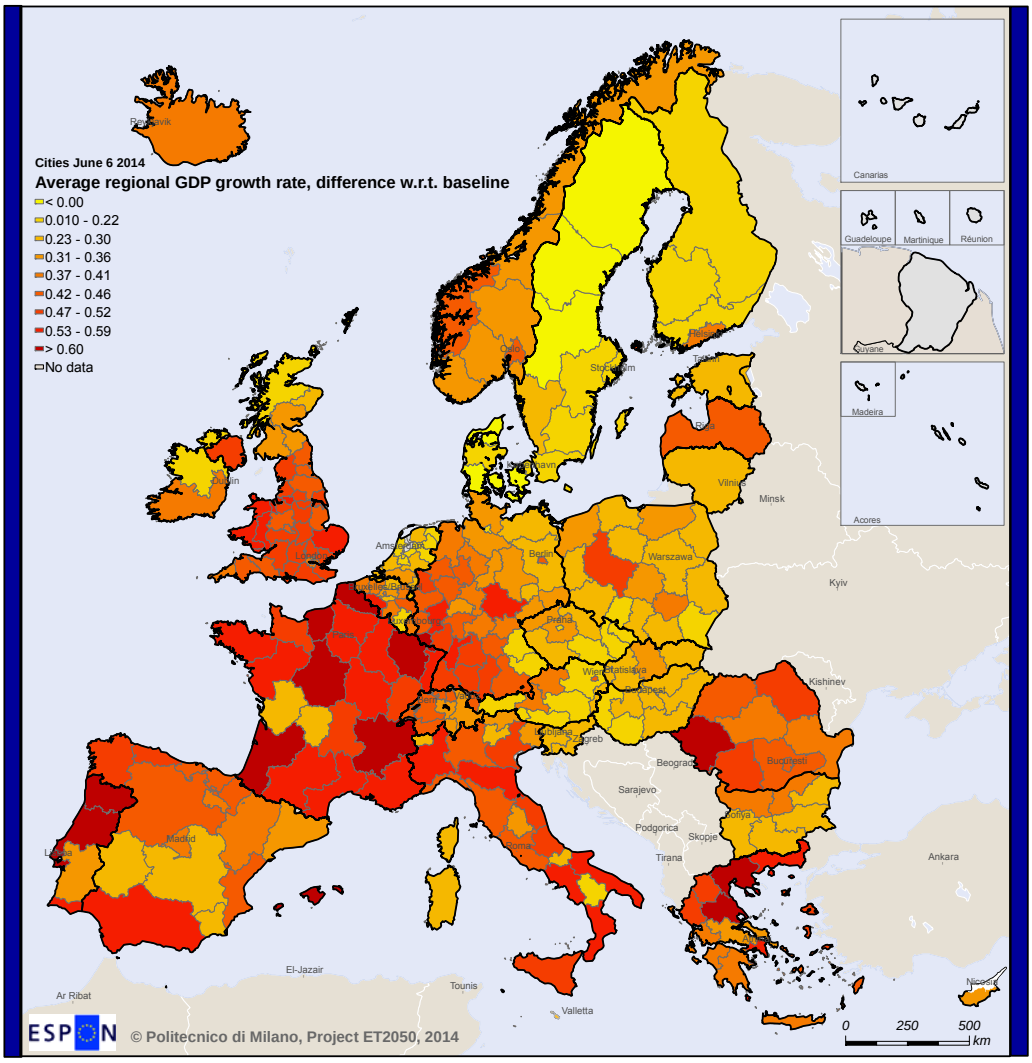
The Cities scenario is by far the most expansionary of the exploratory scenarios. At the aggregate ESON space level, regional GDP is expected to achieve sustained growth (the average annual GDP growth rate equals 2.31 per cent between 2012 and 2030), with a remarkable diffusion of the growth process, although a non negligible growth advantage characterizes western countries (the growth rate being higher by 0.08 in western countries).

This Scenario suggests a particularly remarkable performance for Southern European countries, namely Spain, Italy, Greece, and France. Altogether, these countries outperform core areas such as regions in Belgium, the Netherlands, and Austria, which benefit less from the realization of the Cities scenario with respect to the Baseline one.

Map D5 presents the spatial distribution of regional GDP growth rates. From this map and the analysis of the quantitative results of the foresight exercise, a few major conclusions can be inferred:

- the spatial distribution of regional GDP growth rates suggests a *rather original model of development, centered around districts, cooperation networks, and Small-Medium Enterprises (henceforth, SMEs)*. In fact, development takes place mostly in medium-large cities, where the presence of SMEs, industrial districts, clusters is relatively larger;
- *regions in New 12 countries tend to benefit vastly* from the implementation of this scenario, whereas the positive effects are comparable to those stemming from the more competitive "Megas" scenario. However, in Western regions the spatial distribution of GDP growth rates seem to be even more equal, because of the wider presence of second-rank cities in the EU15 (and, conversely, of the relative lack of such cities in New 12);
- *large metropolitan areas generate non-negligible spillover effects*, with scale dis-economies explaining the increasing intensity of economic activity in second-rank cities. As the latter tend to outperform the former, however, scale dis-economies affecting first-rank cities tend to decrease over time.

Map D5: Annual average GDP growth rate in the Cities scenario: difference with respect to the baseline



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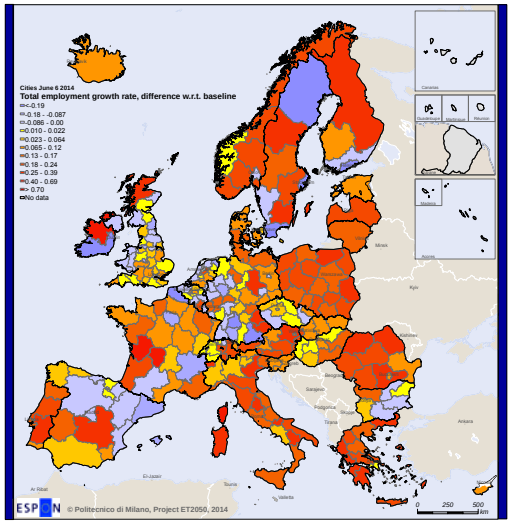
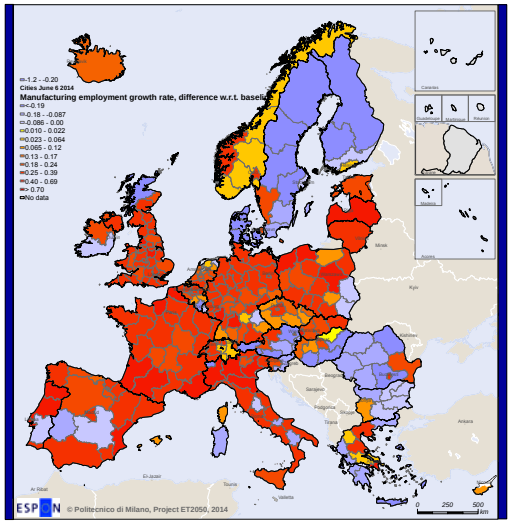
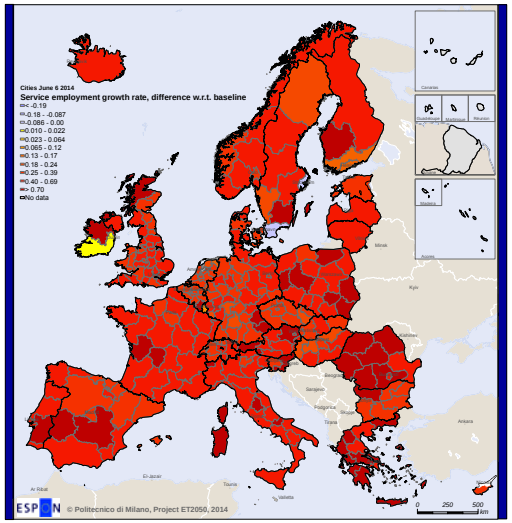
The results of the Cities Scenario simulation also present interesting findings in terms of employment growth rates (Maps D6a, D6b, D6c).

- Similarly to what has been found for GDP growth rates, *employment growth seems to be pervasively diffused over the whole ESPON space*. Employment growth rates are comparable between the western countries and New 12; it turns out to be relatively less pronounced in Germany, Czech Republic, Austria, Netherlands, and Belgium;
- manufacturing employment has a particularly remarkable development in countries such as France, Spain, Italy, the English regions in the UK, and in Baltic countries. However, Scandinavian countries, Bulgaria and Romania, and Greece present a

relatively weaker manufacturing employment growth rates with respect to the Baseline;

- the fact that this scenario is particularly expansive can also be proved by the relatively large number of regions where both manufacturing and service employment register positive medium-run (up to 2030) growth rates;
- in combination with the GDP growth rates map, employment maps suggest that *a few areas (namely, Southern Ireland with Dublin and Cork, and the metro areas of Stockholm and Malmö in Sweden) present remarkably high rates of productivity growth*, mainly because of an overall contraction of total employment, which is nevertheless matched by positive GDP growth;
- *this scenario tends to be manufacturing-driven*. Regions faring bad in manufacturing also tend to register mild GDP growth;
- analogously with what found for the "Megas" scenario, Greece benefits from an overall faster growth of European economies, doing particularly well in the service (and in particular, tourism) industry;
- finally, *areas registering negative manufacturing employment growth rates tend to substitute manufacturing employment with jobs in the service industry*; since overall productivity in this scenario tends, in the areas affected by this substitution process, to decrease, this suggests a process of substitution of jobs from relatively high productivity manufacturing activities to service ones with relatively low-function jobs.

Map D6: Annual average total employment, manufacturing employment and service employment growth rate in the Cities scenario

D6a	D6b	D6c
 Regional level: NUTS2 Source: Politecnico di Milano, 2014 Origin of data: - MASST3 model © EuroGeographics Association for administrative boundaries	 Regional level: NUTS2 Source: Politecnico di Milano, 2014 Origin of data: - MASST3 model © EuroGeographics Association for administrative boundaries	 Regional level: NUTS2 Source: Politecnico di Milano, 2014 Origin of data: - MASST3 model © EuroGeographics Association for administrative boundaries

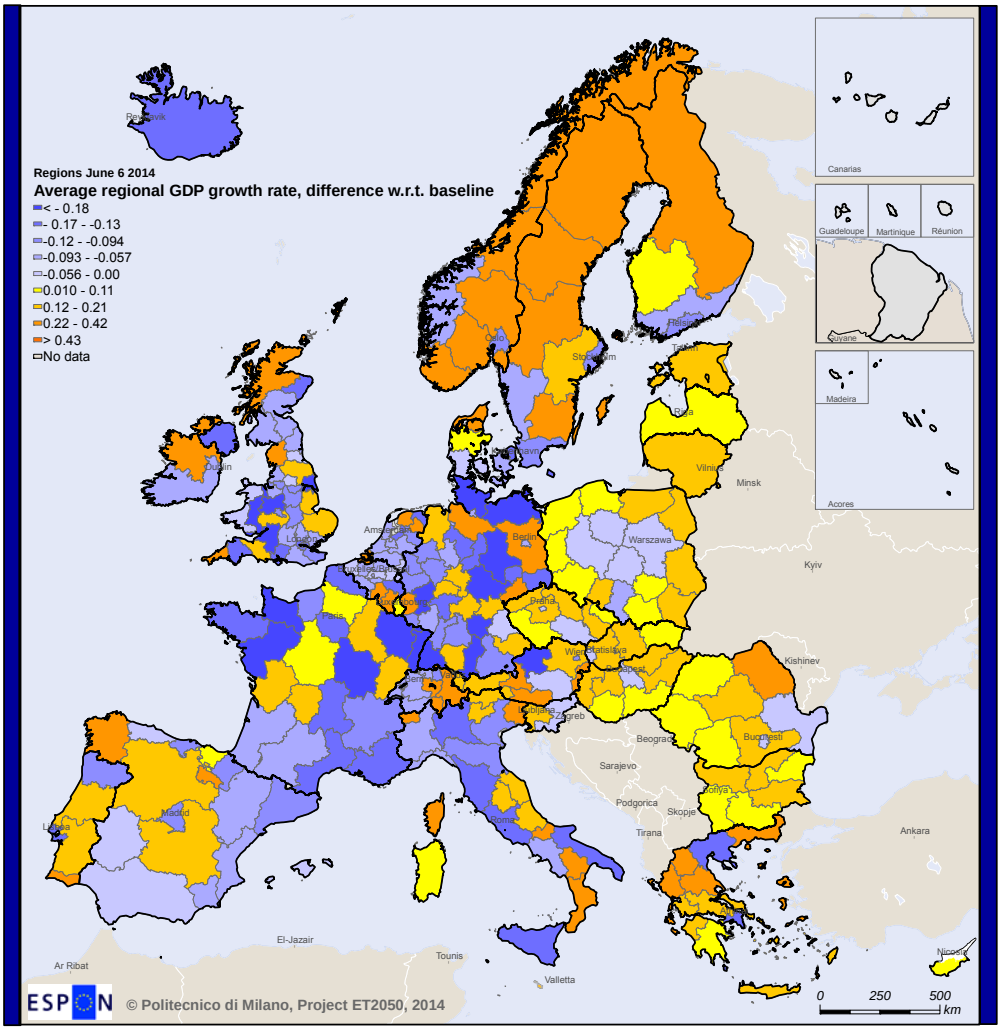
7. Regional results of the "Regions" scenario

This scenario presents on average a relatively slower rate of GDP growth with respect to the Baseline scenario (Map D6). This is mostly driven by slower growth in western countries, whilst the convergence process (New 12 regions growing on average faster than their western counterparts) becomes even more pronounced, mostly because of the slowing down of growth in western regions. The difference between western and New 12 countries as a whole reaches about 0.2 percentage points per year, which implies about 15 per cent of the current GDP differences between these two areas would be eroded by 2030.

Several interesting patterns emerge in this scenario (Map D7):

- *among countries, more peripheral ones take particular advantage of the "Regions" scenario*; on average New 12 grow faster than western countries;
- *within countries, irrespective of the macro area where regions are located, rural and peripheral areas tend to benefit more from this scenario* (e.g., Northern Sweden and Finland, Southern Italy, rural Spain and France). This also implies that, within each country, rural areas perform relatively better with respect to the baseline scenario.
- Analogously to what found for the "Cities" scenario, in the "Regions" scenario there seems to be a positive correlation between GDP growth and manufacturing employment growth (Map D8a). Map D8 presents in general the main employment trends in this scenario, which suggest interesting findings:

Map D7: Annual average GDP growth rate in the Regions scenario: difference with respect to the baseline



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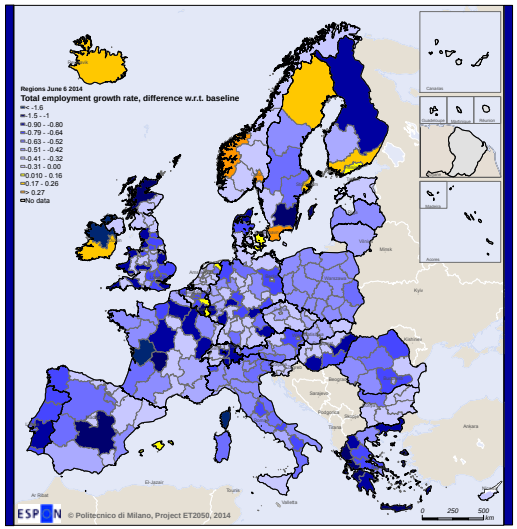
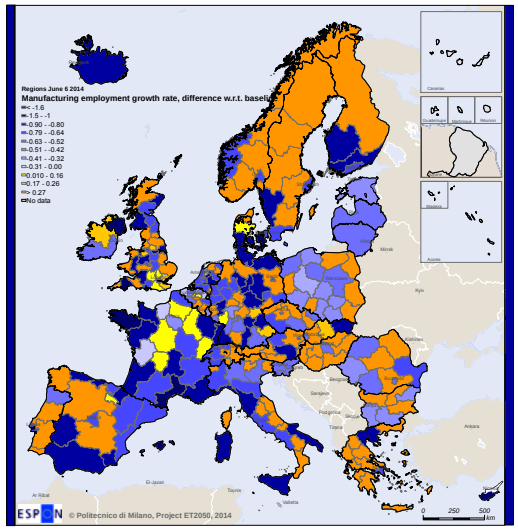
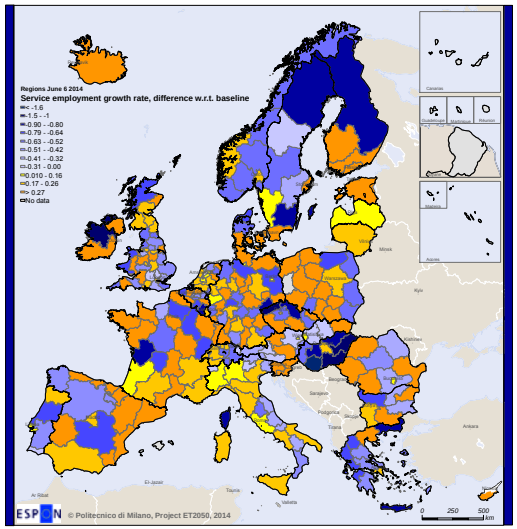
Map D8: Annual average total employment, manufacturing employment and service employment growth rate in the Regions scenario

D8a	D8b	D8c
		

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- with the sole exception of Italy, *employment growth in this scenario takes place mostly in first-rank and second-rank metro areas*, both in New 12 as well as in western countries;
- as mentioned above, *Italy represents a major exception in this trend*; it seems like most peripheral areas in this country are not able to fully reap the benefits of cohesion policies, with a few notable exceptions faring way better than in the Baseline scenario (namely, Apulia, Campania, and the islands);
- *employment-wise, cohesion policies positively affect both rural and peripheral areas*, which are expected to benefit the most from this scenario; interestingly enough, also some strong regions benefit from job creation policies;
- *strong regions present nevertheless a very strong pattern*. They tend to register positive employment growth rates, matched, however, by a relatively mild GDP growth (typically, GDP growth is slower for strong regions with respect to the baseline scenario). This implies that overall productivity growth tends to slow down in metro areas, with a likely restructuring of the industrial composition of the labour market from high-level functions towards relatively low-level services. This goes the opposite way with respect to the “Megas” scenario;
- conversely, *rural and peripheral areas benefit from a buoyant GDP growth, even higher than the increase of manufacturing employment, which testifies for a remarkable productivity increase*, at the roots of the continuing process of convergence which can be found in this scenario. This increase in productivity is either obtained by the creation of qualified small businesses and handcrafting activities, or by eliminating un-efficient industries, reconverting towards higher value-added sectors. Examples of this kind can be found throughout Europe, in Spain, Scandinavia, Greece, the Italian Adriatic coast regions, Eastern Polish regions, bordering Belarus and Ukraine;
- some rural areas and metropolitan areas of peripheral countries register an increase in service employment, not enough to compensate for the loss of manufacturing jobs, ending up with a lower total employment growth ate with respect to the Baseline. When this situation is accompanied by a higher decrease in GDP growth rate, *this implies a loss in productivity gains, probably due to the increase in low value-added service jobs*. This situation is found in some regions like areas in southern France, North of Portugal, regions around Warsaw.

8. Evolution of regional disparities in the three exploratory scenarios

Fig. D2 presents the Theil indices, measuring the trend in regional disparities that accompany the four scenarios. In particular, Fig. 2a represents the total regional disparities, while Fig. 2b and 2c separate out the trend in disparities among countries (between country disparities) and among regions within countries (within country disparities) respectively.

The first interesting message is that all four scenarios register an increase in regional disparities (Fig. 2a). There are however differences between countries with respect to the baseline: the “Megas” scenario is the one registering the highest increase in regional disparities, while, as expected, the “Regions” scenario show a relatively less pronounced increase with respect to all other countries. Cohesion and social policies are able to keep the increase in regional disparity caused by the present crisis under control.

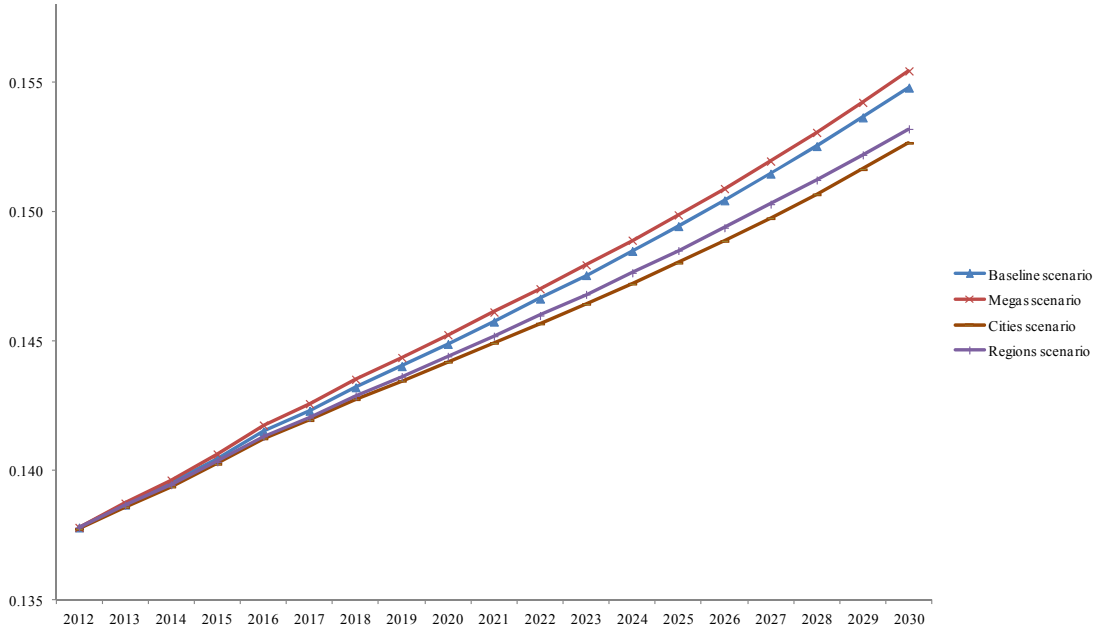
In all scenarios the between country disparities decrease (Fig. 2b) while the total disparity increase is caused by an increase in the within country disparities (Fig. 2c). The “Regions” scenario registers a more contained decrease in the between country disparities, and a limited increase in within-country disparities; cohesion policies are therefore more useful to act on core/periphery disparities within a country, rather than being able to increase the catching up of the eastern countries towards the western.

The most competitive scenario, the “Megas” scenario, strongly worsen intra-national disparities, pushing growth through the national champions; however, is improves the intra-country disparities, imposing a competitive edge also to eastern countries, that are able to catch-up thanks to their competitiveness policies even more than in the Baseline.

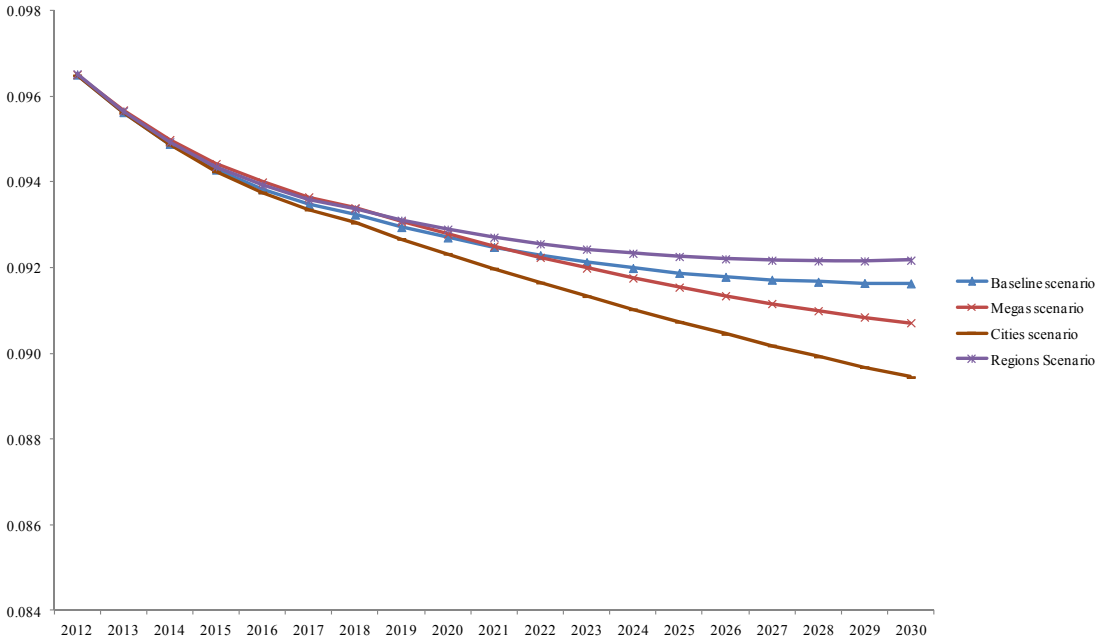
The most expansionary scenario, the “Cities” scenario, registers also the lowest regional disparities among the four scenarios (fig. 2a); the disparities among countries decrease the most among the four scenarios (Fig. 2c), while if the within country disparities are similar to the Baseline (Fig. 2b), being the amount of budget devoted to cohesion policies the same in the Baseline and in the “Cities”. Moreover, the “Cities” scenario has more contained within country disparities than the “Megas”. This result can be explained by the fact that the “Cities” scenario is oriented towards a competitive but spatially dispersed growth, based on the specificities and territorial capital elements of each region. Each nation therefore grows not only through its champions, but through equilibrated urban systems, and through an efficient exploitation of local territorial assets.

Figure D2. Regional disparities (Theil index) for the four scenarios

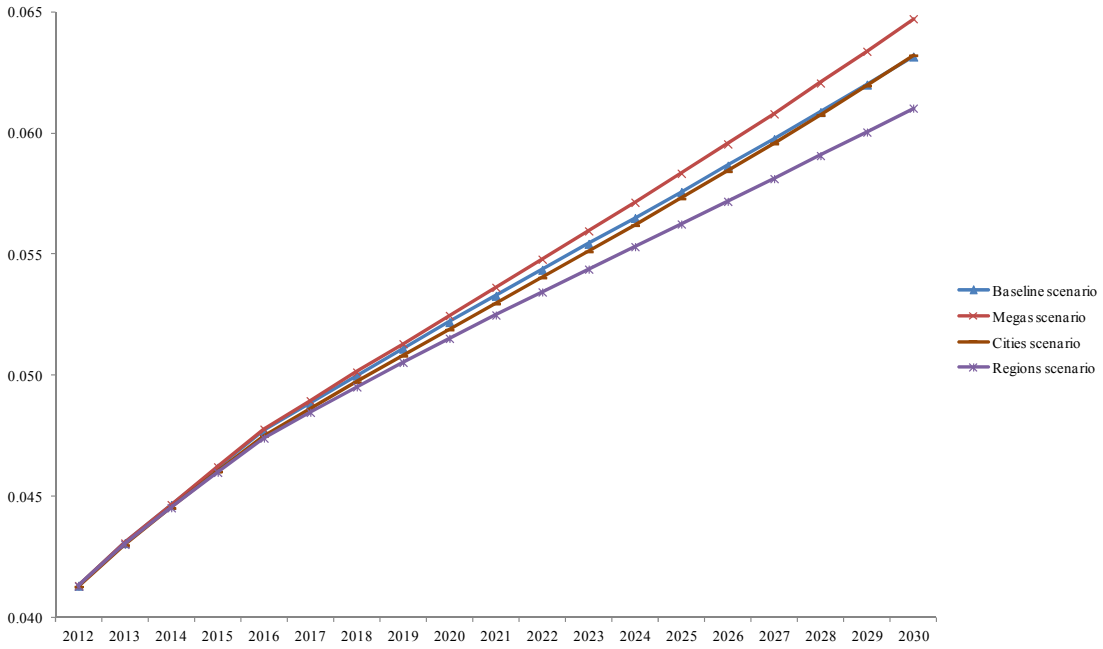
a) Total disparities



b) Between country disparities



c) Within country disparities


0.065
0.060
0.055
0.050
0.045
0.040
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
Baseline scenario
Megas scenario
Cities scenario
Regions scenario

Part E
Sensitivity of Forecasts on Regional Growth and Disparities to Models' Nature and Assumptions

1. Forecasting regional growth and disparities inside the ET2050 Project

Models are simplified representations of reality, as all the elements and complex interactions that act and happen in the real world can hardly be considered and appropriately replicated through quantitative modelling.

Therefore, models' forecasts – or better: foresights, conditioned by specific scenario assumptions – have to be deeply inspected considering the nature of the single models and the relative assumptions, especially when a comparative analysis is carried out.

Moreover, it looks important to inspect the sensitivity of the single results to changes in some exogenous assumptions, as, in the multiple interactions happening inside the operational logics of models, some variables may prove much more relevant than others in determining the final outcome (and therefore their future assumed trend should be more carefully assessed).

In the ET2050 Project two best-practice econometric and simulation models have been utilised in order to provide foresights on the future development of regional economies in the EU and in particular of inter-regional disparities, according to the main features characterising a baseline scenario and three "exploratory" scenarios: the MASST model and the SASI model. According to the two models, the comparative performance of regions in the four scenarios, in terms of both aggregate EU growth rates and an indicator of disparities, turned out to be quite similar: both models indicated the "cities" scenario as the most, or among the most expansionary and at the same time the most, or among the most cohesive of the four scenarios. But on the other hand, comparing the forecasts concerning a same scenario, the two models showed an opposite sign as far as the evolution of regional growth and disparities is concerned: the SASI model was much more optimistic, forecasting a decisive expansionary trend and an increasing convergence among regions, while the MASST model was more pessimistic, forecasting a much lower GDP growth rate and a divergence trend (mainly due to strong increasing disparities inside countries and slowly decreasing disparities among countries).

The differences among the results of the two models call for a careful inspection and interpretation.

2. The different nature of the two models.

The two models that were utilised, namely MASST and SASI, are very different in nature, and this explains a relevant share of the diverging conclusions on regional growth and interregional convergence/divergence.

The SASI model is a mainly supply-side model, based on regional production functions, regional endowments, labour markets structure, transport accessibility and population dynamics. Therefore, it is particularly appropriate for forecasts in the transportation field and in forecasting population and GDP evolutions as depending on real, supply side, policies and trends.

On the other hand, the MASST model is both a supply-side and a demand-side model: it is based on regional endowments and territorial capital assets, but at the same time it takes into consideration demand-side, national and macroeconomic effects connected to fiscal and public expenditure policies, constrains coming from national public debt burden and European rules on public deficits, currency devaluations/re-evaluations, monetary and not just real (constant-price) adjustments in a crisis condition. All these latter elements were introduced or strengthened in the new version of the model, explicitly built for the Project, given the present relevance of macroeconomic and monetary constraints.

The huge impact of austerity measures in lagging countries like Greece (that lost 20% of its real GDP from 2008 to 2012) and Italy (-7%); the so called processes of “internal devaluations” in some weak euro-countries (namely the decrease in internal wages and salaries) like Spain and Portugal; the restrictive fiscal and monetary policies in some New Member Countries; all these elements were taken into consideration and – given the fact that they hit particularly countries with a lower than average GDP per capita –they generated the above mentioned pessimistic forecasts on convergence, particularly concerning the short and medium term. The SASI model was not in a measure to fully include and consider the crisis effects.Its forecasts concerning the mentioned countries were very (and probably too) optimistic.

3. Sensitivity of regional disparities to some exogenous assumptions in the two models.

The main exogenous assumptions of the two models (in each scenario) were by and large similar, and came from the important effort devoted by all teams of the TPG to an appropriate and consistent definition of the different scenarios. But these assumptions were not identical, given the different exogenous variables considered by each model.

A first visible difference concerns the assumptions of the size of the EU expenditure in structural funds: in the baseline scenario, it was held constant in the MASST model, according to the early decision of the group, but was held constant as a share of GDP in the SASI model, according to a subsequent decision. This difference contributes for sure to explain a part of the difference in end results.

Concerning the MASST model alone, the sensitivity of a Theil index of regional disparities was tested concerning a list of variables, linked to macro-economic elements or to relevant demand-supply elements like foreign direct investments in New Member Countries. This last variable did not prove to impact on disparities: even hypothesizing a faster growth of FDI after the crisis, the catching-up process of NMCs was not substantially lifted, as their direct benefits were counterbalanced by an increase in imports.

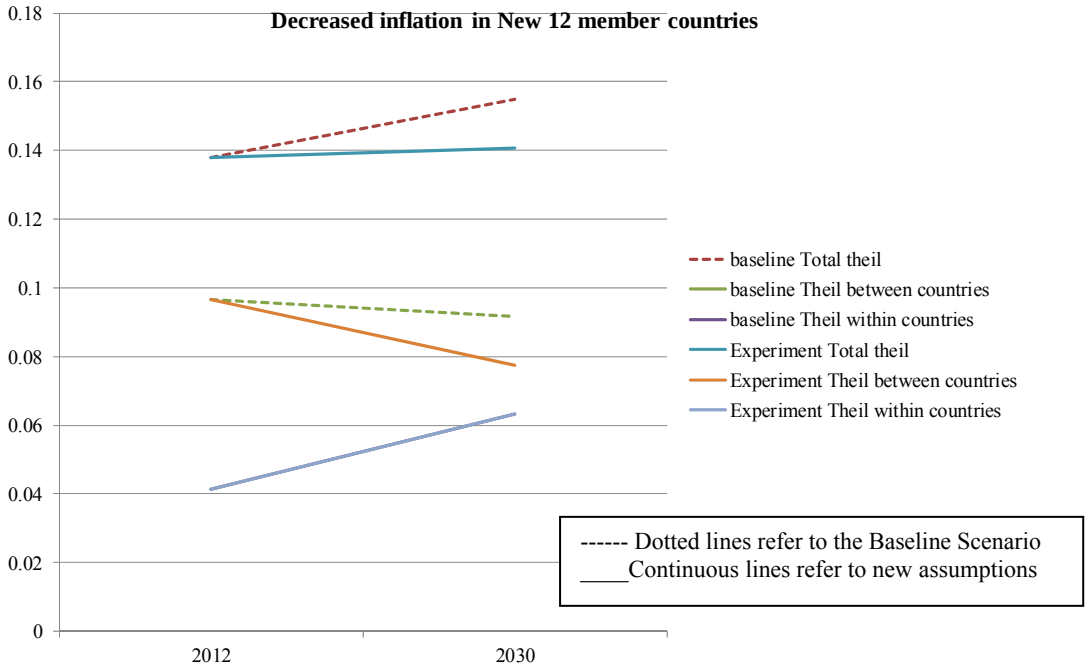
Two variables, on the other hand, proved very effective in determining growth potentials of countries (and consequently of their regions): namely the expected (exogenous) inflation rate of NMCs with respect to Old Member Countries and the expected rise in internal average tax rate in countries with a high public debt. As the countries involved, in both cases, are by and large lagging with respect to the European average in per capita GDP, a change in these exogenous variables bears a significant impact on the regional disparities index.

In particular, in the first case, a decrease in the expected inflation rates in Eastern Member countries (from 5% assumed in the baseline scenario to 3%) keeping equal to 2,5% inflation rates in Western ones, is likely to generate a better control of the former group of countries on their external competitiveness, and therefore contribute, through higher exports, to faster catching-up with respect to the latter group. This process is well visible in terms of its effects on regional disparities in the EU (Fig. 1): between countries disparities would decrease substantially with respect to what was forecasted in the baseline scenario and consequently, in presence of a persistent negative trend in within countries disparities, total disparities would show only a slight increase.

This important result could lead us to two conclusions: that this precise variable should be subject to a careful monitoring both by model builders, in order to continuously figure out its most likely future trend and by policy makers, given its strong potential effects on NMCs economic performance.

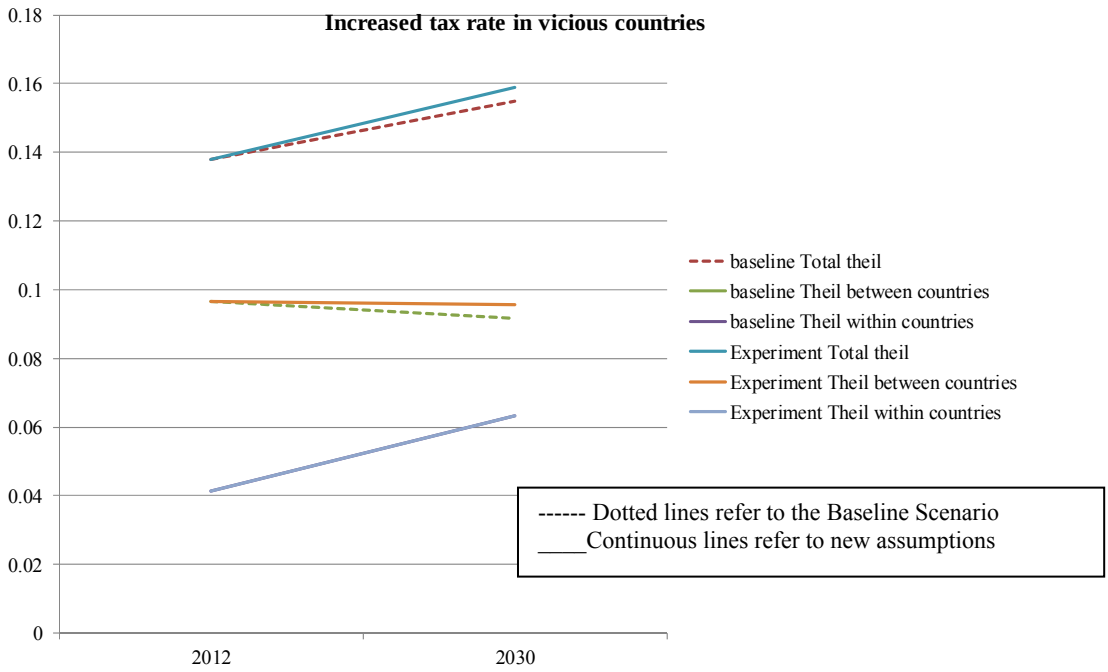
The second variable inspected in the same way is tax rate in highly indebted countries: a rise of internal tax rates imposed by excessive deficits or by EU constraints would jeopardise the potential growth of these countries, and consequently determine a rise in total disparities (Fig. 2).

Figure E1 – Impact of a decrease in inflation rates in New 12 MCs on overall regional disparities (Theil index) (MASST model forecasts)



Note: Inflation in New 12 countries is lowered from 5% (baseline) to 3%. Baseline assumption for Old15 member countries is 2.5%.

Figure E2 – Impact of higher taxation rates in wide-public debt countries on overall regional disparities (Theil index) (MASST model forecasts)



Note: an increase of 5% of the internal tax rate is assumed.

With reference to the SASI model, here again a change in some exogenous variables may determine relevant effects on national or regional performances and consequently on the forecasted trend in overall inter-regional disparities. In particular, the assumptions on a single variable may generate huge effects: namely the exogenous hypotheses on the catching-up rate in productivity levels by NMCs with respect to Old MCs.

In the baseline scenario, an extrapolative hypothesis was followed with respect to the past, observed trend. Two alternative hypotheses were then tested: an extreme one of no productivity convergence and a more realistic one of slow productivity convergence (Fig. 3 and 4).

The evidence is clear, showing a huge sensitivity of the regional GDP divergence index (Gini coefficient) to these simulations. In the first case, the previous result (baseline scenario: black line 00) showing a fast decrease in regional disparities almost disappears, as new forecasts indicate a substantial stability in disparities with an increase in the last four decades (grey line 02); in the second, more likely case, disparities decrease much less than before, up to 2031, and then remain approximately constant (grey line 03).

Figure E3 – Hypothesis of no productivity convergence in NMCs: impact on overall regional disparities (Gini coefficient) (SASI model forecasts)

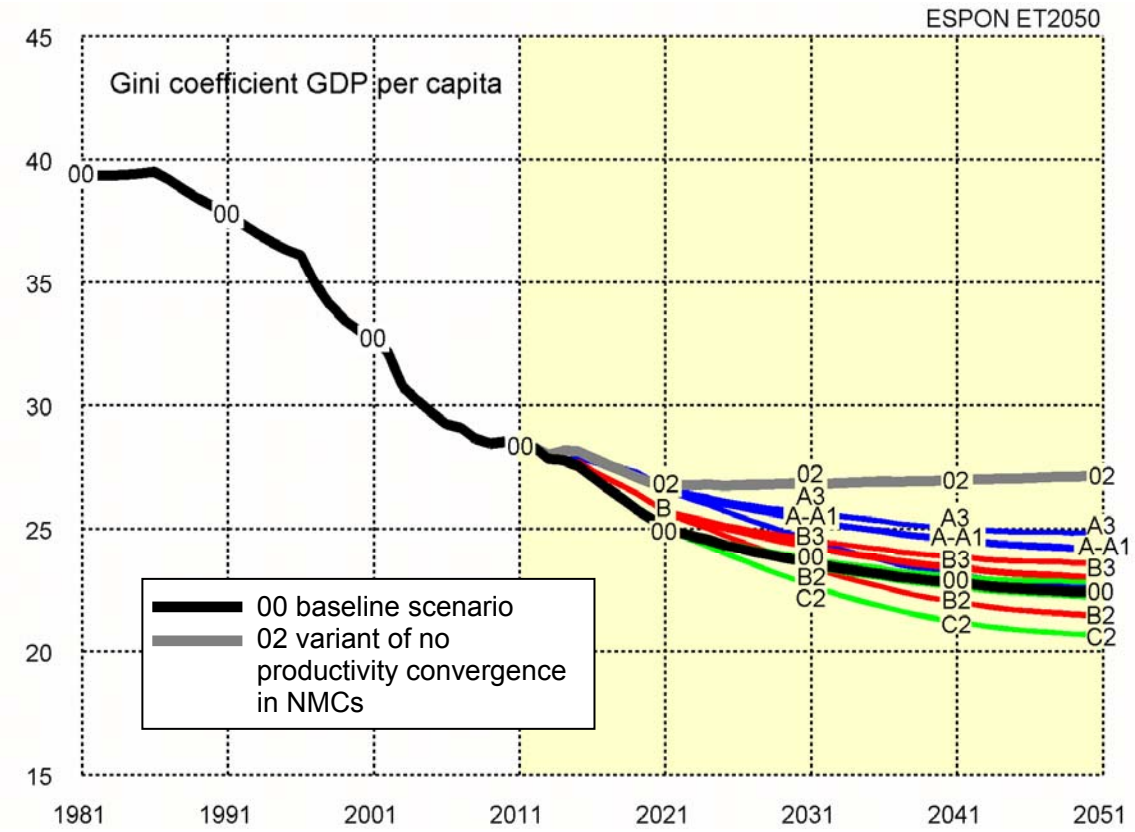
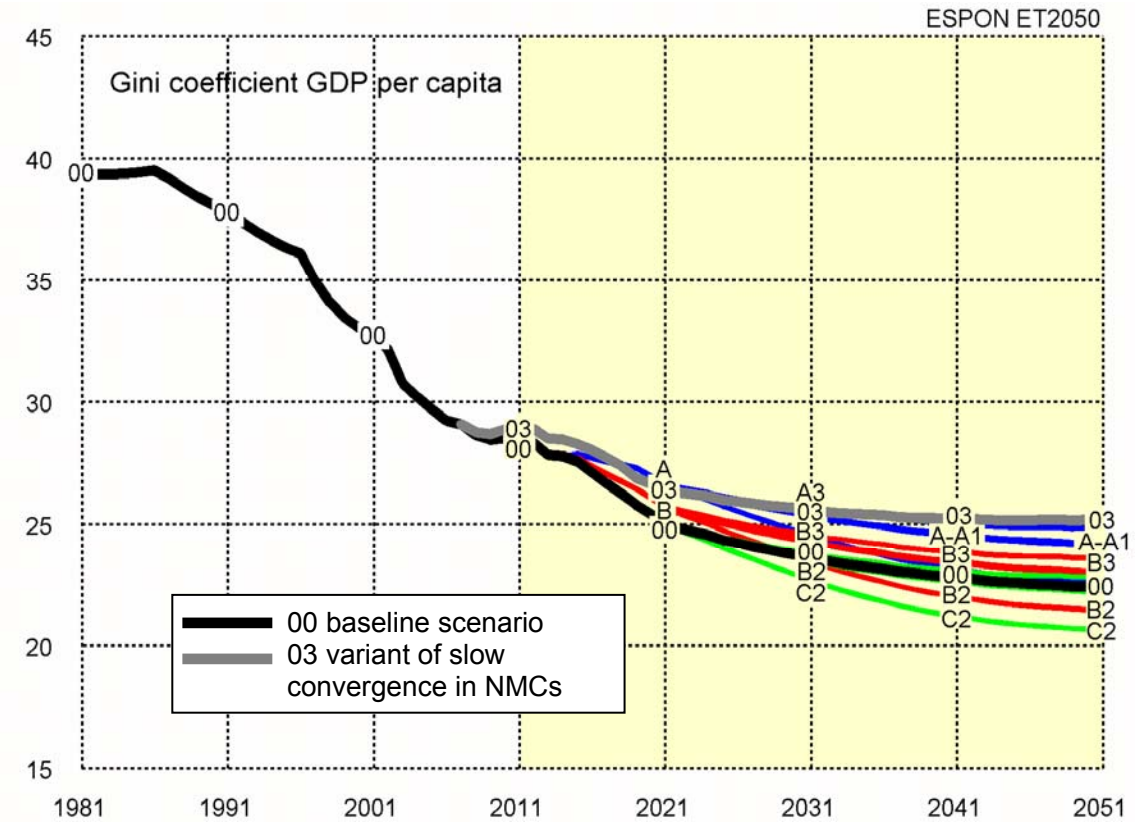


Figure E4 – Hypothesis of slow productivity convergence in NMCs: impact on overall regional disparities (Gini coefficient) (SASI model forecasts)



4. Conclusions

In conclusion, the differences in forecasts on regional growth and convergence/divergence in the EU between the two econometric and simulation models may be widely explained by the different nature of the two models and by some divergence in their exogenous assumptions.

Besides this, some exogenous variables specific to each model are found to have relevant impacts on the forecasted average growth rates of single countries and overall disparities. A renewed consideration of the “right” future value and trend of these variables could bring the expected outcomes of the two models much closer to each other.

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