Potential Growth in the EU : Prospects from Technical Progress and Eastern Enlargment

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Prospects from technical progress and Eastern enlargement

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Abstract

In sharp contrast with the buoyant economic dynamism observed in most other areas of the world, slow growth and persistently high unemployment have been characterizing the European Union (EU) economy for a number of years. This report investigates some of the possible causes of this poor macroeconomic performance, analyzing in depth the hypotheses of technological backwardness and of inappropriate economic policies, as major determinants of potential growth. It then proposes some contrasted scenarios for economic and social policies in the EU and explores, with the help of the INGENUE, overlapping-generations, general-equilibrium model of the world economy, some of the possible long-term evolutions of economic growth and other macroeconomic indicators for various scenarios. In particular, we look at the aggregate economic consequences over the next decades of various ways in which the combination of policies being implemented and the recent enlargement of the European Union may affect the growth potential of the area. More specifically, among the many possible changes that may be forthcoming with this new EU enlargement, we simulate the changes in the time-path of macroeconomic variables resulting from the achievement of the "Lisbon strategy" objective of higher employment rates in the EU, from faster technological convergence of Eastern European economies towards Western European levels of total factor productivity (TFP), and from larger migration flows from Eastern European new members to the EU-15 countries. Although the consequences may in some cases be quite large for the enlarged EU economy, the induced effects on the rest of the world are, in all cases, relatively small, due to the small weight of Eastern Europe in the world economy and population.

Table of contents

Introduction

Is Europe in decline? Over the recent years, the macroeconomic performance of the European Union has been conspicuously weak, with low growth and high unemployment, especially when compared to the rest of the world. While some of this poor showing may be attributable to cyclical factors, there is clearly a more profound, structural nature of the European lack of economic dynamism. But then what are the major causes of this "structural slump" (Phelps, 1994)? There seems to be a widely shared consensus on the idea that potential growth is low in Europe, but the reasons why this is so, hence the possible remedies for the European economic disease, are not unanimously agreed upon. The combined hypotheses of technological lag compared to the leading, US economy, of some assumed negative effects of demographic evolutions – population ageing –, and of relatively low employment rates in Europe, are often cited; indeed, they constitute the common analytical background of the so-called "Lisbon strategy", adopted by the European Council at the Lisbon Summit in the Spring of 2000, and of many reports published in recent years on the EU economy or on its national components[2].

Whatever the true determinants of potential growth, the stakes of this debate are paramount: for the setting of macroeconomic policies, i.e. the single monetary policy of the European Central Bank (ECB) and the aggregate of individual fiscal policies of the member states, the assumed value of the potential growth rate is a major ingredient; if, as is currently the case in Europe, it is assumed to be low and mostly independent from the macroeconomic policy mix, then the constraints imposed on the latter will be quite strict, resulting in overly restrictive orientations.

However, the hypothesis behind the setting of ambitious objectives for growth and employment rates is clearly that policies matter, at least some of them. But which ones? Will the completion of the European Single market and of monetary union in the Euro zone boost potential growth in Europe, as expected? And what may be the effects of the enlargement of the EU to Central and Eastern European countries?

This Report proposes an analysis of some major determinants of potential growth in the EU and an exploration of some scenarios for the future evolutions of macroeconomic conditions in the EU after the 2004 enlargement to ten new members, most of which from Central and Eastern Europe. The first section is devoted to the analysis of the role of innovation and the diffusion of information and communication technologies (ICT) in the determination of potential growth in Europe. The second section analyzes the possible role of

[2] See, for instance, Sapir *et al*, 2003, Kok *et al*., 2004, Camdessus *et al*., 2004.

institutions and economic policies in setting overall economic performance. It also presents a number of results of an empirical study of determinants of potential growth in the EU and describes some broad policy scenarios for the near future. In the third section, a new version of the INGENUE model, an overlapping-generations, general-equilibrium model of the world economy, is used to simulate the long-run consequences on major macroeconomic aggregates of some simple scenarios regarding the convergence process of Eastern Europe after enlargement. Finally, Section 4 offers some conclusions. It can also be viewed as an executive summary of the Report.

Section 1 . ICT and European growth

One of the most striking features of the nineties is the dismal performance of the European Union (EU-15) compare to that of the United States (US). Since the mid 1990s, in the EU-15, not only the average growth rates of real GDP has fallen behind the US ones but also the growth rates of labor productivity and total factor productivity. While a key ingredient, productivity growth explains only a part of country differences in per capita income but it remains as a disturbing stylized fact that, since 1995, productivity growth has indeed accelerated in the US while it has correspondingly decelerated in the EU-15. Compared with the first half of the 1990s, the contribution of labor to EU-15 GDP growth has significantly increased in the second half but these gains have been offset by a reduction in the contribution of labor productivity. The US has benefited from both sources of growth, enjoying a higher contribution of labor allied to an acceleration of labor productivity. And the latest data covering the first years of the 21st century support a continuation of this picture of the 1990s.

According to the most recent data jointly compiled by the Conference Board and the Groningen Growth and Development Centre, the figures are self-explanatory (McGuckin and van Ark (2004)). US productivity (as measured by output per hour) grew on average by 1 % per year during the first half of the 1990s, then accelerating to a 1.9 % annual average growth rate during the second half. And the first recession of the American New Economy did not even seriously derail this performance, since US productivity also grow on average by 1.9 % per year during 2001-2003 (0.4 % in 2001, 2.7 % in 2002 and 2.6 % in 2003). Meanwhile, Europe has gone in the opposite direction. During 1990-1995, EU-15 annual average 2.5 % productivity growth was substantially higher than US productivity, but then lost some ground to a 1.6 % average annual rate of growth during 1995-2000, and further again during 2001-2003 to a meager 0.9 % average annual rate of growth (0.9 % in 2001, 0.9 % in 2002 and 0.8 % in 2003). Surely, there is a wide variation across the EU-15 in productivity performance, both in terms of growth rate as well as levels (see table 1)[3]. However, nearly all countries show a recent erosion of their productivity level relative to the US.

[3] Tables, charts and equations of the Report are numbered consecutively within each Section.

Table 1. Average Annual Growth Rates of Real GDP, Total Hours and Labor Productivity

	Real GDP				Total hours				GDP/hour			
	1980-90	1990-95	1995-00	2000-02	1980-90	1990-95	1995-00	2000-02	1980-90	1990-95	1995-00	2000-02
Austria	2.3	2.0	2.8	0.9	0.6	0.3	-0.5	0.1	1.7	1.8	3.2	0.8
Belgium	1.9	1.6	2.7	0.7	-0.4	-0.7	0.0	1.4	2.3	2.3	2.8	-0.7
Denmark	2.0	2.0	2.7	1.5	0.1	-0.4	1.1	0.0	1.9	2.4	1.6	1.5
Finland	3.1	-0.7	4.8	1.1	0.1	-3.4	1.9	-0.2	3.0	2.8	2.9	1.4
France	2.3	1.1	2.7	1.4	-0.6	-0.4	1.4	-0.2	2.9	1.4	1.3	1.7
Germany	2.2	2.0	1.8	0.4	-0.3	-1.9	-0.3	-0.9	2.5	4.0	2.2	1.3
Greece	1.6	1.2	3.4	4.0	0.6	0.7	0.6	-0.2	1.0	0.6	2.8	4.2
Ireland	3.6	4.7	9.8	4.7	-0.4	1.1	3.9	1.4	4.1	3.6	5.7	3.2
Italy	2.2	1.3	1.9	1.1	0.3	-1.0	1.0	1.2	2.0	2.3	1.0	-0.1
Netherlands	2.2	2.1	3.7	0.7	0.2	0.7	3.1	0.4	1.9	1.4	0.6	0.3
Portugal	3.2	1.7	3.9	1.0	1.4	-1.8	0.8	1.0	1.7	3.5	3.1	0.1
Spain	2.9	1.5	3.8	2.2	-0.1	-0.7	4.2	2.6	3.0	2.3	-0.3	-0.4
Sweden	2.0	0.7	3.3	1.5	09	-1.3	1.0	-0.5	1.1	2.0	2.2	2.0
UK	2.6	1.8	2.9	1.7	0.5	-1.2	1.0	0.7	2.2	3.0	1.8	1.1
EU	2.4	1.6	2.7	1.3	0.1	-1.0	1.1	0.4	2.3	2.6	1.5	0.8
US	3.2	2.4	4.0	1.3	1.7	1.2	2.0	-0.4	1.4	1.1	2.0	1.7
Japan	4.0	1.4	1.4	-0.7	1.0	-0.4	-0.9	-0.9	3.0	1.8	2.3	0.2

Note: Germany 1980-1990 refers to West Germany; EU 1980-1990 excludes Eastern Lander of Germany; the EU-15 here excludes Luxembourg. Data may be slightly different from the aggregate ones mentioned in the text because they are a bit less recent.
Sources: GGDC/The Conference Board, Total Economy Database (June 2003) – O'Mahony – van Ark (2003)

This dramatic change in relative performance signals an arrest in the process of convergence between the EU-15 and the US that began after World War II. And this divergence clearly goes against the ambitions of the Lisbon Strategy adopted by the EU-15 in March 2000,[4] in response to the ICT-linked acceleration of US productivity growth and supposed to make Europe the most competitive economy in the world by 2010. Five years later, huge progresses remain to be made and the diagnosis of Europe's problems does not invite to be overly optimistic as for a quick solution. Indeed, the slower diffusion of ICT and their lower contribution to GDP and productivity growth are only a limited and not so convincing part of the problem. It is necessary to turn to a different set of explanations to better understand why Europe is falling behind. These explanations focus on issues which are not directly related to the effects of the ICT revolution, and so are much more difficult to tackle with (for instance all the supposed rigidities in the product and labor markets...).

[4] See next Section for a presentation.

The aim of this Section is certainly not to pinpoint these structural explanations, but only to shed light on the ICT aspect of the question. ICT may not play in Europe a role as important as in the US, but it is quite instructive to fully understand in what way.

The link between ICT and growth has been first largely debated in the US and widely documented for the US[5]. International comparisons came a bit later on and first produced comparable estimates of ICT contributions to GDP and productivity growth derived from a growth accounting framework[6].

As the debate was raging, a complementary approach at the industry level of detail has been gaining some credit to locate where the productivity gains were exactly coming from[7]. This industry perspective has hence developed a precise and useful ICT taxonomy, based on whether industries were producers or users of ICT (and within the latter their intensity of use). A clearer and more comprehensive picture of the European case, compared to the US, has then only recently emerged. A recent report commissioned by and prepared for the Enterprise Directorate-General of the European Commission is of particular interest (O'Mahony and van Ark, 2003). The OECD (2004), the European Commission (Denis, McMorrow and Röger, 2004) and Jorgenson (2004b) also provide interesting and updated results.

This Section of the Report is constructed as follows. The first part will review the main results derived from the growth accounting framework. This analysis provides an idea of the magnitude of the direct effects on GDP and labor productivity growth of ICT (through the contribution of capital deepening and total factor productivity (TFP)). The second part will outline the main points of the industry perspective, summarizing the findings of the O'Mahony – van Ark study. The third part will give some conclusions.

1. Lessons from the growth accounting framework

Growth accounting results presented in this section are taken from Jorgenson (2004b). This work presents international comparisons of economic growth among the G7 nations (Canada, France, Germany, Italy, Japan, the UK and the US) using internationally harmonized data for the period 1980-2001. The methodology used is the usual growth accounting framework first introduced by Jorgenson and Griliches (1967) and regularly updated by Jorgenson and his associates (see Jorgenson, 2004a for the latest version). In this framework,

[5] Gordon (1999, 2000, 2003), Jorgenson (2001), Jorgenson and Stiroh (1999, 2000), Jorgenson, Ho and Stiroh (2002), McGuckin and Stiroh (1998), Oliner and Sichel (2000, 2002), Sichel (1997, 1999), Stiroh (1998, 1999).

[6] Schreyer (2000), European Commission (2000), Colecchia and Schreyer (2001), Daveri (2001), OECD (2000, 2001). These estimates were preliminary findings as the data and the underlying assumptions have been later revised and completed.

[7] Van Ark (2001), Pilat and Lee (2001), McGuckin and van Ark (2001), Van Ark, Inklaar and McGuckin (2002).

Total Factor Productivity (TFP, thereafter) is computed as a residual that measures growth of output not explained by growth of inputs[8]:

$$\Delta \ln TFP = \Delta \ln Y_t - \bar{\omega}_{L,t} \Delta \ln L_t - \bar{\omega}_{Ki,t} \Delta \ln Ki_t - \bar{\omega}_{Kn,t} \Delta \ln Kn_t \quad (1)$$

where Y is real output, L is labor, Ki and Kn denote, respectively, ICT and non-ICT capital. The $\bar{\omega}$'s represent average input shares in nominal income for the subscripted variables. The method assumes perfect markets and constant returns to scale so that the share of total capital is one minus labor's share. Capital inputs are measured as services flows and the share of each type in the value of capital is based on its user cost.

Rearranging equation (1) enables us to present results in terms of growth in labor productivity, defined as $y_t = Y_t / H_t$ where H_t is the number of hours worked and $k_t = K_t / H_t$ is the ratio of capital services to hours work worked:

$$\Delta \ln y_t = \bar{\omega}_{K,t} \Delta \ln k_t + \bar{\omega}_{L,t} \left(\Delta \ln L_t - \Delta \ln H_t \right) + \Delta \ln TFP_t \quad (2)$$

Equation (2) gives the familiar allocation of labor productivity growth among three factors. The first is capital deepening, that is the growth in capital services per hour worked. Capital deepening makes workers more productive by providing more capital for each hour of work. The second term is the improvement of labor quality, defined as the difference between growth rates of labor input and hours worked. The third factor is TFP growth.

The first striking result of this study is the wide gap in output per capita existing between the US and European countries throughout the period 1980-2001 (see Table 2). Interestingly, no such a gap exists for TFP levels. The US TFP languished below the levels of France and Italy. This result suggests that technology does not play a major role in explaining output per capita differences. The culprit has to be found in the very low levels of input per capita, which includes here labor and capital inputs. The US was the leader among the G7 in input per capita over the period 1980-2001. France and Italy started at the bottom of the ranking and remained there throughout the period. Low employment levels and weak investment seem to be the prevailing causes of poor European economic growth performance. TFP gains allowed by ICT diffusion are just a small part of the story. One has to put the focus on the role of economic policy and institutional environment to understand properly the huge performance gap existing between the US and European economies[9].

[8] See Hulten (2000) for a careful exposition.
[9] See next Section for an investigation.

Table 2. Levels of Output and Input Per Capita and Total Factor Productivity
(US = 100 in 2000, Canada data begins in 1981)

Year	US	Canada	UK	France	Germany	Italy	Japan
			Output Per Capita				
1980	63.9	67.6	45.0	45.9	49.3	45.9	39.6
1989	79.7	78.8	56.5	54.1	58.6	57.3	56.0
1995	85.6	79.6	61.4	57.0	65.0	62.1	64.0
2001	100.3	91.9	71.3	64.0	69.2	68.8	70.6
			Input Per Capita				
1980	70.5	64.2	50.2	46.5	61.0	43.1	57.7
1989	83.9	74.4	61.2	53.3	71.1	55.5	72.0
1995	88.8	75.2	67.0	57.0	73.7	58.8	77.8
2001	100.8	83.7	73.6	61.7	79.0	67.2	80.9
			Total Factor Productivity				
1980	90.6	105.4	89.5	98.6	80.8	106.6	68.7
1989	94.9	105.9	92.3	101.5	82.4	103.2	77.7
1995	96.4	105.9	91.7	99.9	88.1	105.6	82.3
2001	99.5	109.7	96.9	103.6	87.6	102.5	87.2

Source: Jorgenson (2004b), Table 1.

This argument seems to be reinforced by the analysis of the sources of output growth. Table 3 summarizes the contribution of labor, capital and TFP to output growth and table 4 the contribution of labor quality, capital deepening and TFP to labor productivity growth. Capital input is divided between ICT and non-ICT.

In order to make some comparisons of results (and to be sure these results are of the same magnitude, and if not, where the differences are), the estimates of Timmer, Ypma and van Ark (2003) for the US and the EU-15 as a whole have been added to Jorgenson's ones.

Except for Japan, TFP played a minor role as a source of growth for the G7 countries. Even in the US, TFP accounted for less than 14 percent of growth on the whole period. The same order of values prevails for European countries. On the contrary, the contribution of capital alone widely exceeds that of TFP for most countries and most time periods. Note that the contribution of non-ICT capital generally predominates over ICT capital.

But the most striking difference between European economies and the US is the contribution of labor. This input contribution is even negative for France between 1980 and 1989 and for the UK and Germany for the period 1989-1995.

About 40 % of US GDP growth and 30 % of the EU-15 growth during 1995-2001 hold to ICT. And ICT explains half of the acceleration of US GDP growth and nearly 40 % of the acceleration of the EU-15 growth between the first half and the second half of the 1990s.

ICT may be a powerful engine of growth, but labor and non-ICT capital are also important sources of growth for both countries.

Table 3. Sources of Output Growth
(Percentage Point Contributions. Canada data begins in 1981)

Year	US (1)	US (2)	Canada	UK	France	Germany	Italy	EU-15	Japan
Output									
1980-1989	3.19	3.34	3.10	2.69	2.38	1.99	2.51	2.38	4.42
1989-1995	2.42	2.36	1.39	1.62	1.30	2.34	1.52	1.58	2.56
1995-2001	3.52	3.58	3.34	2.74	2.34	1.18	1.90	2.42	1.85
Labour									
1980-1989	1.22	1.35	1.33	0.56	-0.06	0.32	0.32	0.05	1.20
1989-1995	0.86	0.98	0.62	-0.24	0.44	-0.09	0.03	-0.59	0.15
1995-2001	1.15	1.12	1.08	0.88	0.59	0.17	0.93	0.69	-0.22
ICT-Capital (1)									
1980-1989	0.59	0.46	0.39	0.24	0.18	0.19	0.24	0.35	0.43
1989-1995	0.46	0.47	0.49	0.27	0.19	0.26	0.26	0.27	0.31
1995-2001	0.82	0.93	0.86	0.76	0.42	0.46	0.49	0.46	0.75
Non-ICT-Capital									
1980-1989	0.62	1.00	1.32	1.56	1.94	1.25	2.31	0.86	1.42
1989-1995	0.49	0.68	0.27	1.69	0.93	1.05	0.86	0.77	1.16
1995-2001	0.75	1.11	0.81	0.18	0.73	0.65	0.98	0.81	0.35
Total Factor Productivity from ICT production (2)									
1980-1989		0.22	0.14	0.23	0.29	0.28	0.32		0.23
1989-1995	0.24	0.25	0.14	0.32	0.29	0.43	0.38	0.15	0.29
1995-2001	0.44	0.41	0.17	0.82	0.56	0.65	0.68	0.27	0.57
Total Factor Productivity from non-ICT production									
1980-1989		0.31	-0.08	0.11	0.03	-0.05	-0.68		1.14
1989-1995	0.37	-0.02	-0.14	-0.43	-0.55	0.69	-0.01	0.99	0.65
1995-2001	0.36	0.01	0.41	0.09	0.04	-0.75	-1.17	0.19	0.41
Total ICT contribution to output growth (1)+(2)									
1980-1989		0.68	0.53	0.47	0.47	0.47	0.56		0.66
1989-1995	0.70	0.72	0.63	0.59	0.48	0.69	0.64	0.42	0.60
1995-2001	1.26	1.34	1.03	1.58	0.98	1.11	1.17	0.73	1.32

Sources: Jorgenson (2004b), from Table 15, for US (2) and individual G7 countries; Timmer, Ypma and van Ark (2003), from tables 6 and 13, for US (1) and the EU-15.

As for labor productivity growth, the diagnosis is quite different because labor productivity growth has accelerated in the US but decelerated in the EU-15. ICT contributed positively in both countries to labor productivity change over both periods of time. But in the US case, this positive contribution has been enhanced by the increased contribution of non-ICT capital deepening and of TFP from non-ICT production; in the EU-15 case, it has been erased by the sharp decline of the non-ICT capital deepening contribution and of TFP from non-ICT production.

These observations call for a deeper analysis of the real determinants of productivity, too often reduced to the determinants of the diffusion of innovations. To tackle this issue, it is firstly important to examine what is really explained by technical progress on the one hand, and what is the role that investment has played in the determination of potential growth, on the other. This is the kind of investigation that needs to be extended to European economies.

Table 4. Sources of Labor Productivity Growth
(Percentage Point Contributions. Canada data begins in 1981)

Year	US (1)	US (2)	Canada	UK	France	Germany	Italy	EU-15	Japan
Output									
1980-1989	3.19	3.34	3.10	2.69	2.38	1.99	2.51	2.38	4.42
1989-1995	2.42	2.36	1.39	1.62	1.30	2.34	1.52	1.58	2.56
1995-2001	3.52	3.58	3.34	2.74	2.34	1.18	1.90	2.42	1.85
Hours									
1980-1989	1.73	1.79	1.87	0.82	-0.66	0.11	0.15	0.10	0.56
1989-1995	1.23	1.02	0.20	-1.17	-0.41	-0.71	-0.57	-0.85	-067
1995-2001	1.67	1.53	1.93	1.03	0.91	-0.11	0.99	1.05	-0.73
Labor productivity									
1980-1989	1.46	1.55	1.23	1.87	3.04	1.88	2.36	2.28	3.86
1989-1995	1.19	1.34	1.19	2.79	1.71	3.05	2.09	2.43	3.23
1995-2001	1.85	2.05	1.41	1.71	1.43	1.29	0.92	1.37	2.58
ICT Capital deepening (1)									
1980-1989	0.52	0.41	0.35	0.22	0.19	0.19	0.23	0.34	0.42
1989-1995	0.40	0.43	0.48	0.29	0.20	0.28	0.28	0.29	0.33
1995-2001	0.72	0.85	0.79	0.71	0.39	0.46	0.45	0.42	0.78
Non-ICT Capital deepening									
1980-1989	0.19	0.31	0.42	1.20	2.29	1.20	2.25	0.82	1.20
1989-1995	0.19	0.32	0.16	2.11	1.15	1.33	1.06	1.01	1.42
1995-2001	0.32	0.55	-0.14	-0.21	0.25	0.70	0.61	0.48	0.61
Labor quality									
1980-1989	n.d	0.30	0.40	0.12	0.24	0.26	0.23	n.d	0.87
1989-1995	n.d	0.36	0.55	0.49	0.61	0.33	0.38	n.d	0.54
1995-2001	n.d	0.23	0.18	0.30	0.19	0.23	0.35	n.d	0.21
Total Factor Productivity from ICT production (2)									
1980-1989		0.22	0.14	0.23	0.29	0.28	0.32		0.23
1989-1995	0.24	0.25	0.14	0.32	0.29	0.43	0.38	0.15	0.29
1995-2001	0.44	0.41	0.17	0.82	0.56	0.65	0.68	0.27	0.57
Total Factor Productivity from non-ICT production									
1980-1989		0.31	-0.08	0.11	0.03	-0.05	-0.68		1.14
1989-1995	0.37	-0.02	-0.14	-0.43	-0.55	0.69	-0.01	0.99	0.65
1995-2001	0.36	0.01	0.41	0.09	0.04	-0.75	-1.17	0.19	0.41
Total ICT contribution to labor productivity growth (1)+(2)									
1980-1989		0.63	0.49	0.45	0.48	0.47	0.55		0.65
1989-1995	0.64	0.68	0.62	0.61	0.49	0.71	0.66	0.44	0.62
1995-2001	1.16	1.26	0.96	1.53	0.95	1.11	1.13	0.69	1.35

Sources: Jorgenson (2004b), from Table 16, for US (2) and individual G7 countries; Timmer, Ypma and van Ark (2003), from tables 7 and 13, for US (1) and the EU-15.

In a recent work (Musso, 2005), we have intended to replicate growth accounting analyses, which are at the core of the main recent studies that explain the contribution of ICT to the evolution of productivity and economic growth in the US. This exercise has permitted to measure the effect on the measurement of TFP of the hypothesis regarding estimates of capital inputs.

Two important preliminary results have been obtained:

1- The measurement of TFP is very sensitive to the hypothesis of a constant lifespan of equipment. A relatively modest increase in the physical depreciation rate of capital from the beginning of the 1970s would be sufficient to annihilate the TFP slowdown observed in the US till the end of the 1990s. The study of the sensitivity of productivity measurement and the results of a vintage capital model of obsolescence calibrated on the US data (Musso, 2004b) suggest that the TFP slowdown observed in the US during the 1970-1995 period could essentially be due to measurement errors mainly induced by the acceleration of capital obsolescence. Then one may admit that, far from slowing down, the rhythm of technical progress and the rhythm of diffusion of innovations have rather increased since the beginning of the 1970s, partly thanks to the spectacular performances exhibited by the semiconductor industry. This result is interesting because the choice of a constant rate of physical depreciation has been widely criticized (see for instance Feldstein and Foot, 1971; Harper, 1982; and Feldstein and Rothschild, 1974). Many studies have insisted on the endogenous property of the capital lifespan. From a theoretical point of view, this question is mostly handled by means of vintage capital models[10]. These studies insist on the role played by the rhythm of technical progress (obsolescence), the evolution of the interest rate, and fiscal policies. From an empirical viewpoint, several case studies have confirmed these institutions[11]. Although these results can hardly be generalized and therefore cannot offer alternative measures of the global stock of capital, their conclusions suggest that the use of a constant rate of physical decay introduces a considerable bias in the estimation of the evolution of the stock of capital.

2- The use of hedonic prices indexes is aimed at better handling the evolution of the quality of different vintages of capital goods. This also significantly modifies the results of measurement of growth sources. The use of price indexes produced by Cummins and Violante (2002)[12] based on the seminal work of Gordon (1990) limits the contribution of TFP to potential growth, and conversely accentuate the role of capital accumulation. As a consequence, investment seems to play an essential role in the process of determination of potential growth through diverse channels. Technical progress does matter. But long-run growth depends more on the way technical progress is sustained by investment. Thus, all things being equal, an acceleration of investment is likely to have a significant positive impact on potential growth by favoring the accumulation of capital and employment. But this acceleration of investment may increase the obsolescence of equipment at the same time, subsequently impacting negatively the increase of available capital stock. More generally, the net impact of investment on potential growth will be strongly dependent on macroeconomic

[10] Feldstein and Rothschild (1974), Gilchrist and Williams (2000), Lindh (2000), Whelan (2002) and Musso (2004a).
[11] Feldstein and Foot (1971), Cockburn and Murray (1992) and Oliner (1994, 1996).
[12] These price indexes have been kindly provided by the authors.

factors such as the level of economic activity and employment, the cost of capital and the age structure of equipment.

As a summary, when price indexes are adjusted to better take into account the evolution of the quality of equipment, the contribution of TFP to potential growth proves to be considerably overestimated by traditional analyses of growth accounting. Then, *investment actually is an essential determinant of the long-term potential growth.* These results and the subsequent questions leads to extend the investigation to European countries in order to take into deeper consideration the determinants of productivity and potential growth, far beyond a simple study of the diffusion of innovations.

2. The useful ICT taxonomy

Although it is still too early to answer definitively the question of a structural break in US output and productivity growth since 1995, many observers now believe that the US has experienced such a structural break leading to somewhat faster productivity growth and so faster potential growth[13].

As for the EU-15 case, in contrast to the US position, one has to keep in mind that there is yet less evidence that its own productivity slowdown is also of structural nature. Firstly and noteworthy, the productivity growth rates experienced in recent years in the EU-15 are no less than those in the US in the 1980s. Secondly, the EU-15 may simply suffer from a lag of three to five years in the diffusion of ICT compare to the US, which means there are more benefits to come in the next decade. The issue for the EU-15 is whether these resources can indeed be mobilized in a productive way. The industry perspective both helps put this issue and the EU-15 laggard status into perspective but also magnifies some of its structural flaws.

The industry perspective has first been used to pinpoint in which specific industries the US was achieving superior performance in order to clarify whether the productivity acceleration was just confined to a few sectors or was more generally widespread. While the first results based on a smaller and imperfect set of data were tilted towards the confined version, a consensus has progressively emerged supporting the widespread version. ICT producing sectors do exhibit very high labor and total factor productivity growth rates, but a small number of service sectors also make important contributions (wholesale and retail trade, financial securities). The industry perspective helps to know whether EU-15 productivity growth rates have improved in those industries where the US has also shown acceleration, with the poor EU-15 performance attributable elsewhere.

[13] Jorgenson, Ho and Stiroh (2004) have even revised upwards their projection. During the next decade, private sector productivity will grow at a rate of 2.6 % per year on average, a significant increase from their 2002 projection of 2.2 %.

For the purpose of the DG-European Commission report (O'Mahony and van Ark, 2003), a unique database, the Industry Labor Productivity Database, has been developed for all 15 EU member states and the US at the level of 56 industries for 1979 to 2001. The above-mentioned ICT taxonomy divides these 56 industries into ICT producing, ICT using and non-ICT, with the latter two dependent on intensity of use of ICT equipment, and distinguishing manufacturing and services industries. These data reveal without any surprise that the US has higher value added shares in both ICT producing sectors (7.7 % for the US compare to 6.2 % for the EU-15) and ICT using services (29.5 % compare to 23.3 %). This greater concentration in high technology industries, which are industries that are more likely to use highly skilled labor, clearly contributes to the US productivity advantage over the EU. These highly disaggregated data are not available for capital services and thus only allow for labor productivity computations and comparisons. They confirm that (see Table 5):

- The US labor productivity acceleration is widespread and concerns 29 of the 56 industries. Using employment shares as weights, one can compute the contribution of each industry to the aggregate. This shows that a limited number of manufacturing industries in the ICT producing sectors (computers, electronic valves and communication equipment), and three major service industries (wholesale, retail and auxiliary financial services) account for the lion's share of the US improvement.
- Compared the EU-15 score, the US score becomes even more impressive. Indeed, in contrast, decelerating labor productivity growth is the norm in the EU-15: 45 of the 56 industries exhibit lower productivity gains in 1995-2001 than in 1990-1995.
- One positive point is that in ICT producing manufacturing, in both the US and the EU-15, labor productivity growth rates are significantly higher than all other sectors and show a similar pattern of accelerated growth in the late 1990s (although at a much higher rate in the US).
- Another one is that the ICT producing services industries is the only ICT group for which the EU-15 shows an acceleration from the mid 1990s, whereas the US shows a deceleration.
- The main differences between the US and the EU-15 occur in ICT using services industries and non-ICT industries. In the case of ICT using services industries, there is a sharp acceleration of labor productivity growth in the US not matched in the EU-15. In fact, the deceleration of EU-15 productivity growth is largely due to non-ICT industries, in particular service industries.

Table 5. Average Annual Labor Productivity Growth of ICT Producing, ICT Using and Non-ICT Industries in the EU-15 and the US

	1979-1990		1990-1995		1995-2001		Value added share, 1999	
	EU	US	EU	US	EU	US	EU	US
Total	**2.2**	**1.3**	**2.3**	**1.1**	**1.7**	**2.2**	**100**	**100**
ICT producing industries	**7.2**	**8.7**	**5.9**	**8.1**	**7.5**	**10.0**	**6.2**	**7.7**
ICT producing manufacturing	*12.5*	*16.6*	*8.4*	*16.1*	*11.9*	*23.7*	*1.3*	*2.7*
ICT producing services	*4.4*	*2.4*	*4.8*	*2.4*	*5.9*	*1.8*	*4.9*	*5.0*
ICT using industries	**2.2**	**1.2**	**2.0**	**1.2**	**1.9**	**4.7**	**30.2**	**34.6**
ICT using manufacturing	*2.4*	*0.5*	*2.4*	*0.6*	*1.8*	*0.4*	*6.9*	*5.1*
ICT using services	*2.1*	*1.4*	*1.8*	*1.6*	*1.8*	*5.3*	*23.3*	*29.5*
Non-ICT industries	**1.8**	**0.5**	**2.1**	**0.3**	**1.0**	**-0.2**	**63.6**	**57.7**
Non-ICT manufacturing	*3.0*	*2.1*	*3.6*	*2.7*	*1.6*	*0.3*	*13.6*	*10.6*
Non-ICT services	*0.6*	*-0.2*	*1.2*	*-0.5*	*0.5*	*-0.3*	*38.3*	*36.5*
Non-ICT other	*3.4*	*2.0*	*3.2*	*1.2*	*2.1*	*0.7*	*11.7*	*10.6*

Note: ideally, the year 2001 should be distinguished from the whole period in order to have a better picture of the true acceleration of labor productivity growth between 1990-1995 and 1995-2000.

Sources: GGDC/The Conference Board, Total Economy Database (June 2003) – O'Mahony – van Ark (2003)

One can also find in the European Commission report a growth accounting analysis implemented for each of the major group (ICT producing, ICT using, non-ICT). It helps to identify the corresponding contributions of labor quality, ICT and non-ICT capital deepening and TFP to labor productivity growth. Because of data availability, this analysis has been carried out only up to 2000 and only for the United States, France, Germany, the Netherlands and the United Kingdom. The most important results are the following (we focus on capital deepening and TFP):

- The main contribution to labor productivity growth in ICT producing industries comes from TFP growth, and it has been rising over time in both regions. The contribution of ICT capital deepening has also increased across the two time periods (first half and second half of the 1990s) but by more in the US than in the EU-4. And while non-ICT capital deepening contribution has also increased in the US, it has not in the EU-4.
- The ICT using group is characterized by a proportionally higher contribution of ICT capital deepening than was the case for the ICT producing group. The contribution of

ICT capital deepening was comparable in the first half of the 1990s, but it has risen by more in the US than in the EU-4 during 1995-2000. A dramatic decline in the non-ICT capital deepening contribution to EU-4 labor productivity growth is also to be mentioned, while it has fallen only marginally in the US. The TFP contribution has been rising over time for both countries, but the increase is sharper in the US than in the EU-4.

- In non-ICT using industries, non-ICT capital deepening is more important than ICT capital deepening as a source of labor productivity growth in the EU-4 (but its contribution has strongly decreased over time whilst the ICT capital deepening contribution has been rising a bit). It is the opposite for the US (besides both contributions have slightly increased over time). The TFP contribution has declined in both countries but it remains positive in the EU-4 while it is strongly negative in the US[14].
- There is no widespread acceleration of TFP growth in the EU-4 neither in the US. In the EU-4 and in the US, it is largely confined to the ICT producing manufacturing sector, communications and some industries subject to a high degree of deregulation (agriculture, utilities and transport). In the US, the wholesale and retail trade sectors also exhibit a higher TFP growth rate, which mirrors the findings in terms of labor productivity.

To sum up, if capital deepening has declined in importance as a source of labor productivity growth in the EU-4 across time, it is largely because of traditional non-ICT capital. The EU has enhanced policies which may have in turn changed the traditional economic channels of substitution of capital for labor. Wage moderation and pro-active labor markets policies in recent years may have led to substitution of labor for capital, in particular in traditional industries.

3. Concluding remarks

Contrary to the common wisdom, the changes in the determinants of growth in the EU-15 during the 1990s may have been much more dramatic than in the US. Whereas US labor productivity growth accelerated through higher contributions of all sources of growth, EU-15 labor productivity growth slow downed because of a decline in contributions from both non-ICT capital deepening and non-ICT TFP, erasing the increased contribution from ICT-capital deepening and TFP growth in ICT producing industries. Moreover, pro-labor policies might

[14] This may reflect measurement problems rather than a superior performance of the EU.

have changed the trade-off between productivity and employment, in favor of low TFP, low skilled, low productive jobs.

It is always possible to consider that both the growth accounting and the industry perspective results highlight a significant role for the competitive/regulatory environment in explaining the difference in productivity performance between the US and the EU-15. The main point is, the O'Mahony – van Ark report argues, that, on balance, "policies to strengthen product market competition are usually worthwhile, in particular in service industries, but the arguments in favor of intervention in labor markets are weaker". In this perspective, the dismal performance of Europe seems only marginally ICT-related, so the EU catch-up should be inevitable but it may be slowed by the institutional environment. When this latter is supportive to innovation, growth and so on, productivity (and employment) growth follows. In fact, the smaller EU Member States which are among the best performing States are precisely the same countries that have already undertaken deep and successful reforms well before the launch of the Lisbon strategy. While some larger EU Member States seem to have failed to recognize on time the extent of such needed reforms and are clear laggards in terms of labor productivity growth. Their experience would demonstrate there is nothing inherently wrong with the policy framework of the Lisbon strategy.

However such conclusion is highly sensitive to the data, as revealed by the work of McMorrow and Röger (2001) who have developed a model allowing testing for the role of market rigidities. One of their questions was "*whether Europe could have benefited substantially more from the ICT revolution if it had a more flexible economy in the form of lower capital adjustment costs and less wage rigidities*". Their conclusion was that, "*rather than blaming Eurosclerosis in general for the reason for Europe lagging behind US rates of growth, European policy makers should perhaps instead focus more narrowly on the determinants of the US apparent comparative advantage in the production of leading edge, high technology goods*". It was based on their simulations which suggested "*that it is the high rates of TFP growth in the production of these goods, rather than the capital accumulation effects, which has provided the single greatest contribution to the acceleration in the US growth performance over the recent years*". Unfortunately, the most recent estimates do not suggest this anymore, which implies that policy makers should also focus on the other determinants of the US' apparent comparative advantage. The sole differences in the rate of technical progress are no longer an adequate explanation of the growth differential between the two countries.

Section 2 . Institutions, economic policies and performance

One way to enlarge further the debate and in fact to change of perspective is to consider that the key issues to be addressed might not revolve around the possibility of convergence towards some pre-determined equilibrium growth path. They might be about the nature of growth regimes in the history of our economies and their relevant stability features. As a matter of fact, the central stylized fact revealed by international comparisons is the diversity of evolution across countries that still have faced the same kind of shocks and have had access to the same technologies. This diversity is closely related to the nature and the profile of the accumulation process and economic policies.

The different productivity trends in Europe and the US in the 1990s and the apparent disappearance of the productivity paradox in those years in the US[15] confirm the scenario that focuses on co-ordination failures. The truly important difference between most of the European countries and the US is likely to be this: in the US, the rate of investment has remained constant and investment has always actually increased following supply shocks. At the same time, the stock market bubble pushed capital costs downward and allowed firms to carry out their desired investments. As a consequence, the rate of growth consistent with the price stability has risen, and correlatively the NAIRU has decreased.

The US economy did not experience structural fluctuations to the same extent as some other, perhaps core EU countries (Böhm, Gaffard and Punzo, 2001, Gaffard and Punzo, 2005). This was mainly due to the fact that "*policy has not generated bouts of severe inflation and so has not had to generate bouts of recession to control it*" (Romer, 1999, p. 32). Conversely, the poor performance of productivity in Europe is the result of a reduced process of accumulation (also characterized by strong fluctuations) that could be due to a tight monetary policy, and more generally to a wrong policy management.

Behind these different realized accumulation processes, different co-ordination mechanisms have been at work, one actually sustaining this process and the other failing to do so. Good coordination of the process of accumulation of capital, not price flexibility, is the main reason of the satisfactory performance of the US, although the behavior of prices may have helped. A strong wage flexibility associated with a strong increase in personal inequalities has not resulted in perturbations of the economic activity because a strong growth made possible by good co-ordination mechanisms has led to a huge creation of jobs and hence to a stability of wage shares. In Europe, where the restrictive policies adopted have checked the process of capital accumulation, strong fluctuations of the wage shares in the gross

[15] See Section 1 of the Report.

national products due to mistakes in economic policy may have contributed to exacerbate the existing distortions, instead of helping to reduce them.

The economic transformation of Europe such as involved by technological changes, enlargement of EU, and competition with emerging economies (China, India) and US as well, requires a new deal that should really both promote growth and enhance social welfare and cohesion. The key issue to be addressed is not the realization of the institutional conditions supposed to automatically allow the choice of best technology practices and hence the convergence towards a predetermined optimal growth path. We have, in fact, to look at growth as the result of an adaptive process that allows discovering the relevant information and hence capturing the potential gains associated with the development of new technologies and market extensions.

The real issue is about the necessarily complex set of conditions that make the process of accumulation and restructuring of capital regular and hence determine the actual growth rate of the potential output. This set cannot be reduced to the choice of an institutional arrangement presumed optimal. Thus, contrary to the current consensus, macroeconomic stability, far from being regarded as a precondition of growth, regarded as a set of rules aimed at guaranteeing monetary stability and fiscal discipline, will result from a process that requires discretionary interventions.

In this perspective, monetary policy should be aimed at promoting banking behaviors and structures that sustain necessary investment instead of maintaining a constraint on firms' behaviors in order to maintain full price stability[16]. Employment protection, and more generally institutional rules that favor social cohesion, should be viewed (and amended) as a means for allowing the economy to deal with turbulences, and hence guaranteeing the effectiveness of the learning process. Competition and regulatory policies should be oriented in such a way as considering market imperfections as integral and necessary aspects of the production and the dissemination of knowledge in a market economy, i.e. as the natural features of an economic process driven by creative destruction. Cohesion policies should make it compatible to promote growth in each region or country and maintain an economic and political equilibrium between them.

Of course, institutions matter. However, they have to be considered in relation to the adjustment process required by structural changes rather than in relation to the presumed performance in the long run. *"Their role has to be altogether redefined, to be one of helping reducing the irregularity in the growth process generated by e.g. technology shocks and generally innovation, rather than in determining the growth trend. They do contribute to the*

[16] Unlike the US Fed, the European Central Bank has been imposed a sole objective in the Maastricht treaty: price stability.

latter by accomplishing the former task. Effective institutional systems contribute to regular dynamic patterns, not those that just incorporate stronger incentives for growth. The reason is that innovation *in its variety of forms is by its very nature a break up and implies a discontinuity: e.g. a break up in the existing production structure and markets. It brings about adjustment costs and specific problems of coordination between economic activities. Depending upon the way these new problems are dealt with, an economy's growth is more or less regular and accordingly the productivity and output gains ripped out of innovation greater or smaller. The challenge is to render the technological and institutional evolution as gradual as possible. This being their appropriate role, economic policies need only go the same way*" (Gaffard and Punzo, 2005).

1. Growth strategy in the EU: Quo Vadis Europa?

a. Institutions and Growth in Europe

The link between institutions and growth is now an object of wide consent among economists. [17] The exploration of this theoretically rich relation has given rise, in our economic time, to a new wave of comparative economics in the form of a "new-new institutionalism" (that in some ways resembles the "old" one of such founding fathers as Ely, Commons and Veblen) devoted to analytically identify and empirically document the complex interactions between institutions and growth (see, among many others in this fast-growing literature, Hall and Jones, 1999; Acemoglu, Johnson and Robinson, 2001; and Rodrik et al., 2002) [18].

The elementary question remains: "what do we mean by 'institutions'?". In this respect, one should note that an intriguing feature of the new literature cited above is that it seems almost exclusively focused on developing countries, leaving aside the link between institutions and growth in developed economies. What is more, when it comes to economically advanced countries, the role of macroeconomic policies –and their crucial articulation or, better, coherence with "structural" institutions– seem to disappear in favour of monochromic diagnoses of harmful "rigidities".

Indeed, on the other theoretical end of the new "comparative growth economics" devoted to shed some light on recent miracles and enduring failures among emerging economies, has

[17] One can think of the quasi-unanimous praise that welcomed the work of D. North and R. Fogel, who were awarded the Nobel Prize in 1993 for their analysis of the "role institutions play in economic growth".

[18] One must certainly keep in mind that the debate is only heating at the highest level of the academic community and that many refutations, validations and tests of all kinds separate us from an integrated view, if it is ever to exist, on this issue (see, among the methodical doubters, Sachs, 2003, Glaeser et al., 2004 and, for a very first survey of the field and some clarifications, Rodrik, 2004). Whatever the future refinements, no one would seriously present growth theory today without institutional perspectives (for a state of the art panorama, see Aghion and Durlauf, 2005).

stand alone, until recently, a "comparative structuralism" aimed at fundamentally relating economic performance of developed nations to their labor market structures (for classic contributions, see Layard, Nickell and Jackman, 1991 and Calmfors and Driffill, 1988 ; for counter-argumentation, see Fitoussi and Passet, 2000; Fitoussi, 2002; and Freeman, 2000). The recent "comparative capitalism" or "varieties of capitalism" literature, focused on the key issues of co-ordination (and the subsequent distinction between "liberal market economies" and "coordinated market economies") and "institutional complementarities", is a fertile new ground for a more accurate perception of dynamic institutional interactions and their economic outcomes (see Hall and Soskice, 2001 and, most recently, Gingerich and Hall, 2004).

When considering the classical and rather broad definition of "institutions" given by Douglas North (1994): *"the humanly devised constraints that structure human interaction [...] made up of formal constraints (rules, laws, constitutions), informal constraints (norms of behavior, conventions, and self imposed codes of conduct), and their enforcement characteristics. Together [defining] the incentive structure of societies and specifically economies"* (see North, 1990 for the original formulation), it actually appears problematic, to say the least, not to think of macroeconomic policies, and of the "macro-structural" (policy) mix, as part of the institutional operational system of any given modern economy.

In this regard, the EU looks lopsided. It has developed, for almost two decades since the Single Act in 1986, a growth strategy along a structural pattern, with little consideration for economic governance.

Yet, while the Single Market – although not fully – is largely enforced since 1993 and has also been reinforced, for six years now, by the single currency (the "Euro"), the EU growth performance for the last four years has been repeatedly deceptive and the overall assessment of the last European decade, when compared with the American and Asian performances, is nothing less than dismal (see Chart 1).

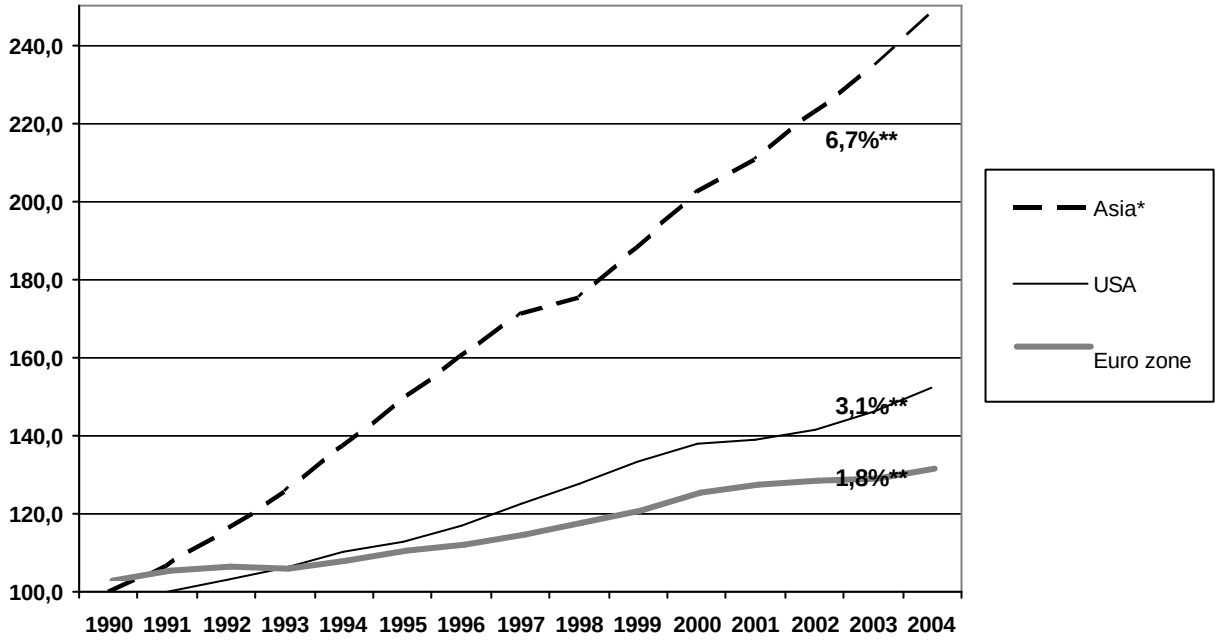
The problem looks even more serious: the "juvenile" Asian economies put aside, the EU, not catching-up anymore since the mid-70's, has been lagging behind the US economy for more than two decades by an estimated 30 % gap in GDP per capita (see, among many others, Sapir et al., 2003), this gap currently amounting, after the Eastward enlargement and the "roaring" American decade of the 90's, to roughly 40%.

The exact nature of the transatlantic gap must here be briefly highlighted and related to the previous institutional considerations. The "American model", made of flexibility, creativity and "risk-loving" culture, to which EU officials are often referring with envy (*cf.* infra), seems misunderstood by them or, better, underestimated in its complexity.

While the "structures" of the American economy undeniably played a major role in the phase of innovation and investment acceleration observed after 1995, the sparking and stabilizing effects of both monetary and fiscal policies throughout the decade, fostering in return, in the process of high non-inflationary growth, long-lasting efficient metamorphoses in the economy, must not be neglected (see Solow and Krueger, 2002 for an overview).

Thus, beside the "deepening hypothesis", according to which the EU integration would not yet be sufficient to deliver a durable high level of GDP growth, one of the reasons of the poor economic performance of the region might well be that the EU has not developed the coherent economic policy institutions able to make the most of its potentially powerful economic and monetary integration, in other words: the EU has not developed the coherent economic policy institutions able to foster its potential growth.

Chart 1: the dismal decade



*: Asia is composed of China, India, South Korea, Hong Kong, Taiwan and Singapore.
**: Mean annual growth rate of real GDP between 1990 (index 100) and 2004.
Source: Fitoussi and Le Cacheux (2005).

b. Potential growth and potential output: where do we stand?

Determining potential growth and output is a crucial task in order to figure out the necessity and consequences of economic policies. The necessity of implementing a fiscal and/or a monetary policy depends on the output gap, i.e. the difference between actual and

potential output: economic policies may be effective only insofar as the output gap is negative. Consequences of economic policies also depend on the output gap: increasing fiscal deficits or reducing nominal interest rates for stabilization purposes when potential output is below actual output will prove inflationary and inefficient. Potential output and potential growth give also key information: high potential growth may attract long-term capital flows.

Although potential output and the ensuing output gap are widely used by policymakers, and are thus crucial for designing an adequate if not optimal economic policy, two definitions still coexist and no consensus has arisen so far as regards a unique, uncontroversial estimation methodology.

From a statistical point of view, potential output is computed as the trend or smooth component of actual GDP series. The underlying concept is thus totally disconnected with a specific economic theory and cannot explain the determinants of potential output: by construction, actual GDP smoothly fluctuates around potential output in the mid-run.

If economic rationale prevails, potential output is generally said to be defined as the level of output consistent with a stable inflation rate. More precisely, it is the "*sustainable aggregate supply capabilities of an economy, as determined by the structure of production, the state of technology and the available inputs*" (ECB, 2000). The estimation methodology thus depends on the time horizon: in the short run, the capital stock is constant and potential output only depends on the maximum utilization of inputs – capital and labor. Tensions only stem from the reduction of the gap between actual and maximum utilization rates. However, assessing those tensions necessitates that the degree of acceptance of tensions in the economy be known and constant over time. The same gap between actual and maximum utilization rates is not accepted similarly in an economy with low or strong aversion *vis-à-vis* inflation, for instance (Passet et al., 1997). As European economies have moved from low to strong aversion *vis-à-vis* inflation since the mid-eighties, potential output may have been underestimated ever since. Moreover, the relatively inertial behavior of European policymakers, in comparison with their US counterparts, could be attributable to a change in social norms which has already been achieved in the US but which is still "on air" in Europe (see Fitoussi and Le Cacheux, 2005): lower aversion *vis-à-vis* inequalities in Europe would tend to let European authorities accept a higher *natural* rate of unemployment than in the Seventies.

In the mid-run, potential output depends on the speed of and extent to which capital is accumulated. Technical progress is no longer considered as a constant data and its determinants have to be assessed. Measuring the dynamics of capital accumulation and the diffusion and determinants of technical progress remains a major theoretical, methodological and empirical issue (see Section 1 of the Report). The calculations by Jorgenson and Motohashi (2004) on the contribution of information technology (IT) to effective growth in

Japan is a very good example: after harmonizing the national accounts for Japan and the USA, Jorgenson and Motohashi concluded that the gap between economic growth in Japan and in the USA is exclusively attributable to the drop in non-IT investment in Japan, as well as to a fall in employment, a conclusion which totally reversed past estimations.

Assessing potential output is definitely not straightforward as potential output is not "observable". Estimation techniques were twofold in the past[19]. On the one hand, for those economists who acknowledged the statistical view of potential output, various trend and univariate methods were proposed: potential output was considered as a linear trend component of actual output[20], but the trend component could also be extracted by a filter (the Hodrick-Prescott (HP), the Baxter-King filter or the Kalman filter)[21].

On the other hand, for those economists who acknowledged an economic view of potential output, a second type of methodology – the production function approach – has given the possibility of identifying the various factors contributing to potential growth.

Both types of estimation methodology have its advantages and drawbacks. Statistical methods are easy to implement but since they draw extensively on past observations of actual output and do not give information on its determinants, they cannot serve the purpose of forecasting potential output or growth.

Non-statistical structural methods rely on a specific economic theory and identify explicitly the factors that are driving economic growth: they can be used for forecasting purposes. Moreover, they are widely used by international institutions (OECD, IMF, etc.) and can be used for comparison purposes. The production-function approach is also recommended by the EU Economic Policy Committee (EPC, 2001). Cotis et al. (2004) note that this approach should be the preferred method for estimating potential output in Europe as it is, among the array of available methods, the most consistent with policy priority, namely achieving structural long-term targets like those induced by the Lisbon European Council (the target of a trend growth of 3 per cent per year over a decade). In order to meet this target, it is of the uppermost importance to know clearly which type of structural reforms in labor, product and capital markets is likely to drive future economic growth. Nevertheless, the production-function approach is not devoid of strong drawbacks: firstly, the appropriate form (Cobb-Douglas, CES, etc.) of the production function has to be chosen but no uncontroversial method can definitely discriminate between different specifications. Secondly, structural changes like those arising from a productivity shock are difficult to incorporate in stable estimated production functions. Thirdly, this approach raises the issue of how to measure

[19] For a recent review, see Cotis et al., 2004; a comparison of various methods using European data is available in Chagny and Döpke (2001). See also Rennison (2003) with artificially-generated data.

[20] Or a split trend: trend output was calculated as a linear trend during a cycle, where the cycle is defined as a period between two peaks in economic growth.

[21] Beveridge-Nelson decomposition between trend and cycle could also be introduced.

unobservable variables like total factor productivity (TFP) or the equilibrium (or natural) level of unemployment. As such, data on the stocks of labor and capital may be of poor quality to implement reliable estimations of production functions (although we will perform some rough tests using these stocks in a following section).

It is highly probable that the reliance on total factor productivity (TFP) as a measure of technical progress is quite heavily biased by measurement errors. Both inputs are at stake. As for labor, the growth in labor productivity can be broken into three components: an increase in capital input per hour worked (or capital deepening), a rise in the growth of TFP or output per unit of input, and an increase in labor quality, labor input per hour worked, due to a shift toward better educated and more experienced labor force.

On labor quality, three elements are noteworthy. Firstly, it is very likely that the quality of the labor force has to do with that of education: in some countries, mostly European ones, human capital is resulting from public involvement in providing education, hence from some part of public expenditures. This would mean that those expenditures may impinge positively on labor productivity and, consequently, on potential output.

Secondly, the relationship between labor quality and employment quality has to be somewhat scrutinized: the changing organization of work after the decay of Taylorism is now said to have dramatically deteriorated safety and health of working people (see Askenazy, 2004, for an enlightening presentation): cumulative trauma disorders would have been highly and positively correlated with innovative organization of work in the USA between 1984 and 1994[22], and this would have been the case also in European countries since the beginning of the 1990s. The lower overall quality of employment may impinge negatively on labor productivity and on potential output.

Thirdly, labor quality is dependent on the actual level of unemployment: potential output thus depends on effective output. Long-lasting unemployment is unfavorable to labor quality as it pushes some unemployed workers to quit the labor market via early retirement schemes: the average skill of the labor force then drops automatically. High unemployment is also unfavorable to labor quality as it discourages the young and married women (generally with kids) to try to enter on the labor market.

As for capital, two major issues are at stake: as shown in Section 1 of the Report, the measurement of TFP is very sensitive to the assumption of a constant lifespan of equipment; and, adjusting prices of capital goods to better take into account the evolution in the quality of equipment drastically limits the contribution of TFP to potential growth and, conversely, accentuate the role of capital accumulation.

[22] This trend has been reversed in the US due to the better account by business managers of the cost of these traumas in terms of productivity: safety and health of the working people has been enhanced.

It is noteworthy that the most recent empirical papers[23] now propose combining multivariate filtering techniques[24] with the production-function approach. This methodology thus combines a model-based approach to estimate potential output with explicit statistical assumptions concerning the estimation of the potential values of the components of the production function. Unfortunately, those sophisticated techniques do not help to discriminate between different specifications (Cobb-Douglas, translog, etc.) of the production function and may therefore remain highly sensitive to the chosen specification.

As a conclusion to this general overview of the literature on potential growth, figures in table 1 should help to understand the substantial uncertainty surrounding the estimations on which economic policies are based. Remarks are threefold. Firstly, using the battery of estimations performed at the Banque de France, it appears that estimation results are highly sensitive to the estimation technique and that error margins for potential growth may be substantial (the case of France is rather emblematic in this regard).

Table 1. A comparison of different estimations for potential growth (average annual variations in %)

		USA	Japan	Euro zone	Germany	France
2002	BdF	[2.8;3.4]	[1.3;1.5]	[1.9;2.3]	[1.0;1.4]	[1.7;2.2]
	OECD	2.9	1.2	2.0	1.5	1.9
2003	BdF	[3.1;3.4]	[1.5;1.8]	[1.7;2.3]	[1.0;1.4]	[1.4;2.1]
	OECD	3.2	1.3	1.9	1.6	2.3
2004	BdF	[3.4;3.5]	[1.5;2.2]	[1.7;2.3]	[1.1;1.4]	[1.7;2.2]
	OECD	2.9	1.3	1.9	1.6	2.2

Sources: Cette et al. (2004), OECD.

Note: Figures in brackets give the intervals of Banque de France estimations based upon six different techniques (production function, split trend, HP 1600, HP 7000, structural VAR and unobserved components).

Secondly, estimations by different institutions give quite different results: for instance, OECD estimations for Japan are below the lower limit of Banque de France estimations.

Thirdly, estimations of potential growth are not constant over a short time period (2002-2004) although potential growth estimated *via* a production function (this is the case at the OECD) is a long-term economic indicator. In the United States, but also in France, potential growth may hence gain 0.3 point within a year: all else equal, and assuming that central banks follow a monetary rule with Taylor coefficients, mismatching potential growth by 0.3 point may lead to a false reaction in the short-run interest rate of at least 0.15 percentage point. For

[23] See Chagny and Lemoine (2003) for a recent review and an application to the Euro zone.

[24] HP and Kalman filters are respectively extended to incorporate various structural relationships, notably a Phillips curve. Other multivariate techniques include unobserved components models and structural vector auto-regressive models.

the purpose of illustration, this would mean that if potential growth had been constantly underestimated by the US Fed, the short-run interest rate would not have grown from 1% to 2% between July and October 2004, but from 1% to 2.6%. Surely, this would not be the same story.

Uncertainty regarding the "good" estimation technique of potential output or potential growth, and the discrepancy of estimation results across techniques or over time surely has not facilitated the path towards the "Lisbon strategy" – the growth strategy decided and implemented at the turn of the century by the EU–: this discrepancy has added to "governance incoherence".

c. The "Lisbon strategy": If desirable, is it possible?

To fully understand how "governance incoherence" could stand in the way of an efficient European growth strategy, and on the verge of the Mid-term Review of the "Lisbon strategy" due next Spring, one has to recapture the essence of this strategy, as it was proposed and agreed upon in March 2000 (see Table 2). Europe's "Millennium Goal", the overall *"new strategic goal* for the next decade" was *"to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion."*

The Lisbon strategy rests on a double economic diagnosis: the EU would suffer from a "labor deficit" and an "innovation deficit". Both of them stem clearly from the following quotations (European Council, 2000): *"More than 15 million Europeans are still out of work. The employment rate is too low and is characterized by insufficient participation in the labor market by women and older workers. Long-term structural unemployment and marked regional unemployment imbalances remain endemic in parts of the Union*", here for the "labor deficit", and: *"The services sector is underdeveloped, particularly in the areas of telecommunications and the Internet. There is a widening skills gap, especially in information technology where increasing numbers of jobs remain unfilled. With the current improved economic situation, the time is right to undertake both economic and social reforms as part of a positive strategy which combines competitiveness and social cohesion*", here for the "innovation deficit".

One must also recall, as we will discuss this point later on, that both "innovation deficit" and "labor deficit" were to be abolished in a context of high growth, which was the case in the late 1990's, made possible by *"applying an appropriate macro-economic policy mix"*

(European Council, 2000). Finally, the strategy rested on one major governance instrument: *"a new open method of coordination at all levels"* in the EU.[25]

Table 2. The "Lisbon strategy" in a nutshell

Potential growth rate component at stake*	**Nature of the diagnosis***	**Nature of the prescription****
Productivity growth rate	"Innovation deficit"	"*Preparing the **transition to a knowledge-based economy** and society by **better policies for the information society and R&D**, as well as by stepping up the process of structural reform for competitiveness and innovation and by completing the internal market*".
Labor force growth rate	"Labor deficit"	"***Modernizing the European social model**, investing in people and combating social exclusion*".

* : Authors' terms.

** : As stated in the "Presidency conclusions" of the Lisbon European Council (European Council, 2000).

Many objections can be raised when examining in details the Lisbon diagnosis. Blanchard (2003) for instance has showed that, of the two deficits, the "labor" one was by far the most important, since, according to his calculations, average GDP per hour worked in the Euro zone is only 5% less than in the US, France and Germany workers even producing 5% more per hour than their American homologues. He accordingly concludes that *quantity* is at stake in the per capita income gap with the US, not *quality*[26]. In Section 1 of the Report, we have showed evidence that the gap with the US had more to do with non-ICT capital deepening and non-ICT TFP growth, hence on neither type of "Lisbon deficits".

[25] Stated shortly, the open method of coordination is a "soft unconstrained" coordination with variable geometry. Topics and countries involved are "variable" in this respect.

[26] The nature of this quantity gap then remaining to be determined, in the form of a "preference" in Blanchard view, or in the form of a constraint, for instance in Prescott's terms (see Prescott, 2002).

There is little doubt in the EU officials' mind that something is wrong with the results obtained so far in the implementation of the Lisbon strategy. In fact, in the own European Council Presidency recent words, something like a partial failure is acknowledged: *"The Union set itself ambitious goals in March 2000. Four years later, the picture is a mixed one."* [...] *"the pace of reform needs to be significantly stepped up if the 2010 targets are to be achieved."* (European Council, 2004).

While the importance of a proactive macro-structural policy mix is not stressed among recommendations to speed up the Lisbon process preparing the Mid-term review of the strategy next year[27], there are strong reasons to believe it should be: the main explanation of the Lisbon strategy failure so far might well be that implementing "structural reforms" without a coherent growth-friendly macroeconomic governance is an impossible task[28]. In brief, what the EU lacks to build the growth-deliverable and autonomous economy it deserves given its efforts is institutional coherence (see Chart 2).

♦ ***The "innovation deficit" closing incoherence***

In the light of the modern theory of economic growth and stabilization policy, the relevance of the European economic governance given the objective of reducing or even abolishing the "innovation deficit" set by the "Lisbon strategy" must first be questioned.

The EU "federal budget", the Stability and Growth Pact, the ECB monetary policy and exchange rate management all appear to be ill-design instruments in this perspective.

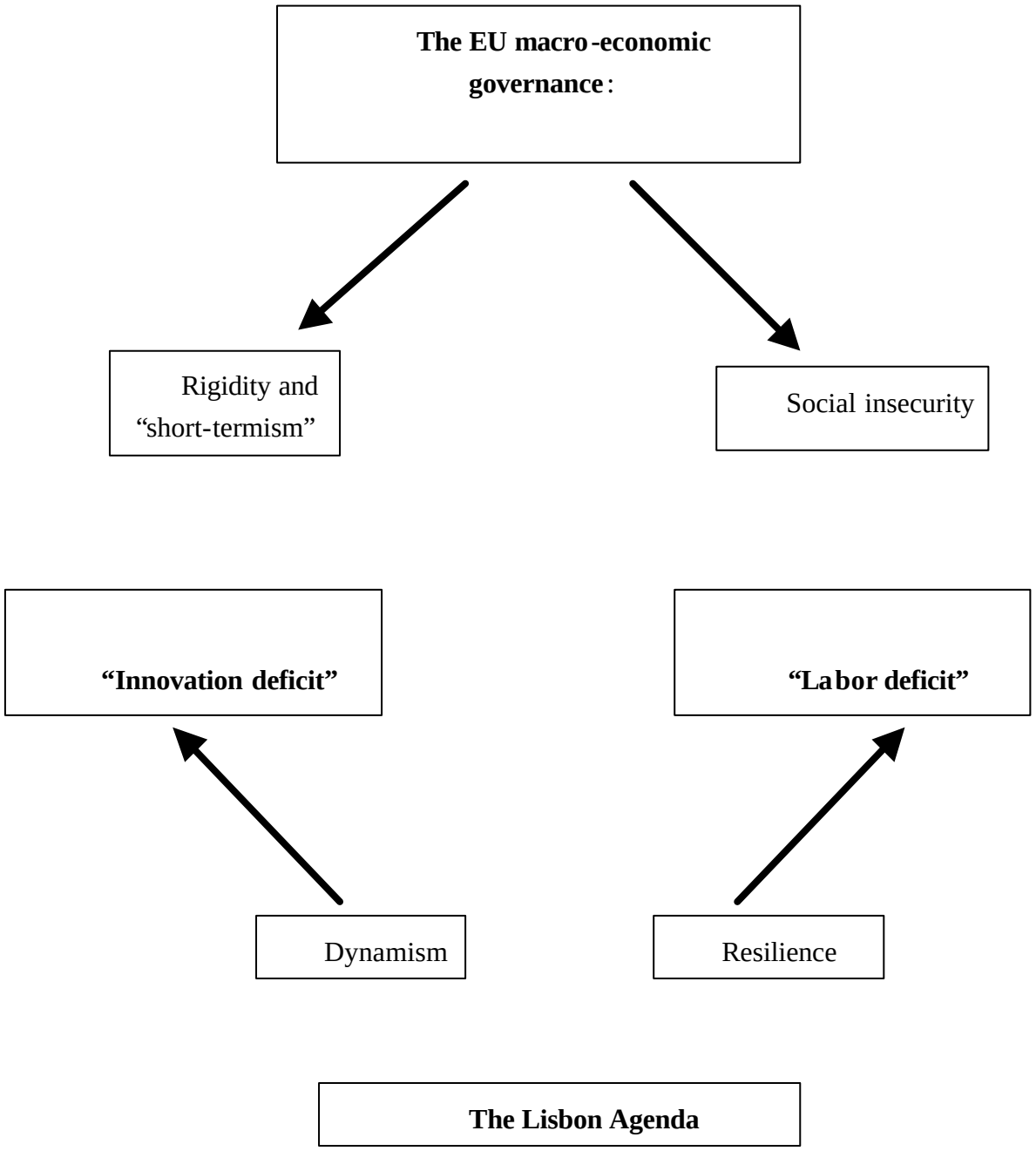
The EU budget is, at the same time, quite small (1% of the EU GNI) and almost fully devoted to agricultural and regional aides (80% of total spending)[29]. As recently documented by the "Sapir Report" (Sapir et al., 2003), the amount left to "growth spending" at the EU level is almost negligible. This situation is likely to worsen in the EU-25, with new members planned to receive only 40 billions Euros in the next 3 years from the EU budget and old members willing to reduce their own contributions (strong claims to keep the EU budget at 1% the EU GNI have been made by EU founding members). As is well known, new members are markedly less developed than the 15 older members; and this makes the negotiations over the future EU budget more difficult, especially in times of bad overall economic performance and very tight budget conditions in most member states.

[27] To be fair, we must acknowledge that at least "an appropriate macroeconomic policy mix" is recommended. However, in the European view, the appropriate policy mix is desperately constituted of a "fiscal consolidation" and the so-called "sustainability of public finances". Budgetary margins for maneuver are still conditional on countries having already sharply reduced their public deficits. The transition period and the influence of business cycles on deficits have long been absent from the Europe discourse.

[28] See the end of Section 2 for some investigation on this peculiar topic.

[29] These developments on the EU budget hinge extensively on Le Cacheux (2004).

Chart 2. The EU "incoherence diamond"



Instead of reasoning on common goals and appropriate tools to reach them, the new negotiations over the size and structure of the EU budget for the next decade are dominated by a petty accounting logic and by the concern of major current contributors to minimize their net financial "burdens" and get closer to the "*juste retour*" once advocated by former British Prime Minister Margaret Thatcher in the early 1980s.

Amounting to a little less than €100 billion in 2003 and due to rise to only €115 billion in 2006, the European budget is both small, relative to national or even, some local budgets, and highly tilted towards two major expenditure items: the Common agricultural policy (CAP) eats up about €45 billion, and structural and regional policies about €33 billion. While the former has been considerably trimmed over the past ten years, in the process of adapting EU agriculture to the rules of world trade and of reducing public support to production prices and farmers' incomes, structural policies have progressively emerged as the major financial instrument for promoting economic convergence and social and spatial cohesion amongst EU countries and regions. With their low income per capita and, for many of them, relatively large and backward agricultural sectors, the new member states would, in the absence of any change in the rules for distributing EU funds, have been important beneficiaries on both accounts.

Although the mere idea of calculating net gains and losses may seem contrary to the spirit of European integration and the notion of financial solidarity that goes with it, it has become a habit to start all budgetary negotiations in the EU with an assessment of net financial gains and losses of each member state, and indeed to reason almost exclusively in these terms even in the course of the negotiation. In an effort to curb the opposition of net contributors *vis-à-vis* the extreme polarization of net benefits and contributions, which the new enlargement to relatively poor, and in some cases, agricultural countries, reinforces, the EU Commission has recently proposed a generalized correction formula for net budgetary balances of member states, that would leave no country with a net contribution larger than what all would regard as "fair". Although such an approach may be necessary to win the support of major net contributors to a larger EU budget, it also tends to postpone the reflection on better sources of financing and to institutionalize the notion of "*juste retour*", with all the theoretical objections and practical problems of assessment that may be raised against it.

Rather than focusing the debates on the overall size of the EU budget or on net contributions of member states, a more constructive and potentially more fruitful approach would emphasize the common objectives and possible collective goods that European countries recognize are willing to provide, either jointly through the direct intervention of the EU level via its budget, or indirectly, by inducing national governments to provide them. The way the EU Commission has tried to reformulate common policies and recast the various spending items in terms of major objectives (essentially competitiveness, cohesion and

external actions, see Table 3) is an interesting attempt in this direction, although it appears quite artificial and mostly cosmetic.

Table 3. EU Planned expenditures under the 2007-2013 financial perspective (% of total budget)

Policy heading	**2006***	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
1a. Competitiveness	7.3	9.1	10.4	11.7	12.0	14.1	15.3	16.3
1b. Cohesion	32.1	35.6	34.9	34.3	33.6	32.9	32.5	32.2
2a. Agriculture	36.2	32.6	41.7	40.6	39.5	38.5	37.5	36.5
2b. Other "sustainable management"	10.2	10.2	10.3	10.3	10.2	10.1	9.9	9.8
3. Citizenship, security, etc.	1.1	1.2	1.5	1.6	1.8	2.0	2.1	2.3
4. EU as global partner	9.3	8.5	8.8	9.0	9.4	9.7	9.8	9.9
5. Administration	2.8	2.8	2.8	2.8	2.8	2.8	2.8	2.8

- Due to a one-off adjustment made by the Commission in the current structure to make it comparable to the planned one, this column adds up to a little less than 100%.
- *Sources:* EU Commission, 2004, calculations by Begg (2004).

The Stability and Growth Pact (SGP), although widely and, at times, officially criticized for its weak theoretical rationale and poor record (see Fitoussi and Creel, 2002), is still in place. While not discriminating, as the "golden rule" for public finances for instance would do, between consumption and investment governmental spending, the SGP harms the potential growth of each Member State. The integration of ten new members, 60% of which violated the SGP at the date of their adhesion –after more than a decade of convergence– does not offer any perspective that the member States will feel safe enough to ease their common budgetary rule. Furthermore, the still informal propositions of reform of the SGP recently presented by the EU Commission do not allow national budgets to be more heavily used to foster innovation: the constraining rule of an overall public deficit below 3% of GDP remains, and only the enforcement of some procedures dedicated to the deviations from the rule would possibly be reformed. For instance, the time schedule for achieving the balanced-budget target would depend on economic circumstances (business cycles, the debt level, etc.).

As for monetary policy, it should be reminded that the European Central Bank (ECB) is the most independent Central Bank in the world. It is also a young institution in search of credibility (see Fitoussi and Creel, 2002). These two elements explain why the ECB has, until now, shown little reaction in front of the deteriorating economic context in the EU since the downturn of 2001. The arrival of ten new members, many of which have officially announced their intention to join the Euro zone as fast as possible is, there also, likely to rigidify even

more the position of the European monetary institution, undermining effective and potential growth in the Euro zone, which accounts for more than 80% of the EU-25 GDP. Monetary policy, when carefully but effectively used (i.e. under "constrained discretion", see for instance Bernanke and Mishkin, 1997 and, for a reassessment, King, 2004), is a mighty tool to sustain high level of growth, that is to fully realize the potential of the economy. This stabilization policy naturally entails structural effects: maintaining unnecessarily high levels of real interest rate and/or mass unemployment, as it has been the case in the EU for most of the 90's, harms long-term growth.

Finally, exchange rate management, which is taken care of *de facto* by the ECB (but is *de jure* the shared custody of the ECB and the European Council) is also far from being coherent with the "Lisbon strategy". To begin with, the Euro does not play a positive role in stabilizing the European economy: on the contrary, it is pro-cyclical since the beginning of the 90's. The Euro has appreciated from 1991 to 1996, when growth was weak in Europe, it has depreciated from 1996 until 2000, when growth was strong and is it appreciating ever since, while Europe is experiencing a severe economic downturn (Chart 3).

Chart 3. A destabilizing Euro

Source: ECB Monthly Bulletin, December 2004.

The current organization of economic policies in Europe is thus at stake in that it is definitely incoherent with the major step towards "more growth in Europe" which is the cornerstone of the Lisbon strategy. Another intriguing question has to do with evidence regarding the impact of public capital and/or public investment on economic growth. This is a major issue as the Lisbon strategy explicitly refers to "better policies" in the "transition to a knowledge-based economy". Since the growth potential of a given economy relies mostly on its ability to accumulate endogenous technical progress, fiscal policy, notably through R & D and higher education spending, may be a powerful instrument of this social human capital accumulation. Can we infer from a look at the data that public policies and more specifically public investments are a key variable for explaining growth?

♦ ***Public policy and endogenous growth?***

The neoclassical growth model *à la* Solow[30] states that actual growth per capita is conditional on capital and labor accumulation and on exogenous technological progress. Assuming decreasing returns to scale, output growth equals that of the population plus technical progress in the long run. Within this framework, it is straightforward that economic policies are devoid of an impact on growth per capita in the long run.

This conclusion has been largely debated since the development of the so-called "New" growth theory which acknowledges the endogenous nature of technical progress and assigns a key role to fiscal policy as a determinant of long-run economic growth[31]. Basically, extending inputs to public capital (or human capital) and fully taking into account the interactions between the three possible inputs, returns to scale may turn positive. These interactions may notably involve R & D expenditures. By their specific nature of non-rival goods, they may have positive externalities, spreading to broader technical progress and ensuring a social return superior a private, isolated, return. In this context, public intervention financing fundamental research, infrastructures, etc., may substantially enhance economic growth above the steady-state compatible with the assumption that goods and labor markets clear.

Unfortunately, empirical evidence on the links between public capital and economic growth are still debatable, with the output elasticity of public capital ranging from 6% to 70%, depending on the sample used or the country studied (see Table 4).

According to Kneller et al. (1999), results are extremely *ad hoc* because they lack a complete specification of the government budget constraint. Kneller et al. (1999) perform empirical tests in which they distinguish between productive/unproductive expenditures and distortionary/non-distortionary taxes and show that financing expenditures counts. The

[30] See Solow (1999) for an extensive presentation.
[31] See Turnovsky (2004) for a recent contribution.

endogenous growth theory outcome would only be met had distortionary taxes remained constant. Noteworthy however, Kneller et al. did not investigate the possibility that expenditures could be financed by public bonds' issuance. In an intergenerational logic, the fact that productive expenditures could be financed by public debt seems appropriate.

Table 4. A parsimonious survey on the contribution of public capital to economic growth

Methodology	**Contribution of public capital to economic growth**
Production-function approach	**Elasticity**
Ratner (1983)	= 0.056 (US data)
Aschauer (1989)	= [0.29, 0.56] depending on assumptions regarding productivity (US data)
Ram and Ramsey (1989)	= 0.24 (US data)
Garcia-Mila and McGuire (1992)	= 0.05 (48 US states)
Eisner (1994)	= 0.27 (US data)
Sturm and De Haan (1995)	= 0.41 (US data)
Vijverberg et al. (1997)	= 0.48 (US data)
Evans and Karras (1994)	estimates are fragile and generally not significant (7 OECD countries)
Dessus and Herrera (1996)	= 0.26 (panel, 28 countries)
Merriman (1990)	= 0.58 (9 Japanese regions)
Berndt and Hansson (1991)	= 0.68 (Swedish data)
Bajo-Rubio et al. (1993)	= 0.19 (Spanish data)
Otto and Voss (1994)	= 0.38 (Australian data)
Wylie (1996)	= 0.51 (Canadian data)
Gong et al. (2004)	= 0.50 (US data) = 0.29 (German data)
Estimations including the budget composition	
Kneller, Bleaney and Gemmel (1999) Bleaney, Gemmel and Kneller (2001)	a 1-point increase in productive public expenditures increases per capita growth by 0.29 point; and a 1-point increase in distortionary taxation decreases per capita growth by 0.45 point.

Considering the wide range of output elasticity to public capital in the literature, we have decided to add our own estimations. We have performed some rough estimations of the production function with an application to the US, Japan and the Euro zone. For the latter, two different specifications have been proposed: an aggregate specification and a panel specification. Results clearly show that public investment has a significant and substantial favorable impact on output in the US and the Euro zone, but not in Japan. The "Lisbon strategy" in Europe is legitimized by the data.

We have used a Cobb-Douglas production function

$$Y = a\, N^{1-s} K^{s} K_G^{h} \qquad (1)$$

where N denotes labor, K is the stock of private capital and K_G is the stock of government capital. It is assumed here that producers face constant returns to scale in the two private inputs, and increasing returns to scale in all three inputs.

After log-linearization and stated in first difference, eqn. (1) can be rewritten as

$$\Delta Y = (1-s)\Delta N + sI + hI_G \qquad (2)$$

where a "Δ" denotes a growth rate, I is (gross) private investment and I_G is (gross) public investment.

Disregarding at this stage the depreciation rate of the capital stock, unconstrained estimations of eqn. (2) for the US, Japan and the Euro zone are reported in table 5. Like Kneller et al. (1999), though not on a 22-country panel, we find that initial GDP enters all regressions with a significant negative coefficient, henceforth indicating conditional convergence of growth rates over the period.

Labor force growth, estimated via total employment series available in the OECD dataset, enters all regressions with a significant positive coefficient; that of the US is quite substantial and that could be due to estimations implemented without having introduced sufficient constraints on the coefficients.

In the US case, increasing returns to scale in all inputs is clearly noticeable. In Japan, results indicate constant returns to scale in three inputs, whereas they would be decreasing in the Euro zone.

As far as public investment is concerned, it enters the regression with a significant positive coefficient in the US, though the elasticity is low and closer to that found by Ratner (1983) than by other studies performed since then (see Table 4). Public investment is not a significant determinant of economic growth in Japan and the Euro zone, except in the latter when a panel estimation is performed. In this case, the elasticity of output to public capital is very low (1.3%) but it is positive.

Though these results are not econometrically non debatable[32], they illustrate three important features as regards the application of endogenous growth theory to the US, Japan and the Euro zone. Firstly, endogenous growth seems to work in the former country, but thanks to the major influence of labor on private output. This is an argument in favor of a new strand of literature which tries to capture the positive influence of labor organization on private output (see Askenazy, 2003, for a recent presentation).

Secondly, though public investment does not seem to be a significant determinant of output growth in Japan, constant returns to scale are attainable. In the recent past, the low and persistent economic growth in Japan has surely not been exclusively due to private inputs, but also to financial fragilities which have led governments to intervene massively "to the rescue" and to divert attention from public investment. In more "normal" times, inputs, be they private

[32] Stationarity, cointegration relationships and panel estimations with fixed effects are not investigated.

or public, may play a more crucial role in Japan's economic growth; the "at-least-constant returns to scale" would thus be confirmed.

Thirdly, in the Euro zone, the recurrent call for an innovation strategy, for a better competitiveness of the whole area and high potential growth seems largely unmet by the data in table 5: one could thus presume that decreasing returns to scale testify for a failure of the European economic strategy. Europe would have "missed the train" of enhancing growth.

Table 5. Estimations of production functions – explained variable ΔGDP – annual data over the sample 1960-2003

	USA	Japan	Euro zone (Aggregate)[a]	Euro zone (Panel without fixed effects)[b]
constant	0.715	1.970	1.116	0.289
	(2.3)	(8.9)	(2.6)	(12.1)
GDP_{-1}	-0.128	-0.128	-0.080	-0.082
	(3.5)	(4.1)	(3.3)	(10.9)
I_G	0.046	-0.026	-0.043	0.013
	(3.9)	(1.3)	(1.2)	(4.3)
I	0.068	0.098	0.085	0.065
	(2.4)	(3.8)	(2.9)	(9.2)
Δ(employment)	1.001	0.816	0.613	0.491
	(5.7)	(2.3)	(5.1)	(9.7)
$\bar{R}^2$	0.69	0.79	0.64	0.44
see	0.011	0.017	0.009	0.018
D-W	2.08	1.59	1.92	-

[a]: sample 1970-2003.

[b]: including Austria, Belgium, France, Germany, Greece, Ireland, Italy, the Netherlands and Spain. We are grateful to Gwenaëlle Poilon for able research assistance.

t-stat in parentheses.

Source: OECD.

However, some more tests performed in levels show that at least constant returns to scale are attainable in the Euro zone, like in the Japanese case (see Table 6). There would thus be some scope for adopting an ambitious economic growth strategy. As shown in table 6, the elasticity of output to public capital would equal 30% on average. Estimated with fixed effects, elasticity would range from 8% for Germany to 16% for Ireland. Unfortunately, the constant term is significantly negative and total employment enters the regression with a much higher coefficient (i.e. four times higher) than without fixed effects.

Table 6. Production function estimations in levels – Euro zone* – annual data over the sample 1965-2002

	Panel without fixed effects	Panel with fixed effects
constant	1.75	-5.93
	(9.5)	(11.0)
Private capital	0.53	0.68
	(17.7)	(25.9)
Public capital	0.30	-
	(12.4)	
Total employment	0.16	0.69
	(6.5)	(15.6)
Austria	-	0.12
		(5.2)
Belgium	-	0.13
		(5.2)
Germany	-	0.08
		(3.6)
Spain	-	0.10
		(4.3)
France	-	0.09
		(4.1)
Greece	-	0.12
		(4.7)
Ireland	-	0.16
		(6.5)
Italy	-	0.09
		(3.9)
The Netherlands	-	0.12
		(4.9)
$\bar{R}^2$	0.99	0.99
see	0.13	0.05

*: including Austria, Belgium, France, Germany, Greece, Ireland, Italy, the Netherlands and Spain. We are grateful to Gwenaëlle Poilon for able research assistance.

t-stat in parentheses.

Source: OECD.

The discrepancy between the elasticity of output to public capital in the Euro zone in table 5 and table 6 ensues first from the difference in the specifications: the first panel regression (in Table 5) takes conditional convergence into account. A second reason for this discrepancy may stem from overestimation or simply bad estimation of "public capital". Statistics related to the flows of government fixed capital formation are generally more accurate and homogenous across countries than capital stock figures. Overestimation may also stem from the inability of statisticians to take fully into account the depreciation of capital: in an era of strong innovation, the depreciation of the capital stock may be quite high (see Section 1 of the Report).

In order to gain more insight in the understanding of the incidence of public investment on domestic growth, we also employ an unrestricted vector autoregression (VAR) model and analyze the dynamic interactions between public investment, private investment, employment (in first difference) and output growth. Impulse response functions and variance decompositions help to quantify the dynamic relationships and an international comparison is also performed.

A summary of previous VAR studies dedicated to the empirics of growth is reported in table 7. Except for the Netherlands at the end of the Nineteenth century (Sturm et al., 1995), public capital or public investment has not had a significant impact on economic growth. As we shall see below, our results are somewhat more promising.

Table 7. Growth studies performed with VARs

Study	Data	Model	Variables [a]	Conclusions
Clarida (1993)	US, France, Germany, UK	VECM	MFP, KGV	MFP and KGV are cointegrated but direction of causality is unclear
McMillin and Smyth (1994)	US, 1952-1990	VAR, levels and first diff.	H/KPV, P^E/P^Q, KGV/KPV, inflation	No significant effect of KGV
Sturm et al. (1995)	Netherlands, 1853-1913	VAR	Q, KPV, KGV, L	Infrastructure Granger-causes output
Otto et Voss (1996)	Australia, 1959-1992	VAR	Q, KPV, KGV, H	No relationship between public capital and labour or output; private capital affects public capital positively
Voss (2002)	US, 1947-1998 Canada, 1947-1996	VAR	GDP, pg, pp, I_G/GDP, I/GDP, r	I_G crowd out I in both countries

[a]: MFP: multifactor productivity; KPV: private capital stock; L: private labor; Y: private sector GDP; KGV: public capital stock; H/KPV: hours of work per unit of capital; P^E/P^Q: relative price of energy, pg: relative price of public sector investment good; pp: relative price of private sector investment good; r: real interest rate.

Within an unrestricted VAR, every endogenous variable is modeled as a function of its own lagged values and the lagged values of the other endogenous variables in the system. The ordering of endogenous variables is clearly an important task in the context of annual data: it is assumed here that output is the most endogenous of all variables; this assumption corresponds to specification (2) ensuing from a production function. Moreover, public investment is assumed to be the least endogenous of all variables, meaning that private investment immediately responds (i.e. within a year) to a contemporaneous innovation in public investment.

Our estimated VAR is of the form:

$$Z_t' = [I_{Kt}\ I_t\ ET_t\ GDP_t], \qquad (3)$$

where ET is total employment. All variables are in log; public and private investments are in levels whereas ET and GDP are in first difference.

Although some variables are non stationary[33], the VAR has been estimated under the form given in (3) for the USA, Japan and the Euro zone. Except in the case of Japan, such a specification is reasonable. Performing VAR by ordinary least squares with cointegrated though non-stationary variables is acceptable, as discussed by Sims, Stock and Watson (1990).

For the USA, public investment is non stationary but Johansen cointegration technique indicated at least 3 cointegration relations between the 4 endogenous variables.

For the Euro zone, public and private investments are respectively non stationary but Johansen cointegration technique indicated at least 2 cointegration relations.

For Japan, over the full sample, public investment is non stationary and no cointegration relation has been found. The VAR estimation is thus only a "rough" illustration of the dynamic interactions between the endogenous variables. Over a short sample however – the most recent years are discarded and the sample covers 1960-1990 –, although public investment was still non stationary, Johansen cointegration technique indicated at least 2 cointegration relations, so that we have been able to perform a rigorous unrestricted VAR.

Results from the impulse response functions (IRF, see appendix 1) confirm previous estimations via a production-function approach but they also shed light on the causality between private and public investment.

On the one hand, an innovation in public investment has a positive and significant impact on GDP only in the USA. Between 1960 and 1990, one can find the same significant impact in Japan, but over the whole sample, this effect disappears.

On the other hand, in the Euro zone, despite no significant impact on economic growth, a positive innovation on public investment has at least a three-year long positive impact on private investment and growth in total employment. Moreover, a positive innovation on private investment also has a positive significant impact on public investment, growth in total employment and economic growth, hence revealing a virtuous circle between public investment, private investment and growth in the Euro zone. In the USA, private investment has no impact on public investment; whereas in Japan, over the full sample, a causal relation between private and public investment is identified up to 4 years after the shock on private

[33] Augmented Dickey-Fuller tests have been performed.

investment has occurred, but no virtuous circle (i.e. a two-direction causation) can be identified.

Variance decomposition provides information on the quantitative importance of stochastic shocks to the 4 variables in the system. In appendix 1, the *k*-steps ahead forecast error of economic growth in the USA, Japan and the Euro zone, are explained by the contemporaneous shocks on the 4 variables.

In the USA, a non-marginal share of the variation in economic growth is due to innovations in public investment (15% in year 1), although this share decreases over time (13% in year 10). In Japan and, most noteworthy, in the Euro zone, the trend is reversed: the share due to innovations in public investment is increasing, from 4% (year 1) to 9 % (year 10) and from 9% (year 1) and 13% (year 10) respectively. All in all, the influence of public investment on economic growth, estimated via the variance decomposition, is quite similar from one country to the other.

The main difference occurs between the Euro zone, on the one hand, and the USA and Japan, on the other hand, as far as employment and GDP exogeneity are concerned. Whereas the highest share of economic growth is explained by shocks on private investment in the USA and Japan (almost 70% in year 10), this share is about one-third in the Euro zone; another one-third is explained by innovations on employment growth (a change in working time, for instance) and one-fifth of economic growth is due to exogenous factors. In comparison with the USA and Japan, economic growth variations in Europe have numerous determinants. Enhancing growth thus necessitates implementing a tri-dimensional policy: boosting employment, private investment and public investment is a major challenge.

As a conclusion to this general overview of the determinants of output and economic growth in the USA, Japan and the Euro zone, it is now straightforward that public investment has a key importance; although it is solely responsible for a small share of economic growth in the best case, it has been shown that a virtuous circle could be revealed in the case of the Euro zone.

♦ ***The "labor deficit" closing incoherence***

One of the most underestimated features of the "labor deficit" diagnosis is the socio-economic impact of massive unemployment experienced by the EU for two decades. This is problematic, since two important consequences derive from the structurally depressed European labor market. The EU willingness, but apparent incapacity, to close its "labor deficit" is indeed related to the role played by both "Keynesian" and "Classical" unemployment in maintaining low participation rates of the working age population as well as in crystallizing a strong feeling of social insecurity (see Chart 2), at the source of the rational

resistance of workers to alter the structures or change the rules of existing social systems (i.e. The Welfare State).

To begin with, there is little doubt that macroeconomic policies, and specially the excessively recessive monetary policy that has been the specific feature of the EU in the 90's, have played a major role in the over-accumulation of Keynesian unemployment phases that have resulted in structural unemployment, through "hysteresis" of the unemployment rate, on the European Continent. Second, the "modernization of the European social model" prone by the Lisbon strategy is logically strongly resisted in a context of soft growth and rigid macroeconomic management by populations with no perspective of full-employment, stagnant wages, and job insecurity experience[34].

What is thus at stake is the relationship between the policy mix and labor market institutions, that we have already labeled the "macro-structural" mix. In a recent work (Creel and Fitoussi, 2001), we have performed panel estimations of the growth in the unemployment rate for the major OECD countries. Our departure point has been the following: over the 1970-1995 period[35], unemployment increased steadily in most OECD countries, but the trend varied markedly from country to country. In order to take into account both dimensions, a panel data approach has seemed appropriate.

Blanchard and Wolfers (2000) also investigated the interaction between institutions and shocks, with much emphasis on the real interest rate. They estimated unemployment equations in a panel of 5-years-average variables from 1960 to 1995, and considered the effects of macroeconomic shocks[36], institutions[37], and their interactions. They concluded that interactions between shocks and institutions explain the evolution of unemployment over time and across countries in a better way than shocks or institutions separately. Contrary to them, we will investigate the determinants of unemployment growth *and* give much emphasis on fiscal policy.

We here rely on a panel of 12 OECD countries, and more than 80 variables over 20 years are involved in the robustness tests; the data set covers various topics from labor market

[34] Job insecurity is dramatically important in the new EU members, mostly the Central and Eastern European ones (see Cazes and Nesporova, 2004, for a comprehensive analysis).

[35] Stopping in 1995 can be explained by the fact that we wanted to reduce the incidence on the estimators of the convergence process towards the European Monetary Union in some of the countries under study. As most of them were carrying out restrictive fiscal policies (following the Maastricht criteria) and were undergoing still large unemployment rates, they were living "exceptional circumstances" that would have been very difficult to tackle in the estimations. Unfortunately, those "exceptional circumstances" were not short-lived.

[36] Namely, total factor productivity growth, real interest rates and the difference between effective and equilibrium unemployment.

[37] Namely, replacement rate, employment protection, the number of years over which unemployment benefits are paid, active labor market policies, tax wedge, union contract coverage, union density and union and employer co-ordination of bargaining.

structures to the macroeconomic environment. Two complementary panel techniques are used[38].

Firstly, Leamer (1983) Levine & Renelt (1992) robustness tests are performed for each variable. The result is a list of variables that cannot be excluded as potential determinants of unemployment growth.

Secondly, we estimate unemployment equations that always include labor force growth and (at least) one of the robust determinants identified in the first step. We thus analyze the effect of these variables on unemployment growth once the impact of labor force growth has been controlled for.

Robustness tests for the cross-effects of institutions and economic policies led us to discard the monetary stance since it has never proven robust[39]. As for the fiscal stance, it is robust only if it is crossed with the replacement rate, union coverage or employment protection.

Indeed, introducing the primary structural surplus, i.e. the cyclically-adjusted surplus, to which net interests are added, and institutions, gives significant results in the Nineties, but has no effect before (see Table 8). The sign of significant cross effects is always negative: higher surpluses combined with rigid institutions[40] tend to decrease unemployment growth; or, higher deficits combined with flexible institutions tend to decrease unemployment growth.

The assignment problem of Mundell (1962) thus can be adapted to fiscal policies and institutions, hence to the "macro-structural" mix. Assuming that both "instruments", fiscal policy on the one hand, labor-market institutions on the other, can be assigned two targets, unemployment and inflation, two possible configurations may emerge from their relationships: fiscal policy (resp. institutions) could be aimed at reducing unemployment while institutions related to the labor market (resp. fiscal policy) would curb inflation.

[38] Details on the methodology and on the data are available in appendix 2.

[39] The monetary stance has been computed as the discrepancy between the actual nominal interest rate and the nominal rate inferred from a Taylor-rule estimation. The monetary stance is more or less the unexpected discretionary part of monetary policy.

[40] By rigid institutions, we mean high replacement rates, high union coverage and high employment protection.

Table 8: Unemployment equations with cross-effects						
A. Cross-effects of the primary structural surplus (PSS) and the replacement rate (RR)						
	Active Pop.	Const.	pss*rr	R^2		
1975-1980						
coefficient	-6,269	0,145	0,000	0,192		
t-stat	-3,405	5,484	1,706			
1981-1989						
coefficient	-1,368	-0,013	0,000	0,012		
t-stat	-0,995	-0,842	-0,507			
1990-1995						
coefficient	-6,818	0,093	-0,001	0,454		
t-stat	-4,398	6,483	-4,033			
B. Cross-effects of the primary structural surplus (PSS) and union coverage (UC)						
	Active Pop.	Const.	pss*uc	R^2		
1975-1980						
coefficient	-6,330	0,148	0,000	0,189		
t-stat	-3,430	5,525	1,635			
1981-1989						
coefficient	-1,399	-0,013	0,000	0,015		
t-stat	-1,021	-0,803	-0,764			
1990-1995						
coefficient	-6,746	0,092	-0,001	0,476		
t-stat	-4,450	6,551	-4,399			
C. Cross-effects of the primary structural surplus (PSS) and employment protection (EP)						
	Active Pop.	Const.	pss*ep	R^2		
1975-1980						
coefficient	-6,395	0,147	0,001	0,177		
t-stat	-3,431	5,445	1,313			
1981-1989						
coefficient	-1,160	-0,016	0,000	0,012		
t-stat	-0,841	-1,038	0,566			
1990-1995						
coefficient	-7,815	0,097	-0,002	0,387		
t-stat	-4,885	6,257	-2,802			

Source: Creel and Fitoussi (2001).

The choice between both configurations should depend on the relative efficiency of instruments on the different targets, as in Mundell (1962). According to the first configuration, fiscal policy would boost aggregate demand to reduce unemployment while flexible labor-market institutions would curb wage and inflation pressure arising from the decrease in unemployment. In the second configuration, fiscal policy would limit the extent to which

demand might be in excess to aggregate supply, hence curbing inflation, while active labor-market institutions would preserve employment and social cohesion.

Results are such that they entail that in some countries, fiscal policies are still efficient in reducing unemployment, but that their efficiency is conditional on the existence of relatively flexible labor institutions. Strong constraints on fiscal policy in the EU, within the Stability and Growth Pact and the Broad Economic Policy Guidelines, do appear illegitimate so long as the Welfare State is also being dismantled. As stated in the introduction to this second Section of the Report, a better coordination between institutions, among which economic policies shall be taken into account, is dramatically needed.

2. Governance scenarios: the importance of being coherent

a. The "European Constitution": a non-economic governance event

This analysis of the EU institutional stakes shows why it would be hardly conceivable to consider the prospect of growth in the EU in the next decade without contemplating alternative economic governance scenarios and their outcomes. In this regard, the perspective of the ratification, by all member States' population or Parliaments, of the "European Constitution" signed last October by EU governments should be an important event[41].

The reason this is hardly the case, is that, although the text contains in its Third Part the provisions regulating the economic governance of the EMU, it does not contain any significant change of the current governance system, which negative impact has been detailed above[42].

This amazing *status quo* is in itself quite easily understood when one recalls the conditions under which the Third Part of the European "Constitution" has been aggregated to the rest of the text, in the very end of the "Convention for the future of Europe" sessions and without any debate.

b. Two scenarios for the economic future of Europe

Given our analyses, two credible scenarios are foreseeable, based on the idea that the "Lisbon strategy" can not be attained within the existing European governance framework. Hence, two trade-offs appear to be conceivable: the first one consists in reforming the EU governance instruments to reach the Lisbon goals. The second one consists in reforming the

[41] In fact, it is much more a "European Constitutional Treaty" than a "European Constitution", since it relies on unanimity rather than on majority voting (see Weiler, 2002, for a in-depth analysis)

[42] See Creel (2004) for a description of the macroeconomic content of the "European constitution".

"Lisbon strategy" to make it coherent with the current orientation of economic policies in the EU.

The first, at this time, unfortunately, the most probable, would result in a "Frozen Landscape" of the EU growth strategy under the impact of the enlargement: A even smaller central budget, a stronger fiscal surveillance without reform of the SGP, a credibility-focused monetary policy; the growth outcome attached to this perspective is at best stable, meaning the pursuit of the dismal decade into the new century.

The second one, "Fulfilled Potential", optimistically predicts a reform of the economic governance of the EU and the definition of an integrated growth strategy, implying a substantial growth-orientated EU budget, a more public investment-friendly SGP and a growth-focused ECB. The growth outcome attached to it is naturally positive.

The "Frozen Landscape" is unfortunately for EU growth prospects the most likely scenario because the latest enlargement has enhanced the relative position of "small countries" *vis-à-vis* "large countries": as already mentioned, EU newcomers are relatively poor (though EU-25 has seen its population grow by 20%, its GDP has only increased by a mere 5%)[43] and wide-opened to international trade. Their reliance on good competitiveness for growth purposes is thus higher than that of "large countries" whose main growth engine comes from domestic side (consumption, investment). "Small countries" face incentives to abide by rules that ensure stable prices (or low inflation rates) *via* a strong monetary policy and a strict nominal exchange rate anchor (such is the case for the smallest newcomers like Estonia, Lithuania and Slovenia, and, to a lesser extent, Hungary).

As for the "Fulfilled Potential, it is sensitive to the assumption that the objective of the ECB would be enlarged to also embody a "growth objective", quite similarly to the US Fed 's twin objectives. As was already mentioned earlier, the "European Constitution" (still to be adopted) does not go in the good direction. What is worse: the "Constitution" project now includes "price stability" within the general EU objectives and almost definitely legitimizes the ECB policy, although the "Convention" intended to prepare the "Constitution" project at least could have proposed an upheaval in the Maastricht treaty.

[43] See Creel and Levasseur (2004) for in-depth analyses of the consequences of the EU enlargement for incumbents and EU newcomers.

Section 3 . Simulating convergence scenarios with the INGENUE model

Even though the scenarios described in the previous Section of the Report are obviously complex, and involve many dimensions of the economic and social policies of the EU, it would appear desirable to try to evaluate their likely consequences on the long-run evolutions of the European economy as well as, possibly, on the rest of the world. What we propose in this Section is an exploration of some significant dimensions of these complex scenarios, by numerically simulating a large, overlapping-generations, general-equilibrium model of the world economy, the INGENUE model.

1. A brief overview of the INGENUE model[44]

The INGENUE model is a multi-region, world model, in the spirit of those developed by Obstfeld and Rogoff (1996, chap. 3), in which the structure of each regional economy is in the line of other applied, Overlapping Generations, General Equilibrium (OGGE) models, such as Auerbach and Kotlikoff's (1987).

In the INGENUE model v.2, the world is divided in 10 regions according to geographical criteria: Western Europe ('Denmark', 'Finland', 'Iceland', 'Ireland', 'Norway', 'Sweden', 'United Kingdom', 'Greece', 'Italy', 'Malta', 'Portugal', 'Spain', 'Austria', 'Belgium', 'France', 'Ger many', 'Luxembourg', 'Netherlands', 'Switzerland'), Eastern Europe ('Estonia', 'Latvia', Lithuania', 'Bulgaria', 'Czech Republic', 'Hungary', 'Poland' 'Romania', 'Slovakia', 'Slovenia'), Japan, North America, South America, Chinese World, Indian World, Russian World, Mediterranean World and Sub-Saharian Africa.

The period of the model is set to five years. In each region, the economy is populated by 21 overlapping generations of one-sex agents who may not live longer than 105 years. Population evolutions are exogenously calculated according to a standard population projection method on the basis of historical and prospective UN data[45]. Each economic region is made up of three sectors: the households, the firms and the public sector.

[44] The version of the INGENUE model used in this paper is the second version, for which no detailed, published description is available yet. The first version has been described and used in a number of publications, including INGENUE (2002) and IMF (2004).

[45] We can then perform our own population projections according to different mortality, fertility and migration scenarios.

a. Households

Individuals are assumed to become adults when they turn 20. During each period, the household sector is then made of 17 overlapping cohorts of "adults", of age between 20 and 105, and 4 cohorts of "young". Adults may not stay in the labor force after a legal maximal mandatory retirement age. Labor supply is exogenous – with the possibility of exogenously changing participation rates – and economic decisions are their consumption, savings and bequest decisions, made under perfect foresight at the beginning of their adult life. Voluntary bequests are distributed to children according to the fertility calendar of their deceased parents. In our international context, households can choose the region they want for investing their wealth. Due to life uncertainty at the individual level, one may expect unintended bequests; instead, in the spirit of Yaari (1965), it has been assumed that there exists perfect annuities markets that pool death risk within the same generation so that the return to capital is "corrected" by the instantaneous survival probability of the generation.

Between 15 and 50 yrs. adults are supposed to give birth to children, according to the fertility calendar. Children are dependent until they turn 20, they consume with a cost per child that is supposed to be proportional to the parents consumption. People may work since the age of 10, so we take into account children labor income to the budget constraint of their parents.

b. The public sector

The public sector is reduced to a social security department; it is a pay-as-you-go (PAYG) public pension scheme that is supposed to exist in all regions of the world. It is financed by a payroll tax on all labor incomes and pays pensions to retired households. The regional PAYG systems operate according to a defined-benefit rule: pensions paid to individual retired are a fraction or replacement rate – of the current average (net of tax) wage. We assume a time-to-time balanced-budget rule.

c. Production side

The production side is composed of two sectors: an intermediate good sector and a final good one. Each zone specializes in the production of a single, imperfectly substitutable, intermediate good with a constant return to scale technology using capital stock and the domestic labor force.

In the spirit of Backus et al. (1995), we assume that the domestic, composite final good of a region (consumption and investment) is produced thanks to a combination of two intermediate goods: a "domestic" intermediate good and an "imported" intermediate good[46].

For a world model to be realistic, the world asset capital market has to be imperfect. Because sources of imperfections and asymmetries in financial markets are various and uneasy to model with rigorous micro-foundations in such a large-scale model as INGENUE, we have adopted an *ad hoc* formulation linking the region-specific rate of economic depreciation and the aggregate wealth across overall cohorts in this region. Aggregate financial wealth is equal to the sum of the region capital stock and the net assets on the rest of the world. Hence, capital invested in a region *z* depreciates more rapidly than the average when the region is a net debtor of the rest of the world: the net-of-depreciation return from capital invested in indebted regions are, other things being equal, lower than in creditor regions.

In each productive sector, and in each region, the level of Total Factor Productivity (TFP) is exogenous and grows at a constant rate. This rate is the result of a given, exogenous growth of 2% per annum in North America, supposed to be the technological leader, and a region-sector-specific, exogenous, catching-up factor, reflecting international diffusion of technological progress[47]. This formulation of the productive sector implies the existence of real effective exchange rates between the different regions. Here the main determinants of exchange rates are the relative productivities in the two productive sectors as in the standard view developed since Obstfeld and Rogoff works (i.e. the famous *Balassa-Samuelson effect* that is predominant in long run explanations of difference in real exchange rates).

d. The competitive world equilibrium

Given the initial stock of capital installed in each zone, initial distributions of savings across age groups and zones, initial prices and exogenous population prospects with the children distribution, the technical progress process and social security policies that satisfy a balanced-budget rule, a competitive world equilibrium with social security is a set of sequences for prices and social security transfers and an allocation of quantities such that for each period:

Households maximize behavior;

Firms maximize profit in intermediate and final good sectors;

A fictive world producer of an homogenous world intermediate good maximizes profit; and

[46] This "imported" intermediate good is an aggregate of all the intermediate goods.
[47] For Eastern Europe, the leader zone is Western Europe.

Markets are cleared.

e. Calibration

The INGENUE model v.2 has been calibrated with aggregate data covering the period 1960-2000, to fit the average observed values over the 1995-2000 period. Data include: trade balances, current account balances, GDP per capita, savings and investment.

2. UE growth scenarios and enlargement

Various convergence scenarios may be simulated with the INGENUE model, yielding long-term evolutions of macroeconomic variables in the UE-15, in the Eastern-European newcomers, and in the rest of the world. In the following, we focus our analysis on the first half of the century (until 2050) and on outcomes in the two European zones: given the relative size of Eastern Europe, the induced effects of various convergence paths on the rest of the world are of a very small magnitude and will not be discussed.

a. A baseline scenario for the world economy

In the reference scenario chosen for the world economy in the INGENUE model v.2, the populations of the various areas of the world are internationally mostly immobile, with only minor migration flows, in accordance with the UN demographic projections; the evolutions of each area's population are thus driven by the assumed fertility and mortality rates, according to the central demographic scenario of the UN.

In addition, it has been assumed that existing institutional differences amongst the ten areas of the world defined in the model – in particular the differences in the generosity of the public, pay-as-you-go, pension systems, as measured by the replacement ratios – persist indefinitely. In such a context, the main driving forces behind the economic evolutions of the various regions of the world are the demographic changes and the assumed pace of exogenous technical progress in the production sectors. As in the INGENUE model v.1 (INGENUE, 2002; IMF, 2004), the baseline scenario is characterized by relatively conservative assumptions with regard to the latter: indeed, it is assumed that the exogenous rate of technical progress in the leading economy – i.e. the US – is constant at its long-term estimated level of 1.7% per annum, and that all other economies of the world are catching-up relatively slowly, according to an exogenously imposed low of motion of each region's TFP (see Chart 1, a)[48].

[48] Charts of the simulations have been left to appendix 3.

Although we have introduced differences to take into account the different economic dynamism of the various regions – in particular China and India , this scenario is slightly pessimistic, in that the relative per-capita GDP remain widely dispersed (see Chart 1, b). Even within the EU, the differences between the EU-15 and the newcomers are extremely persistent in the baseline scenario.

b. Migrations

Thanks to the detailed demographic module integrated in the INGENUE model v.2, it is possible to simulate the economic effects of various migration assumptions. The scenario on which we focus in this paper is meant to represent the consequences of an extension to Eastern European countries of the Schengen agreement, which allows in principle the fully free mobility of people, i.e. labor migration.

Given the existing differences in the generosity of the social protection systems in the two European regions[49], it may be assumed that such a move would induce a significant increase in migrations from Eastern to Western European countries. However, the free mobility in the whole EU of people from its Eastern part has been postponed until, at best, 2007, and, at worst, 2011, and most empirical studies on this topic evaluate the inflow of Eastern migrants to the West at approximately 2% of Eastern Europe workforce. In this scenario, the number of Eastern European migrating to Western Europe thus leaps in 2010 from current small levels to a rise of .8% of their workforce that vanishes progressively (we use an autoregressive shock with coefficient .6).

Expectedly (see Chart 2, a, b, c), the economic consequences of this migration scenario are quite dramatic for the countries of origin, which bear a drop in their working age population, hence in potential and economic growth. In Western Europe, the consequences are clearly beneficial, both in terms of GDP growth and, for several decades, in terms of dependency ratios, hence on the evolution of pension contribution rates: the flow of migrants participate in the financing of the PAYG system.

This scenario is interesting in relation to the present situation in France for instance: new available data on total population (January 2005) have testified for a leap in immigration that may contradict the gloomy predictions regarding the presumed unsustainability of the French public pension scheme. Would the pension reform enacted in 2003 have come too soon? Or has it just been part of the dismantling of the Welfare State that we analyzed in the previous Section?

[49] See Cazes and Nesporova (2004) on labor markets protection and Dupont (2004) on pension systems in Eastern European countries.

c. Higher employment rates in Europe

As emphasized in the previous Section, a major ingredient of the so-called "Lisbon strategy" is to obtain, through various policies of structural reforms in the European labor markets, an important increase in employment rates. Insofar as labor supplies are exogenous and include an evaluation of participation rates in the baseline scenario of the INGENUE model, it is quite straightforward to simulate the economic consequences of such a change in measured labor market conditions.

Due to the diagnosis of low employment rates in the EU, the objectives stated in the Lisbon strategy were the following: *"The European Council considers that the overall aim of these measures should be […] to raise the employment rate from an average of 61% today to as close as possible to 70% by 2010 and to increase the number of women in employment from an average of 51% today to more than 60% by 2010"*. Mixing up men and women, as well as Western and Eastern European countries, enhancing average participation rates up to 60% in 2010 yet would be a feat. As shown in table 1, employment rates in 2000 were highly diversified across cohorts of the same region, and across regions (or countries).

Table 1. EU Employment rates in 2000

Cohorts	Poland	Czech Rep.	Hungary	Slovakia	Slovenia
50-54 yrs.	61.4	80.4	66.4	69.0	64.4
55-59 yrs.	37.7	50.2	33.7	34.5	29.0
60-64 yrs.	20.9	16.9	7.6	6.1	15.1
15-64 yrs.	55.1	64.9	55.9	56.3	62.7
	Latvia	**Estonia**	**Lithuania**		**EU-15**
50-54 yrs.	69.9	73.6	72.8		70.0
55-59 yrs.	49.3	58.4	56.8		51.9
60-64 yrs.	21.8	29.4	26.4		33.6
15-64 yrs.	58.2	60.6	60.1		63.2

Source: European Commission (2003)

In this second scenario, we have thus assumed the occurrence of the following situation: the employment rate in Western Europe for the cohort 60-65 yrs. would converge to the employment rate for the cohort 55-59 yrs. in 2025 (hence a major shock); in Eastern Europe, the scenario would consist of a convergence of employment rates towards the Western European levels to end in 2075.[50]

The economic consequences of such an increase in the European labor force, clearly more sustainable than in the migration scenario, are quite large (see Chart 3, a, b, c). Because this increase initially depresses the European capital-labor ratio, hence productivity, it has a negative impact on GDP per capita, but since it also boosts investment, GDP growth progressively increases, to reach its highest rate in the EU-15 after employment rates have converged within this region, whereas the evolution of economic growth in the Eastern part of Europe is lower and reaches its highest point in 2040.

Because this increase in labor supply is obtained without changing the rules of the public pension systems, especially the mandatory retirement age, it does not depress household savings, so that the rise in investment is entirely responsible for the deterioration of the European current account, while the domestic consequences are clearly favorable, in particular for the evolution of the dependency ratios and that of the pension contribution rates. In Western European countries, the major improvement in "old-workers" employment rates would permit a substantial reduction in pension contribution rates of about 5 points. Improving growth perspectives, while enforcing a recommendation of the Lisbon strategy, would thus also permit to substantially reduce the size of compulsory levies in Europe. This would certainly be a coherent strategy that would in turn favor private initiative. It is however conditional on the ability of European economies to actually increase employment rates and decrease mass unemployment.

d. Fast technological convergence of Eastern Europe

In this third simulation scenario conducted with the INGENUE model, it is assumed that that the parameters of the exogenous law of motion of the Eastern European TFP are set in such a way that it catches up quickly on Western Europe: indeed, we have assumed that the level of Eastern European TFP reaches that of Western Europe by the end of the century, quite an optimistic scenario given the current very large gap.

Even so, however, the evolutions of growth in the Western European area are only slightly more favorable than in the baseline scenario, for at least two reasons: one is the

[50] Such a convergence towards higher participation rates is likely in the Central and Eastern European countries as a consequence to the recent pension systems' reforms (Dupont, 2004): because pensions are now depending on contributions paid or on declared earnings, employees face incentives to officially declare jobs and subsequent earnings.

relative small size of Eastern Europe; the other is the result of a feature of the current version of the INGENUE model, in which the specification of trade is such that the consequences of improvement in the Eastern European performance are dispersed over the whole world, not just its main trade partners.

The incidence of higher TFP growth in Eastern European countries is more substantial in this region: GDP growth rate increases by an average of .8 point after 5 and 10 years and remains above the baseline case until 2050 at least. The underlying dynamics is as follows: Higher TFP growth induces smaller savings (hence, higher consumption) and net inflows of foreign capital: the first effect in turn provokes higher imports that deteriorate the trade balance; whereas the second effect deteriorates the current account balance. In the mid-run, the positive impact of the TFP shock on Eastern European economic growth has thus mainly a domestic origin. In the longer run, however, higher TFP growth is converted in lower prices that boost Eastern European competitiveness. This in turn improves the trade and current account balance; the persistence in higher growth, in comparison with the baseline case, has now a foreign origin. A virtuous circle would be under way if the scenario took place.

Section 4 . General conclusion

To conclude, we summarize the main outcomes of the Report.

In the first Section, basing upon different sources in the economic literature, we have suggested that technology does not play a major role in explaining output per capita differences between the USA, Japan and the European Union (EU). As our own work has shown, the measurement of Total Factor Productivity (TFP) is very sensitive to the assumption of a constant lifespan of equipment, and to a change in the price index used: better handling the evolution of quality significantly modifies the computed growth components. It has been shown that low employment levels as well as weak investment were the prevailing causes of poor European economic growth performance. As such, investment seems to play an essential role in the process of determination of potential growth. Although technical progress does matter, long-run growth depends more on the way this technical progress has been made sustainable thanks to appropriate investment.

As for labor, it has been shown that the deceleration of EU-15 productivity growth has largely been due to non-ICT industries, in particular service industries. Whereas US labor productivity growth accelerated through higher contributions of all sources of growth, EU-15 labor productivity growth slow downed because of a decline in contributions from both non-ICT capital deepening and non-ICT TFP, erasing the increased contribution from ICT-capital deepening and TFP growth in ICT producing industries.

In the second Section, the incidence of institutions on economic performance has been documented and an in-depth analysis has been produced. The so-called "Lisbon strategy" has been presented; its diagnosis and recommendations have been precisely analyzed. Main outcomes have stemmed from empirical investigations.

In order to investigate further the so-called European "innovation deficit" that the "Lisbon strategy" has diagnosed, we have tested the incidence of higher public investment on economic growth in the USA, Japan and the Euro Zone. Although public investment *per se* does not exclusively include the type of "productive expenditures" the "Lisbon strategy" recommends performing, our empirical results clearly show that public investment has a significant and substantial favorable impact on output in the US and the Euro zone, although not in Japan. The "Lisbon strategy" in Europe is legitimized by the data. A complementary VAR study reveals that a virtuous circle between public investment, private investment and growth would be occurring in the Euro zone.

One can conclude from this empirical study dedicated to the determinants of output and economic growth in the USA, Japan and the Euro zone, that public investment matters.

In order to investigate further the so-called European "labor deficit" that the "Lisbon strategy" has diagnosed, panel tests have been performed. Harsh robustness checks have been implemented and results show that fiscal policies are efficient in reducing unemployment, but their efficiency is conditional on the existence of relatively flexible labor institutions. Reversing the logic, strong constraints on fiscal policy in the EU, within the Stability and Growth Pact (SGP) and the Broad Economic Policy Guidelines, would appear legitimate only insofar as "rigid" labor institutions would be in place. As a conclusion, the SGP is inappropriate if the Welfare State is being dismantled. Hence, a better coordination between institutions, or an appropriate "macro-structural" mix, is dramatically needed in the EU.

Unfortunately, the "European Constitution" has led to a "Frozen Landscape" of the EU growth strategy, although it has been shown, in this Report, and elsewhere in the literature, that EU institutions had failed to endorse the "Lisbon strategy". Despite the recent EU enlargement towards ten relatively poor countries, the "Frozen Landscape" consists of a smaller central budget, a stronger fiscal surveillance without reform of the SGP, and a credibility-focused monetary policy. The growth outcome attached to this perspective is at best stable, meaning the pursuit of the dismal decade into the new century.

In the third Section, we have investigated a more optimistic situation: the "Fulfilled Potential". Using for the first time the version 2 of the large, overlapping-generations, general-equilibrium model of the world economy the INGENUE model developed by three French economic institutes (CEPII, CEPREMAP, OFCE), we have studied numerically the impact on European countries of the EU enlargement and of a successful "Lisbon strategy". In this latter case, it has been assumed that the EU accorded its means to its objectives, rather than the opposite.

The "enlargement scenario" has focused on migration from the Eastern part of Europe to its Western part. The economic consequences of this migration scenario have been shown to be quite dramatic for the countries of origin, which bear a drop in their working age population, hence in potential and economic growth. In Western Europe, the consequences would be clearly beneficial, both in terms of GDP growth and, for several decades, in terms of dependency ratios, hence on the evolution of pension contribution rates: the flow of migrants would participate in the financing of the public pension system.

The "Lisbon scenario" has focused on the increase in employment rates the Presidency conclusions of the Lisbon European Council had wished in 2000. In Western European countries, the major improvement in "old-workers" employment rates would permit a substantial reduction in pension contribution rates. Improving growth perspectives, while enforcing a recommendation of the "Lisbon strategy", would indeed permit to substantially reduce the size of compulsory levies in Europe. This would certainly be a coherent strategy

that would in turn favor private initiative. It is however conditional on the ability of European economies to actually increase employment rates and decrease mass unemployment, hence on their ability to effectively endorse the “Fulfilled Potential” scenario.

Section 5 . References

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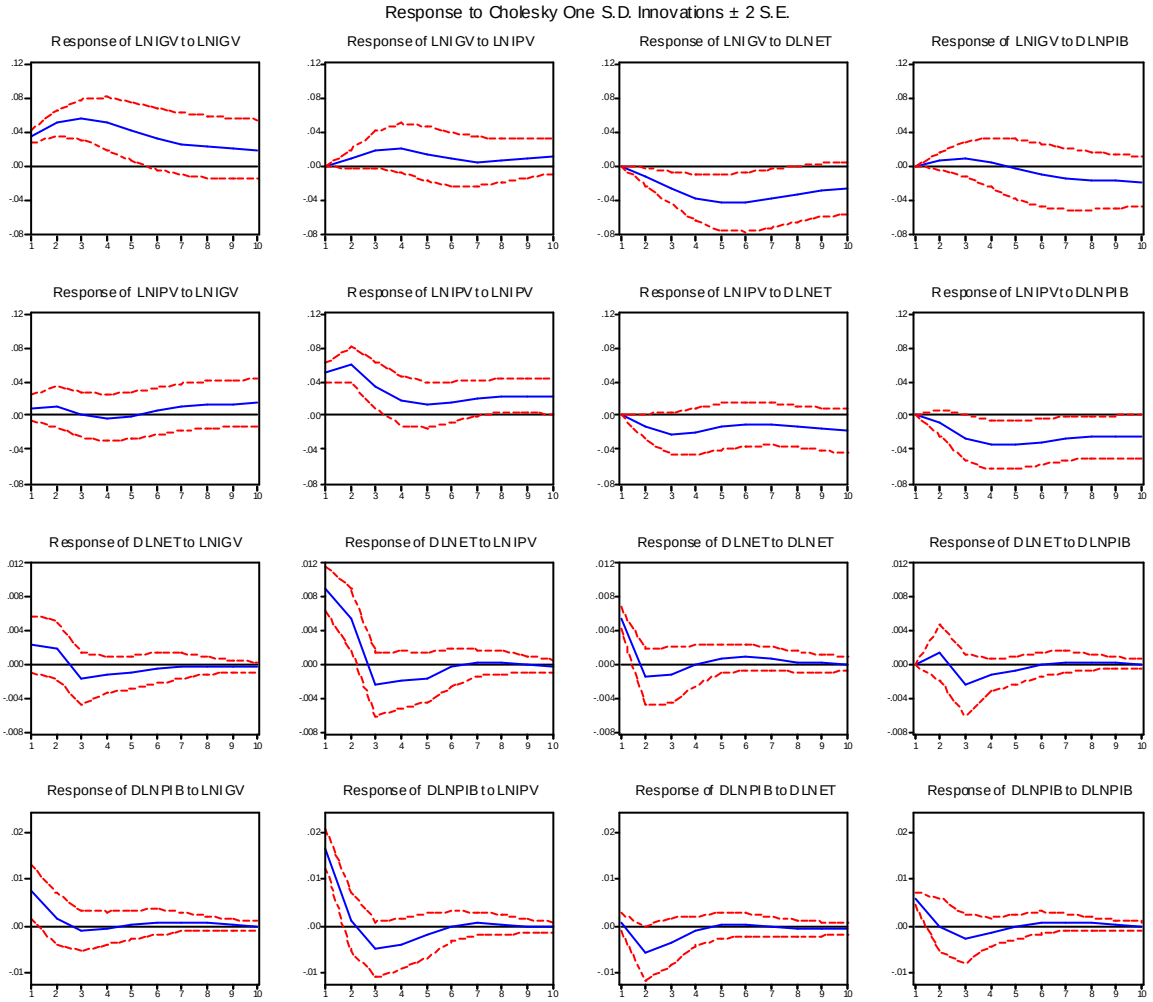
Section 6 . Appendix 1: Results from VAR estimations

Unrestricted VAR – **USA** – full sample

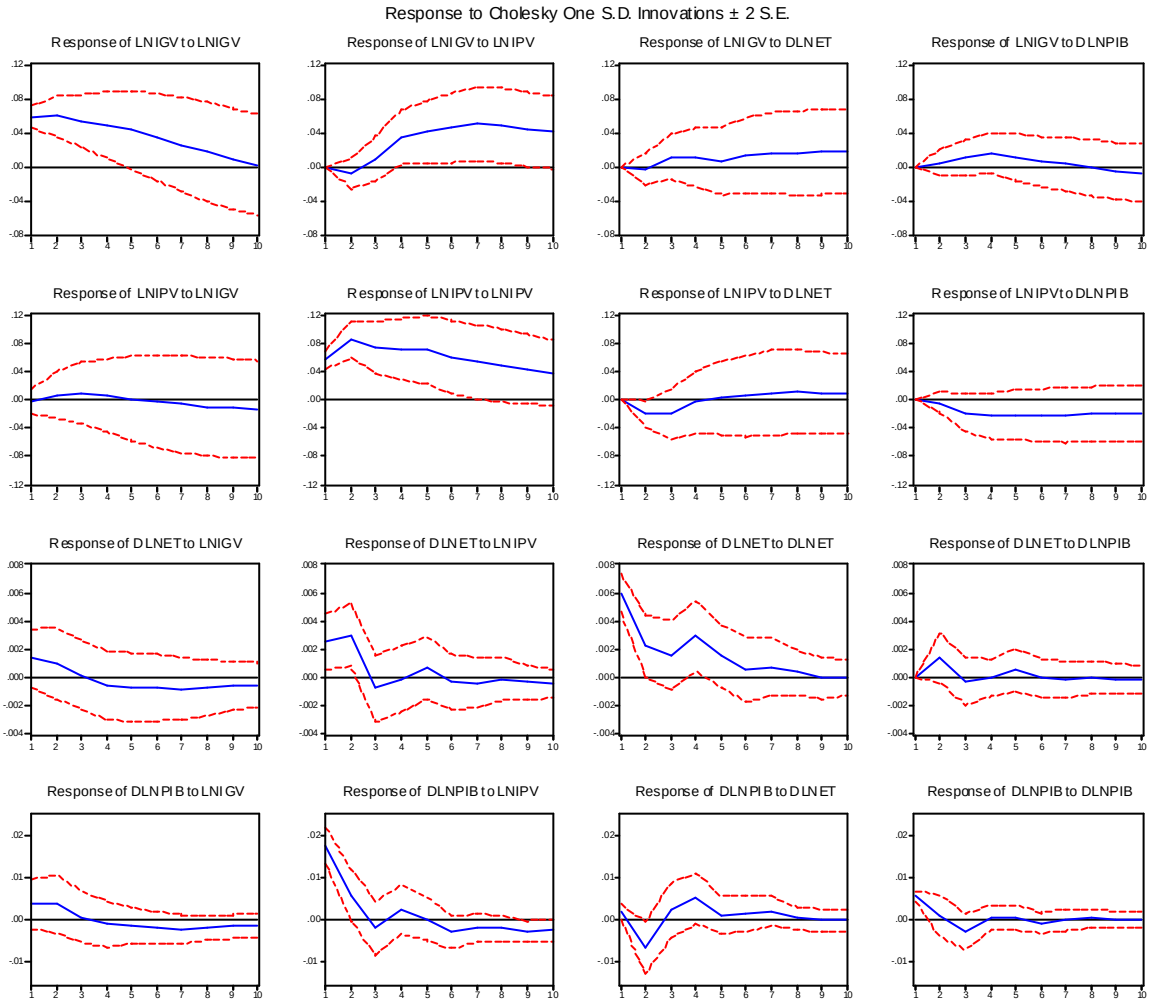


Variance decomposition of economic growth - **USA**

Period	S.E.	LNIGV	LNIPV	DLNET	DLNPIB
1	0.034368	15.11395	75.09928	0.192023	9.594750
2	0.062777	14.36753	68.55567	8.352935	8.723863
3	0.089577	13.19229	67.35806	10.03313	9.416529
4	0.111419	12.72759	67.99240	9.899555	9.380453
5	0.127187	12.62598	68.25757	9.816482	9.299973
6	0.138538	12.74847	68.05288	9.805270	9.393382
7	0.146866	12.86917	67.85069	9.770136	9.509998
8	0.153237	12.92095	67.72498	9.796539	9.557534
9	0.158508	12.92690	67.65723	9.854446	9.561424
10	0.163248	12.92054	67.63426	9.888865	9.556336

Cholesky Ordering: LNIGV LNIPV DLNET DLNPIB

Unrestricted VAR – **Japan** (full sample)

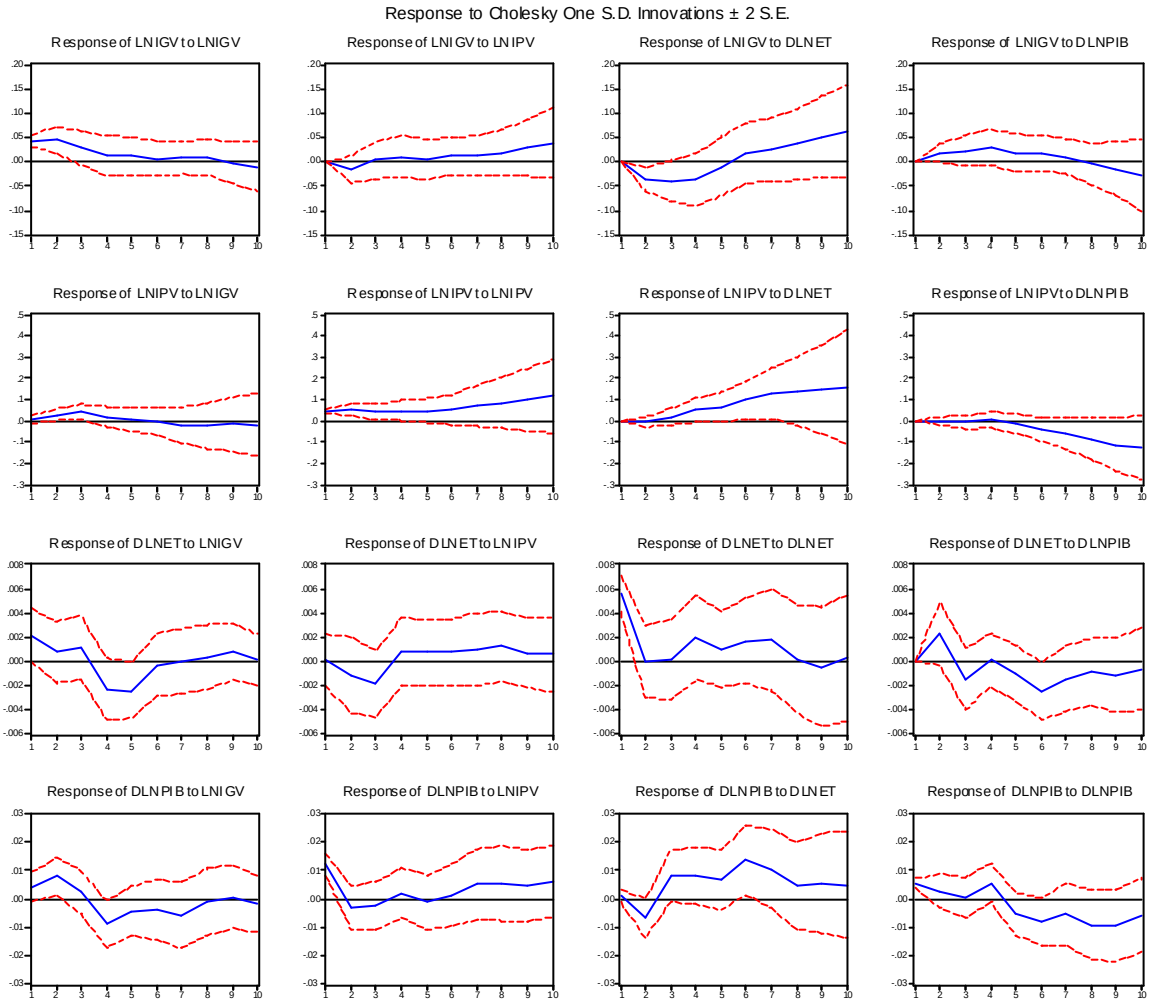


Variance decomposition of economic growth – **Japan** – full sample

Period	S.E.	LNIGV	LNIPV	DLNET	DLNPIB
1	0.058564	4.028928	86.09031	1.043095	8.837663
2	0.084156	6.340345	76.01899	10.43903	7.201632
3	0.101729	6.228766	74.02047	11.13091	8.619858
4	0.120009	6.014981	70.35084	15.53567	8.098507
5	0.134986	6.322067	69.88197	15.69048	8.105479
6	0.147446	6.852152	69.43338	15.74976	7.964711
7	0.158855	7.573447	68.43540	16.21798	7.773169
8	0.167837	8.094429	68.17838	16.03200	7.695186
9	0.174796	8.368445	68.33109	15.74495	7.555520
10	0.180479	8.520227	68.48645	15.53446	7.458867

Cholesky Ordering: LNIGV LNIPV DLNET DLNPIB

Unrestricted VAR – **Japan** – sample 1960-1990

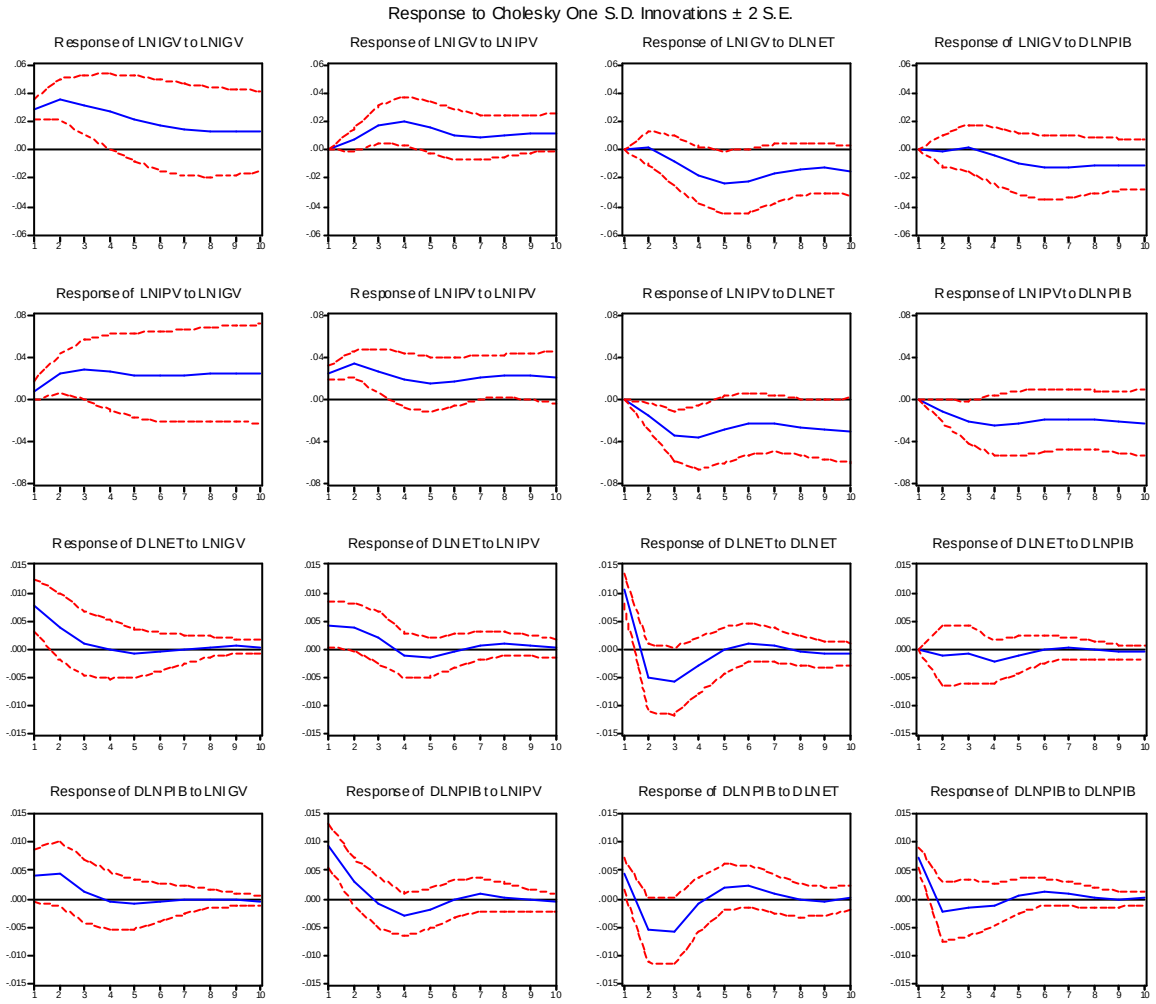


Variance decomposition of economic growth – **Japan** – short sample

Period	S.E.	LNIGV	LNIPV	DLNET	DLNPIB
1	0.044110	8.253752	75.17587	0.412667	16.15771
2	0.076325	24.40699	48.53524	14.97852	12.07926
3	0.093592	21.13481	40.86830	28.13075	9.866128
4	0.106296	27.75281	28.97519	31.03493	12.23706
5	0.108998	26.68222	25.18096	33.22226	14.91457
6	0.113071	20.55464	18.22923	43.65318	17.56295
7	0.117495	19.88634	17.43839	45.60866	17.06661
8	0.124854	17.85691	17.79893	42.37374	21.97042
9	0.139031	16.07080	17.59395	40.24614	26.08910
10	0.160542	15.23653	18.86332	39.26626	26.63389

Cholesky Ordering: LNIGV LNIPV DLNET DLNPIB

Unrestricted VAR – **Euro zone** (aggregate) – 1970-2003



Variance decomposition of economic growth – **Euro zone**

Period	S.E.	LNIGV	LNIPV	DLNET	DLNPIB
1	0.028613	9.177900	49.89313	10.71865	30.21032
2	0.046071	15.16064	40.22777	20.20916	24.40242
3	0.059295	13.83572	34.99495	29.17205	21.99729
4	0.070778	13.39017	36.51200	28.47982	21.61801
5	0.080001	13.34144	36.52764	29.03065	21.10027
6	0.086300	13.18174	35.70092	30.02056	21.09678
7	0.090278	13.10394	35.64871	30.05997	21.18738
8	0.093265	13.09243	35.66244	30.06254	21.18260
9	0.096255	13.08732	35.66108	30.08801	21.16360
10	0.099575	13.10632	35.73362	30.03593	21.12413

Cholesky Ordering: LNIGV LNIPV DLNET DLNPIB

Section 7 . Appendix 2: Methodology and data for the panel estimation of unemployment growth

A two-step approach has been implemented. Firstly, we expose the robustness tests; and secondly, we describe our specifications of unemployment equations.

Robustness tests investigate the sensitivity of a parameter to different alternative specifications. We have used the Extreme Bound Analysis of Leamer (1983) introduced by Levine and Renelt (1992) in the literature on growth empirical studies. The test investigates the sensitivity of a parameter to different control variables.

Consider the following equation:

$$Y = c + b.M + g.Z + e, \qquad \text{(A1)}$$

where M is the variable to test, Z the set of control variables. Equation (A1) is estimated for all possible combinations of three variables contained in Z[51]. Then, consider the set of estimates of b that are significantly different from zero at the 5% significance level, $\hat{b}$. For each of these estimates, we compute $\hat{b}$ -std($\hat{b}$) and $\hat{b}$ +std($\hat{b}$) (where std($\hat{b}$) is the estimated standard error of the estimated coefficient $\hat{b}$). The confidence interval is constructed as follows: the lower bound is the smallest value of $\hat{b}$ -std($\hat{b}$), the higher bound is the highest value of $\hat{b}$ +std($\hat{b}$).

We have adopted the following rule: the variable M is said to be robust if two conditions are met: (i) it is significant, at the 5% significance level, in more than 0,5% of the cases; (ii) the confidence interval does not contain zero. Equation (A1) is estimated by OLS, with no fixed effects nor time dummies. The result of this procedure is a list of robust variables, i.e. variables that cannot be excluded as potential determinants of unemployment growth for at least one of the sub-periods.

The second step of our analysis has been to estimate unemployment equations for the robust variables. Labor force growth is always included, in order to control for the changes in this variable[52]. Thus we estimate the following equation for each of the robust variable:

$$\dot{U}_{i,t} = q + g.\dot{L}_{i,t} + d.x_{i,t} + h_{i,t}, \qquad \text{(A2)}$$

where $\dot{U}$ stands for unemployment growth, and $\dot{L}$ for labor force growth, and x is the variable of interest.

[51] The number of control variables is restricted to three in order to avoid multicolinearity problems.

[52] The number of unemployed is the difference between labor force and the number of jobs created. Thus, there is a relationship between the growth rate of the unemployment rate, the growth rate of the labor force and the growth rate of employment. This relationship is non-linear so that the regression of unemployment rate growth on labor force growth and employment growth does not yield a perfect fit.

We have taken somewhat into account the endogeneity of some variables using instrumental variables estimation (two-stage-least squares). For instance, we have considered labor force growth as endogenous in order to take into account flexion effects in response to unemployment rate changes. The set of instruments was made of the following variables (in first difference of log): lagged GDP, lagged public expenditures, participation rate, working age population, spread between long and short run interest rates, output gap, percentage of employment in public administration, degree of openness, competitiveness, the variation in the percentage of women in labor force from 1970 to 1990, schooling rate at 23 years.

Among these instruments, the participation rate at first sight seems irrelevant, due to its endogeneity with unemployment. We contest this endogeneity on grounds of the panel data. Using the results of a cross-sectional analysis in the mid-90s, one can verify that countries with the same participation rates had very heterogeneous unemployment rates. For instance, with a participation rate equal to 77%, unemployment rate was 5.6% of active population in the US, 7.7% in Sweden and 9.5% in Canada; with a participation rate close to 65%, unemployment rate was 7.1% of active population in the Netherlands and 11.5% in France. Such heterogeneity in work supply behaviors among OECD countries is confirmed in difference also.

The data set covers 12 countries: Austria, Belgium, Canada, Finland, France, Germany, Italy, the Netherlands, Spain, Sweden, the United Kingdom and the United States. It covers 20 years, from 1975 to 1995. We have considered three different sub-periods: 1975-1980, 1981-1989, 1990-1995, to take into account regime changes in the determinants of unemployment growth. The first period is a period of stagflation along which unemployment growth is not as steep as it will be in the eighties; the second period illustrates the steep growth in the unemployment rates and their stabilization at very high levels; meanwhile, real interest rates are raised sharply. At the end of this second period, European countries faced an upheaval: namely, German reunification, which had strong consequences on the implementation of economic policies and macroeconomic performance. In the early nineties, OECD countries therefore face quite different situations: the Netherlands, the United Kingdom and the United States benefit from a recovery; Finland and Sweden are facing a dramatic banking crises and the loss of export markets; while the other countries do not show any noteworthy improvement in their situation regarding unemployment: most of them (except Belgium) suffered even from higher unemployment rate.

The entire data set includes more than 80 variables, that we organized in six topics: (1) general economic structure: labor force size, labor supply structure by sex, employment structure by sector, international competition, production structure by sector, inequalities; (2) macroeconomic environment: real GDP, output gap, investment, real unit labor costs, real wages, inflation rates, long-term interest rates, the spread between the long and short-term

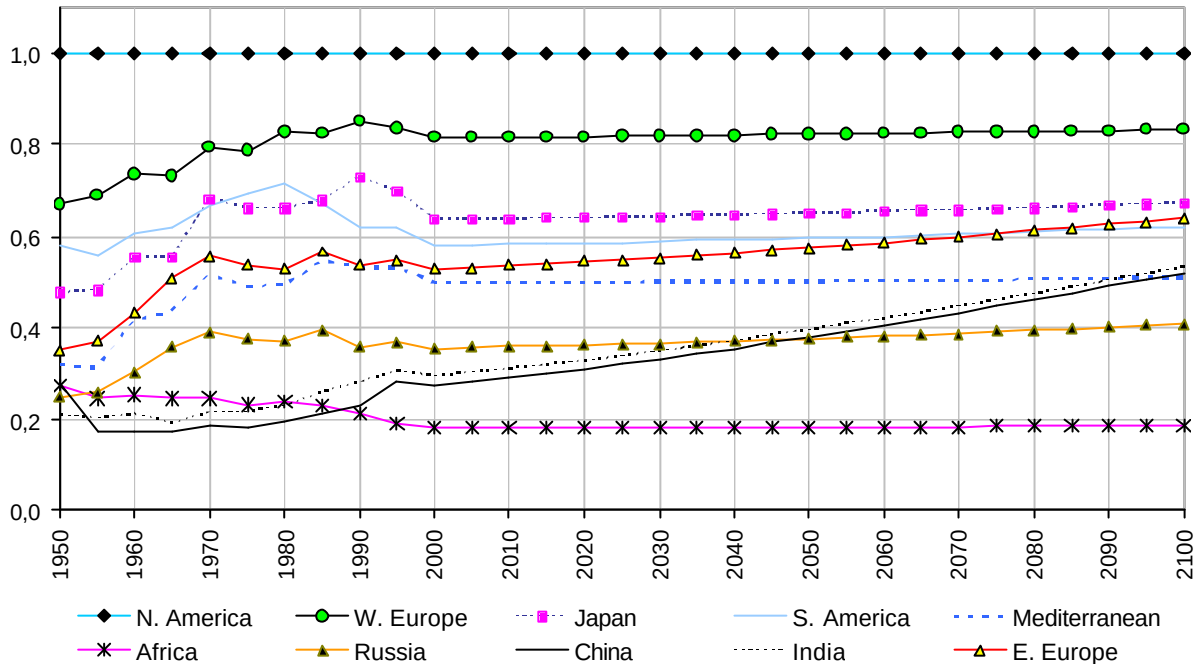
interest rates; (3) the role of the state: level and structure of public expenditures, public employment, tax structure, income tax, social security expenditures, contributions and deficit, human capital proxies and education expenditures; (4) labor market structure: union coverage, active labor market policies, job protection, replacement rate; (5) monetary policy, (6) fiscal policy.

Data sources are the OECD, but also the PNUD, the World Bank development indicators, and the Luxembourg Income Studies**.** The data set involves panel series (most macroeconomic series) which capture both the cross-section and time-series dimensions, and cross-section series, which capture the cross-section differences only. This is the case for labor market structure (union coverage in 1970 and in 1990, variation in the union coverage from 1970 to 1990, active labor market policies, employment protection), allocation of public expenditures (towards social security, education, housing and health), income tax, labor market structure by sex, production structure by sector (agricultural vs. manufacturing products), inequalities, human capital and education.

Section 8 . Appendix 3: Charts for the simulations performed with the INGENUE v.2 model

Chart 1. Baseline scenario

a.Total Factor Productivity: 1960 - 2100 (percentage of US level)



b. Evolution of GDP per capita : 2000-2050
(relative to "north-america" level)

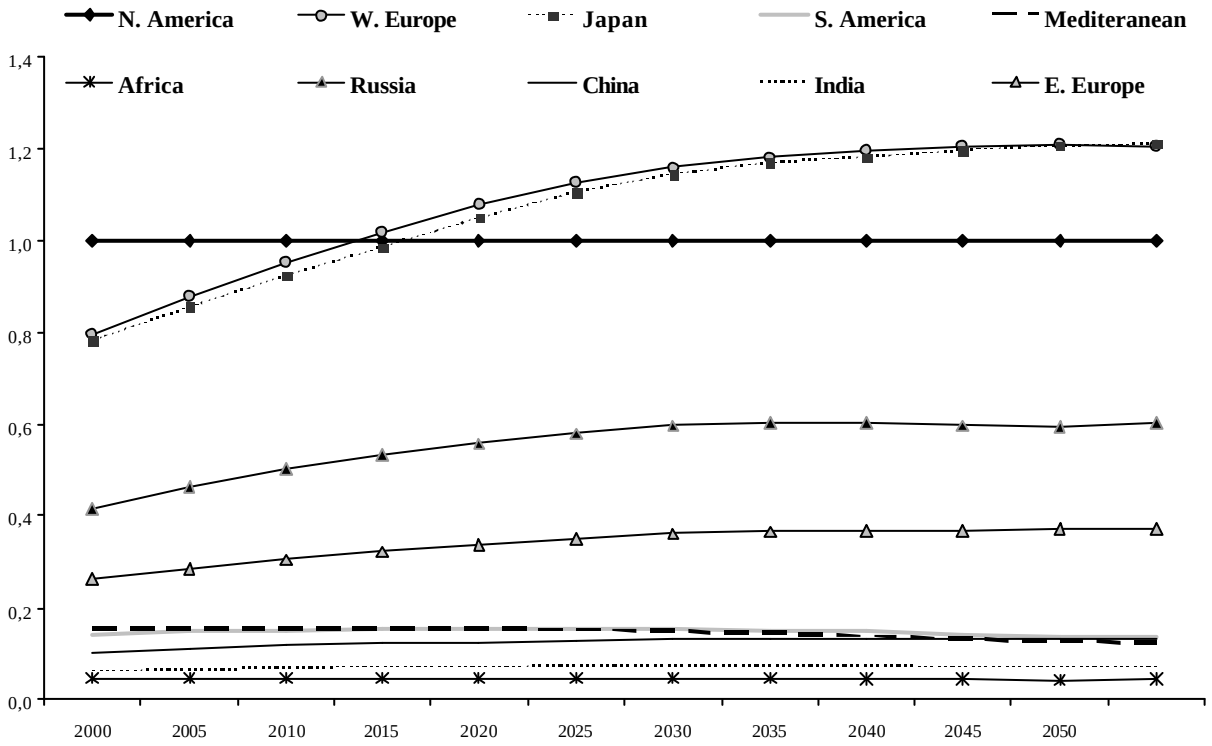
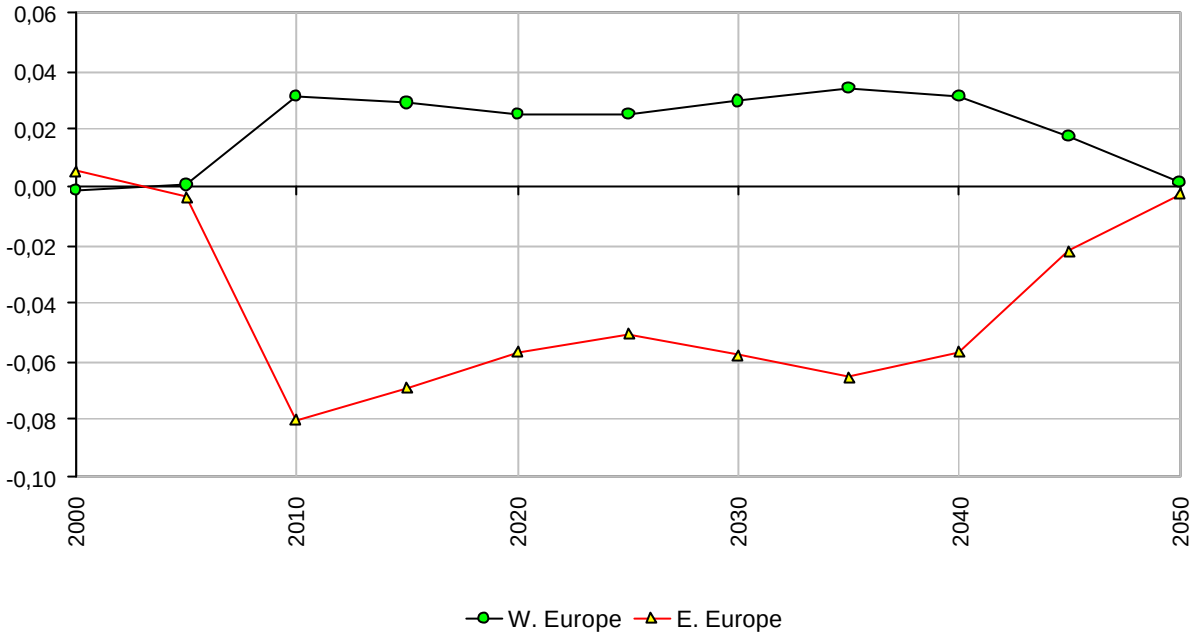
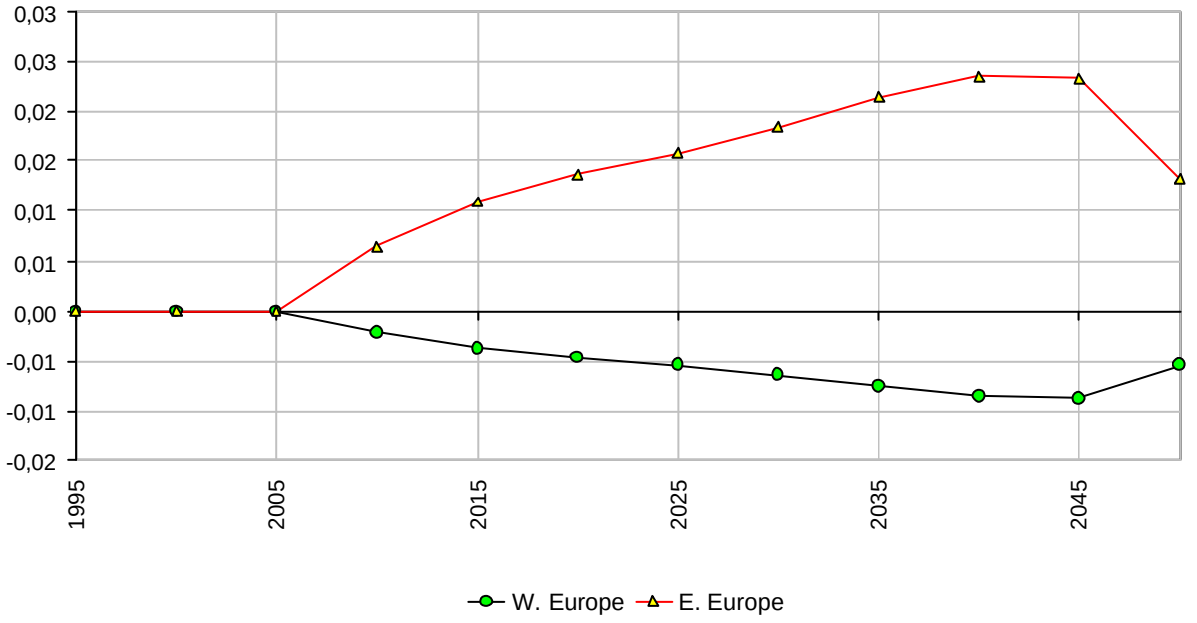


Chart 2. Migrations, or simulating a consequence of the EU enlargement process

a. GDP Growth rate (2000-2050)
(difference from baseline scenario)



b. Evolution of Social Security contribution Rate (2000-2050)
(difference from baseline scenario)



c. Dependency ratio (retirees in percentage of total active population):
(Percentage point difference from baseline scenario)

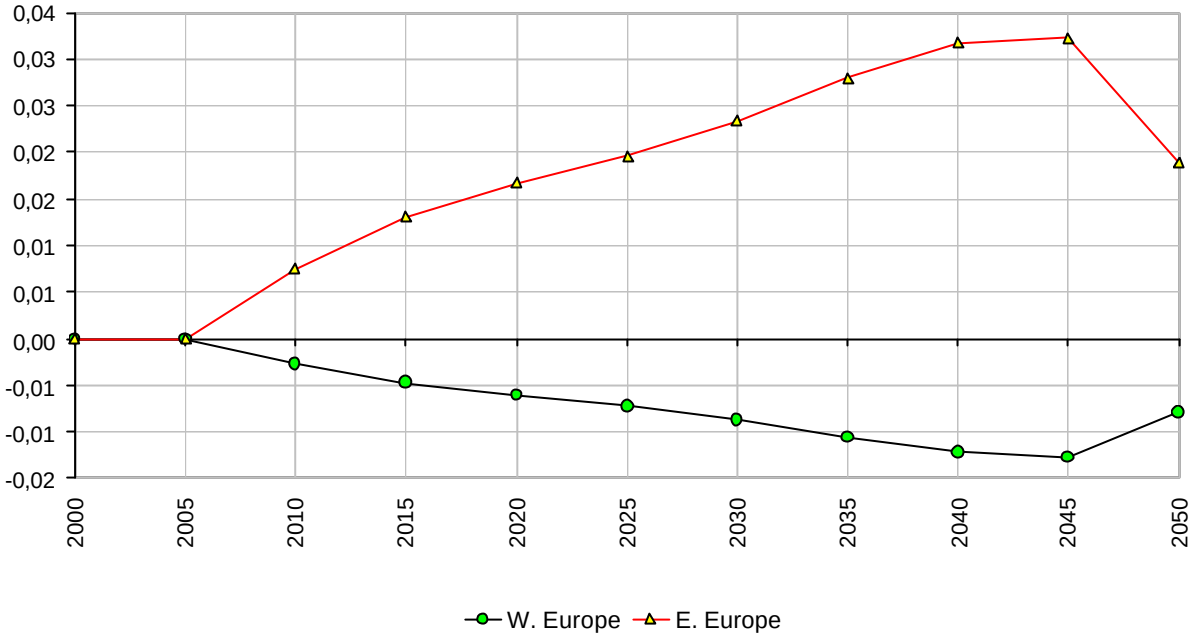
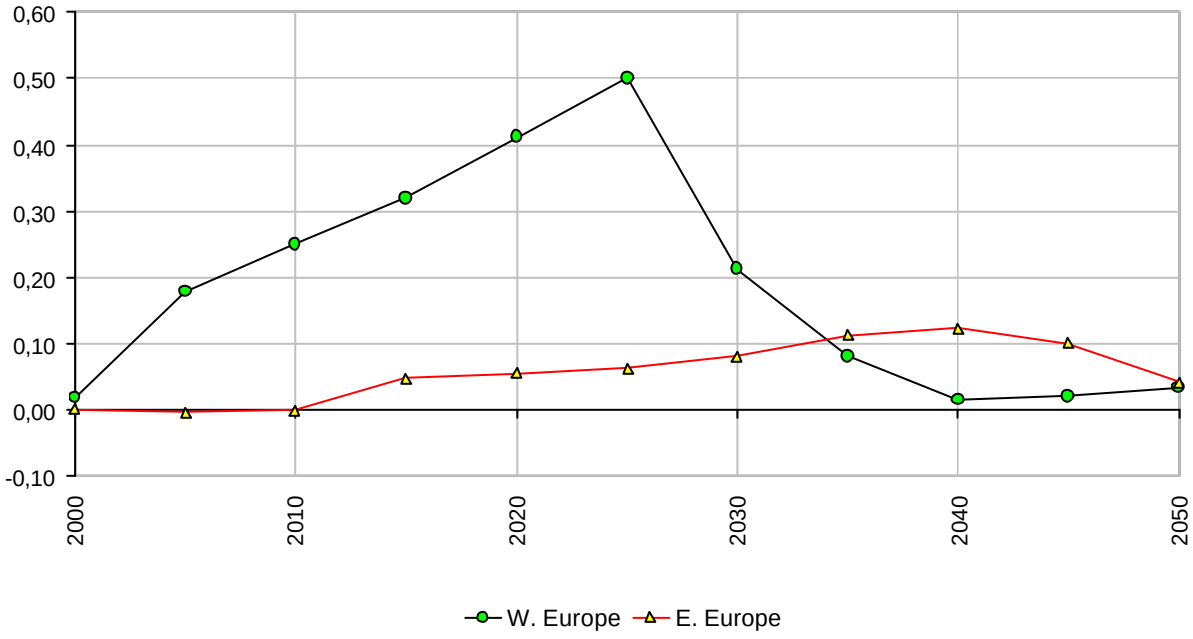
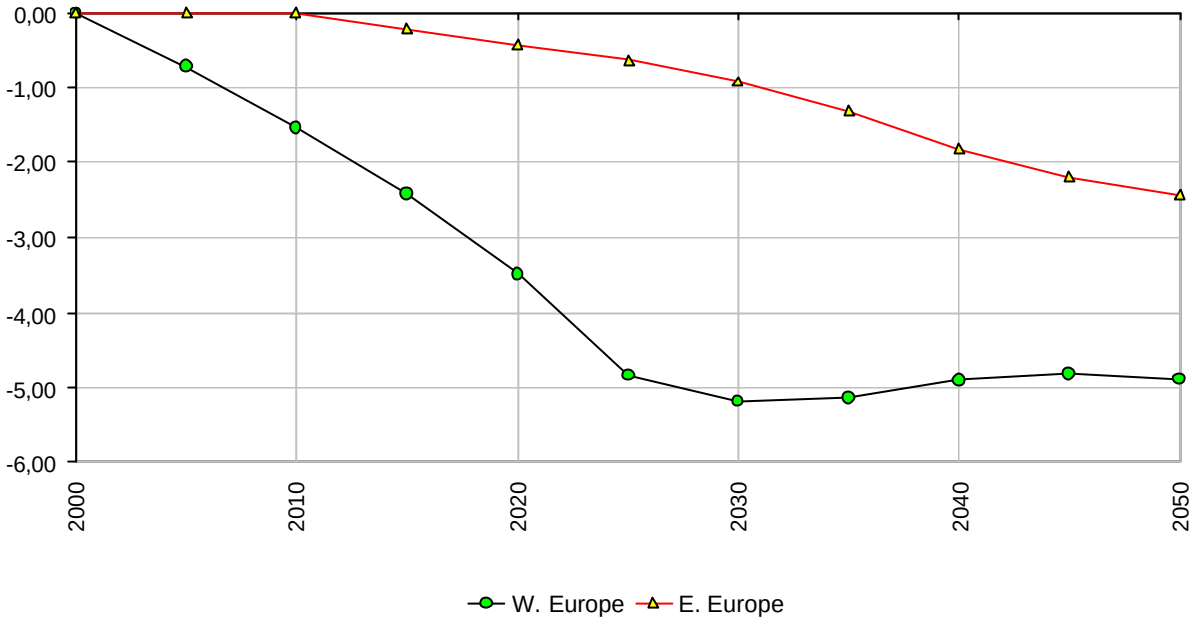


Chart 3. Higher employment rates in the EU, or simulating the Lisbon strategy

a. GDP Growth rate (2000-2050)
(difference from baseline scenario)



b. Evolution of Social Security contribution Rate (2000-2050)
(difference from baseline scenario)



c. Evolution of Current Balance (percentage of regional GDP) :
(difference from baseline scenario)

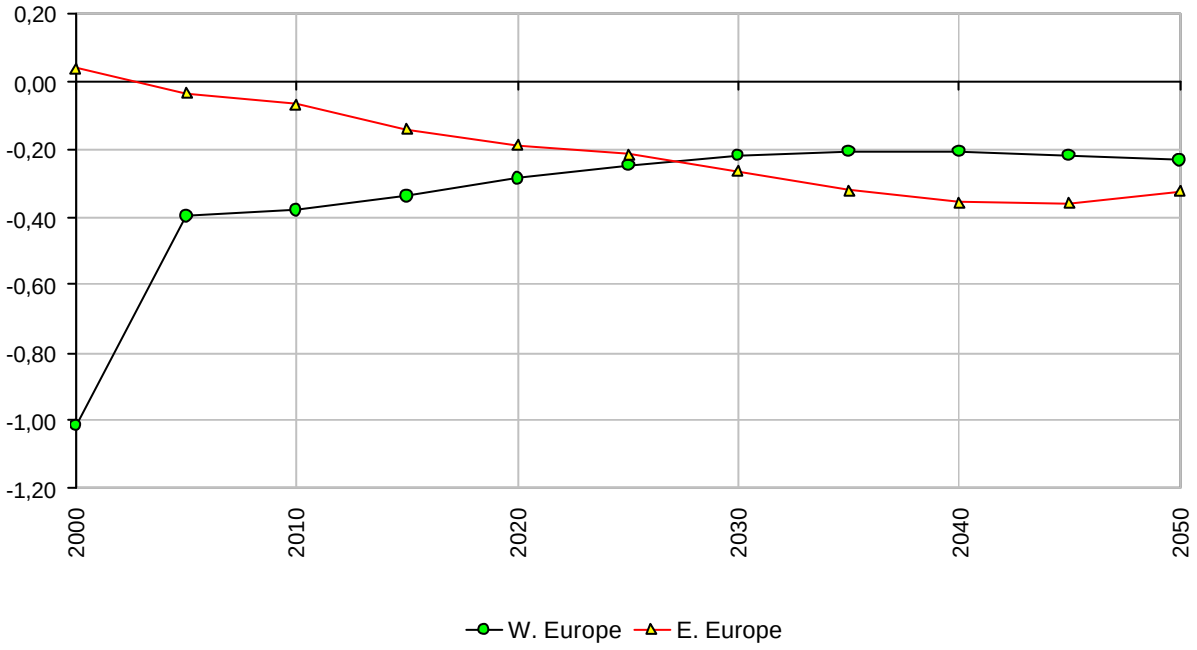
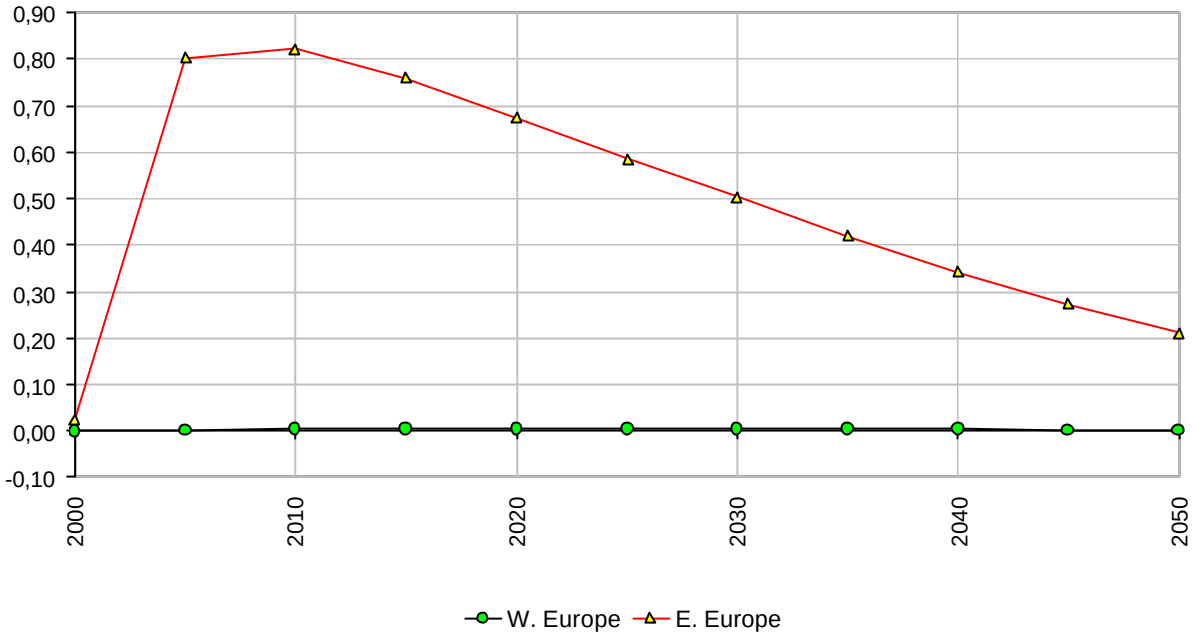
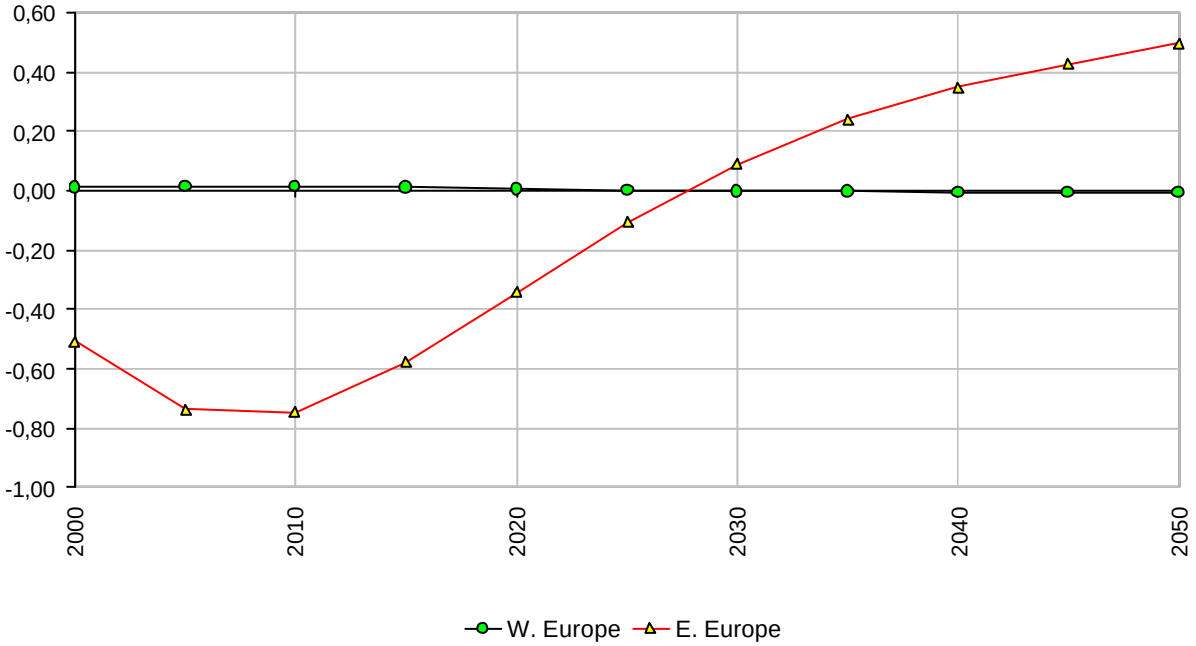


Chart 4. Fast technological convergence of Eastern Europe

a. GDP Growth rate (2000-2050)
(difference from baseline scenario)



b. Evolution of Current Balance (percentage of regional GDP) :
(difference from baseline scenario)



c. Evolution of Trade Balance (percentage of regional GDP) :
(difference from baseline scenario)