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# Growth, Structural Dynamics and EU Integration in the Context of the Lisbon Agenda

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**Summary:** The long term dynamics of growth and structural change in open economies are discussed where integration aspects are included. Taking a closer look at basic economic dynamics, namely developments in terms of sustainable growth and international interdependencies, the theoretical section emphasizes international links on the demand side as well as (within a theoretical innovation) on the supply side. The latter basically means the production function where a broader range of inputs, including technology effects and aspects of foreign direct investment are considered. For the first time, the distinction between efficient international specialization and golden efficient international specialization is discussed here. With respect to the EU, the Lisbon Agenda is discussed and various policy conclusions are drawn. The Euro area has considerable strong points in terms of a high potential for sustained growth; at the same time, one cannot overlook that aging, and partly weak prudential supervision represent serious challenges. The EU has achieved some increase in the growth of productivity and output due to its modernization efforts in the field of telecommunications and information as well as communication technology. Major challenges for policymakers are identified, including the field of green ICT, which could become a common field of cooperation between the EU and China.

**Zusammenfassung:** In diesem Beitrag werden die Verbindungen von Wachstumsdynamik und Strukturwandel in offenen Volkswirtschaften dargestellt, wobei zudem Integrationsaspekte berücksichtigt werden. Wenn man einen genaueren Blick auf die grundlegende ökonomische Dynamik richtet, und zwar unter den Gesichtspunkten nachhaltiges Wachstum und internationale Interdependenzen, dann ergeben sich wichtige nachfrageseitige internationale Verbindungen einerseits und neue Angebotsperspektiven – mit theoretischer Innovation – anderseits. Letzteres bedeutet, dass eine Produktionsfunktion mit mehreren Faktorinputs betrachtet wird – unter Einschluss von Technologieaspekten und Direktinvestitionen. Erstmals diskutiert wird hier die Unterscheidung zwischen effizienter internationaler Spezialisierung und einer „goldenen effizienten internationalen Spezialisierung“. Bezüglich der EU bzw. der Lissabon Agenda werden relevante Aspekte thematisiert und einige wirtschaftspolitische Schlussfolgerungen gezogen. In der Eurozone gibt es durchaus starke Ansatzpunkte, die Möglichkeiten eines nachhaltigen Wachstums betreffen, zugleich ist jedoch nicht zu übersehen, dass die Alterung der Gesellschaft und eine teilweise schwache Bankenaufsicht ernste Herausforderungen darstellen. Immerhin hat die EU auch eine Erhöhung der Arbeitsproduktivität bzw. der Produktion dank der Modernisierungseffekte im Bereich der Informations- und Telekommunikationstechnologie erreicht. Es bleiben wesentliche Herausforderungen für die Politik – dies schließt den Bereicht Green IT ein – der auch ein neues Kooperationsfeld zwischen der EU und China werden könnte.

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# 1. Introduction

Competition is a natural driver of structural change, innovations and growth. The EU Lisbon Agenda has emphasized the need to exploit the new opportunities for growth related to the information and communication technology (ICT). The European Commission has pushed for liberalization of the telecommunications sector, and in 1998 both network operation and voice telephony in the fixed-line segment were opened up for competition. Prices of telecommunications fell remarkably, a wave of product innovations has been observed and internationalization of the telecommunications sector has been stimulated by international mergers & acquisitions as well as greenfield investment in the EU single market. However, among EU27 countries only a few countries – in particular the Scandinavian small open economies, the UK and the Netherlands – have strongly benefited in terms of higher productivity growth; complementary human capital formation was rather modest and national (de)regulation in large economies obviously was more slowly in creating sustained competition than in small open economies (WELFENS, 2008).

Compared to the US, the EU has achieved only modest growth in the 15 years following 1990. As regards the Euro zone, the relative income gap vis-à-vis the US increased considerably in the last two decades of the 20$^{th}$ century. In 2006 and 2007, however, Euroland's growth seemed to match that of the US and even to temporarily overtake it – with good prospects for enhanced growth in the medium term. Interestingly, the number of jobs created in the period 1999-2006 reached more than 10 million and thus exceeded the number in the US (EUROPEAN COMMISSION, 2007, p.3). In the EU, Germany suffered from rather low growth in the decade after the German unification boom 1991-93. However, after 2006 there was a considerable revival of Germany's economy which was partly due to labor market reforms under the Schröder government – plus the incentives for more innovation, ICT expansion and growth under the grand coalition; the high growth rate of the world economy also benefited Germany which is the world's No. 1 exporter.

Germany's economic recovery has played a key role for the improvement of the dynamics of the euro area. Two to three percent annual growth per capita in the euro area seems to be rather low compared to China and India where per capita growth achieved about 9% and 6% over more than a decade. At the same time, those countries have become more open in terms of the trade-GDP ratio so that international interdependency is growing. The Euro area – as a distinct dynamic subgroup of the EU – has achieved considerable economic expansion and output growth; part of these dynamics are related to internal adjustments, policy measures of the ECB and the member states as well as external impulses which range from EU eastern enlargement to economic globalization. Globalization mainly means the rapid increase of capital flows, in particular foreign direct investment, after 1985. The global internet network is also an element of globalization as it, on the one hand, contributes enormously to the worldwide diffusion of knowledge; on the other hand, the internet is the basis of the expansion of e-commerce, which is a new pillar of economic growth in OECD countries and newly industrialized countries. The US is the dominant OECD economy in the field of ICT expansion and it also is the most important source country of foreign direct investment flows. Given the fact that the high US has recorded

high current account deficits in an environment of a strong performance in terms of productivity growth, innovations and output expansion after 1995 it is not surprising that the United States has attracted high capital inflows from all over the world. Capital exports from Asia have financed the US current account deficit, however, the banking crisis made the US look rather fragile in 2007/08. By contrast the banking sector in most countries of the euro zone looked more stable; not the least because regulation of banks was stricter than in the US and since long term financing – including mortgages – plays a much larger role in the continental EU countries than in the UK or the US.

At the beginning of the 21st century, the US is the only superpower and the dominant global source country of foreign direct investment. For a few decades it is unclear whether the world economy will be characterized by stability: the US might engage in a quasi-imperial overstretch, as it is the only superpower; the rise in new challengers might also generate impulses for instability. China which already has become a leading Asian regional power is likely to become a long term rival of the US. The subsequent table (ignoring military power) gives a few key figures for large economies in the world. The US leads with a share of about 1/5 of global GDP – on the basis of purchasing power parity figures. China already has come close to the economic size of Euroland in 2001-05 (IMF, 2007).

The US represented about 30% of global GDP at the beginning of the 21st century if we focus on figures at market exchange rates (figures for the US are expressed in $, figures for the Euro area in Euro and then converted, at the current exchange rate, into US dollars; figures for China are expressed in Yuan and then converted into US dollars; then the shares of individual countries in world GDP are calculated). However, the US share in world GDP is lower within the PPP concept: it is 1/5 of the world economy's gross domestic product if one uses purchasing power parity figures – that is if one controls for differences in the price of nontradables across countries (e.g., the price of a hair cut in China is lower than in the US and so are rents for apartments: adjusting for such international differences allows to compare income figures of individual countries). The output share of the – hypothetical – Euro area in the early 1970s was close to that of the US, while at the beginning of the 21st century it was 5 percentage points behind that of the US (20.5%), whose growth performance had been much higher in the 1990s than in the Euro area. At the beginning of the 21st century, the share of Japan in global output is 7% and the share of the UK about 3%. China has increased its share by roughly ten percentage points over the past three decades and stood at 14% in the period 2001-05. Canada, Mexico and Korea each account for about 2%; India was close to 6% and Brazil close to 3% at the start of the 21st century.

In 2010, the economic weight of China will be about the same as that of Euroland. Thus there are more countries which cannot be considered as small open economies. Rather the US, the EU/Euroland, China and the ASEAN are large open economies where politico-economic decisions in one country have an effect on the rest of the world and from there, feedback effects will in turn affect the respective country.

If one takes a look at the share of countries in global merchandise trade one finds that the US and the Euro area dominate – with a slight lead of the Euro area at the beginning of the 21st century. China has strongly increased its position in the period 1970-2005; in the period 2000-05 its share on the import side and the export side exceeded that of the UK and it is only a question of time before China becomes the world's largest trading power.

The relative stock market capitalization of the US (value of stocks relative to GDP) – which is twice its share in world output at PPP figures – is much higher than that of the euro zone. The ratio of stock market capitalization relative to US output share was 2 in 2001-05, while that ratio was 1/7 in China. In the euro area the respective ratio was 1. Thus the euro area should have considerable medium term potential for a rise in that ratio.

With respect to China, the EUROPEAN COMMISSION (2007, p.42/43) notes, "The increase in openness was particularly marked in the case of China (from an average of 35% in the 1990s to 63% in 2005)…China's share in global output has risen from 1.7% in 1990 to 5% in 2005. Since 2000 the country has contributed about one third to overall worldwide GDP growth. Fixed asset investment, both in the industrial sector and in real estate, has contributed strongly to this impressive growth performance, as has the ongoing rise in exports, which are supported by a very competitive exchange rate. At the same time, the growth rate of private consumption has been much lower, as the lack of an adequate social security system keeps the savings rate at high levels. As a consequence, the savings-investment gap has increased, driving up the current account surplus and foreign exchange reserves…Trade and investment flows between China and the euro area have been rising. The euro area is a very important export destination for China, accounting for 19.4% of its total exports in 2005, equaling 9.7% of overall euro-area exports in that year…The euro-area trade deficit with China has kept growing, reaching slightly more than € 74 billion in 2005. Regarding, Foreign Direct Investment (FDI), euro-area flows to China have been rising both in absolute value and as a percentage of total euro-area outward FDI. The euro area, however, remains a less important direct investment partner for China than the United States or Japan."

If high growth in Asia continues, OECD countries – in particular the EU, the US and Japan – stand to benefit in terms of economic expansion of output and a rise in national income which will partly reflect higher profits accruing from abroad, that is from multinational subsidiaries in Asia, Latin America and elsewhere. With the adoption of the Lisbon Agenda of 2000, the European Union has started to emphasize growth and employment expansion in the context of the knowledge society. Subsequently we will take a closer look at selected theoretical aspects of growth and of the expansion of ICT and structural change. Using the OECD nomenclature for classifying goods in accordance with factor intensities, we will also point out the different adjustment dynamics in terms of structural change over time – the analysis will put the focus on selected EU countries, the US and China (in particular we will look at the relative export performance in the EU15 market). At the bottom line, we can draw some key policy conclusions.

# 2. Selected Theoretical and Empirical Aspects of Economic Growth

## 2.1. Theoretical Aspects

Understanding long term economic growth is not possible without growth theory, which basically puts the focus on the supply-side; in contrast, short-term and medium term growth analysis will often take into account a demand side perspective. In certain cases, both perspectives can be adequately combined (WELFENS, 2007). The standard analysis of supply-side oriented growth theory is summarized in AGHION/DURLAUF (2005) and additional ideas are discussed in EICHER/RÖHN (2007) and ALGAN/CAHUC (2007). In modern Economics, there is often a strong emphasis on the microeconomic foundation of Macroeconomics which certainly is useful for many issues. However, one may raise some doubts as to whether typical assumptions about economic agents maximizing profits or utility over infinite horizons are always adequate. At least in the context of business cycle dynamics, one will often find that relevant time horizons are changing and that a shortening of time horizons and a sudden rise in risk premiums in capital markets can play an important role. (The subprime housing market crisis in the US in summer 2007 is indeed a good example for a major confidence crisis that started in the US, then affecting many banks and countries.) For long term growth analysis, the assumption of long term planning of households and firms is rather convincing. However, it is also adequate to call for a Macroeconomic foundation of Microeconomis (see appendix); there is a mutual need for consistency.

An important aspect of growth interdependence in the world economy is related to the relative size of countries as measured by real GDP on the basis of purchasing power parity. In the context of a simple two-country model, the world GDP Y## = Y + q*Y* (with Y* denoting GDP in country II and q*=: eP*/P the real exchange rate where e is the nominal exchange rate and P the price level); hence the growth rate – g denotes growth rates – of the world economy is calculated as $g_{Y\#\#} = \varepsilon g_Y + (1-\varepsilon)[g_Y^* + g_{q^*}]$, where ε is the share of Y in world GDP. Let ε denote the share of OECD GDP in global income – about 40% at the beginning of the 21st century. Taking into account that the world growth rate will increasingly be determined by Asia and that Asian growth rates (which might be around 5% in the medium term), at least for one or two decades, might well exceed that of OECD countries, it is clear that Asia will increasingly affect the development of global economic growth (here we ignore potential long term changes in the real exchange rate). This, however, does not imply that Asian economic dynamics will dominate the world economy around 2030 or 2040 unless the weight of Asian stock markets in global stock markets – as measured by stock market capitalization – should strongly increase; here world markets are still dominated by the US.

What determines economic growth in the long run? The standard neoclassical growth model is a useful starting point for our analysis and can be extended in various ways, e.g. by considering more input variables than just capital, labor and knowledge. Economic

growth must carefully be considered in various ways. One important aspect concerns the distinction between the level of the growth path and the trend growth rate (the growth path itself). The distinction becomes clear if we briefly recall the neoclassical standard growth model based on the following assumptions (with e' denoting the Euler number, Y output, K capital, L labor, A knowledge, S savings, δ depreciation rate of capital, τ tax rate):

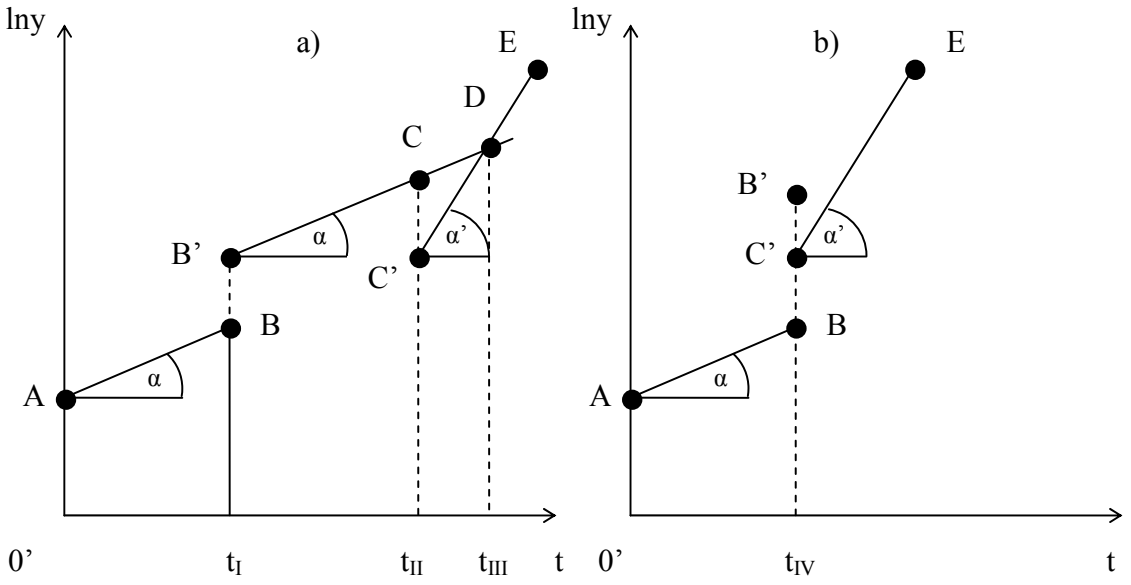
- production function is linear-homogeneous; we will use $Y=K^{ß}(AL)^{1-ß}$; $0<ß<1$
- savings $S=s(1-\tau)Y$ where τ is the income tax rate and the savings rate s is in [0,1]
- equilibrium condition for the goods market which is S= investment I where I is the sum of net investment dK/dt and capital depreciations δK (δ is depreciation rate)
- growth rate of labor (L) is exogenous, namely dlnL/dt=n;
- growth rate of knowledge (A) is exogenous: dlnA/dt= a: hence $A(t)=A_0e'^{at}$
- the steady state ratio $Y/(AL)=:y' = [s(1-\tau)/(a+\delta+n)]^{ß/1-ß}$
- per capita income in the steady state is $y\# =:Y/L= \{[s(1-\tau)/(a+\delta+n)]^{ß/1-ß} A_0\}e'^{at}$.

Hence the growth rate of the per capita income y in the steady state is equal to "a". At the bottom line, the level of the growth path is given by the bracket term {…} and the long term trend growth rate is given by a. Hence a rise in the savings rate s, a fall in the tax rate τ, a fall in the depreciation rate δ and in the population growth rate n will raise the level of the growth path of per capita income. The growth rate of real GDP is given by the sum of a and n. The above per capita equilibrium will also hold for an open economy as long as there is no foreign direct investment and as long as we assume a balanced trade account and a balanced government budget as long run constraints for economic policy (see on this and a potential trade-related impact of trade WELFENS (2007)). In an endogenous growth model the trend growth rate – read the progress rate a – could be explained through expenditures on research and development (R&D), human capital formation or high-technology imports.

In a lny-t diagram (see panel a) in the following diagram), we may consider a country which experiences an upward shift in the level of the growth path in a certain point of time ($t_I$) – see the switch from point B to B' – while the growth rate (the slope of the line: see tg α) remains the same. At a later point of time $t_{II}$, there could be a rise in the progress rate a so that there is a downward shift in the level of the growth path combined with a steeper slope (tg α'). It will take some time until – in $t_{III}$ – per capita income on the new path is higher than it would have been under the old regime. In panel b) we have shown the case that there is a simultaneous increase in the level of the growth path and the trend growth rate, so that the overall path of y is given by ABC'E.

Policy measures such as a cut of the tax rate or incentives designed to increase the savings rate s raise the level of the growth path (see the upward shift of the path in panel a) at $t_I$; along the new path B'C the slope of the growth path is the same as initially, namely tg α). One should not, however, overlook the fact that specific tax incentives – tax rebates for firms investing in R&D – can also affect the trend growth rate a.

**Figure 1: Change in the Level of the Growth Path and the Trend Growth Rate (b)**




An exogenous increase in the trend growth rate "a" will obviously reduce the level of the growth path and raise the trend growth rate at the same time. In a politico-economic system, which is extremely short-sighted, a policy option to increase "a" will not seriously be considered, as the short-term effect of a fall of the growth rate will dominate. However, politicians who take a long term perspective will clearly favour options that raise the trend growth rate since over time a rise in the trend growth rate dominates the short-term fall of the level of the growth rate.

Cross-country empirical analyses as well as panel analyses of economic growth typically suffer from a specific problem, namely that they do not apply a double test on structural breaks. There could be a structural break with respect to:

- the level of the growth path;
- the trend growth rate;
- both the level of the growth path and the growth rate itself.

We can learn from empirical analysis only if the sample of countries considered is rather homogeneous and if adequate dummy variables for trend breaks have been used.

One should emphasize that in an open economy context with foreign direct investment, one will have to carefully make a distinction between gross domestic product and gross national product where GNP per capita will normally exceed GDP per capita if the country considered is a net investor in the world economy (e.g., the case of the US, the Netherlands or Germany as opposed to the UK, Ireland, Italy or China – the latter four countries all being important host countries for foreign direct investment). Disregarding international labor mobility, one may state for the case of a pure source country of foreign direct investment: the gross national product Z is the sum of Y (GDP) and profits accruing from abroad which under certain conditions are proportionate to foreign gross domestic product Y*. If there is two-way foreign direct investment it is naturally net international profit accruing which has to be taken into account.

In a broader approach to economic growth the role of trade and monetary integration should be adequately considered which basically means with respect to the euro area:

- Consider the effect that monetary integration has on trade: ROSE (2001; 2002, 2004) has strongly argued that regional monetary integration stimulates regional trade. In this perspective efficiency gains associated with trade could contribute to output expansion. In an enhanced neoclassical growth model with trade one can argue that trade indeed should affect the level of the growth path and – if innovation dynamics are affected – also the growth trend itself (WELFENS, 2007).
- Consider the effects which (European) monetary integration has on intra-foreign direct investment and extra-foreign direct investment dynamics – both for outflows and inflows – and the associated structural change which could lead to more vertical trade, namely trade with intermediate products, within the integration zone (or in terms of more vertical globalization which means that extra-FDI dynamics contribute more strongly to vertical global production networks) so that the correlation of shocks could become more similar as world market shocks will affect final goods producers and intermediate goods producers in a similar way.
- Consider the effect of institutional changes in economic policy – associated with monetary union (in the case of the euro zone the Stability and Growth Pact is important as well as the switch to a single monetary policy); if policy intervention becomes more efficient this could contribute to long run output expansion. Mainly with respect to this important aspect BAGELLA/BECCHETTI/HASAN (2004) have presented some evidence that more stable macro policies have had a positive significant impact on the level and growth rates of per capita GDP in euro area countries (it would, however, be more interesting to analyze the effects on per capita gross national product or net national product per capita).

In their simulations based on a general equilibrium model, KEUSCHNIGG/KOHLER (2002) have shown that the level of GDP in Austria would permanently be raised by 1.25% and the level of the capital stock by 1.73% while the welfare effect without considering adjustment cost – thus we have a gross effect based on an equivalent income variation (roughly: which transfers Austrian households require to get the same level of welfare without EU eastern enlargement) – should be 0.58% of GDP. For Germany, a similar analysis by KEUSCHNIGG/KEUSCHNIGG/KOHLER (2001) – with a hypothetical small eastern enlargement comprised of Poland, Hungary, Czech Republic, Slovakia and Slovenia – would raise the capital stock by 0.55% of GDP, 0.44 of GDP and 0.37% of GDP with respect to economic welfare. Thus EU eastern enlargement could have positive effects on EU15 countries. It is, however, unclear to which extent digital modernization of western Europe and eastern Europe contributes to such favorable dynamics. However, it is obvious that the scope for high growth through technological catching-up with EU15 will decline over time in accession countries. Hence more emphasis on digital modernization, including network modernization allowing faster dissemination of information/knowledge, should be a natural element of a growth-enhancing policy approach.

## 2.2. Endogenous Growth Models and Empirical Issues

In endogenous growth models, the term "a" is no longer exogenous but explained – e.g., by the ratio of R&D expenditures to GDP or the share of researchers in the overall labor force. There is a broad range of endogenous growth models (BRETSCHGER, 2005) which basically emphasize several potentially important drivers of the trend growth rate:

- the non-rivalry of technology and hence of technology spillovers across both sectors and countries;
- the possibility that individual firms' capital formation creates positive spillover effects so that the aggregate marginal productivity of growth does not decline (ROMER, 1986);
- the role of product differentiation in intermediate products on the basic of an R&D sector (ROMER 1990a) which allows for the production of more variants of heterogeneous goods, which in turn stimulates demand and hence output growth;
- the role of static and dynamic scale economies – the latter refers to learning-by-doing effects as emphasized by ARROW (1962), which are particularly important for certain sectors, including automotive, air and space sector as well as ICT;
- the role of human capital formation as emphasized, for example, by LUCAS (1988) and ROMER (1990b). In the approaches of ROMER (1990a) and AGHION/HOWITT (1992) the idea of NELSON/PHELPS (1966) is picked up, namely that human capital is necessary for both R&D and innovations. As a result, the growth rate of output depends on the level of human capital. It is a priori unclear whether human capital formation affects the level of the growth path or – through increasing the rate of technological progress – the trend growth rate. If human capital is an input like other standard variables, the growth rate of output depends on the growth rate of human capital (as in LUCAS, 1988; for a discussion of both approaches see CANNON, 2000). The empirical evidence on the US suggests that the growth rate of human capital has an impact on the growth rate of output (JONES, 1995). This implies that government has a role with respect to the growth rate, as government is typically quite involved in the education system and also subsidizes R&D in most OECD countries; and this is justified from an economic perspective to the extent that there are positive external effects of private R&D.

Without taking a detailed look at the many empirical studies (see, e.g., the studies discussed in BRETSCHGER, 2005; WELFENS, 2007) dealing with the link between input factors and output expansion one should clearly state a critical caveat:

- Cross-country (and panel-based) empirical growth studies generally do not distinguish between countries with a break in the level of the growth path on the one hand or a break in the trend of the growth rate of output on the other. Only results of studies which incidentally have focused on groups of homogenous countries should be considered without caution. As authors typically have not tested for the breaks in the respective data series in an adequate way, one may

partly discard a large share of the empirical growth analysis. The relevant testing procedure based on unit root tests basically is available (JUNGMITTAG, 2006).

- A consistent empirical growth analysis requires considering homogenous groups of countries, that is countries should be grouped according to countries a) without a break in the level of the growth path and b) without a break in the trend of the growth rate; c) countries which have experienced both types of breaks and d) countries with neither a break in the level of the growth path nor in the level of the growth rate.

For the EU15 countries, a modern growth decomposition analysis shows a triple impact of technology on growth (JUNGMITTAG, 2006):

- Growth of patent stocks, reflecting the stock of knowledge which can be patented, show a positive effect on output growth in all EU countries covered. In some of the smaller EU countries – such as Ireland or Belgium – part of this effect is related to innovative subsidiaries of multinational companies from the US, the EU or Asia; and such subsidiaries are also partly involved in international high technology competition. Naturally, multinational companies will be strongly involved in international trade as well so that in fact foreign direct investment is visible four times: in the category high technology specialization, knowledge diffusion, patent stock and capital accumulation.
- The type of specialization is relevant for growth; there is a high relevance of high-technology specialization (dubbed technological specialization in the subsequent graph) for several countries: It is not simply specialization which matters but high-technology specialization. Surprisingly, some EU countries have a negative contribution of high-technology which might be explained by inadequate government interference or by historically high technology specialization, which is no longer efficient against the background of the present international division of knowledge and technology. In this respect deep EU integration in its two main pillars, the EU single market and the creation of the euro area, are crucial – in the economic and monetary union there is increased pressure on specialization and for high wage countries (particularly those where government stimulates innovation adequately), this typically implies high-technology specialization.
- Knowledge diffusion – which is related to trade intensity in the analysis of JUNGMITTAG (2004; 2006) – in like manner positively affects economic growth so that institutions which support effective and efficient diffusion of new knowledge are important for growth. More intensive regional integration dynamics (raising trade intensity) imply a higher rate of knowledge diffusion. As we can see for all countries, knowledge diffusion and capital stock accumulation are the two most important impulses for economic growth.

For Germany, France, the UK, Italy, Ireland, Portugal and the Netherlands, all three technology factors had a positive impact on economic growth in the period 1969-1998.

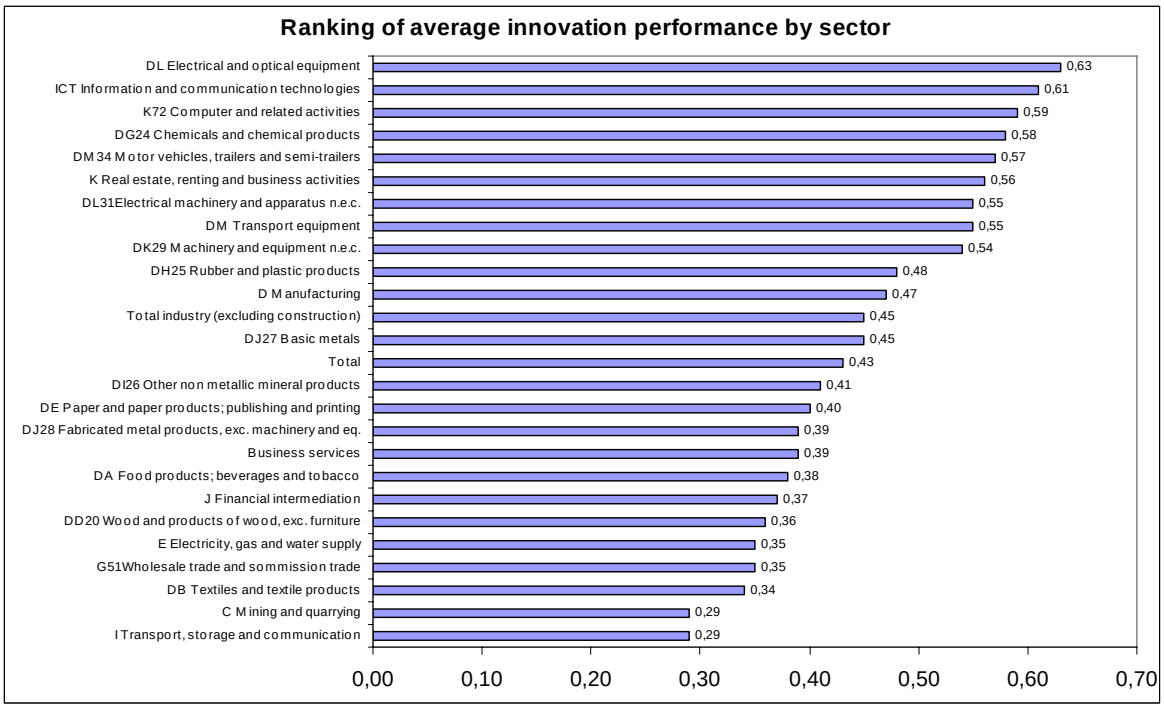
## 2.3. Role of Information and Communication Technology

Economic growth in many OECD countries has considerably increased in the 1990s, and certainly information and communication technology (ICT) has contributed to higher long term growth in the US. In the literature we find considerable evidence that information & communication technology plays an important role for the growth differential US vs. EU15: JORGENSON/STIROH (2000), COLECCHIA/SCHREYER (2002), OLINER/SICHEL (2002), STIROH (2001), INKLAAR ET AL. (2003) and VAN ARK/PIATKOWSKI (2004) have argued that ICT production and the use of ICT – that is ICT investment – are important drivers of productivity growth. Comparing the periods 1995-2000 to 1979-1995 the INKLAR ET AL., analysis of labor productivity growth in the US and EU-4 finds an increase of 1.25 percentage points in the US and a reduction of 0.27 points in the EU. The growth accounting estimates show that labor quality changes have reduced in both the US and the EU-4 labor productivity. The employment reallocation effect in the US was good for + 0.05 points, but in the EU-4 the figure was -0.06 points. ICT producing industries generated similar impacts on productivity growth in the US and the EU, namely 0.04 and 0.03 percentage points. As regards the impact of ICT using industries, the EU did not reach even half the increase of the US which was 0.29 points – the main effect stemming from financial services (0.17 in the US; 0.02 in EU-4). Non-ICT capital deepening contributed to 0.08 points in the US and -.45 points in the EU. Total factor productivity contributed 0.79 points in the US, but only 0.13 points in the EU-4. The impact from ICT producing industries were rather similar on both sides of the Atlantic (.36 in the US vs. .24 in the EU), but in ICT-using industries, there were much bigger differences. In particular wholesale trade, retail trade and financial services seem to be problem areas for Western Europe.

An EU study on the Lisbon Process (DENIS/McMORROW/RÖGER/VEUGELERS, 2005, p.4) summarizes its findings as follows: “The structural nature of the EU’s productivity downturn is confirmed by the analysis…, with the bulk of the deterioration emanating from an outdated and inflexible structure which has been slow to adapt to the intensifying pressures of globalization and rapid technological change. The EU’s productivity problems are driven by the combined effect of an excessive focus on low and medium-technology industries (with declining productivity growth rates and a globalization-induced contraction in investment levels); an inability to seriously challenge the US’s dominance in large areas of the ICT industry, as reflected in the relatively small size of its ICT in a range of ICT-using industries, although measurement issues severely complicate an assessment of the gains from ICT production and diffusion. The post-1995 differences in EU-US productivity patterns are fundamentally driven by the US’s superiority in terms of its capacity to produce and absorb new technologies, most notably in the case of ICT. Healthy knowledge production and absorption processes are mutually supportive elements of any successful long run productivity strategy…The systematic inadequacies of the EU’s innovation system are highlighted by the experience of the ICT industry, with the history of this industry suggesting that a “national champions” strategy in high technology industries is highly problematic.”

Here the analysis will not focus much on the ICT – contributing about 1/3 to US productivity growth in the 1990s – since many ICT issues have been largely explored elsewhere (AUDRETSCH/WELFENS, 2003; BARFIELD/HEIDUK/WELFENS, 2004; WELFENS/ZOCHE/JUNGMITTAG ET AL., 2004).

**Figure 2: Innovation Dynamics by Sectors in the EU**




Source: EUROPEAN COMMISSION, European Innovation Scoreboard (2005), S. 23

The EUROPEAN COMMISSION (2007, p. 19-20) has noticed with respect to both productivity growth and the role of ICT:

*"The comparison of average growth figures from the period 1970-1995 to the period 1995-2004 indicates that labor productivity growth decelerated for all euro-area Member States except Ireland and Greece. While annual productivity growth decelerated from 2.4% to 1.3% in the euro area between the two periods, it accelerated from 1.3% to 2.4% in the United States…Wider positive spillovers from the acceleration of productivity in the high-tech sector have not been visible. Evidence suggests that information and communication technologies (ICT) play a significant role in the revival of productivity in advanced countries. But although productivity accelerated markedly in the ICT-producing sector of the euro area in the 1995-2004 period, its contribution to aggregate euro-area productivity figures remained small…This is due to its low share in total output and the absence of discernable productivity spillovers to other sectors..."*

One should not exclude that other EU countries will follow similar developments as in Finland, Sweden, the UK and the Netherlands which are rather strong in ICT; and the rise in productivity growth in 2005-07 might indeed have not only a cyclical component but a long term structural component as well. The European Commission has presented some figures on the structural breakdown of labor productivity growth in the euro area and the US where several sectors are considered (EUROPEAN COMMISSION, 2007, p.19):

- ELECOM= Electrical machinery, post and communications: here labor productivity growth – already close to five % p.a. in the first period – has increased in the period 1995-2004 in comparison to 1970-1995 (in the second period it was close to 7%).
- MexElec = Manufacturing excluding electrical; here labor productivity growth has declined
- OtherG = Other goods producing industries: sectoral labor productivity slightly increased
- DISTR = Distribution services: sectoral labor productivity growth has fallen over time
- FINBU = Finance and business services: strange enough one finds a decline of labor productivity in the second period while labor productivity growth was slightly positive in the first period; such a development bodes ill for the long term dynamics of the overall economy since weak productivity performance in the FINBU raises doubt about the dynamic efficiency in the EU single market;
- PERS = Personal and social services; here the period 1995-2004 also showed a decline in labor productivity growth. This poor development is likely to be explained by the dominance of government and a remarkable absence of competition in this field.
- NOMAR= Non-market services: sectoral productivity growth has slightly deteriorated.

The following table shows that in the period 1995-2004, mainly ELECOM, MexElec, DISTR and FINBU have contributed to the rise in US labor productivity growth. The Eurozone matched the US performance in MexElec, but not in ELECOM, although the EU enjoys the advantage of having implemented GSM networks and fixed-line liberalization (after 1998). In DISTR the euro area is rather weak compared to the US and in FINBU a contribution of zero to overall labor productivity growth in industry in both periods is a remarkably weak result. By contrast, Euroland achieved a better performance than the US in the field of other goods processing industries.

**Table 1: Contribution to Labour Productivity Growth (in percentage points) in the Euro Area and the US**

| | Euro area | | United States | |
|---|---|---|---|---|
| | 1980-1995 | 1995-2004 | 1980-1995 | 1995-2004 |
| **Total Industries** | 2,4 | 1,3 | 1,3 | 2,4 |
| **ELECOM** | 0,2 | 0,2 | 0,3 | 0,4 |
| **MexElec** | 0,8 | 0,4 | 0,4 | 0,4 |
| **OtherG** | 0,5 | 0,3 | 0,0 | 0,0 |
| **DISTR** | 0,5 | 0,3 | 0,6 | 0,9 |
| **FINBU** | 0,0 | 0,0 | 0,0 | 0,4 |
| **PERS** | 0,0 | 0,0 | 0,0 | 0,4 |
| **NONMAR** | 0,2 | 0,2 | 0,1 | 0,2 |

Note: In the period 1980-1995, reallocation of labour contributes to 0.1 percentage point in the euro area and to -0.1 point in the US.
Source: Commission services and EU KLEMS database in EUROPEAN COMMISSION (2007)

The dynamics of the ICT sector are only partly understood at the regional level. A competitive domestic market, ambitious standards of public procurement, the presence of large innovative companies and the existence of top university research have contributed to regional and national growth impulses from ICT (CALDERINI/SCELLATO, 2005; BERGGREN/LAESTADIUS, 2003). Interestingly, an empirical study for the US (LE BAS/MERIBEL, 2005) shows that the geographic concentration of IT employment has a greater positive effect on labor productivity than the geographic concentration of all other activities. Paradoxically, there are stonger agglomeration economies in the region where IT activities are more concentrated.

As regards ICT development in EU15 and the EU accession countries the EU has adopted various initiatives. It liberalized the EU fixed-line network market (network operation plus voice telephony in 1998) and thus opened up a crucial market which represents roughly 1/3 of ICT. In 2003 a broad EU framework regulation for telecommunications has been adopted which has been revised by the European Commission in 2007. The EU also has adopted several programs to encourage digital modernization.

## 2.4. Cyclical and Structural Aspects of Euro-Area Dynamics

In the euro area the (unweighted) dispersion of growth rates of member countries in the two decades after 1985 where rather similar to the dispersion of growth rates within the US (ECB, 2007); Spain, Greece and Ireland have shown considerable economic catching-up after EU membership, however, as regards Portugal per capita GDP relative to the EU average has declined in the six years after 2000. The impact of the creation of the Euro and the ECB and hence of a common monetary policy have affected growth dynamics in the euro area only after 1999. Taking a look at the average of eight-year rolling correlations of output gaps across euro area countries shows a slight increase of intra-euro area

correlations (GIANNONE/REICHLIN, 2006). This could reflect the impact of a rising share of intra-euro area trade. At the same time one should not overlook that cross-country inflation differences within the euro area have temporarily increased, and consequently the real interest rates have shown considerable cross-country differences after 1999: The combination of a uniform nominal interest rate and cross-country inflation differences implies that real interest rates are different in individual countries of the euro zone and consequently investment-GDP ratios in the various countries of the euro zone will not always develop in a synchronized way. Finally, as regards EU15 and the euro area, a long term decline of economic volatility might also be due to international outsourcing and offshoring dynamics and the corresponding rise in the share of services value-added which typically is less cyclical than manufacturing industry. The US dynamics of the 1990s point to such a development in leading OECD countries (EGGERS/IOANNIDES, 2006). At the same time the EU accession countries in which the share of industrial output – not least due to foreign direct investment inflows – is on the rise might face higher long run cyclical dynamics. Such dynamics can hardly be avoided if countries desire to realize a sustained adjustment process.

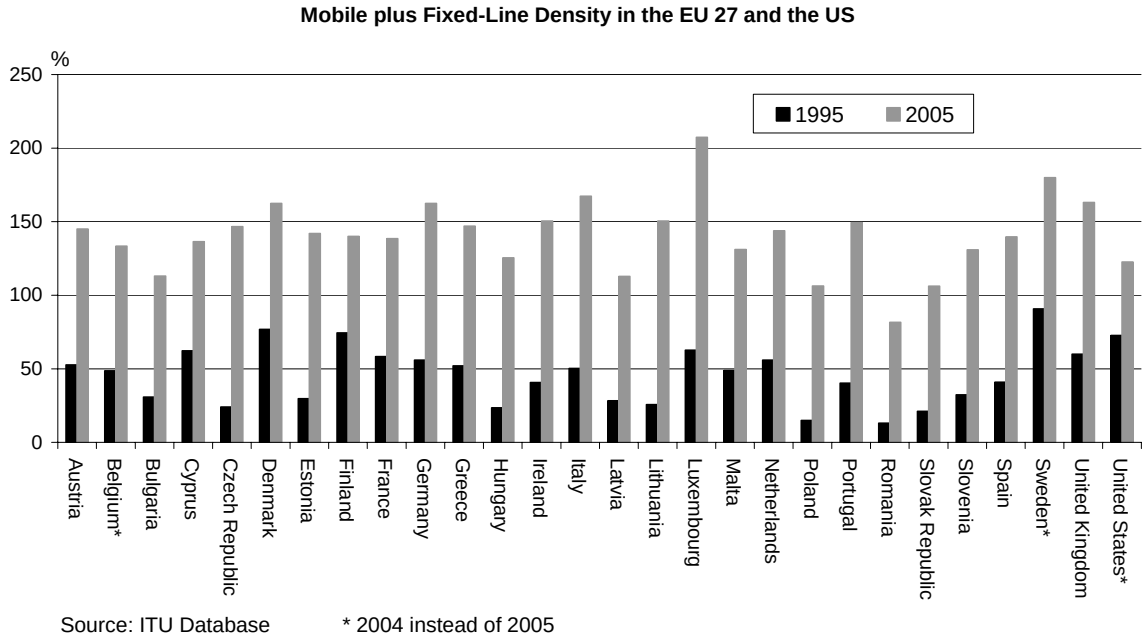
As regards long term cross-country growth differences in the euro area one may point to some natural catching-up growth in relatively poor countries, however, differences in trend growth rates also may reflect differences in national economies policies and in structural problems of adjustment mechanisms (e.g. concerning the labor market) in some of the member countries. Ireland, Spain and Luxembourg have benefited from favorable demographic dynamics since the mid-1990s, particularly high immigration flows. The ECB (2007, p.78) also emphasizes that structural rigidities in some countries have contributed to weak growth contribution of labor input, sub-optimal adoption of new knowledge and reduced innovation dynamics. Financial integration in the Euro zone also might have contributed to higher long term growth, and indeed there are some arguments in the literature why more efficient financial intermediation and output growth go together (LEVINE, 2005**;** CICCONE/PAPAIOANNOU, 2006).

The ECB (2007, p.80) has emphasized that the overall evidence from empirical analysis suggests that country-specific shocks have played a larger role in generating growth differentials than common shocks – and the impact of such shocks have been highly persistent (e.g. the one-off fiscal policy/budget consolidation convergence requirements for some of the candidate countries for the euro zone are relevant in this context). At the same time one should notice that the impact of country-specific output fluctuations on national consumption has decreased since the start of the euro area (GIANNONE/REICHLIN, 2006).

As regards long term demographic dynamics there are considerable differences across EU countries where we assume that such dynamics are adequately covered by UN projections for 2030 and 2050. A rather difficult aspect of potential economic convergence concerns the role of technology and converging innovation abilities across countries. It may suffice here to point to the relative per capita patent position at the European Patent Agency. One may assume that large differences in the relative patent position are quite difficult to reduce in the medium term in the EU27. Adequate national innovation policies can be quite important for technological and economic convergence.

There is much broader long term convergence in another field relevant for economic growth, namely in internet density and in the combined fixed and mobile telecommunication density.

**Figure 3: Combined Fixed and Mobile Telecommunication**




Source: ITU Database, EIIW calculations

One should emphasize that eastern European accession countries heavily rely on mobile telecommunications since fixed network communication was much neglected in the socialist countries. With EU Eastern enlargement the accession countries have to comply with the e-communications regulatory framework of the European Community. Eastern European accession countries of 2004 represented 5% of EU15 GDP in nominal terms, but in PPP terms it accounted for about 10% - and the EU has broadly supported economic catching-up in the accession countries where full access to the EU single market also stimulated economic expansion (SOLBES, 2004). Nurturing entrepreneurship and adopting digital modernization is crucial for accession countries and there is no doubt that such modernization also is conducive to high FDI inflows, competition dynamics and more trade in the EU27. The European Commission has earmarked considerable funds for supporting the digital modernization in eastern Europe – with eEurope+ and i2010 being major policy elements along the basic line aiming at improving the competitiveness of the new member states and the overall Community.

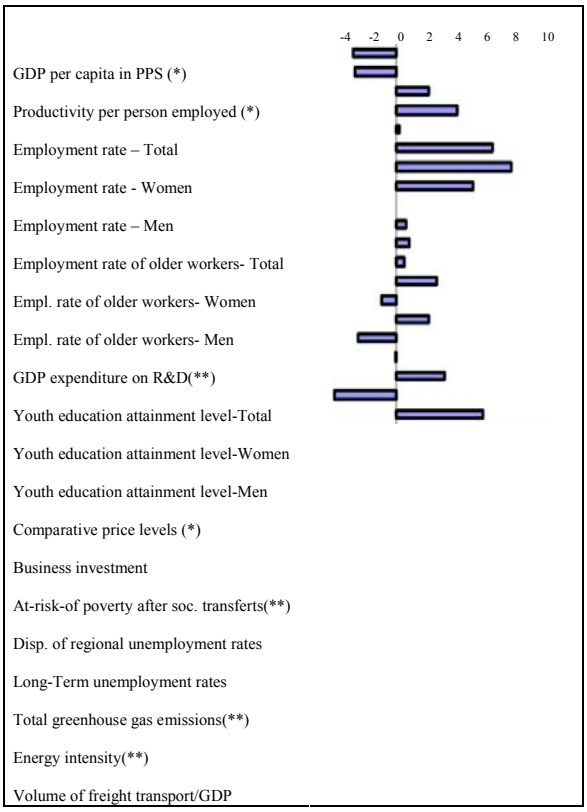
# 3. The Lisbon Agenda, Structural Change and Growth

## 3.1. Basic Dimensions of Policies for the Lisbon Agenda

The Lisbon Agenda aims at making the EU the most competitive knowledge-based society by 2010. In the interim KOK Report, the findings were sobering and indeed rather disappointing as only modest progress had been made in terms of higher employment, higher growth and a rise in R&D-expenditures relative to GDP (3% is the target ratio for 2010). As a consequence the EU has de-emphasized the role of supranational policies which could not deliver much in the relevant fields; instead member countries have been asked to come forward with programs which contribute to the list of Lisbon goals – the list itself has been streamlined, but emphasis on reforms in product markets, budgetary institutions and financial markets and labor markets has remained. In the period 2004-07 there is considerable progress in some fields, and in the case of euro area countries one may not exclude that the necessity to operate in an economy with a common monetary policy has reinforced in some countries the willingness to adopt structural reform programs which reinforces ability to absorb shocks and shifts through a system of flexible markets.

As regards development of some structural indicators relevant for the EU's Growth and Job Strategy, the European Commission has published indicators with mixed results. Employment has increased and higher levels of education have been achieved, but in many other fields only modest progress has been made.

**Figure 4: Structural indicators earmarked for the Growth and Jobs Strategy, euro area (change in percentage points from 2000 to 2005)**




Data and methodology: Eurostat http://europa.eu.int/comm/eurostat/structuralindicators;
(*) change in relation to the EU25 average; (**) 2000-2004 change
Source: 2006 Commission assessment of National Reform Programmes, euro-area fiche in EUROPEAN COMMISSION (2007*)*

The EUROPEAN COMMISSION (2007, p.23) notes:

"Euro-area Member states have addressed many reform areas that are important to stimulate growth and jobs. This is shown in the Annual Progress Report of December 2006 in which the Commission assesses the National Reform Programmes and Implementation Reports of the Member States. Promising reforms have been undertaken, or have been planned, to increase labour participation rates, boost R&D and innovation, develop human capital and create a more attractive business environment, notably through policies improving the quality of regulation. There have also been important steps to reinforce fiscal sustainability, with government generally setting out measures to improve their budgetary positions and tackling projected increases in pension and health care costs…Structural indicators point to progress in several areas. In particular, the employment rate in the euro area rose by 2 percentage points between 2000 and 2005 to reach 63,5%." One should, however, note that the unemployment rate is still high in Germany, France, Italy and Spain. With a strong cyclical upswing in 2005-07 in EU countries – and sustained growth in the world economy –, it is not surprising that employment is growing. Germany has made progress mainly on the basis of rising net exports which partly are due to strongly falling unit labor costs in the seven years after 2000. By contrast, the French current account position has worsened and this partly seems

to be explained by rising unit labor costs relative to Germany and many other EU countries. With supply-side modernization going on in both eastern Europe and western Europe (and indeed worldwide), it is no surprise to see Germany's exports rise continuously, and this not least in the field of exports of machinery and equipment.

The EUROPEAN COMMISSION (2007, p.23) advocates that it is important to "effectively implement measures to improve competition, especially in services, and step up measures that promote the full integration of financial markets and competition in retail financial services". This view is, however, not adequate since it is inconsistent to advocate for deeper financial integration while several countries have serious problems with prudential supervision of the banking sector. This sector is important not only for financing investment but also for structural change and innovation. In a global perspective the economic logic of the international division of labor calls for leading OECD countries to increasingly specialize on capital-intensive and technology-intensive production as these input factors are relatively abundant in these countries. Relatively poor countries should rather specialize on labor intensive production; and only gradually – as foreign direct investment inflows, human capital formation and government R&D promotion stimulate Schumpeterian innovation dynamics – those economies could move towards increasing the production of technology-intensive goods. Subsequently we will take a look at the dynamics of sectoral specialization and also consider the development of export unit values over time: Cumulated FDI inflows as well as the accumulation of R&D capital and human capital should allow to produce more sophisticated export products so that export unit values will increase over time.

## 3.2. Selected Innovation Traits and Structural Change

Product innovations allow for the increase in product prices in world markets and hence the earning of high incomes (wages and profit). Process innovations are equivalent to cost reductions and allow firms to fetch higher market shares and high incomes, in particular if price elasticity is larger than unity or if increased market share also allows for the exploitation of dynamic scale economies (e.g., learning-by-doing effects). Innovation dynamics can be assessed in different ways:

- Innovation expenditures, usually scaled by sales ("R&D intensity"); this in an R&D input indicator
- Patents per capita (R&D output indicator)
- Product innovation rate (new products to the market in % of sales, survey data, innovation output indicator)
- Diffusion rate (new-to-the-firm products, figures are from surveys)

Taking a closer look at selected EU countries, one finds that Sweden, Germany and Finland were leading in R&D intensity in manufacturing (6.4, 4.7 and 3.9, respectively, in 2003; EU average 3.45; see the following table). France and the Netherlands achieved 3.1, the UK 3.0. Germany's R&D intensity in the services sector was much weaker, namely 1.6 compared to the EU average of 1.8. Sweden was a clear leader in this field. France and the

UK recorded 1.6 and 1.4, respectively. It is interesting to observe that in the field of product innovations in manufacturing, Germany was below the EU average despite its leading position in R&D intensity. Finland, Sweden and France were leading countries in the field of product innovations. This suggests that the German innovation system might have considerable efficiency problems.

**Table 2: European Innovation Scoreboard, 2003**

| | EU 15 | DE | FR | NL | AT | FI | SE | UK |
|---|---|---|---|---|---|---|---|---|
| Innov exp manuf | 3.45 | 4.71 | 3.08 | 3.07 | 2.83 | 3.91 | 6.42 | 2.96 |
| Innov exp serv | 1.83 | 1.64 | 1.57 | 0.79 | 0.92 | 0.96 | 19.11 | 1.39 |
| New-to-mark prods manuf | 10.5 | 7.1 | 9.5 | - | 8.4 | 27.2 | 3.5 | 9.5 |
| New-to-mark prods serv | 7.4 | 3.7 | 5.5 | - | 4.3 | 12.2 | 9.3 | - |
| New-to-firm prods manuf | 28.6 | 40.3 | 17.5 | 23.8 | 23.1 | 31.1 | 32.1 | - |
| New-to-firm prods serv | 18.8 | 16.4 | 17.1 | 13.9 | 12.8 | 18.8 | 23.7 | - |
| New-to-firm/New-to-mark prods manuf | 2.7 | 5.7 | 1.8 | - | 2.8 | 1.1 | 9.2 | - |
| New-to-firm/New-to mark prods serv | 2.5 | 4.4 | 3.1 | - | 3.0 | 1.5 | 2.5 | - |

Source: European Commission (2003), Staff Working Papers, European Innovation Scoreboard 2003, page 27, Brussels and own calculations.

A similar picture is found in production innovation in the services market. As regards diffusion indicators, Germany is a leading EU country. Moreover, Sweden and Germany recorded a high ratio of New-to-firm to New-to-market in the manufacturing industry, which points to relatively fast diffusion (this could reflect strong competition).

Against such apparent innovation weakness, one might consider it surprising that Germany has such a high current account surplus, e.g. 5% of GDP in 2002-07. However, 90 billion net exports recorded in 2002 would quickly melt away, for example, if full employment could be restored; investment would increase by about 10% or by about Euro 20 billion, consumption also by about 5% or 60 bill., which would leave net exports down at Euro 10 bill. The assumption here is that consumption is a positive function of disposable income and a negative function of the expected unemployment rate. Investment is assumed to depend negatively on the real interest rate and the expected unemployment rate. To put it differently, a high net export position of a country with a high unemployment rate cannot simply be considered an indicator of high international competitiveness. Rather, it largely reflects weak domestic demand. The reduction of net exports in the case of rising employment and hence a falling expected and actual unemployment rate will hold even if one takes into account the expansionary impact of higher employment on the supply side. This perspective is, of course, not to deny that in a situation of high net exports (and also in the case of net imports: see the US in the 1990s), certain sectors are positively successfully-specialized in production and export of technology intensive or innovative products.

International competitiveness in specific sectors can be assessed on the basis of revealed comparative advantage indicators (RCA: sectoral relative export share in country *i* as compared to the same industries relative export share on the EU15 single market, with an indicator above unity indicating a sectoral competitive advantage) or with respect to export unit values. A sectoral increase in the weighted export unit value indicates an improved competitiveness in the EU single market as higher prices can be fetched in a very competitive market (there might, however, be cases in which changes in market power or government intervention also affect the export unit value).

According to the Heckscher-Ohlin theory, the RCA should depend on relative factor endowments. Higher RCAs and higher export unit values in certain sectors are likely to contribute quite strongly to output growth in the long run. Scale intensive sectors and science intensive sectors are obviously two potentially relevant sectors. In a high wage economy, emphasis on science-based products can strengthen competitiveness through product innovations which will temporarily lead to rising export unit values and hence higher profitability.

In the following analysis we use the concept of BORBÉLY (2006), whos defined modified comparative advantage in the following way where x is exports to EU15, k the sector concerned, i the country considered and j EU15. We thus compare the relative sectoral export share of country i with the relative sectoral export share of the EU15 countries. If this modified RCA exceeds unity we have a positive specialization of country i in sector k – the sector considered is rather competitive in world markets. The RCA definition used is:

$$RCA_{ik}^{t} = \frac{\left( \frac{x_{ik}}{\sum_{k} x_{ik}} \right)}{\left( \frac{x_{jk}}{\sum_{k} x_{jk}} \right)}$$

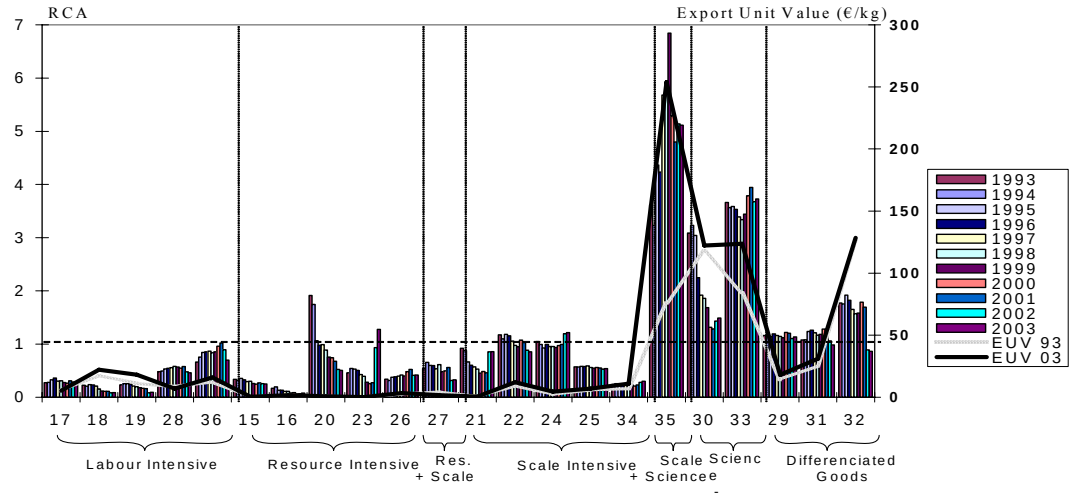
As regards sectors we consider different types of sectors, namely labor-intensive sectors, resource-intensive sectors, scale-intensive sectors, science-intensive sectors and differentiated products, which effectively are knowledge and scale-intensive at the same time. Taking a look at the RCA of various countries over time (in the EU15 market), we can identify specialization patterns and to which extent specialization patterns have changed over time. Sustained growth certainly will require structural change over time which should become partly visible in shifts in RCAs, and high per capita income will naturally be associated with high export unit values – that is high quality products or a high share of final goods production – and an increasing specialization in knowledge-intensive and often also scale-intensive production. Here the focus will be on the US, Germany, Italy and Hungary (the latter as a representative of eastern European countries) as well as China.

Thus we present a Schumpeterian perspective which leads away from perfect competition. Scale intensive products also imply that the perfect competition model does not hold. In some cases, scale intensive products exhibit both static and dynamic scale economies so that high production volumes could be combined with first mover advantages.

As regards the role of the US we clearly see that the US is specialized in technology and knowledge-intensive sectors as the modified RCA for the EU15 market clearly shows. We

also can see that US firms can fetch high export unit values in many markets which are much higher than, for example, the export unit values of Italy or Hungary. The US clearly has a comparative disadvantage in labor intensive products. In the subsequent diagram sectors are the more technology-intensive the more on the right they are placed in the diagram. However, differentiated goods, stand for a somewhat opaque category: There is considerable product differentiation which requires an important role of knowledge and technology as inputs for production so that high quality products can be exported; at the same time one cannot rule out that vital high-technology intermediate products are imported so that mainly the assembly of the final product is located in the country considered. Leading OECD countries should in any case be expected to have a revealed comparative advantage on the EU15 market (the relevant market considered here) in technology-intensive and scale-intensive products. Large leading OECD countries naturally should also be strong in scale-intensive products since a large home market facilitates production of such products. As regards changes over time the dynamics in selected OECD countries and in catching-up countries – here Hungary as an example from accession countries and China as the leading NICs of Asia are considered – one should expect considerable sectoral dynamics over time; and technology-intensive sectors should become more important in the long run.

**Figure 5: USA – RCA and Export Unit Values**




Source: EIIW calculations

In the following analysis, we draw on WELFENS (2007) where we take a closer look at export unit values weighted by both GDP shares and export shares. Interestingly, the US has achieved a higher export unit value for all fields in which it has enjoyed a positive comparative advantage. This suggests a positive feedback mechanism in the sense that a higher export unit value goes along with increased profitability, which in turn reinforces investment and hence should contribute to an improving RCA.

The US has achieved a strong increase in the GDP weighted export unit value in NACE 30, 32, 33 and 35, respectively: manufacture of office machinery and computers; manufacture of radio, television and communication equipment and apparatus; manufacture of medical, precision and optical instruments, watches and clocks;

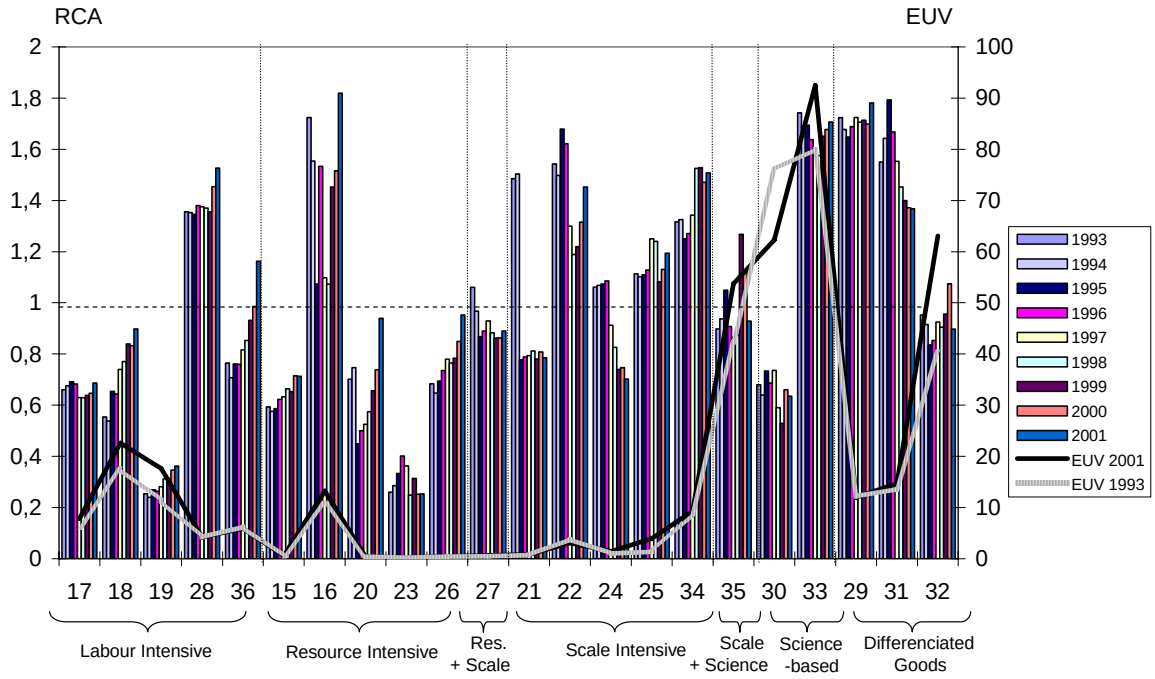
manufacture of other transport equipment (e.g. airplanes). US companies apparently are well-positioned to fetch higher prices in those sectors, which represent a relatively large share of the economy. In the fields of NACE 32 and 35, the improvements in export unit values also signify a large share of US exports. The rise in the export unit value was quite impressive in NACE 32 and NACE 35 in which the respective value doubled and nearly quadrupled, respectively. In NACE 35, the US export value is five times as high as in the case of Germany, ten times as high as in the case of Italy and about fifty times as high as in the case of Hungary.

As regards export unit values and the change of export unit values over time, one should also take a look at weighted export unit values so that the relative economic significance of certain sectors can be understood. As regards Germany, it is well-known that the country has a positive RCA – read RCA above unity – in both the automotive industry and in other transport equipment (NACE 34 and 35). Taking a closer look at German industry, one can see that specialization in terms of RCA changed slightly in the decade after 1993. Germany has one important loser industry (see by contrast Italy), namely NACE 19 which represents not only a negative RCA but also for declining export unit values: tanning and dressing of leather, manufacture of luggage, handbags, saddlery, harness and footwear; NACE 17 and 18 – they are classified as labor intensive sectors – also show weak international competitiveness (RCA<1); sectors 28 and 36 which also are labor-intensive show at least an improvement in export unit values. There is a high RCA in the manufacturing of fabricated metal products (NACE 28, not including machinery and equipment). It is also noteworthy that the export unit value has increased over time for this product group. In the field of office machinery and computers (NACE 30) – a sector which (together with NACE 32: telecommunications equipment) is considered highly relevant for productivity growth, Germany has a negative RCA. Worse yet, the export unit value in this sector has declined. NACE 32 has improved over time. The overall picture with respect to the long term development of export unit values in German industrial export reveals that export unit values – average revenue per quantity unit (e.g., kilogram of steel, etc.) – showed few changes over the period from 1993 to 2001. Which sectors are most important for economic dynamics: In a narrow sense those sectors which show a positive RCA and a high weighted export unit value; this at least is the concept presented here. As regards the economic significance of export unit values, it is indeed useful to take a closer look at weighted unit values where sectoral shares in overall manufacturing exports are taken as weights: considering only weighted indicators reaching at least 0.75 (hence export unit value must be high or the share of the respective sector in overall export of manufacturing) – see the bold figures in the respective tables – we see that 29, 30, 32, 33, 34 and 35 are crucial sectors for Germany.

Note that the change in the weighted export unit value of 32, 33 and 34 was positive in Germany over the period 1992-2001; and this should translate into relatively rising wages for skilled workers as we may assume that these sectors are using skilled labor intensively. As regards Germany, 29, 33, 34 and 35 signify an economically significant positive RCA; as regards Hungary we find 18, 30, 31, 32, 34 as positive RCA: 34 is an overlap with Germany. The fact that Hungary could improve the weighted export unit value strongly in 34, the automotive sector, points to a strong catching-up process in the Hungarian automotive sector. To the extent that this finding is representative for accession countries

in eastern Europe, Germany's automotive firms acting in the lower quality segments of the market might face profitability problems in their German plants. The new international division of labor in Europe suggests that mass production of standard cars will be largely relocated to eastern Europe's low wage countries. Hence the respective regions will face serious labor reallocation challenges in the early 21st century.

**Figure 6: Germany – RCA and Export Unit Values**



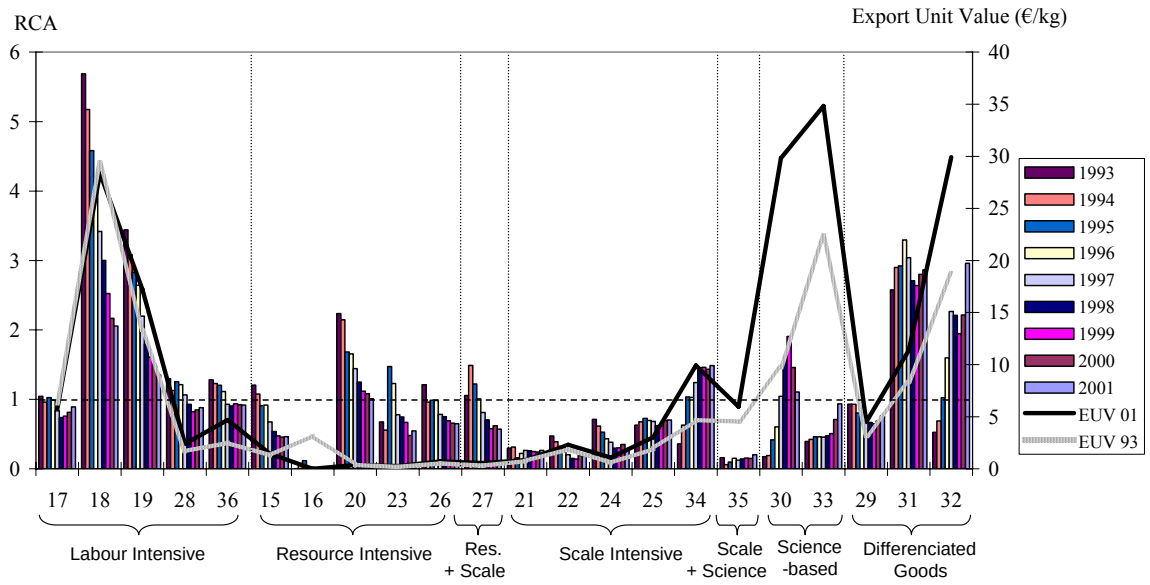

Source: EIIW calculations

NACE 30, 31 and 32 indicate successful Hungarian specialization. However, note that 31 and 32 – differentiated goods (this also includes 29) – reveal relative footloose industries: the manufacturing of office machinery and computers (30) and of electrical machinery and apparatus n.e.c. (31) could be internationally relocated relatively quickly.

One should point out that RCAs typically follow relative sectoral patent positions. A rising share in global patents in the respective sector translates with a time lag of 3-4 years into an improved sectoral RCA. Hence expenditures on research & development and innovation policies are important.

Compared to the apparently stable German industrial specialization pattern, Hungary has launched a rather impressive catching-up process since reinforcing the RCAs in some technology intensive sectors and was also able to fetch higher export unit values – a proxy for its ability to extract high prices in competitive EU market – in EU-15 markets. Hungary has many fields which have shown a rise in the export unit value.

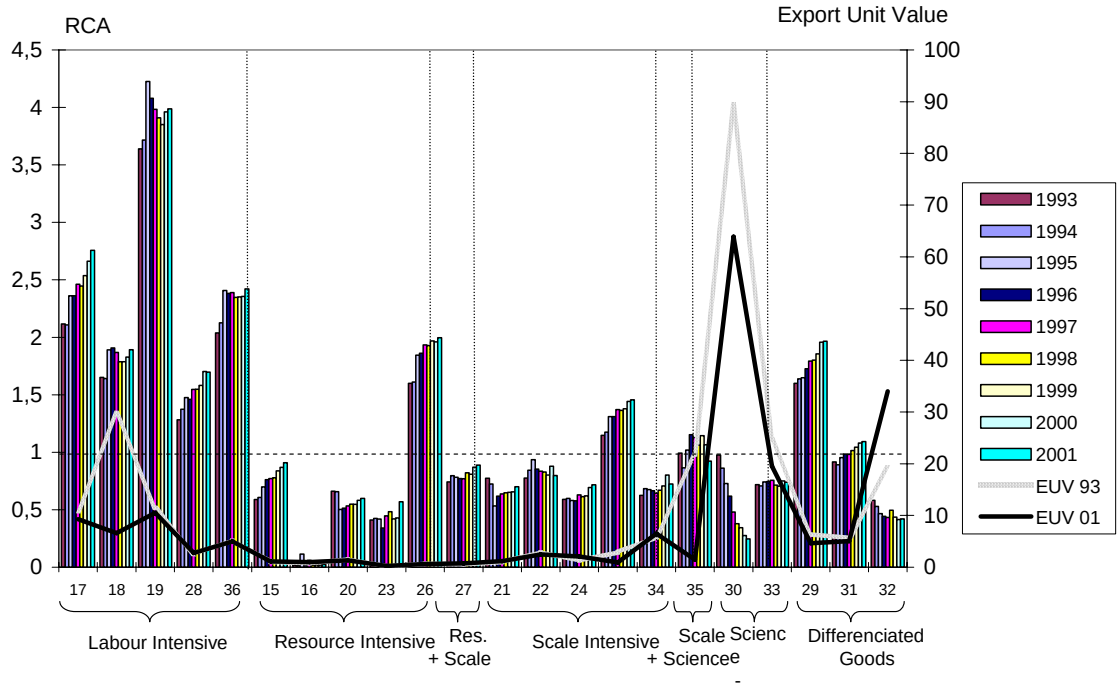
**Figure 7: Hungary – RCA and Export Unit Values**




Source: EIIW calculations

By contrast, Germany's industry shows some clear fields of comparative advantage as does Hungary, an interesting case of new economic dynamics in an EU accession country. It is quite noteworthy that Hungary achieved higher export unit values in several sectors. The table shows that weighted improvements of export unit values were strong in 30, 32 and 34, essentially electronic products which represent scale-intensive goods, science-based goods and differentiated goods.

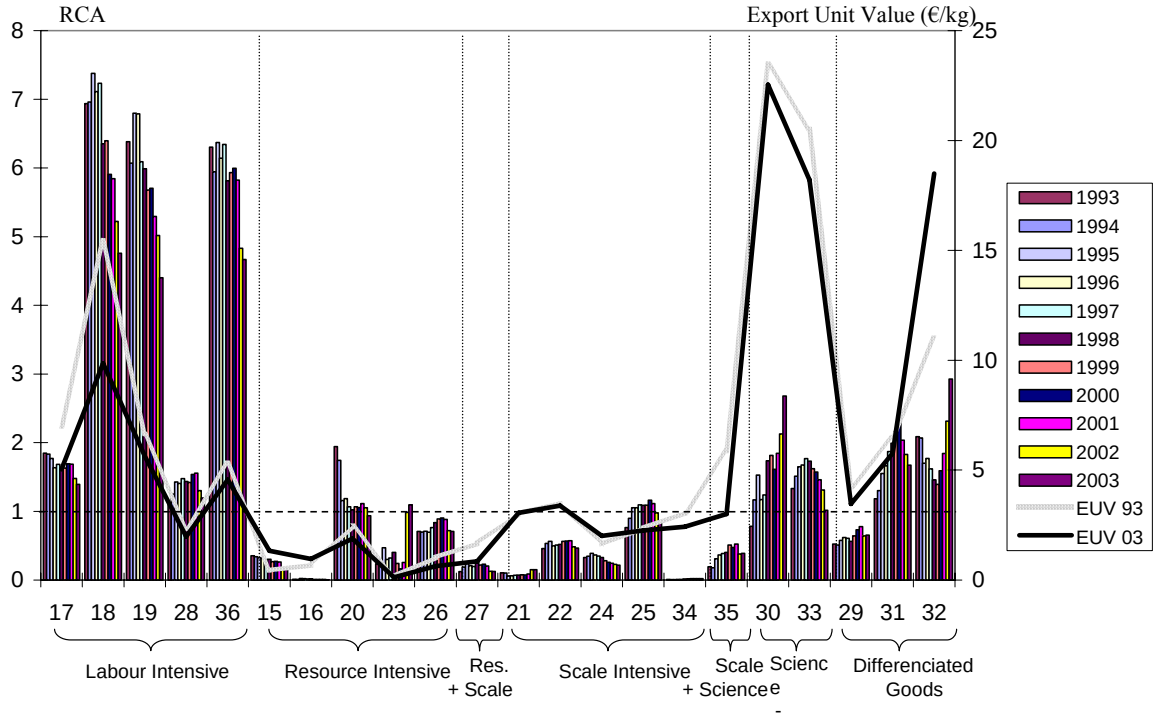
**Figure 8: Italy: RCA and Export Unit Value**




Source: EIIW calculations

Italy has suffered in a traditional field of comparative advantage from a fall of the export unit value, namely in NACE 18 (manufacture of wearing apparel; dressing and dyeing of fur), which indicates stronger global price competition for an important sector of the Italian economy. There also was a strong fall in the export unit value in NACE 30, which is the crucial manufacturing of office machinery and computers, but in this group Italy also reveals a revealed comparative weakness as the RCA is much below unity. More encouraging figures are found with respect to 35, which is close to an RCA exceeding unity and where the export unit value has improved. NACE 19 – with a high RCA and improved export unit value – is also very encouraging in an area which is a traditional strength of the Italian economy: tanning and dressing of leather, manufacture of luggage, handbags, saddlery, harness and footwear. Moreover, successful adjustment is found in NACE 28 and 29, respectively: Manufacture of fabricated metal products, except machinery and equipment (28) and manufacture of machinery and equipment n.e.c. (29). From this perspective, Italy could benefit considerably from EU eastern enlargement both through rising exports of sophisticated consumption goods and of industrial goods.

**Figure 9: Modified RCA for China and Export Unit Values**




Source: EIIW calculations

### *New Challengers in the World Economy: China, India and Russia*

As regards the EU15 market, China has shown a consistent specialization in labor intensive products in the period 1993-2003. China also has developed a positive specialization – in the sense of an RCA>1 – in the field of science intensive goods (sectors 30 and 33) and in differentiated goods (sectors 31 and 32). As regards the latter in these sectors it was able to slightly increase export unit values so that the degree of product sophistication and quality were obviously raised. There is little doubt that favorable specialization and export unit

values in the sector of differentiated products and in science intensive goods partly reflect the high cumulated foreign direct investment which China was able to attract in these sectors. In the long run, one may anticipate that China will be able to become a major exporter of automobiles and other scale intensive goods: the large Chinese market offers great opportunities for such a long term specialization. For the EU this will hardly undermine much long term overall growth, namely for two reasons:

- while the automotive industry is one of the most important sectors of the EU in terms of value-added, employment and innovation, one may anticipate that automotive firms in EU countries will increasingly specialize on the high end of the automotive industry; at the same time EU suppliers of electronic intermediate inputs – important for high fuel efficiency and low CO2 emissions – should find increasing market volumes in expanding Chinese and other Asian markets;
- structural change will bring about a gradual shift in the sectoral composition of sectoral output in the EU. Many EU countries will further expand in the services sectors, in particular in knowledge-intensive industries. This brings, however, a major challenge for EU countries in terms of intensifying human capital formation and the drive towards technology-intensive industries.

Long term structural adjustment in Europe and Asia are a natural part of international competition, sustained innovation dynamics and ongoing economic globalization.

The EUROPEAN COMMISSION (2007, p. 42-43) notes with respect to China, India and Russia:

"China's contribution to world-wide growth in the more recent past has indeed been impressive, particularly considering the Asian financial crisis in 1997/98 and the worldwide slowdown following the bust of the IT-bubble in the United States in 2000. In real terms, GDP growth in China accelerated from 7.8% in 1998 to reach slightly more than 10% on average per year over the period 2003-2006. China's share in global output has risen from 1.7% in 1990 to 5% in 2005. Since 2000 the country has contributed about one third to overall worldwide GDP growth. Fixed asset investment, both in the industrial sector and in real estate, has contributed strongly to this impressive growth performance, as has the ongoing rise in exports, which are supported by a very competitive exchange rate. At the same time, the growth rate of private consumption has been much lower, as the lack of an adequate social security system keeps the savings ratio at high levels. As a consequence, the savings investment gap has increased, driving up the current account surplus and foreign exchange reserves...

Trade and investment flows between China and the euro area have been rising. The euro area is a very important export destination for China, accounting for 19.4% of its total exports in 2005, equalling 9.7% of overall euro area imports in that year … Although euro-area exports to China have also risen considerably, to EUR 43.5 billion in 2005, they remain modest as a percentage of total euro area exports. This suggests, however, a significant potential for further expansion. The euro-area trade deficit with China has kept growing, reaching slightly more than EUR 74 billion in 2005. Regarding, Foreign Direct Investment (FDI), euro-area flows to China have been rising both in absolute value and as a percentage of total euro-area outward FDI .... The euro area, however, remains a less

important direct investment partner for China than the United States or Japan, which together accounted for 18.1% of China's total FDI inflows in 2005."

Against this background, it would be useful to broaden the political, economic and scientific links between Europe and China as well as between the EU and India and the EU and Russia. The economic relations between the EU and ASEAN will be of particular relevance in the future (WELFENS/KNIPPING/RYAN/SUTHIPAND, 2006; WELFENS/RYAN/KNIPPING/SUTHIPAND, 2008). If the EU can achieve sustained growth the European integration model will become an important role model for international cooperation.

# 4. Policy Conclusions

Long run growth in the EU and sustainable growth in Asia – and in the NAFTA – might well go together for many decades. In an era of increasing trade in technology-intensive products it seems that among advanced OECD countries there is a high share of intra-industrial trade in overall trade. In a EU15-EU12 perspective (where EU12 represents accession countries from Eastern Europe) and in an EU-Asia perspective one should, however, anticipate rather an expansion of trade in intermediate products. International outsourcing and offshoring thus could be complementary, and the benefits from international outsourcing – rasing price competitiveness of firms in EU15 producing increasingly high-quality products cannot be exploited without some offshoring, which raises the level of knowledge in catching-up countries with suitable institutions and adequate economic policy providing the rule of law, adequate infrastructure and sustained efforts in the field of human capital formation. For the countries of the Euro area, it will become increasingly important to invest in human capital and innovation; accelerated structural change will thus be crucial for long term growth in Western Europe (the miserable PISA result of Germany, namely rank 21 among 30 countries, thus urgently requires adequate reforms). For the EU accession countries modernization of infrastructure, maintaining competition and encouraging investment and innovation will remain high on the agenda of policymakers.

Generally policymakers should focus more on long term growth policies while not neglecting the responsibilities in the field of short-term and medium-term stabilization policies. With financial markets becoming more internationalized and adjustment speeds in the digital networked economies increasing in the financial sphere, it will remain an important task for monetary policy to maintain stability and restore confidence in a situation of crisis. Avoiding unnecessary crises in OECD countries and in the world economy is also a formidable challenge which cannot be addressed in an effective manner if there is not sufficient international collaboration in the field of prudential supervision. If US regulation allows real estate banks to offer loans without adequate income, documentation of the respective private household and without any realistic requirements in terms of equity capital of those who want to buy a house, this will naturally contribute to overlending in the US followed at some point by a real estate sector crisis. If the EU is seriously interested in long term growth it should put loose prudential supervision in the

US on the agenda for transatlantic talks – not least in the context of the Merkel initiative. It would be useful to discuss those problems in the G7 meeting as well.

As regards medium term multiplier analysis in a model with (asymmetric) foreign direct investment, it has been shown that multiplier uncertainty is much greater than in the traditional Mundell-Fleming approach. On the one hand, this calls for more empirical analysis on the one hand. On the other hand, more international cooperation in fiscal and monetary policy could be useful as such cooperation is bringing us closer towards a closed economy model (the world economy is the only economy which indeed is closed) – and hence towards a set of familiar and rather unambiguous results. Putting more emphasis of economic policy on long term sustainable growth is likewise desirable. More analysis on medium and long term macro models with foreign direct investment is quite important in a world of strongly rising foreign direct investment.

With growth in OECD countries becomes more driven by technology and the use of modern information and communication technology – that is with factors that cannot be considered as strictly rivalry inputs –, the opportunities for sustained growth are favorable, provided that liberal trade and capital flows continue. The latter in turn largely depends on macroeconomic stability in all major regions and countries.

The main risk for regional and global stability in Europe is that structural is to slow and that the challenges for the education systems are not timely understood by the political system and the public at large. The largest risk for regional and global stability stemming from China is the increasing internationalization of China in terms of rising trade and capital flows – relative to GDP – in combination with an inward-looking Chinese political elite. As the new economic heavyweight, there is a crucial challenge for China in internationalizing the thinking of policymakers and in understanding its new responsibilities. Mistakes in national economic policy (and in the design of the institutional setup) in China in the 1980s would not affect the world economy negatively, but major mistakes and inconsistencies in the 21st century will profoundly affect the world economy. Instabilities in financial markets in Asia, Europe or the US could be major new challenges of the 21st century which can be solved only through a new approach in international cooperation. Here the IMF should become particularly active in a new role as should be an enlarged G8 group which should include China and India within a few years.

For the EU it is natural to seek stronger political and economic ties not only with China but in particular with ASEAN countries which are a group of ten countries that have based regional cooperation on partly similar principles as the EU (WELFENS/KNIPPING /RYAN/SUTHIPAND, 2006). With the new giant China ever more rising in economic terms, the ASEAN countries will come under pressure to enhance its political cooperation. The EU should encourage Chinese economic dynamics by awarding China the status of a market economy once China has made broader steps in establishing sustained competition in all its major industries and once the role of state-owned firms has fallen below a critical threshold.

The euro area has achieved some progress in the field of economic growth, employment and fiscal consolidation in the first decade of both the Euro and the ECB. While it is true that the UK, Sweden and Denmark as non-euro area members have also achieved considerable economic growth, one should not exclude that Euroland could outpace those

countries in the long term. Much will depend on a consistent policy mix and adequate structural reforms in Euroland and a gradual eastern enlargement of the euro area. Taking the Stability and Growth Pact seriously and thereby maintaining a high degree of credibility should be a natural task for policymakers in the euro area.

The flexible enlargement strategy of the EU has allowed for implementation of two successive rounds of eastern enlargement, namely with favorable economic results for EU accession countries. In the enlarged EU there is a modest risk that Brussels could become an increasing burden for the business community in the EU; it will be all the more important to cut back the bureaucracy in major policy fields of the Community. With 27 countries, the EU offers a rich variety of experiences for governments willing to adopt new reforms based on international benchmarking. Here the many EU reports as well as comparative studies of the ECB are highly valuable for the reform process in many countries. However, the EU27 also faces a problem, namely that decision-making has become more complex and much slower after the two rounds of EU eastern enlargement; this undermines the economic and political weight of the EU/Euroland to some extent. At the same time, one may point out the rising weight of the Euro in international bond emissions and in international reserve (see appendix) holdings, suggesting that the long term economic influence of the EU is on the rise.

Sustained growth in the EU requires more innovation and more human capital formation, clearly identifying two policy challenges. The global innovation race has intensified and therefore more flexibility and greater incentives for innovations, learning and flexible adjustment are needed in Europe. There is an adjustment overhang in those countries which have high unemployment rates, and this particularly concerns some of the large Euro zone countries. Germany and Italy are two countries with serious problems, not least because of their declining trend in growth rates and stubborn budget problems. Italy's rising unit labor costs after the start of the Euro zone point to a failure of the country's collective bargaining system to adjust to the new monetary reality. However, Germany is not much better since the Euro zone's largest economy has had enormous problems for many years, not only materializing first with German unification. The R&D-GDP ratio, which stood at 2.9% in 1989, has fallen over a decade and only after 1999 has there been a modest increase. Germany's position in ICT modernization is not top in the EU, and recent analysis (WELFENS/JUNGMITTAG/VOGELSANG, 2007) points to problems with technological progress in core regions both in western Germany and eastern Germany. France has emphasized high-technology growth in Western Europe more than other EU15 countries. However, it has recorded both success stories – including Airbus (actually an EU joint venture) and the nuclear industry – and failures (e.g., Bull in the computer sector) with its industrial policy. Germany's structural adjustment has been relatively slow in industry, with the adjustment dynamics in the UK and France being more pronounced. Italy is rather dependent on the international economy, and it risks – similar to Germany – facing reduced growth if global economic growth should slow down. At the same time, Germany with its geographical proximity to dynamic eastern European accession countries stands to benefit from the long term growth in this group of countries; after 2011 and the liberalization of migration in the EU25, one also may anticipate a considerable influx of skilled innovative people from Eastern Europe.

EU eastern enlargement will bring the full adjustment pressure of the single market to accession countries; at the same time full EU membership for these countries implies the elimination of any political risk premium. We may therefore expect high inflows of foreign direct investment, which will often be vertical foreign direct investment (i.e., offshoring). This will stimulate output and innovation dynamics in the host country but will also reinforce global competitiveness of firms in the source country of foreign direct investment. Several EU accession countries whose R&D-GDP ratios have recovered after the collapse in the first years of post-socialist transformation should achieve a ratio of above 1 percentage point by 2010, thus becoming active innovators in their own right.

Some of the EU accession countries have shown remarkable structural adjustment; technological upgrading has been an important element in several eastern European countries which have been able to attract high FDI inflows. Given high sustained unemployment rates in most accession countries, one must, however, be worried about the unemployment problem. Jobless growth could be one of the new problems in transition countries. To the extent that the mass unemployment problem contributes to social and political conflicts as well as political radicalization, high long term unemployment could contribute to political destabilization which would in turn increase the political risk premium and weaken growth in the long run.

The basic policy conclusion is that the EU27 should be able to benefit from both EU enlargement and from economic globalization. The EU is a major host country of FDI and also a major source country so that it can benefit from outsourcing. In high wage economies of Western Europe it is fairly clear that the accelerated structural change in Europe requires more wage differentiation, which should be more in line with differential productivity growth rates in EU countries. The existence of a high minimum wage is a doubtful exercise, in particular if it is a nation-wide minimum wage as in France and Italy which both have high unemployment. Germany's social security system is still relatively generous and implicitly defines a minimum wage which is relatively high, namely in the sense that overall labor costs of unskilled labor is high. The specific unemployment rate of unskilled workers should gradually be brought down to the average unemployment rate; greater wage dispersion as well as stronger retraining could be useful in Germany, France and Italy. More wage dispersion could go along with a higher average growth rate of wages provided that greater wage flexibility brings about higher average productivity – partly related to higher regional labor mobility. As regards incentives of firms to invest more in training and retraining, one should clearly point out that the globalization process is weakening such incentives; the average tenure of workers is declining so that the incentive for firms to invest in training and retraining is declining. Here government's tax policy might want to envisage new adequate incentives which stimulate training and retraining.

In an EU in which national R&D programs are increasingly likely to generate cross-border benefits through international technology spillovers, there is some risk that national policymakers will cut innovation promotion expenditures; R&D expenditures could fall below an optimum level – positive external effects of innovation would not be fully internalized in the EU. From this perspective, a new Lissabon Agenda is desirable so that national policymakers are encouraged to maintain a high R&D-GDP ratio. Shifting more funds in R&D to the supranational policy level might not be a reasonable way to cope with

the problem since the poor political control of the European Commission and the established budgetary priorities for agriculture and structural funds leads one to doubt an efficient EU innovation policy. However, the EU could be quite useful in innovation policy, in particular by regular analysis of innovation dynamics in EU countries and in the regions of the EU. More transparency could generate stronger incentives towards adequate national policy reforms. In Europe's ageing society, there is also the problem that the majority of increasingly elderly voters might be reluctant to support rising outlays for education and for higher R&D-GDP expenditure ratios. Rather a political bias in favor of spending more on social security could undermine necessary increases for R&D or the education system.

A major long term challenge concerns the reform of the social security systems in the EU. With more and more governments in EU countries establishing a broader pillar of a capital funded system, there are favorable prospects for a more capital-market driven growth process. A broader role of both the capital market and stock markets could stimulate efficiency gains and lead to more innovation provided major actors in these markets take a long term perspective. New policy options should be considered in this respect – indeed a more long term investment strategy of investment funds could be achieved:

- if corporate tax rates for investment funds would encourage more long term investment (that is investment over more than five years or so);
- investment in highly volatile stocks should be discouraged in the sense that the tax base should not just be yields but also a measure of volatility; naturally, investments in diversified portfolios would thus benefit and its share in overall investment would increase. It is not necessarily clear that this will stimulate long term growth but such a volatility-based tax policy will dampen volatility of growth. A key economic argument in favor of such a new tax policy is that excessive volatility typically creates negative external effects, namely international spillover effects which have repercussion effects on the home country.

Long term EU growth as well as global growth faces the problem that output growth is not easily decoupled from the growth of fossil energy sources. The problem of global warming should be taken seriously. The EU has made an innovative effort in combating greenhouse gas emissions through the introduction of emissions certificate trading, which should be an instrument for cutting $CO_2$ emissions in an efficient way. As the US has refused to adopt a similar initiative, the US has not only shown a surprisingly low commitment to the goals of the Kyoto protocol but also missed in the first round the opportunities related to the creation of a new financial market. The EU would be wise to invite Russia, ASEAN countries and China as well as other countries to also adopt an emissions trading scheme. The more China closes the per capita income gap vis-à-vis the OECD countries, the more it will have to switch from a diffusion-oriented and investment-focused growth strategy towards strong emphasis on a knowledge-based open economy. As per capita income in China and other Asian countries rises, the demand for a cleaner environment will likewise become stronger, and many firms from Europe could certainly offer highly valuable technologies for raising efficiency in production and increasing environmental quality.

The new long term challenge for China and Europe could be India, whose population around 2040 will be the largest in the world. From a European perspective, it would be

useful to encourage the liberalization and modernization of India, whose trade specialization to some extent could be complementary to that of China; to a considerable extent India has become a major exporter not only of many goods but of digital services as well. There is no doubt that India's role in global trade is much weaker than that of China at the beginning of the 21st century. However, there are considerable new growth opportunities in India provided the economy system is liberalized and economic policy at the national and regional levels promotes internationalization of the economy and economic growth.

Finally, long term growth in a democracy can hardly be maintained if the income distribution grows increasingly uneven – a problem which could be observed in the US in the 15 years after 1990. With respect to Europe, one may argue (FITOUSSI, 2004) that political stability can only be achieved if government policy contributes to avoiding a strong rise in inequality. Indeed, one cannot rule out that technological dynamics in the long run are such that the production elasticity of capital is increased (one may think of the role of ICT here) so that within a setup in which factors are rewarded in accordance with their respective marginal products, the inequality between capital owners and workers would increase. If such technological dynamics were to occur, it would be wise for governments to provide tax incentives for workers to invest in real capital over the long run so that many private households would benefit from these innovation dynamics with respect to their overall income. It is interesting to note that the share of workers holding stocks in the US is much higher than in the EU. A broader debate about broadening capital ownership in the EU is desirable.

As regards long term challenges the world-wide expansion of ICT will raise the demand for electricity and thus raise new problems in terms of sustainable growth. This challenge will be relevant for both the EU and for many Newly Industrializing Countries, including China. It would be wise to emphasize the greening of ICT – as done e.g. by the German government in the context of its national ICT summing in Hanover in 2007. Green ICT is a common challenge for all leading countries in the world economy:

- ICT production could become more energy efficient and could also be based on lower resource intensities (based on calculations of the entire range of inputs and the production process narrowly defined).
- ICT products would be optimized in terms of resource intensity and its use could become more energy efficient. Capacity utilization of computers often is not optimal in both the public administration and in industry.
- The use of advanced software programmes for establishing efficient virtual electricity grids is a key challenge in the energy sector.
- Green labeling of ICT products – carrying information about the energy intensity of the use of such products – would be useful for guiding the purchase of ICT goods: Governments, firms and households all stand to benefit from such measures.
- The internet could become a powerful platform for dissemination of knowledge about green ICT; and certainly time management of internet users could be more efficient in terms of energy use – users should know (e.g., through a simple traffic light system) at what time an inquiry at a search engine is rather cheap in terms of

the use of energy: With hundred of millions of households having a flat rate for the use of the internet the price signal is not available as a natural instrument for stimulating a higher degree of energy efficiency. Thus alternatives should be explored.

The EU and China plus Japan and the US (plus other countries) should adopt common research projects in the field of green ICT. All partners stand to benefit strongly from such an innovative long term approach. Indeed, sustainable growth in a comprehensive approach (WORLD BANK, 2006) should look explicitly at the role of natural capital and enhanced resource efficiency. Long term cooperation between Europe and Asia is needed.

# Appendix: NACE rev. 1.1. Classification (in parts)

| | |
|---|---|
| D | Manufacturing |
| 15 | Manufacture of food products and beverages |
| 16 | Manufacture of tobacco products |
| 17 | Manufacture of textiles |
| 18 | Manufacture of wearing apparel; dressing and dyeing of fur |
| 19 | Tanning and dressing of leather, manufacture of luggage, handbags, saddlery, harness and footwear |
| 20 | Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials |
| 21 | Manufacture of pulp, paper and paper products |
| 22 | Publishing, printing and reproduction of recorded media |
| 23 | Manufacture of coke, refined petroleum products and nuclear fuel |
| 24 | Manufacture of chemicals and chemical products |
| 25 | Manufacture of rubber and plastic products |
| 26 | Manufacture of other non-metallic mineral products |
| 27 | Manufacture of basic metals |
| 28 | Manufacture of fabricated metal products, except machinery and equipment |
| 29 | Manufacture of machinery and equipment n.e.c. |
| 30 | Manufacture of office machinery and computers |
| 31 | Manufacture of electrical machinery and apparatus n.e.c. |
| 32 | Manufacture of radio, television and communication equipment and apparatus |
| 33 | Manufacture of medical, precision and optical instruments, watches and clocks |
| 34 | Manufacture of motor vehicles, trailers and semi-trailers |
| 35 | Manufacture of other transport equipment |
| 36 | Manufacture of furniture, manufacturing n.e.c. |
| 37 | Recycling |

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