**Table 2.14 Civic engagement in European countries (%)**

| Country | Contacted politician or government member in the last 12 months | Worked in a political party or activist group in the last 12 months | Worked in another organization in the last 12 months | Signed a petition in the last 12 months | Boycotted certain products in the last 12 months | Bought a product for political/ethical environmental reasons in the last 12 months | Engagement ranking |
|---|---|---|---|---|---|---|---|
| Portugal | 11.16 | 3.89 | 5.24 | 6.80 | 3.16 | 7.53 | 23rd (–1) |
| Austria | 17.35 | 9.39 | 17.52 | 27.72 | 21.92 | 29.18 | 9th |
| Belgium | 17.73 | 5.42 | 23.25 | 33.92 | 12.79 | 26.98 | 10th |
| Switzerland | 16.91 | 7.61 | 16.74 | 40.40 | 33.66 | 46.93 | 2nd |
| Czech Rep. | 21.42 | 3.87 | 13.98 | 15.07 | 11.05 | 22.10 | 15th |
| Germany | 12.98 | 3.83 | 18.18 | 31.32 | 24.60 | 39.69 | 6th |
| Denmark | 17.93 | 4.13 | 17.28 | 28.27 | 22.98 | 43.67 | 5th |
| Spain | 11.66 | 5.79 | 14.60 | 22.25 | 7.72 | 11.48 | 16th |
| Finland | 24.28 | 3.56 | 30.71 | 24.04 | 26.73 | 41.90 | 4th |
| France | 16.83 | 4.52 | 17.03 | 33.75 | 25.84 | 27.46 | 8th |
| U.K. | 18.33 | 3.16 | 9.30 | 39.45 | 26.19 | 32.78 | 7th |
| Greece | 14.46 | 4.97 | 5.67 | 4.63 | 8.52 | 6.62 | 19th |
| Hungary | 14.65 | 2.85 | 2.85 | 4.21 | 4.83 | 10.43 | 22nd |
| Ireland | 22.36 | 4.63 | 13.71 | 27.24 | 13.33 | 24.41 | 13th |
| Israel | 11.59 | 5.89 | 6.98 | 16.92 | 12.96 | 16.41 | 17th |
| Italy | 12.13 | 3.25 | 8.16 | 18.49 | 7.90 | 6.34 | 18th |
| Luxembourg | 17.14 | 2.85 | 16.66 | 27.77 | 14.28 | 28.57 | 12th |
| Netherlands | 14.66 | 3.28 | 22.84 | 22.74 | 10.98 | 27.11 | 14th |
| Norway | 23.85 | 9.48 | 28.16 | 37.17 | 20.11 | 36.59 | 3rd |
| Poland | 9.55 | 2.89 | 6.03 | 7.15 | 3.84 | 10.50 | 21st |
| Sweden | 16.43 | 4.96 | 24.55 | 40.75 | 32.45 | 55.12 | 1st |
| Slovenia | 12.19 | 3.63 | 2.42 | 11.58 | 4.87 | 9.75 | 20th |
| Average | 14.59 | 4.12 | 13.61 | 25.74 | 17.17 | 24.53 | – |

Source: European Social Survey 2002/2003.

**Table 2.15 Participation over time in established and new democracies**

| | During and before change of regime | After change of regime | Change |
|---|---|---|---|
| Argentina | 34 | 29 | –5 |
| Brazil | 25 | 25 | 0 |
| Chile | 38 | 25 | –13 |
| Mexico | 32 | 22 | –7 |
| Bulgaria | 28 | 18 | –10 |
| Czech Republic | 24 | 23 | –1 |
| East Germany | 75 | 63 | –12 |
| Hungary | 20 | 24 | 4 |
| Poland | 20 | 26 | 6 |
| Slovenia | 27 | 30 | 3 |
| Slovakia | 28 | 15 | –13 |
| | **1981/1991** | **1995/2001** | **Difference** |
| Portugal | 25 | 27 | 2 |
| Spain | 31 | 34 | 3 |
| Italy | 52 | 62 | 10 |
| USA | 68 | 79 | 11 |
| Belgium | 39 | 75 | 36 |
| France | 54 | 72 | 18 |
| Denmark | 55 | 68 | 13 |
| Japan | 49 | 55 | 6 |
| West Germany | 54 | 60 | 6 |
| Switzerland | 62 | 68 | 6 |
| United Kingdom | 71 | 80 | 9 |

Source: Adapted from Inglehart (2001) on the basis of 1981-2001 World Values Survey.

According to Inglehart (2001), the data show that in 21 countries studied between 1981 and 1990, although the people vote less regularly, they are not becoming more apathetic. On the contrary, they would seem to have become more interested in politics. This opinion is confirmed by the studies carried out by Castells (2003a) in Catalonia and Cardoso (2005) in Portugal.

As Table 3.18 shows, interest in politics increased in 16 countries and decreased in only 4. Portugal is in the group of countries where political participation is lowest and has stagnated, as is Spain. In both countries, a period of rapid increase in participation in the 1970s was followed by a process of democratic normalization.

Although Inglehart does not present data that allow one to compare the 1970s, the decade of revolution and transition to democracy in Spain and Portugal, one can observe this type of behavior in the new democracies in Eastern Europe, which are characterized by periods of a rapid surge in participation followed by periods of less civic involvement. What the data do allow us to infer is the relative proximity of the participation levels between all the countries that have gone through transition to democracy in the last thirty years, regardless of whether they are in Europe or South America.

The *post-honeymoon decline* is no doubt significant but the fact that these societies experienced authoritarian regimes, be they of the left or the right, for many years is also justification for the low levels of political participation.

A third factor one must take into account in analyzing participation is the relationship between participation and trust in others. The World Values Survey data (2001) furthermore shows that countries with geographical and cultural affinities with Portugal—such as Spain, France and Italy—present relatively homogeneous intermediate values for membership of associations.

In Spain, the figures, for men and women respectively, are 32% and 26%, for Italy 46% and 38% and for France 36% and 43%. Where the differences are clearly greater is in the *trust in others*, for Spain (35%), Italy (32%) and France (20%) are clearly above the Portuguese values. This mistrust in relation to others is also obviously a factor to be taken into account in analyzing the low levels of civic participation.

Continuing the analysis of the possible factors that condition political participation in the context of the informational development models, one must including one more explanatory factor—education.

An analysis of the participation dimensions must also make reference to the Putnam analyses (1993) on the relationship between reading newspapers and participation in civic associations. Putnam argues that there is a direct correlation between reading newspapers and membership of associations (other than religious associations) and that the regions with the highest readership levels are also those that, as a rule, have the strongest civic communities. If we test this hypothesis, we see that, at least in Europe, more than just influencing engage-

**Table 2.16 Signed petition in the last 12 months, according to highest education level (%)**

| Country | Not completed primary education* | Primary or first stage of basic* | Lower secondary or second stage of basic* | Upper secondary* | Post secondary, non-tertiary* | First stage non-tertiary* | Second stage of tertiary* |
|---|---|---|---|---|---|---|---|
| Portugal | 0.91 | 4.63 | 2.11 | 15.26 | – | 19.44 | 50 |
| Austria | 9.09 | – | 20 | 25.85 | 32.57 | – | 43.58 |
| Belgium | 15.38 | 13.39 | 26.06 | 36.65 | 43.10 | – | 50.89 |
| Switzerland | 35.29 | – | 29.03 | 38.03 | 50.74 | 52 | 60 |
| Czech Rep. | – | – | 5.55 | 14.72 | 22.72 | 25.64 | 46.66 |
| Germany | – | 1.70 | 21.00 | 30.34 | 37.34 | 40.46 | 60.75 |
| Denmark | – | 16.66 | 24.50 | 23.26 | 36.73 | 42.25 | 33.33 |
| Spain | 3.40 | 15.90 | 24.09 | 28.99 | 34.54 | 40.00 | 38.88 |
| Finland | – | 8.86 | 22.22 | 27.89 | | 31.68 | 33.33 |
| France | 15.72 | 20.24 | 31.71 | 39.34 | 33.33 | 44.731 | 53.58 |
| U.K. | – | 15.15 | 32.13 | 46.54 | 44.44 | 51.64 | 61.22 |
| Greece | 1.75 | 2.56 | 2.68 | 4.51 | 7.46 | 12.93 | 20 |
| Hungary | – | 3.01 | 3.52 | 4.37 | – | 9.83 | 11.11 |
| Ireland | 7.69 | 11.11 | 24 | 31.42 | 38 | 38.88 | 38.09 |
| Israel | – | 5.26 | 14.75 | 12.92 | 13.46 | 27.45 | 29.26 |
| Italy | – | 6.84 | 16.06 | 25.47 | 21.91 | 30.53 | 64.91 |
| Luxembourg | – | 18.18 | 25 | 33.33 | – | – | 40 |
| Netherlands | 10 | 10.07 | 17.26 | 22.80 | 30.76 | 34.44 | 20 |
| Norway | – | – | 26 | 36.02 | 33.33 | 43.42 | 52.63 |
| Poland | – | 2.48 | 4.94 | 9.90 | 7.46 | 20.80 | 12.37 |
| Sweden | – | 31.28 | 40.57 | 44.51 | | 47.61 | 46.49 |
| Slovenia | – | 12.5 | 7.31 | 7.69 | 17.64 | 11.11 | 21.42 |

Source: European Social Survey 2002/2003. *Note: given the different names for education levels in the European context we opted to use the original ESS terms.

**Table 2.17—Contacted politicians/government members in the last year, by education level (%)**

| Country | Not completed primary education* | Primary or first stage of basic* | Lower secondary or second stage of basic* | Upper secondary* | Post secondary, non-tertiary* | First stage non-tertiary* | Second stage of tertiary* |
|---|---|---|---|---|---|---|---|
| Portugal | 3.66 | 10.62 | 8.45 | 17.42 | – | 20.83 | – |
| Austria | 9.09 | – | 10.61 | 18.04 | 18.18 | – | 30.76 |
| Belgium | 14.28 | 11.50 | 10.24 | 17.94 | 25.86 | – | 26.54 |
| Switzerland | 17.64 | – | 4.34 | 14.89 | 25.37 | 30.26 | 23.80 |
| Czech Rep. | 10.00 | – | 9.60 | 23.27 | 18.18 | 30 | 20 |
| Germany | – | 1.70 | 5.71 | 11.14 | 22.28 | 20.44 | 39.24 |
| Denmark | – | 20 | 12.74 | 15.84 | 22.44 | 26.76 | 33.33 |
| Spain | 2.782 | 9.66 | 10.37 | 13.40 | 15.90 | 22.62 | 61.11 |
| Finland | 12.5 | 13.92 | 18.51 | 23.97 | – | 37.62 | 66.66 |
| France | 7.49 | 16.66 | 14.21 | 14.34 | 16.66 | 18.07 | 26.28 |
| UK | – | 42.42 | 12.96 | 15.22 | 23.11 | 29.40 | 46.93 |
| Greece | 10.52 | 12.82 | 13.42 | 12.99 | 19.40 | 20.68 | 40.0 |
| Hungary | 5.97 | 7.53 | 16 | 15.30 |  | 25 | 31.11 |
| Ireland | 23.07 | 20 | 22.36 | 21.42 | 25.49 | 22.22 | 28.57 |
| Israel | – | 7.89 | 11.29 | 7.43 | 13.46 | 14.70 | 21.95 |
| Italy | – | 7.74 | 7.89 | 17.12 | 16.43 | 21.23 | 42.10 |
| Luxembourg | – | 9.09 | 25 | 16.66 | 0 | 0 | 25.00 |
| Netherlands | – | 5.38 | 10.28 | 13.18 | 11.53 | 27.66 | 20.00 |
| Norway | – | – | 14.00 | 22.04 | 25.00 | 31.16 | 42.10 |
| Poland | 0.89 | 3.41 | 7.08 | 11.20 | 13.33 | 18 | 23.10 |
| Sweden | 11.11 | 10.76 | 14.18 | 14.74 |  | 23.58 | 25 |
| Slovenia |  | 12.5 | 7.31 | 7.89 | 15.38 | 11.11 | 26.66 |

Source: European Social Survey 2002/2003. *Note: given the different names for education levels in the European context we opted to use the original ESS terms.

ment, newspaper readership (and membership of associations) is directly correlated to the education level of the citizens. As seen below (Table 3.22), education, much more than newspaper readership or watching TV news, is a central element in the civic engagement options made by the different citizens.

Another indicator of an informational society is the relationship it has with its media, i.e. both the freedom of the media to report freely and give opinions and the relationship between the beneficiaries and producers of the information.

Of all the societies in transition under analysis here, only Italy, Argentina and Brazil are classified as partially free in terms of the freedom of the press.

In classifying the freedom of the press, factors such as the legal framework for journalism, political influence and economic pressures on the freedom of expression are taken into account. Between 2001 and 2003, Portugal improved its general score (going from 17 to 15), accompanying a trend similar to that of Finland, while the United Sates revealed an opposite trend (from 17 to 19) and Singapore continued to be classified as a country without freedom of the press.[6]

Positive development, such as in the case of Portugal, may conceal that the final value is due to a positive assessment of the evolution of the legislation and regulation that may influence the contents of the media. However, this is offset by an increase in the economic pressures on news content. To quote the Press Freedom Survey, 2003, "Most media outlets are independent of the government; however, print and broadcast ownership is concentrated in the hands of four main media companies." (Press Freedom Survey 2003).

The comparison of models of social openness and citizenship carried out here, as well as the analysis of the social well-being, reveals much more clearly the differences than the data common to all the societies dealt with herein.

---

[6] Identical positions emerge when one looks at the online presence analysis. Finland, Portugal and the USA are amongst the least restrictive of the media's freedoms and Singapore is included in the moderately free (*Press Freedom Survey 2001)*.

**Table 2.18 Relationship between watching TV news and reading newspapers, by education level/country (%)**

| Country | | Not completed primary education* | Primary or first stage of basic* | Lower secondary or second stage of basic* | Upper secondary* | Post secondary, non-tertiary* | First stage non-tertiary* | Second stage of tertiary* |
|---|---|---|---|---|---|---|---|---|
| Portugal | Watches TV news | 92.15 | 95.87 | 97.18 | 98.48 | 0 | 97.22 | 100 |
| | Reads newspapers | 9.25 | 48.38 | 63.88 | 70.67 | - | 82.19 | 50 |
| Austria | Watches TV news | 88.88 | 0 | 93.60 | 96.93 | 97.52 | 0 | 98.63 |
| | Reads newspapers | 58.33 | - | 83.51 | 86.53 | 87.21 | - | 88.60 |
| Belgium | Watches TV news | 71.42 | 93.75 | 90.18 | 93.06 | 96.49 | 0 | 96.22 |
| | Reads newspapers | 35.71 | 54.86 | 56.62 | 62.93 | 60.68 | - | 68.42 |
| Switzerland | Watches TV news | 93.33 | - | 92.13 | 95.40 | 96.82 | 95.38 | 100 |
| | Reads newspapers | 94.11 | - | 83.87 | 90.88 | 91.30 | 89.47 | 90.47 |
| Czech Republic | Watches TV news | 70 | - | 93.44 | 97.30 | 95.23 | 100 | 100 |
| | Reads newspapers | 44.44 | - | 69.84 | 82.75 | 86.36 | 92.5 | 93.75 |
| Germany | Watches TV news | 89.28 | 91.08 | 97.06 | 99.37 | 99.85 | 100 | 89.28 |
| | Reads newspapers | 57.26 | 71.41 | 84.72 | 84.93 | 90.76 | 93.67 | 57.26 |
| Denmark | Watches TV news | 100 | 100 | 93.87 | 98.5 | 100 | 98.59 | 100 |
| | Reads newspapers | 100 | 80 | 68.31 | 77.22 | 79.59 | 83.09 | 100 |
| Spain | Watches TV news | 82.35 | 92.46 | 88.88 | 92.07 | 91.78 | 96.07 | 100 |
| | Reads newspapers | 24.88 | 43.26 | 45.58 | 67.40 | 69.19 | 80.49 | 89.47 |
| Finland | Watches TV news | 100 | 96.10 | 98.70 | 98.60 | - | 98.98 | 100 |
| | Reads newspapers | 87.5 | 92.40 | 92.59 | 91.83 | - | 95.04 | 100 |
| France | Watches TV news | 90.66 | 91.15 | 92.77 | 97.43 | 96.24 | 96.65 | 96.14 |
| | Reads newspapers | 57.14 | 66.66 | 58.27 | 67.21 | 62.43 | 55.53 | 69.48 |
| UK | Watches TV news | 100 | 84.84 | 90.78 | 94.99 | 96.13 | 95.06 | 95.65 |
| | Reads newspapers | - | 21.21 | 74.53 | 78.58 | 78.53 | 77.80 | 71.42 |
| Greece | Watches TV news | 100 | 84.84 | 90.78 | 94.99 | 96.13 | 95.06 | 95.65 |
| | Reads newspapers | 6.14 | 22.97 | 38.00 | 42.69 | 52.23 | 62.93 | 80 |

**Table 2.18 Relationship between watching TV news and reading newspapers, by education level/country (%) (continued)**

| Country | | Not completed primary education* | Primary or first stage of basic* | Lower secondary or second stage of basic* | Upper secondary* | Post secondary, non-tertiary* | First stage non-tertiary* | Second stage of tertiary* |
|---|---|---|---|---|---|---|---|---|
| Hungary | Watches TV news | 100 | 84.84 | 90.78 | 94.99 | 96.13 | 95.06 | 95.65 |
| | Reads newspapers | 40.90 | 74.37 | 80.61 | 89.07 | | 88.33 | 93.33 |
| Ireland | Watches TV news | 84.61 | 87.5 | 89.33 | 92.95 | 94.11 | 94.44 | 95.23 |
| | Reads newspapers | 76.92 | 85.45 | 84.21 | 88.88 | 82.69 | 94.44 | 90.00 |
| Israel | Watches TV news | 71.42 | 91.42 | 86.20 | 89.05 | 91.30 | 91.30 | 94.87 |
| | Reads newspapers | 22.22 | 47.36 | 64.51 | 72.29 | 75.00 | 72.81 | 80.95 |
| Italy | Watches TV news | 80.93 | 97.30 | 93.75 | 96.34 | 89.04 | 97.56 | 100 |
| | Reads newspapers | 16.20 | 51.61 | 68.28 | 82.64 | 94.52 | 92.79 | 100 |
| Luxembourg | Watches TV news | 90.90 | 100 | 91.66 | 100 | 100 | 100 | 90.90 |
| | Reads newspapers | . | 72.72 | 75.00 | 83.33 | 100 | 100 | 80.00 |
| Netherlands | Watches TV news | 90.90 | 94.48 | 96.82 | 97.75 | 98.70 | 99.65 | 100 |
| | Reads newspapers | 72.72 | 69.23 | 82.14 | 81.64 | 87.17 | 86.71 | 100 |
| Norway | Watches TV news | - | - | 98.03 | 97.82 | 100 | 100 | 95.00 |
| | Reads newspapers | - | - | 96.07 | 96.25 | 88.88 | 97.40 | 100 |
| Poland | Watches TV news | 89.47 | 94.34 | 95.49 | 97.40 | 97.69 | 100 | 99.64 |
| | Reads newspapers | 24.10 | 44.53 | 60.28 | 74.60 | 79.10 | 76 | 87.37 |
| Sweden | Watches TV news | 88.88 | 95.36 | 97.12 | 95.42 | - | 98.03 | 97.39 |
| | Reads newspapers | 88.88 | 90.30 | 93.57 | 89.10 | - | 88.67 | 93.96 |
| Slovenia | Watches TV news | - | 85.71 | 87.80 | 89.74 | 94 | 100 | 92.85 |
| | Reads newspapers | 44.44 | 73.17 | 79.48 | 88.23 | 88.88 | 92.85 | 44.44 |

Source: European Social Survey 2002/2003. *Note: given the different names for education levels in the European context we opted to use the original ESS terms.

However, this is to be expected, for although they share values such as democracy and the wish to adopt informational society models, each society has its individual history and own identity, as well as different well-being models.

## Social Change in Network Societies

The characterization of the societies in transition that we have endeavoured to achieve in this chapter, with a more in-depth treatment of the Portuguese situation, reflects the transition of populations with lower education levels to a society in which the younger generations have already more consolidated educational competences. However, this analysis also reflects societies, which, though they have made great efforts in the area of knowledge, are still trying to assert themselves in the infrastructure and technology production dimensions.

This analysis also reflects a socio-political transition—first from dictatorships to a democratic institutional politization and then to a routinization of democracy. In a process that combines growing scepticism in relation to the political parties and the government institutions and an increase in civic engagement, using autonomous and, at times, individualized forms of expression on the part of civil society.

It is in this context that one produces a fundamental transition in these societies: technological transition. A transition expressed through the diffusion of the Internet and the appearance of the *network society* in the social structure and practice.

After reading the above data and analyses, there is one question still to be answered: is there a generation divide or not in all the societies analyzed here? Though it is true that the data for the Portuguese society confirm the existence of that divide, it is not present in all the societies analyzed. Some of the exceptions are Eastern European countries such as the Czech Republic, Slovakia and Hungary.

The generation divide is not the result of an option; it is, rather, the fruit of a society in which the necessary cognitive resources are distributed unequally amongst the generations, so that societies in which formal learning and literacy are historically better established present transition processes that accentuate the generational differences to a lesser degree.

Only thus can one explain, for Portugal for example, that amongst those who were born before 1967 we find a section of social agents that are similar, in certain practice dimensions and, at times, representations, of the younger Portuguese citizens. This similarity is visible in the fact that they have educational competences that are close to one another, for example in the use of the Internet or in their approach to professional improvement.

The society we live in is not a society in social division. It is a society based on an informational development model, in which some cognitive skills are more valued than others, namely: the highest education level, formal literacy and technological literacies. All these are acquired and not innate skills. As such, social division is not inevitable; there is, rather, a process of transition in which the protagonists are those who most easily master these skills.

At the same time as experiencing multiple transition processes, societies such as the Portuguese and Catalan societies preserve strong social cohesion via a dense network of social and territorial relations. They are societies that change and maintain their cohesion at the same time. They evolve at the global level, while maintaining local and personal control over that which gives meaning to life (Castells 2004c). In the societies in transition that balance between change and social cohesion could be one more common trait.

However, although they share global networks, each societal reality is unique and only a more in-depth analysis of each nation would show us the signs of future evolution in each of our societies. That is the challenge in understanding the transitions in progress in our societies as they become network societies.

## References

CASTELLS, Manuel (2003b), La Societat Xarxa a Catalunya, Barcelona, Editorial UOC.

CASTELLS, Manuel (2003), O Poder da Identidade. A Era da Informação. Economia, Sociedade e Cultura, Volume II, Lisboa, Fundação Calouste Gulbenkian.

GIDDENS, Anthony, HUTTON, Will (2000) On the edge: living with global capitalism. London: Vintage.

SILVERSTONE, Roger (1994) Television And Everyday Life, London: Routledge.

CARDOSO, Gustavo, FIRMINO DA COSTA, António (2005), A Sociedade Rede em Portugal, Porto, Campo das letras.

CIES/ISCTE.

COLE, Jeff (2005), Internet and Society in a Global Perspective: Lessons from Five Years in the Field, Castells M. and Cardoso C., The Network Society, From Knowledge to Policy, Brookings Institution Press.

ITU (2003), Digital Access Index, International Telecommunications Union 2003, Disponível *Online* HTTP: http://www.itu.int/newsarchive/press_releases/2003/30.html

HIMANEN, Pekka, CASTELLS, Manuel (2001), *The Information Society and the Welfare State: The Finnish Model*,*Oxford*, *Oxford University Press.*

HUNTINGTON, Samuel P. (1991)The third wave: Democratization in the Late Twentieth Century, University of Oklahoma Press.

ALTMAN, David (2002), Prospects for e-government in latin America, International review of public administration, 2002, vol. 7, nº2.

CASTELLS, Manuel (2002), A Sociedade em Rede. A Era da Informação. Economia, Sociedade e Cultura, Volume I, Lisboa, Fundação Calouste Gulbenkian.

JORGENSEN, Dale W.(2005), Information, Technology and the World Economy, Castells M. and Cardoso C., The Network Society, From Knowledge to Policy, Brookings Institution Press.

OCDE (2004) Education Outlook, Paris, OCDE.

OCDE (2004), OECD PISA review Available *Online* HTTP: http://www.pisa.oecd.org/ .

OCDE (2004), Patent Database, September 2004, Paris, OCDE.

CASTELLS, Manuel (2004b), A Galáxia Internet, Lisboa Fundação Calouste Gulbenkian.

UNDP (2001), Human Development Report 2001, Available *Online* HTTP:<http://www.undp.org/hdr2001/ >.

UNDP (2003), Human Development Report 2003, Available *Online* HTTP:<http://www.undp.org/hdr2003/ >.

IMD (2004), World Competitiveness Yearbook, 2004, Lausanne, World Competitiveness Center.

AMADEO, Belen (2005), Ciberpolítica en Argentina, Paper presented at Seminário Internacional, 12 e 13 de Maio, Lisboa, ISCTE.

AETIC (2004), Métrica de la sociedad de la información, Madrid.

ESS SURVEY (2003), Available *Online* HTTP: http://ess.nsd.uib.no/

GLOBAL COMPETITIVENESS REPORT (2004), World Economic Forum, Geneva.

INGLEHART, Ronald e Catterberg Gabriela (2001), Trends in Political Action: The Developmental Trend and the Post-Honeymoon Decline, Available *Online* HTTP: http://www.worldvaluessurvey.org/Upload/5_Partapsa.pdf

PUTNAM, Robert , (1993), Making Democracy Work, Princeton, N.J.: Princeton University Press.

PRESS FREEDOM SURVEY (2003), Available *Online* HTTP: http://www.freedomhouse.org/ .

CASTELLS, Manuel e Ince, Martin (2004c) Conversas com Manuel Castells, Porto, Campo das Letras.

# Part II

# The Knowledge Economy, Technology, Innovation, Productivity, Competitiveness: The New Productive Economy

# *Chapter 3*

# Information Technology and the World Economy*

Dale W. Jorgenson and Khuong Vu

## Introduction

The purpose of this paper is to analyze the impact of investment in information technology (IT) equipment and software on the world economy. The resurgence of the U.S. economy during the 1990's and the crucial role of IT investment have been thoroughly documented and widely discussed.[1] Jorgenson (2001) has shown that the remarkable behavior of IT prices is the key to understanding the resurgence of American economic growth. This behavior can be traced to developments in semiconductor technology that are widely understood by technologists and economists.

Jorgenson (2003) has shown that the growth of IT investment jumped to double-digit levels after 1995 in all the G7 economies—Canada, France, Germany, Italy, Japan, and the United Kingdom, as well as the United States.[2] In 1995-2001 these economies accounted for nearly fifty percent of world output and a much larger share of world IT investment. The surge of IT investment after 1995 is a response to the sharp acceleration in the rate of decline of prices of IT

* Department of Economics, Harvard University, 122 Littauer Center, Cambridge, MA 02138-3001. The Economic and Social Research Institute provided financial support for work on the G7 economies from its program on international collaboration through the Nomura Research Institute. We are grateful to Jon Samuels for excellent research assistance and helpful comments. Alessandra Colecchia, Mun S. Ho, Kazuyuki Motohashi, Koji Nomura, Kevin J. Stiroh, Marcel Timmer, and Bart van Ark provided valuable data. The Bureau of Economic Analysis and the Bureau of Labor Statistics assisted with data for the U.S and Statistics Canada contributed the data for Canada. We are grateful to all of them but retain sole responsibility for any remaining deficiencies.

[1] See Jorgenson and Kevin Stiroh (2000) and Stephen Oliner and Daniel Sichel (2000).

[2] Nadim Ahmad, Paul Schreyer, and Anita Wolfl (2004) have analyzed the impact of IT investment in OECD countries. Bart van Ark, et al. (2003) and Francesco Daveri (2002) have presented comparisons among European economies.

equipment and software. Jorgenson (2001) has traced this acceleration to a shift in the semiconductor product cycle from three years to two years in 1995.

In Section 2 we describe economic growth during the period 1989-2001 for the world economy as a whole and 116 economies listed in Table 3.1 below.[3] We have allocated the 116 economies among seven regions of the world listed in the table. We have divided the period in 1995 in order to focus on the response of these economies to the acceleration in the IT price decline. The major developments during the first half of the 1990's were the dramatic rise of Developing Asia and the stunning collapse of Eastern Europe and the former Soviet Union. As shown in Table 3.1, world economic growth has undergone a powerful revival since 1995. The world growth rate jumped nearly a full percentage point from 2.53 percent during 1989-1995 to 3.51 percent in 1995-2001.

In Section 3 we present levels of output per capita, input per capita and productivity for the world economy, seven regions of the world and 116 economies. Our most remarkable finding is that output differences are primarily explained by differences in input, rather than variations in productivity. Taking U.S. output per capita in 2000 as 100.0, world output per capita was a relatively modest 22.6 in 2001. Using similar scales for input per capita and productivity, world input per capita in 2001 was a substantial 34.6 and world productivity a robust 65.4!

In Section 4 we allocate the growth of output between input growth and productivity. World input greatly predominates in the growth of world output. Of the world growth rate of 2.53 percent during 1989-1995, productivity accounts for 0.37 percent or less than fifteen percent, while input growth accounts for 2.16 percent or more than eighty-five percent. Similarly, the higher world growth rate of 3.51 percent from 1995-2001 can be divided between productivity growth of 0.77 percent, less than twenty-two percent of total growth, and input growth of 2.74 percent, more than seventy-eight percent of the total.

[3] We have included countries with more than one million in population and a complete set of national accounting data for the period 1989-2001 from World Bank Development Indicators Online (WBDI). These economies account for more that 96 percent of world output.

In Section 4 we allocate the growth of input between investments in tangible assets, especially IT equipment and software, and investments in human capital. We show that the world economy, all seven regions, and almost every one of the 116 economies experienced a surge in investment in IT after 1995. This was most striking in the G7 economies, led by a rush of IT investment in the U.S. However, the soaring level of IT investment in the U.S. after 1995 was paralleled by increases throughout the G7, the Non-G7 industrialized economies, and Developing Asia. Doubling of IT investment also occurred in Latin America, Eastern Europe, and North Africa and the Middle East with near doubling in Sub-Saharan Africa.

## World Economic Growth, 1989-2001

Table 3.1 presents shares of world product and regional product for each of the seven regions and 116 economies included in our study. The G7 economies accounted for slightly under half of world product from 1989-2001. The growth rates of these economies—2.15 percent before 1995 and 2.78 percent afterward—were considerably below world growth rates. The growth acceleration of 0.60 percent between the two periods also lagged behind the acceleration of world economic growth. The G7 shares in world growth were 41.3 percent during 1989-1995 and 37.2 percent in 1995-2001, well below the G7 shares in world product.

During 1995-2001 the U.S. accounted for more than 22 percent of world product and somewhat less than half of G7 output. Japan fell to a third the size of the U.S., but remained the second largest of the G7 economies and the third largest economy in the world after China. Germany ranked behind the U.S., China, Japan, and India, but remained the leading European economy. France, Italy and the U.K. were similar in size, but less than half the size of Japan. Canada was the smallest of the G7 economies.

The U.S. growth rate jumped sharply from 2.36 percent during 1989-1995 to 3.58 percent in 1995-2001. We note that the period 1995-2001 includes the U.S. recession of 2001 as well as the boom of the last half of the 1990's. The U.S. accounted for more than half of G7 growth before 1995 and over 60 percent afterward. The U.S. share in world growth was less than its share in world product before

1995, but greater after 1995. By contrast Japan's share in world economic growth before 1995 exceeded its share in world product, but fell short of its world product share after 1995. The shares of the G7 economies in world growth during 1989-2001, except for the U.S. and Japan, fell below the G7 shares in world product.

The 16 economies of Developing Asia generated more than 20 percent of world output before 1995 and almost 25 percent afterward. The burgeoning economies of China and India accounted for more than 60 percent of Asian output.[4] China has surpassed Japan to rank as the world's second largest economy and India has outstripped Germany to rank fourth. Indonesia and Korea are similar in size, but together they are only half the size of India. Taiwan and Thailand are also similar in size, jointly about one-tenth the size of China.

The economies of Developing Asia grew at 7.53 percent before 1995, but only 5.66 percent afterward. These economies accounted for an astonishing 60 percent of world growth during 1989-1995. Slightly less than half of this took place in China, while a little more than a third occurred in India. In 1995-2001 the share of Developing Asia in world growth declined to just over 40 percent, still well above the region's share in world product. China accounted for more than half of this and India about a quarter.

The 15 Non-G7 industrialized economies generated more than eight percent of world output during 1989-2001, slightly above Japan. Australia, The Netherlands, and Spain accounted for almost half of this. However, none of these approached Canada, the smallest among the G7 economies, in size. The Non-G7 economies were responsible for lower shares in world economic growth than world product before and after 1995. However, Israel and Norway had larger shares in growth than product before 1995 and Finland and Spain had larger shares in growth after 1995. Australian and Irish shares in world growth exceeded the shares of these countries in world product in both periods. Irish growth rates—5.15 percent during 1989-1995 and 8.85 percent in 1995-2001—compared with the stratospheric growth rates of Developing Asia.

[4] Our data for China are taken from World Bank (2004) indicators and are based on official Chinese estimates. Alwyn Young (2003) presents persuasive evidence that these estimates may exaggerate the growth of output and productivity in China.

The 19 Latin American economies generated more than eight percent of world output with Brazil responsible for a third of the total. During 1995-2001 Brazil's economy ranked ninth in the world, only slightly smaller than France, Italy, and the U.K., but larger than the rapidly fading Russian economy. Mexico was a little over half the size of Brazil and comparable in size to Spain. Argentina was a bit more than half the size of Mexico and ranked with Australia. Argentina and Mexico, taken together, were slightly less than Brazil in size. The remaining sixteen Latin American economies, collectively, also ranked below Brazil.

During 1989-1995 the share of the Latin American economies in world growth of almost ten percent exceeded their eight-and-a-half percent share in world product. In 1995-2001 these economies had a substantially smaller share in world growth of only six percent, while retaining close to an eight-and-a-half share in world product. Brazil's share in world growth was substantially below its three percent share in world product before and after 1995, while Chile, one of the smaller Latin American economies, had a larger share in world growth than product in both periods.

Before the fall of the Berlin Wall and the collapse of the Soviet Union, the 18 economies of Eastern Europe and the former Soviet Union were comparable in size to Latin America, generating more than eight percent of world product. Collectively, these economies subtracted 24.7 percent from world growth during 1989-1995, dragging their share of world product below six percent. Before 1995 the Russian economy was comparable in size to France, Italy, or the U.K., but fell to tenth in the world after Brazil during 1995-2001. The 11 economies of North Africa and the Middle East, taken together, were also comparable in size to France, Italy, or the U.K., while the 30 economies of Sub-Saharan Africa, collectively, ranked with Canada.

Poland was the only economy in Eastern Europe with a positive growth rate during 1989-1995. In 1995-2001 Poland's share in world growth exceeded its share in world product, while Russia's share in growth fell below its share in world product. Growth in the sizeable economy of Ukraine continued to languish during 1995-2001. The economies of North Africa and the Middle East had shares in growth well above their shares in world product during 1989-1995, but this

was reversed in 1995-2001. The economies of Sub-Saharan Africa had shares in world growth below their shares in world product during both periods.

## World Output, Input, and Productivity

Table 3.2 presents levels of output per capita, input per capita, and productivity for the world economy, seven regions, and 116 economies. Following Jorgenson (2001), we have chosen GDP as a measure of output. We have revised and updated the U.S. data presented by Jorgenson (2001) through 2001. Comparable data on investment in information technology have been have been constructed for Canada by Statistics Canada.[5] Data on IT for France, Germany, Italy, and the U.K. have been developed for the European Commission by Bart van Ark, *et al*.[6] Finally, data for Japan have been assembled by Jorgenson and Kazuyuki Motohashi for the Research Institute on Economy, Trade, and Industry.[7] We have linked these data by means of the OECD's purchasing power parities for 1999.[8]

We have distinguished investments in information technology equipment and software from investments in other assets for all 116 economies included in our study. We have employed the World Bank (2004), *World Development Indicators Online*, as a data source on GDP for economies outside the G7,[9] including purchasing power parities.[10] We have relied on the WITSA *Digital Planet Report (1998*, *2000*, 2002, 2004), as the starting point for constructing data on IT investment for these economies.[11] Details are given in the Appendix.

A constant quality index of capital input uses weights that reflect differences in capital consumption, tax treatment, and the rate of decline

[5] See John Baldwin and Tarek Harchaoui (2003).

[6] See van Ark, Johanna Melka, Nanno Mulder, Marcel Timmer, and Gerard Ypma (2003).

[7] See Jorgenson and Motohashi (2004).

[8] See OECD (2002).

[9] Maddison (2001) provides estimates of national product and population for 134 countries for varying periods from 1820-1998 in his magisterial volume, The World Economy: A Millenial Perspective.

[10] See World Bank (2004). Purchasing power parities are also available from the Penn World Table. See Heston, Summers, and Aten (2002).

[11] WITSA stands for the World Information Technology and Services Alliance.

of asset prices. We have derived estimates of capital input and property income from national accounting data for each of the G7 economies. Similarly, a constant quality index of labor input is based on weights by age, sex, educational attainment, and employment status. We have constructed estimates of hours worked and labor compensation from labor force surveys for each of the G7 economies. We have extended these estimates of capital and labor inputs to the 109 Non-G7 countries using data sources and methods described in the Appendix.

In Table 3.2 we present output per capita for the G7 economies from 1989 to 2001. We use 1999 OECD purchasing power parities to convert outputs for the G7 economies from domestic prices into U.S. dollars. In Table 3.2 we also present input per capita for the G7 for 1989-2001, taking the U.S. as 100.0 in 2000. We express input per capita in U.S. dollars, including both capital and labor inputs, using purchasing power parities constructed by Jorgenson (2003).[12] Finally, we present productivity levels for the G7 over the period 1989-2001 in Table 3.2. Productivity is defined as the ratio of output to input.

We find that output differences were primarily due to differences in input, rather than variations in productivity. Taking U.S. output per capita in 2000 as 100.0, G7 output per capita was 83.0 in 2001. Using similar scales for input per capita and productivity, G7 input per capita in 2001 was 85.8 and G7 productivity was 96.7, very close to the U.S. level. The range in output was from 64.4 for France to 100.0 for the U.S., while the range in input was from 62.2 for France to 100.7 for the U.S. Productivity varied considerably less from 87.2 for Japan to 109.6 for Canada. We conclude that differences in output per capita are largely explained by differences in input per capita rather than variations in productivity.

The U.S. sustained its lead in output per capita among the G7 economies throughout the period 1989-2001. Canada was very close to the U.S. in 1989, but fell substantially behind by 1995. The U.S.-Canada gap widened further during the last half of the 1990's. Germany, Japan, Italy, and the U.K. had similar levels of output per capita throughout 1989-2001, but these economies languished considerably below North American levels. France lagged behind the rest of

[12] Purchasing power parities for inputs follow the methodology described in detail by Jorgenson and Yip (2001).

the G7 in output per capita in 1989 and failed to make up lost ground during the subsequent decade.

The U.S. was the leader among the G7 economies in input per capita throughout the period 1989-2001. In 2001 Canada ranked next to the U.S. with Germany third. France and Italy started at the bottom of the ranking and have remained there. Productivity in the G7 has remained close to U.S. levels, rising from 91.7 in 1989 to 93.9 in 1995 and 96.7 in 2001, with the U.S. equal to 100.0 in 2000. Canada was the productivity leader throughout 1989-2001 with Italy and France close behind. The U.S. occupied fourth place, only moderately above the United Kingdom. Japan made substantial gains in productivity, but lagged behind the other members of the G7 in productivity, while Germany also lagged, surpassing only Japan.

In the economies of Developing Asia output per capita rose spectacularly from 5.8 in 1989 to 8.3 1995 and 10.7 in 2001 with the U.S. equal to 100.0 in 2000. The range was enormous with Hong Kong outstripping the G7, except for the U.S. and Canada, after 1995 and Singapore approaching France. By contrast Asia's largest economies, China and India, remained at 12.0 and 7.3, respectively, in 2001. These vast differences are due mainly to differences in input per capita, rather than variations in productivity. Developing Asia's levels of input per capita were 17.2 in 1989, 20.4 in 1995, and 24.9 in 2001, while Asian productivity levels were 33.7, 40.7, and 43.1, respectively, in these years. Hong Kong's productivity levels of 85.8 in 1989 and 90.9 in 1995 exceeded the levels of Germany and Japan, while Taiwan's productivity level exceeded that of Japan in 1995.

China made extraordinary gains in output per capita, growing from 4.7 in 1989 to 7.9 in 1995 and 12.0 in 2001 with the U.S. equal to 100.0 in 2000. India had essentially the same output per capita in 1989, but grew less impressively to levels of 5.8 in 1995 and 7.3 in 2001. China's input per capita—20.3 in 1989, 20.3 in 1995, and 26.5 in 2001—exceeded India's throughout the period. India's 31.0 productivity level in 1989 considerably surpassed China's 27.6. China's productivity swelled to 38.9 in 1995, outstripping India's 33.4. China expanded its lead with a productivity level of 45.3 in 2001 by comparison with India's 35.7.

The 15 Non-G7 industrialized economies, taken together, had lev-

els of output per capita comparable to Germany, Italy, Japan, and the U.K. during 1989-2001. Input per capita for the 15 Non-G7 economies was also very close to these four G7 economies, while productivity for the group was comparable to that of the United Kingdom. This group included a number of star performers: Norway's output per capita of 103.6 in 2001 surpassed that of the United States, while Switzerland's input per capita of 103.5 also topped the U.S. Ireland's productivity greatly outstripped the rest of the industrialized world in 2001 with a level of 125.0! In that year the productivity leaders in the world economy were Ireland, Canada, Norway, France, and Italy.

For the Latin American region output per capita rose from 18.7 to 21.3 during 1989-2001, input per capita rose somewhat more from 28.0 to 33.0, but productivity eased from 66.7 to 64.6. Argentina was the leading Latin American economy in terms of output per capita, achieving the level of 34.5 in 2001. Uruguay led in input per capita, reaching 52.0 in 2001. Argentina, Mexico and Venezuela had high initial levels of productivity, comparable to those of Germany and Japan in 1989. Argentina maintained a relatively high but unchanging level, while Mexico and Venezuela had experienced productivity declines by 2001.

Latin America's lagging output per capita was due chiefly to insufficient input per capita, rather than a shortfall in productivity. However, the decline in productivity from 1989-2001 was pervasive, contrasting sharply with the rise in productivity in the G7 economies, the Non-G7 industrialized economies, and Developing Asia. Brazil's economic performance has been anemic at best and acted as a drag on the growth of Latin America and the world economy. Chile was a rare bright spot with strong performance in input per capita and substantial advances in productivity.

Output per capita in Eastern Europe and the former Soviet Union was 30.0 in 1989, well above the world economy level of 18.5. The collapse between 1989 and 1995 affected every economy except Poland, reducing output per capita to 19.6 and bringing the region below the world economy level of 19.8. A modest recovery between 1995 and 2001 brought the region to 22.9, only slightly above the world economy level of 22.6. Input in the region was stagnant at 37.4 in 1989, 37.2 in 1995, and 37.6 in 2001. Productivity collapsed along with output per capita, declining from 80.2 in 1989 to 52.7 in 1995,

before climbing back to 60.9 in 2001.

Polish output per capita and productivity experienced a steady advance, but by 2001 several East European countries had recovered from the debacle of the early 1990's.[13] In 2001 output per capita was highest in tiny Slovenia at 49.8. This reflected input per capita of 49.4 and a dazzling productivity level of 100.8, comparable to the levels of Western Europe. The Czech Republic was next with output per capita at 42.0 in 2001 and a level of input per capita of 51.4. However, the Czech productivity level of 81.6 lagged behind Hungary's 82.5 and Slovakia's 92.3.

The downturn in output per capita and productivity was especially severe in the economies of the former Soviet Union. Russia's level of output per capita fell from 32.2 in 1989 to 19.3 in 1995 before recovering feebly to 22.5 in 2001. Ukraine fell from a considerably higher level of 39.6 in 1989 to 17.6 in 1995 and 18.2 in 2001. Russian input per capita remained essentially unchanged throughout the period 1989-2001, while productivity mirrored the decline in output, falling from a West European level of 91.0 in 1989 to 55.9 in 1995 before improving to 65.5 in 2001. The most extreme forms of economic collapse, followed by very weak recoveries, can be seen in the small economies of Georgia, the Kyrgyz Republic, and Moldova.

Output per capita in Sub-Sahara Africa was the lowest in the world throughout the period 1989-2001. Only South Africa, tiny Mauritius, and Botswana exceeded world average levels throughout the period. South Africa's economy was largest in the region and generated more than 40 percent of regional product. However, South African output per capita fell slightly, input per capital remained stationary, and productivity slumped during the period 1989-2001. South African productivity in 1989 was 91.4, above the level of the Non-G7 industrialized economies, but fell to 79.4 in 1995 before climbing back to 84.6 in 2001.

All the economies of North Africa and the Middle East fell short of world average levels of output and input per capita, except for Tunisia, which closely tracked world averages. Output per capita grew slowly

[13] A comprehensive analysis of in impact of IT investment in Poland is presented by Piatkowski (2004).

but steadily for the region as a whole during 1989-2001, powered by impressive gains in input per capita, but with stagnant productivity. The region grew more rapidly than the world economy before 1995, but more slowly afterward.

## Sources of World Economic Growth

Table 3.3 presents the sources of world economic growth, following the methodology of Jorgenson (2001). We have allocated growth to the contributions of capital and labor inputs and the growth of productivity for the world economy, seven regions, and 116 economies.

We measure the contribution of IT investment to economic growth by weighting the growth rate of IT capital input by the share of this input in the value of output. Similarly, the contribution of Non-IT investment is a share-weighted growth rate of Non-IT capital input. The contribution of capital input is the sum of these two components.

We have divided labor input growth between the growth of hours worked and labor quality, where quality is defined as the ratio of labor input to hours worked. This reflects changes in the composition of labor input, for example, through increases in the education and experience of the labor force. The contribution of labor input is the rate of growth of this input, weighted by the share of labor in the value of output. Finally, the contribution of total factor productivity is the difference between the rate of growth of output and the rate of growth of input, including both capital and labor inputs.

The contribution of capital input to world output before 1995 was 1.12 percent, a little more than 44 percent of the rate of economic growth of 2.53 percent. Labor input contributed 1.04 percent or slightly more than 41 percent of growth, while total factor productivity growth of 0.37 percent accounted for less than 15 percent. After 1995 the contribution of capital input climbed to 1.55 percent, but remained around 44 percent of output growth, while the contribution of labor input rose to 1.20 percent, around 34 percent. Productivity increased to 0.77 percent or nearly 22 percent of growth. We conclude that capital input was the most important source of world economic growth before and after 1995, labor input was next in importance, and productivity the least important of the three sources of growth.

We have divided the contribution of capital input between IT equipment and software and Non-IT capital input. Non-IT capital input was more important before and after 1995. However, the contribution of IT more than doubled, rising from 0.26 percent to 0.56 percent or from a little over 23 percent of the contribution of capital input to over 36 percent. Similarly, we have divided the contribution of labor input between hours worked and labor quality. Hours rose from 0.44 percent before 1995 to 0.71 after 1995, while labor quality declined from 0.60 percent to 0.48 percent. Labor quality was the predominant source of labor input growth before 1995, but hours was the major source after 1995.

The acceleration in the rate of growth of world output before and after 1995 was 0.98 percent, almost a full percentage point. The contribution of capital input explained 0.43 percent of this increase, while the productivity accounted for another 0.40 percent. Labor input contributed a relatively modest 0.16 percent. The substantial increase in hours worked of 0.31 percent was the most important component of labor input growth. The jump in IT investment of 0.30 percent was most important source of the increase in capital input. This can be traced to the stepped up rate of decline of IT prices after 1995 analyzed by Jorgenson (2001).

Table 3.3 presents the contribution of capital input to economic growth for the G7 nations, divided between IT and Non-IT. This is the most important source of growth, before and after 1995. The contribution of capital input before 1995 was 1.26 or almost three-fifths of the output growth rate of 2.15 percent. The next most important source of growth, labor input, accounted for 0.51 percent before 1995 and 0.74 percent afterward, about 24 percent and 27 percent of growth, respectively. Productivity was the least important source of growth, explaining 0.38 percent before 1995 and 0.45 percent after 1995 or less than 18 percent and slightly more than 16 percent of G7 growth in the two periods.

The powerful surge of IT investment in the U.S. after 1995 is mirrored in similar jumps in growth rates of the contribution of IT capital through the G7. The contribution of IT capital input for the G7 more than doubled from 0.37 during the period 1989-1995 to 0.77 percent during 1995-2001, jumping from 29 percent of the contribution of capital input to more than 48 percent. The contribution of

Non-IT capital input predominated in both periods, but receded slightly from 0.88 percent before 1995 to 0.82 percent afterward. This reflected the substitution of IT capital input for Non-IT capital input in response to rapidly declining prices of IT equipment and software.

Before 1995 the contribution of labor quality of 0.42 percent accounted for more than eighty percent of the contribution of G7 labor input, while after 1995 the contribution of hours worked of 0.50 percent explained almost seventy percent. The modest acceleration of 0.63 percent in G7 output growth after 1995 was powered by investment in IT equipment and software, accounting for 0.40 percent, and the contribution of hours worked of 0.41 percent. Productivity growth in the G7 rose by 0.07 percent, while the contribution of Non-IT investment dropped by 0.06 percent and the contribution of labor quality declined by 0.18 percent.

In Developing Asia the contribution of capital input increased from 1.75 percent before 1995 to 2.38 percent after 1995, while the contribution of labor input fell from 2.02 percent to 1.70 percent. This reversal of roles for capital and labor inputs had a slightly positive impact on growth, so that the significant slowdown in the Asian growth rate from 7.53 percent to 5.66 percent can be traced entirely to a sharp decline in productivity growth from 3.75 to 1.58 percent. Before 1995 productivity explained slightly over half of Asian growth, but productivity fell below both capital and labor inputs after 1995, accounting for less than 28 percent of growth.

The first half of the 1990's was a continuation of the Asian Miracle, analyzed by Paul Krugman (1994), Lawrence Lau (1999), and Young (1995). This period was dominated by the spectacular rise of China and India, and the continuing emergence of the Gang of Four—Hong Kong, Korea, Singapore, and Taiwan. However, all the Asian economies had growth rates considerably in excess of the world average of 2.53 percent with the sole exception of The Philippines. The second half of the 1990's was dominated by the Asian crisis, most evident in the sharp declines in growth rates in Indonesia and Thailand. This period conforms much more closely to the "Krugman thesis," attributing Asian growth to input growth rather than productivity.

Developing Asia experienced a powerful surge in investment in IT equipment and software after 1995. The contribution of IT invest-

ment to Asian growth more than doubled from 0.16 percent to 0.40 percent, explaining less than 10 percent of the contribution of capital input before 1995, but almost 17 percent afterward. The surge in IT investment was particularly strong in China, rising from 0.17 percent before 1995 to 0.59 percent afterward. India fell substantially behind China, but outperformed the region as a whole, increasing from 0.08 to 0.22 percent. The contribution of Non-IT investment in Asia greatly predominated in both periods and also accounted for most of the increase in the contribution of capital input after 1995. Both hours worked and labor quality declined after 1995 with hours worked dominating in both periods.

Economic growth in the fifteen Non-G7 industrialized economies accelerated much more sharply than G7 growth after 1995. The contribution of labor input slightly predominated over capital input before and after 1995. The contribution of labor input was 0.81 percent before 1995, accounting for about 40 percent of Non-G7 growth, and 1.26 after 1995, explaining 39 percent of growth. The corresponding contributions of capital input were 0.75 percent and 1.12 percent, explaining 37 and 34 percent of Non-G7 growth, respectively. Non-G7 productivity also rose from 0.47 before 1995 to 0.89 percent afterward, accounting for 23 and 27 percent of growth in the two periods.

The impact of investment in IT equipment and software in the Non-G7 economies doubled between the two periods, rising from 0.22 percent to 0.44 percent or from 29 percent of the contribution of Non-G7 capital input to 39 percent. This provided a substantial impetus, amounting to 0.22 percent, to the acceleration in Non-G7 growth of 1.25 percent. Australia, Ireland and Sweden emerged as star performances in IT investment, surpassing France, Germany, and Italy. Non-IT investment explained another 0.14 percent of the growth acceleration. However, the most important components of higher Non-G7 growth were the increased contribution of hours worked of 0.49 percent and improved productivity growth of 0.42 percent.

Latin America's growth decelerated slightly after 1995, falling from 2.95 to 2.52 percent. The contribution of labor input was 1.92 percent before 1995 and 1.89 percent afterward, accounting for the lion's share of regional growth in both periods. The contribution of capital

input rose after 1995 from 0.72 percent to 0.99 percent, but remained relatively weak. Nonetheless the contribution of IT investment more than doubled, jumping from 0.15 percent before 1995 to 0.34 percent afterward or from 21 percent of the contribution of capital input to 34 percent. Productivity was essentially flat from 1989 to 2001, rising by 0.31 percent before 1995 and falling by 0.36 percent after 1995. Productivity contributed a little more than ten percent to growth before 1995, but acted as a drag on growth afterward.

The collapse of economic growth in Eastern Europe and the former Soviet Union before 1995 can be attributed almost entirely to a steep decline in productivity. This was followed by a revival in both growth and productivity after 1995. The contribution of capital input declined both before and after 1995, while IT investment jumped from 0.09 to 0.26. Hour worked also declined in both periods, but labor quality improved substantially.

Productivity in Sub-Saharan Africa collapsed during 1989-1995 but recovered slightly, running at—1.63 percent before 1995 and 0.36 percent afterward. The contribution of labor input predominated in both periods, but fell from 2.77 percent to 1.89 percent, while the contribution of capital input rose from 0.52 percent to 0.99 percent. Productivity in North Africa and the Middle East, like that in Latin America, was essentially stationary from 1989-2001, falling from a positive rate of 0.50 percent before 1995 to a negative rate of—0.46 percent afterward.

## Summary and Conclusions

In summary, the world economy, led by the G7 economies and the Non-G7 industrialized economies performed at an outstanding level throughout the period 1989-2001. Latin America hovered around world average levels, while Eastern Europe and the former Soviet Union descended to closely comparable levels. Sub-Saharan Africa and North Africa and the Middle East languished considerably below the world average. Developing Asia accounted for an astonishing 60 percent of world economic growth before 1995 and 40 percent afterward, with China alone responsible for half of this. However, Developing Asia remained well below world average levels of performance.

We have considered the impact of IT investment and the relative importance of input growth and productivity in accounting for economic growth. We conclude that the trends most apparent in the U.S. have counterparts throughout the world. Investments in tangible assets, including IT equipment and software, are the most important sources of growth. However, Non-IT investment still predominates in the contribution of capital input. The contribution of labor input is next in magnitude with labor quality dominant before 1995 and hours worked afterward. Finally, productivity is the least important of the three sources of growth.

The leading role of IT investment in the acceleration of growth in the G7 economies is especially pronounced in the U.S., where IT is coming to dominate the contribution of capital input. The contribution of labor input predominates in the Non-G7 industrialized economies, as well as Latin America, Eastern Europe, Sub-Saharan Africa, and North Africa and the Middle East. Productivity growth was important in Developing Asia before 1995, but assumed a subordinate role after 1995. Productivity has been stagnant or declining in Latin America, Eastern Europe, Sub-Saharan Africa, and North Africa and the Middle East.

All seven regions of the world economy, as well as 112 of the 116 economies we consider,[14] experienced a surge in investment in IT equipment and software after 1995. The impact of IT investment on economic growth has been most striking in the G7 economies. The rush in IT investment was especially conspicuous in the U.S., but the increases in the contribution of IT capital input in Canada, Japan, and the U.K. were only slightly lower. France, Germany, and Italy also experienced a surge in IT investment, but lagged considerably behind the leaders. While IT investment followed similar patterns in all the G7 nations, Non-IT investment varied considerably and helped to explain important differences in G7 growth rates.

Although the surge in investment in IT equipment and software is a global phenomenon, the variation in the contribution of IT investment has increased considerably since 1995. Following the G7, the next most important increase was in Developing Asia, but the contri-

[14] Indonesia, Mexico, Nigeria, and Pakistan are the exceptions.

bution of IT investment after 1995 ranged from China's 0.59 percent to only 0.06 percent in Bangladesh. Developing Asia was followed, in turn, by the Non-G7 industrialized economies, which encompass outstanding performers such as Australia, Ireland, and Sweden, as well as low-performing economies like Austria, Greece, and Spain. The role of IT investment more than doubled in Latin America, Eastern Europe, and North Africa and the Middle East, and nearly doubled in Sub-Saharan Africa.

## Appendix

To measure capital and labor inputs and the sources of economic growth, we employ the production possibility frontier model of production and the index number methodology for input measurement presented by Jorgenson (2001). For the G7 economies we have updated and revised the data constructed by Jorgenson (2003). For the remaining 109 economies, we rely on two primary sources of data[15]: *World Bank Development Indicators Online* (2004) provides national accounting data for 1960-2002 for all economies in the world except Taiwan. WITSA's *Digital Planet Report* (2002, 2004) gives data on expenditures on IT equipment and software for 50 major economies, including the G7.

U.S. data on investment in IT equipment and software, provided by the Bureau of Economic Analysis (BEA) are the most comprehensive.[16] We use these data as a benchmark in estimating IT investment data for other economies. For the economies included in the *Digital Planet Report* we estimate IT investment from IT expenditures. The *Digital Planet Report* provides expenditure data for computer hardware, software, and telecommunication equipment on an annual basis, beginning in 1992.

Expenditure data from the *Digital Planet Report* are given in current U.S. dollars. However, data are not provided separately for investment and intermediate input and for business, household, and government

[15] Other important sources of data include the Penn World Table, the International Telecommunication Union (ITU) telecommunications indicators, and the UNDP Human Development reports.

[16] The BEA data are described by Grimm, Moulton, and Wasshausen (2004).

sectors. We find that the ratio of BEA investment to WITSA expenditure data for the U.S. is fairly constant for the periods 1981-1990 and 1991-2001 for each type of IT equipment and software. Further, data on the global market for telecommunication equipment for 1991-2001, reported by the International Telecommunication Union (ITU), confirms that the ratio of investment to total expenditure for the U.S. is representative of the global market.

We take the ratios of IT investment to IT expenditure for the U.S. as an estimate of the share of investment to expenditure from the *Digital Planet Report*. We use the penetration rate of IT in each economy to extrapolate the investment levels. This extrapolation is based on the assumption that the increase in real IT investment is proportional to the increase in IT penetration.

Investment in each type of IT equipment and software is calculated as follows:

$$I_{c,A,t} = \eta_{c,A,t} * E_{c,A,t}$$

where $I_{c,A,t}$, $\eta_{c,A,t}$, and $E_{c,A,t}$ are investment, the estimated investment-to-expenditure ratio, and the *Digital Planet Report* expenditures, respectively, for asset A in year t for country c.[17]

Given the estimated IT investment flows, we use the perpetual inventory method to estimate IT capital stock. We assume that the geometric depreciation rate is 31.5% and the service life is 7 years for computer hardware, 31.5% and 5 years for software, and 11% and 11 years for telecommunication equipment. Investment in current U.S. dollars for each asset is deflated by the U.S. price index to obtain investment in constant U.S. dollars.

To estimate IT investment for the 66 economies not covered by the *Digital Planet Reports*, we extrapolate the levels of IT capital stock per capita we have estimated for the 50 economies included in these

[17] The IT expenditures for years prior to 1992 are projected by means of the following model:

$$\ln(Ec_{i\,t-1}) = \beta_0 + \beta_1 \ln(Ec_{i\,t}) + \beta_2 \ln(y_{i\,t-1})$$

where $Ec_{i\,t}$ represents expenditure on IT asset c and the subscripts i and t indicate country i in year t, and $y_{i\,t}$ is GDP per capita. The model specifies that, for a country i, spending on IT asset c in year t-1 can be projected from GDP per capita in that year and the spending on the asset c in period t.

*Reports*. We assume that IT capital stock per capita for the 66 additional economies is proportional to the level of IT penetration. The details are as follows:

For computers we divide the 50 economies included in the *Digital Planet Reports* into 10 equal groups, based on the level of personal computer (PC) penetration in 2001. We estimate the current value of computer stock per capita in 2001 for an economy i as:

$$s^i_{HW} = \bar{s}^I_{HW} * (P^i_{HW} / \bar{P}^I_{HW}),$$

where $\bar{s}^I_{HW}$ is the average value of computer capital per capita in 2001 of group I for countries included in the *Digital Planet Report*, $P^i_{HW}$ and $\bar{P}^I_{HW}$ are the PC penetration rates of economy i and the average PC penetration of group I, respectively.

For the economies with data on PC penetration for 1995, we use the growth rates of PC penetration over 1989-2001 to project the current value of computer capital stock per capita backwards. We estimate computer capital stock for each year by multiplying capital stock per capita by population. For economies lacking the data of PC penetration in 1995 and 1989, we estimate computer capital stock by assuming that the growth rates in the two periods, 1995-2001 and 1989-1995, are the same as those for the group to which it belongs.

For software capital stock, we divide the 116 countries into 10 categories by level of PC penetration in 2001. We sub-divide each of these categories into three categories by degree of software piracy[18], generating 30 groups. We assume that the software capital stock-to-hardware capital stock ratio is constant in each year for each of the 30 groups:

$$s^i_{SW} = \bar{s}^I_{SW} * (s^i_{HW} / \bar{s}^I_{HW})$$

where $\bar{s}^I_{SW}$ is the average software capital stock per capita of subgroup I in 2001. Since the value of computer stock per capita has been estimated for 1995 and 1989, this enables us to estimate the software capital stock per capita for these two years.

[18] The information on software piracy is based on study conducted by the Business Software Alliance (2003).

Finally, we define the penetration rate for telecommunications equipment as the sum of main-line and mobile telephone penetration rates. These data are available for all 116 economies in all three years—1989, 1995, and 2001. We have divided these into 10 groups by the level of telecommunications equipment penetration for each year. The current value of telecommunications capital stock per capita is estimated as:

$$s^{it}_{TLC} = \bar{s}^{It}_{TLC} * (P^{it}_{TLC} / \bar{P}^{It}_{TLC})$$

where $\bar{s}^{It}_{TLC}$ is the average current of telecommunications equipment capital stock per capita in year t of group I for economies included in the *Digital Planet Reports* and $P^{it}_{TLC}$ and $\bar{P}^{It}_{TLC}$ are the telecommunications equipment penetration rates of economy i and the average penetration rate of group I in year t.

We employ Gross Fixed Capital Formation for each of the 109 economies provided by the World Bank, measured in current U.S. dollars, as the flow of investment. We use the World Bank investment deflators to convert these flows into constant U.S. dollars. The constant dollar value of capital stock is estimated by the perpetual inventory method for each of the 109 economies for 1989 and the following years. We assume a depreciation rate of 7% and a service life of 30 years.

The current value of the gross capital stock at a year is the product of its constant dollar value and the investment deflator for that year. We estimate the current value of Non-ICT capital stock of an economy for each year by subtracting the current value of IT stock from the current value of capital stock in that year. Given the estimates of the capital stock for each type of asset, we calculate capital input for this stock, using the methodology presented of Jorgenson (2001).

Finally, labor input is the product of hours worked and labor quality:

$$L_t = H_t * q_t$$

where $L_t$, $H_t$, and $q_t$, respectively, are the labor input, the hours worked, and labor quality. A labor quality index requires data on education and hours worked for each of category of workers.

We extrapolate the labor quality indexes for the G7 economies by means of the following model:

$$q_{i,t} = \beta_0 + \beta_1 \text{Education}_{i,t} + \beta_2 \text{Institution1}_i + \beta_3 \text{Institution2}_i + \beta_4 \text{Income1989}_i + \beta_5 T$$

where subscripts i and t indicate economy i in year t. Education is the educational attainment of the population aged 25 or over from the data set constructed by Robert Barro and Jong-Wha Lee (2001). Institution1 = "Rule of Law" and Institution2 = "Regulatory Quality" are constructed by Daniel Kaufmann, Aart Kraay, and Massimo Mastruzzi (2004) for the World Bank; Income1990 is GDP per capita for 1990 from World Bank Development Indicators; and T is a time dummy.

Labor quality is largely explained by educational attainment, institutional quality and living conditions. The model fits well ($R^2 = 0.973$) and all the explanatory variables are statistically significant. We assume that hours worked per worker is constant at 2000 hours per year, so that growth rates of hours worked are the same as employment.

In order to provide a global perspective on the impact of IT investment on economic growth, we have been able to exploit the excellent work on development indicators by the World Bank (2004), as well as information technology expenditures by WITSA (2002, 2004). However, it is important to note that the resulting estimates are far below the quality standards of Bureau of Economic Analysis or research on OECD and EU economies. The next objective should be to develop data on IT expenditures and IT investment within a national accounting framework for the major economies of the world, both industrialized and developing.

# Appendix to Chapter 3
# Tables and Figures

**Table 3.1 The World Economy: Shares in Size and Growth by Region and Individual Economy**

**Notes:** Numbers for growth and shares are in percentage, the shares are weighted by nominal share in the GDP of each country and averaged for each period.

**Group Summaries**

| | Period 1989-1995 | | | Period 1995-2001 | | |
|---|---|---|---|---|---|---|
| | GDP | Average Share | | GDP | Average Share | |
| Group | Growth | Size | Growth | Growth | Size | Growth |
| **World (116 Economies)** | **2.53** | **100.00** | **100.00** | **3.51** | **100.00** | **100.00** |
| G7 | 2.15 | 47.82 | 40.72 | 2.78 | 46.24 | 36.62 |
| Developing Asia | 7.53 | 20.29 | 60.62 | 5.66 | 24.85 | 40.13 |
| Non-G7 | 2.03 | 8.94 | 7.19 | 3.27 | 8.76 | 8.16 |
| Latin America | 2.95 | 8.48 | 9.90 | 2.52 | 8.33 | 5.97 |
| Eastern Europe | –7.13 | 8.67 | –25.15 | 2.09 | 5.98 | 3.56 |
| Sub-Sahara Africa | 1.65 | 2.47 | 1.61 | 3.24 | 2.38 | 2.19 |
| North Africa and Middle-East | 3.87 | 3.33 | 5.11 | 3.43 | 3.46 | 3.38 |

**G7 (7 Economies)**

| Economy | Period 1989-1995 | | | | | Period 1995-2001 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | GDP Share | | Growth Share | | GDP Growth | GDP Share | | Growth Share | |
| | | Group | World | Group | World | | Group | World | Group | World |
| Canada | 1.39 | 4.91 | 2.35 | 3.17 | 1.29 | 3.34 | 4.86 | 2.25 | 5.84 | 2.14 |
| France | 1.30 | 6.93 | 3.32 | 4.19 | 1.71 | 2.34 | 6.65 | 3.08 | 5.60 | 2.05 |
| Germany | 2.34 | 10.81 | 5.17 | 11.76 | 4.79 | 1.18 | 10.37 | 4.80 | 4.40 | 1.61 |
| Italy | 1.52 | 7.42 | 3.55 | 5.24 | 2.13 | 1.90 | 7.07 | 3.27 | 4.83 | 1.77 |
| Japan | 2.56 | 16.23 | 7.76 | 19.31 | 7.86 | 1.85 | 15.98 | 7.39 | 10.63 | 3.90 |
| United Kingdom | 1.62 | 7.44 | 3.56 | 5.60 | 2.28 | 2.74 | 7.30 | 3.38 | 7.20 | 2.64 |
| United States | 2.36 | 46.25 | 22.12 | 50.73 | 20.66 | 3.58 | 47.76 | 22.07 | 61.49 | 22.51 |
| **All Group** | **2.15** | **100.00** | **47.82** | **100.00** | **40.72** | **2.78** | **100.00** | **46.24** | **100.00** | **36.62** |

**Developing Asia(16 Economies)**

| Economy | Period 1989-1995 | | | | | Period 1995-2001 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | GDP Share | | Growth Share | | GDP Growth | GDP Share | | Growth Share | |
| | | Group | World | Group | World | | Group | World | Group | World |
| Bangladesh | 4.54 | 2.23 | 0.45 | 1.35 | 0.80 | 5.09 | 2.00 | 0.50 | 1.80 | 0.72 |
| Cambodia | 7.48 | 0.26 | 0.05 | 0.26 | 0.15 | 6.27 | 0.26 | 0.07 | 0.29 | 0.12 |
| China | 10.14 | 36.58 | 7.50 | 49.27 | 30.10 | 7.79 | 42.12 | 10.51 | 57.96 | 23.31 |
| Hong Kong | 4.90 | 1.87 | 0.38 | 1.22 | 0.73 | 3.22 | 1.59 | 0.39 | 0.91 | 0.36 |
| India | 5.13 | 23.90 | 4.80 | 16.29 | 9.74 | 5.66 | 22.15 | 5.50 | 22.15 | 8.87 |
| Indonesia | 7.75 | 7.27 | 1.48 | 7.49 | 4.53 | 1.14 | 6.46 | 1.59 | 1.30 | 0.52 |
| Malaysia | 8.98 | 1.87 | 0.38 | 2.23 | 1.36 | 3.89 | 1.86 | 0.46 | 1.28 | 0.51 |
| Nepal | 4.99 | 0.31 | 0.06 | 0.21 | 0.12 | 4.70 | 0.28 | 0.07 | 0.23 | 0.09 |
| Pakistan | 4.50 | 3.66 | 0.73 | 2.18 | 1.30 | 3.09 | 3.09 | 0.76 | 1.69 | 0.67 |
| Philippines | 2.28 | 3.54 | 0.70 | 1.08 | 0.64 | 3.49 | 2.83 | 0.70 | 1.75 | 0.70 |
| Singapore | 8.70 | 0.80 | 0.16 | 0.92 | 0.56 | 4.77 | 0.80 | 0.20 | 0.68 | 0.27 |
| South Korea | 7.42 | 6.82 | 1.38 | 6.73 | 4.06 | 4.47 | 6.58 | 1.63 | 5.19 | 2.08 |
| Sri Lanka | 5.41 | 0.68 | 0.14 | 0.49 | 0.29 | 3.83 | 0.61 | 0.15 | 0.41 | 0.16 |
| Taiwan | 6.58 | 4.39 | 0.89 | 3.84 | 2.31 | 3.05 | 3.96 | 0.98 | 2.13 | 0.85 |
| Thailand | 8.68 | 4.43 | 0.90 | 5.11 | 3.11 | 0.64 | 4.00 | 0.99 | 0.45 | 0.18 |
| Vietnam | 7.35 | 1.36 | 0.28 | 1.33 | 0.80 | 7.14 | 1.40 | 0.35 | 1.77 | 0.71 |
| **All Group** | **7.53** | **100.00** | **20.29** | **100.00** | **60.62** | **5.66** | **100.00** | **24.85** | **100.00** | **40.13** |

**Non-G7 (15 Economies)**

| Economy | Period 1989-1995 | | | | | Period 1995-2001 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | GDP Share | | Growth Share | | GDP Growth | GDP Share | | Growth Share | |
| | | Group | World | Group | World | | Group | World | Group | World |
| Australia | 2.74 | 12.93 | 1.16 | 17.42 | 1.25 | 3.70 | 13.34 | 1.17 | 15.09 | 1.23 |
| Austria | 2.46 | 6.12 | 0.55 | 7.41 | 0.53 | 2.29 | 6.02 | 0.53 | 4.21 | 0.34 |
| Belgium | 1.69 | 7.55 | 0.68 | 6.27 | 0.45 | 2.53 | 7.29 | 0.64 | 5.64 | 0.46 |
| Denmark | 1.79 | 4.32 | 0.39 | 3.79 | 0.27 | 2.34 | 4.17 | 0.37 | 2.99 | 0.24 |
| Finland | -0.56 | 3.54 | 0.32 | -0.97 | -0.07 | 4.23 | 3.33 | 0.29 | 4.31 | 0.35 |
| Greece | 1.03 | 4.82 | 0.43 | 2.45 | 0.18 | 3.47 | 4.70 | 0.41 | 4.98 | 0.41 |
| Ireland | 5.15 | 2.08 | 0.19 | 5.27 | 0.38 | 8.85 | 2.71 | 0.24 | 7.32 | 0.60 |
| Israel | 6.40 | 2.93 | 0.26 | 9.22 | 0.66 | 3.34 | 3.31 | 0.29 | 3.38 | 0.28 |
| Netherlands | 2.41 | 11.34 | 1.01 | 13.42 | 0.97 | 3.20 | 11.43 | 1.00 | 11.17 | 0.91 |
| New Zealand | 2.40 | 2.12 | 0.19 | 2.50 | 0.18 | 2.78 | 2.11 | 0.18 | 1.79 | 0.15 |
| Norway | 3.34 | 4.02 | 0.36 | 6.61 | 0.48 | 2.74 | 4.18 | 0.37 | 3.51 | 0.29 |
| Portugal | 2.17 | 4.55 | 0.41 | 4.85 | 0.35 | 3.38 | 4.57 | 0.40 | 4.72 | 0.39 |
| Spain | 1.72 | 21.33 | 1.91 | 18.07 | 1.30 | 3.56 | 21.36 | 1.87 | 23.27 | 1.90 |
| Sweden | 0.67 | 6.12 | 0.55 | 2.02 | 0.15 | 2.63 | 5.80 | 0.51 | 4.67 | 0.38 |
| Switzerland | 0.55 | 6.23 | 0.56 | 1.68 | 0.12 | 1.70 | 5.66 | 0.50 | 2.95 | 0.24 |
| **All Group** | **2.03** | **100.00** | **8.94** | **100.00** | **7.19** | **3.27** | **100.00** | **8.76** | **100.00** | **8.16** |

**Latin America(19 Economies)**

| Economy | Period 1989-1995 | | | | | Period 1995-2001 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | GDP Share | | Growth Share | | GDP Growth | GDP Share | | Growth Share | |
| | | Group | World | Group | World | | Group | World | Group | World |
| Argentina | 4.88 | 12.16 | 1.03 | 20.15 | 2.00 | 1.37 | 12.44 | 1.04 | 6.79 | 0.41 |
| Bolivia | 4.10 | 0.53 | 0.05 | 0.74 | 0.07 | 3.03 | 0.56 | 0.05 | 0.67 | 0.04 |
| Brazil | 1.84 | 37.50 | 3.18 | 23.41 | 2.32 | 2.09 | 35.80 | 2.98 | 29.69 | 1.77 |
| Chile | 7.55 | 3.20 | 0.27 | 8.19 | 0.81 | 4.01 | 3.81 | 0.32 | 6.07 | 0.36 |
| Colombia | 4.35 | 7.64 | 0.65 | 11.27 | 1.12 | 0.96 | 7.61 | 0.63 | 2.91 | 0.17 |
| Costa Rica | 5.02 | 0.84 | 0.07 | 1.43 | 0.14 | 4.19 | 0.94 | 0.08 | 1.57 | 0.09 |
| Ecuador | 2.64 | 1.70 | 0.14 | 1.52 | 0.15 | 1.61 | 1.64 | 0.14 | 1.05 | 0.06 |
| El Salvador | 5.78 | 0.70 | 0.06 | 1.37 | 0.14 | 2.79 | 0.76 | 0.06 | 0.85 | 0.05 |
| Guatemala | 4.00 | 1.17 | 0.10 | 1.59 | 0.16 | 3.61 | 1.25 | 0.10 | 1.79 | 0.11 |
| Honduras | 2.92 | 0.39 | 0.03 | 0.39 | 0.04 | 2.92 | 0.40 | 0.03 | 0.46 | 0.03 |
| Jamaica | 2.29 | 0.31 | 0.03 | 0.24 | 0.02 | 0.22 | 0.29 | 0.02 | 0.03 | 0.00 |
| Mexico | 2.09 | 22.41 | 1.90 | 15.87 | 1.57 | 4.37 | 23.10 | 1.92 | 40.12 | 2.39 |
| Nicaragua | 1.20 | 0.34 | 0.03 | 0.14 | 0.01 | 5.95 | 0.36 | 0.03 | 0.86 | 0.05 |
| Panama | 5.76 | 0.39 | 0.03 | 0.76 | 0.08 | 3.88 | 0.44 | 0.04 | 0.68 | 0.04 |
| Paraguay | 3.16 | 0.98 | 0.08 | 1.05 | 0.10 | 1.03 | 0.94 | 0.08 | 0.39 | 0.02 |
| Peru | 3.56 | 4.28 | 0.36 | 5.17 | 0.51 | 2.06 | 4.30 | 0.36 | 3.52 | 0.21 |
| Trinidad and Tobago | 1.40 | 0.30 | 0.03 | 0.14 | 0.01 | 4.58 | 0.30 | 0.03 | 0.55 | 0.03 |
| Uruguay | 3.27 | 0.95 | 0.08 | 1.05 | 0.10 | 1.17 | 0.92 | 0.08 | 0.43 | 0.03 |
| Venezuela | 3.87 | 4.20 | 0.36 | 5.51 | 0.55 | 0.97 | 4.13 | 0.34 | 1.59 | 0.09 |
| **All Group** | **2.95** | **100.00** | **8.48** | **100.00** | **9.90** | **2.52** | **100.00** | **8.33** | **100.00** | **5.97** |

**Eastern Europe (18 Economies)**

| Economy | Period 1989-1995 | | | | | Period 1995-2001 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | GDP Share | | Growth Share | | GDP Growth | GDP Share | | Growth Share | |
| | | Group | World | Group | World | | Group | World | Group | World |
| Albania | -3.83 | 0.33 | 0.03 | 0.18 | -0.04 | 7.69 | 0.44 | 0.03 | 1.62 | 0.06 |
| Armenia | -10.76 | 0.29 | 0.03 | 0.44 | -0.11 | 5.71 | 0.30 | 0.02 | 0.82 | 0.03 |
| Bulgaria | -3.80 | 2.14 | 0.18 | 1.14 | -0.27 | -0.04 | 2.20 | 0.13 | -0.04 | 0.00 |
| Croatia | -5.18 | 1.65 | 0.14 | 1.20 | -0.29 | 3.41 | 1.83 | 0.11 | 2.99 | 0.11 |
| Czech Republic | -0.97 | 5.12 | 0.42 | 0.69 | -0.16 | 1.52 | 5.93 | 0.36 | 4.30 | 0.15 |
| Estonia | -6.38 | 0.47 | 0.04 | 0.42 | -0.10 | 5.06 | 0.53 | 0.03 | 1.28 | 0.05 |
| Georgia | -22.03 | 0.76 | 0.07 | 2.35 | -0.64 | 5.48 | 0.49 | 0.03 | 1.28 | 0.05 |
| Hungary | -2.59 | 4.01 | 0.33 | 1.46 | -0.34 | 3.90 | 4.80 | 0.29 | 8.96 | 0.32 |
| Kyrgyz Republic | -11.79 | 0.54 | 0.05 | 0.89 | -0.23 | 5.41 | 0.51 | 0.03 | 1.32 | 0.05 |
| Latvia | -12.06 | 0.69 | 0.06 | 1.17 | -0.30 | 5.56 | 0.65 | 0.04 | 1.74 | 0.06 |
| Lithuania | -9.45 | 1.01 | 0.09 | 1.34 | -0.33 | 4.46 | 1.05 | 0.06 | 2.23 | 0.08 |
| Moldova | -16.70 | 0.55 | 0.05 | 1.29 | -0.34 | -1.11 | 0.36 | 0.02 | -0.19 | -0.01 |
| Poland | 2.17 | 10.51 | 0.84 | -3.21 | 0.72 | 4.33 | 14.28 | 0.85 | 29.60 | 1.05 |
| Romania | -2.77 | 5.52 | 0.46 | 2.15 | -0.51 | -0.45 | 5.78 | 0.35 | -1.25 | -0.04 |
| Russian Federation | -8.44 | 46.04 | 4.04 | 54.53 | -13.48 | 1.86 | 44.14 | 2.64 | 39.33 | 1.40 |
| Slovakia | -2.98 | 2.04 | 0.17 | 0.85 | -0.20 | 4.31 | 2.39 | 0.14 | 4.94 | 0.18 |
| Slovenia | -0.59 | 1.00 | 0.08 | 0.08 | -0.02 | 4.02 | 1.26 | 0.08 | 2.43 | 0.09 |
| Ukraine | -13.59 | 17.32 | 1.58 | 33.03 | -8.51 | -0.22 | 13.06 | 0.78 | -1.37 | -0.05 |
| **All Group** | **-7.13** | **100.00** | **8.67** | **100.00** | **-25.15** | **2.09** | **100.00** | **5.98** | **100.00** | **3.56** |

## Sub-Sahara Africa (30 Economies)

| Economy | Period 1989-1995 | | | | | Period 1995-2001 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | GDP Share | | Growth Share | | GDP Growth | GDP Share | | Growth Share | |
| | | Group | World | Group | World | | Group | World | Group | World |
| Benin | 3.99 | 0.56 | 0.01 | 1.35 | 0.02 | 5.15 | 0.64 | 0.02 | 1.01 | 0.02 |
| Botswana | 4.40 | 1.25 | 0.03 | 3.32 | 0.05 | 5.93 | 1.47 | 0.03 | 2.69 | 0.06 |
| Burkina Faso | 2.85 | 1.18 | 0.03 | 2.04 | 0.03 | 4.25 | 1.26 | 0.03 | 1.66 | 0.04 |
| Cameroon | -2.64 | 3.22 | 0.08 | -5.15 | -0.08 | 4.72 | 2.94 | 0.07 | 4.29 | 0.09 |
| Central African Rep. | 0.45 | 0.46 | 0.01 | 0.13 | 0.00 | 2.16 | 0.43 | 0.01 | 0.29 | 0.01 |
| Chad | 0.83 | 0.81 | 0.02 | 0.41 | 0.01 | 3.36 | 0.80 | 0.02 | 0.83 | 0.02 |
| Congo, Rep. | 0.69 | 0.36 | 0.01 | 0.15 | 0.00 | 2.60 | 0.34 | 0.01 | 0.27 | 0.01 |
| Cote d'Ivoire | 1.03 | 2.85 | 0.07 | 1.78 | 0.03 | 2.84 | 2.76 | 0.07 | 2.43 | 0.05 |
| Ethiopia | 1.41 | 4.38 | 0.11 | 3.75 | 0.06 | 5.64 | 4.69 | 0.11 | 8.16 | 0.18 |
| Gabon | 3.36 | 1.00 | 0.02 | 2.03 | 0.03 | 1.79 | 1.01 | 0.02 | 0.56 | 0.01 |
| Gambia, The | 2.31 | 0.22 | 0.01 | 0.31 | 0.01 | 4.84 | 0.24 | 0.01 | 0.36 | 0.01 |
| Ghana | 4.04 | 3.57 | 0.09 | 8.73 | 0.14 | 4.21 | 3.94 | 0.09 | 5.13 | 0.11 |
| Guinea | 3.76 | 1.78 | 0.04 | 4.06 | 0.07 | 4.03 | 1.94 | 0.05 | 2.42 | 0.05 |
| Kenya | 2.00 | 3.20 | 0.08 | 3.87 | 0.06 | 1.66 | 3.09 | 0.07 | 1.59 | 0.03 |
| Madagascar | 0.24 | 1.34 | 0.03 | 0.19 | 0.00 | 4.11 | 1.31 | 0.03 | 1.67 | 0.04 |
| Malawi | 3.37 | 0.57 | 0.01 | 1.16 | 0.02 | 2.47 | 0.59 | 0.01 | 0.45 | 0.01 |
| Mali | 2.08 | 0.99 | 0.02 | 1.24 | 0.02 | 5.19 | 1.06 | 0.03 | 1.70 | 0.04 |
| Mauritius | 5.11 | 1.13 | 0.03 | 3.49 | 0.06 | 5.36 | 1.33 | 0.03 | 2.21 | 0.05 |
| Mozambique | 2.85 | 1.05 | 0.03 | 1.81 | 0.03 | 8.38 | 1.28 | 0.03 | 3.32 | 0.07 |
| Namibia | 4.39 | 1.29 | 0.03 | 3.43 | 0.06 | 3.25 | 1.40 | 0.03 | 1.40 | 0.03 |
| Niger | 0.40 | 0.84 | 0.02 | 0.20 | 0.00 | 3.48 | 0.82 | 0.02 | 0.88 | 0.02 |
| Nigeria | 3.36 | 10.57 | 0.26 | 21.46 | 0.35 | 2.80 | 10.97 | 0.26 | 9.49 | 0.21 |
| Senegal | 1.87 | 1.56 | 0.04 | 1.76 | 0.03 | 5.21 | 1.67 | 0.04 | 2.68 | 0.06 |
| South Africa | 0.66 | 43.68 | 1.08 | 17.50 | 0.28 | 2.64 | 41.64 | 0.99 | 33.93 | 0.74 |
| Swaziland | 3.74 | 0.52 | 0.01 | 1.18 | 0.02 | 2.98 | 0.55 | 0.01 | 0.51 | 0.01 |
| Tanzania | 2.62 | 1.22 | 0.03 | 1.92 | 0.03 | 4.43 | 1.30 | 0.03 | 1.78 | 0.04 |
| Togo | 0.02 | 0.80 | 0.02 | 0.01 | 0.00 | 1.79 | 0.73 | 0.02 | 0.40 | 0.01 |
| Uganda | 6.69 | 2.85 | 0.07 | 11.52 | 0.19 | 6.05 | 3.58 | 0.09 | 6.69 | 0.15 |
| Zambia | -1.26 | 1.12 | 0.03 | -0.86 | -0.01 | 3.10 | 1.02 | 0.02 | 0.98 | 0.02 |
| Zimbabwe | 2.12 | 5.61 | 0.14 | 7.20 | 0.12 | 0.14 | 5.21 | 0.12 | 0.23 | 0.00 |
| **All Group** | **1.65** | **100.00** | **2.47** | **100.00** | **1.61** | **3.24** | **100.00** | **2.38** | **100.00** | **2.19** |

**North Africa and Middle-East (11 Economies)**

| Economy | Period 1989-1995 | | | | | Period 1995-2001 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | GDP Share | | Growth Share | | GDP Growth | GDP Share | | Growth Share | |
| | | Group | World | Group | World | | Group | World | Group | World |
| Igeria | 0.35 | 13.54 | 0.45 | 1.21 | 0.06 | 3.03 | 11.96 | 0.41 | 10.56 | 0.36 |
| Egypt | 3.70 | 14.16 | 0.47 | 13.56 | 0.69 | 4.87 | 14.71 | 0.51 | 20.88 | 0.70 |
| Iran | 5.41 | 25.80 | 0.86 | 36.11 | 1.85 | 3.93 | 27.39 | 0.95 | 31.38 | 1.06 |
| Jordan | 5.88 | 1.25 | 0.04 | 1.90 | 0.10 | 3.27 | 1.32 | 0.05 | 1.26 | 0.04 |
| Lebanon | 13.51 | 0.83 | 0.03 | 2.89 | 0.15 | 2.10 | 1.02 | 0.04 | 0.62 | 0.02 |
| Mauritania | 3.38 | 0.43 | 0.01 | 0.38 | 0.02 | 3.98 | 0.43 | 0.01 | 0.50 | 0.02 |
| Morocco | 1.42 | 8.61 | 0.29 | 3.17 | 0.16 | 3.94 | 8.10 | 0.28 | 9.31 | 0.31 |
| Syrian Arab Rep. | 7.60 | 2.96 | 0.10 | 5.82 | 0.30 | 3.14 | 3.26 | 0.11 | 2.98 | 0.10 |
| Tunisia | 4.45 | 4.16 | 0.14 | 4.79 | 0.24 | 5.33 | 4.49 | 0.16 | 6.98 | 0.24 |
| Turkey | 4.10 | 27.65 | 0.92 | 29.29 | 1.49 | 1.86 | 26.63 | 0.92 | 14.41 | 0.49 |
| Yemen, Rep. | 5.45 | 0.62 | 0.02 | 0.88 | 0.04 | 5.57 | 0.69 | 0.02 | 1.13 | 0.04 |
| **All Group** | **3.87** | **100.00** | **3.33** | **100.00** | **5.11** | **3.43** | **100.00** | **3.46** | **100.00** | **3.38** |

**Table 3.2: Levels of Output and Input per Capita and Productivity (U.S. in 2000 = 100)**

**Group Summaries**

| | Output Per Capita | | | Input Per Capita | | | Productivity | | |
|---|---|---|---|---|---|---|---|---|---|
| Group | 1989 | 1995 | 2001 | 1989 | 1995 | 2001 | 1989 | 1995 | 2001 |
| **World (116 Economies)** | **18.5** | **19.8** | **22.6** | **28.4** | **30.7** | **34.6** | **65.2** | **64.4** | **65.4** |
| G7 | 66.9 | 72.8 | 83.0 | 73.0 | 77.6 | 85.8 | 91.7 | 93.9 | 96.7 |
| Developing Asia | 5.8 | 8.3 | 10.7 | 17.3 | 20.4 | 24.9 | 33.7 | 40.7 | 43.1 |
| Non-G7 | 54.4 | 59.3 | 69.7 | 60.7 | 65.4 | 73.9 | 89.6 | 90.7 | 94.2 |
| Latin America | 18.7 | 20.0 | 21.3 | 28.0 | 29.9 | 33.0 | 66.7 | 67.0 | 64.6 |
| Eastern Europe | 30.0 | 19.6 | 22.9 | 37.4 | 37.2 | 37.6 | 80.2 | 52.7 | 60.9 |
| Sub-Sahara Africa | 5.8 | 5.4 | 5.7 | 15.0 | 15.6 | 16.6 | 38.5 | 34.8 | 34.1 |
| North Africa & Middle East | 11.6 | 12.8 | 14.1 | 21.9 | 23.9 | 27.3 | 52.7 | 53.5 | 51.6 |

**G7 (7 Economies)**

| Group | Output Per Capita | | | Input Per Capita | | | Productivity | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1989 | 1995 | 2001 | 1989 | 1995 | 2001 | 1989 | 1995 | 2001 |
| Canada | 79.4 | 80.2 | 92.5 | 75.0 | 75.7 | 84.4 | 105.9 | 105.9 | 109.6 |
| France | 54.5 | 57.4 | 64.4 | 53.7 | 57.4 | 62.2 | 101.5 | 100.0 | 103.5 |
| Germany | 59.0 | 65.5 | 69.7 | 71.6 | 74.3 | 79.5 | 82.4 | 88.2 | 87.7 |
| Italy | 57.7 | 62.5 | 69.3 | 55.9 | 59.2 | 67.6 | 103.2 | 105.6 | 102.5 |
| Japan | 56.3 | 64.4 | 71.1 | 72.5 | 78.3 | 81.5 | 77.7 | 82.2 | 87.2 |
| United Kingdom | 56.9 | 61.8 | 71.8 | 61.7 | 67.5 | 74.2 | 92.2 | 91.6 | 96.8 |
| United States | 80.6 | 86.3 | 100.0 | 84.4 | 89.1 | 100.7 | 95.5 | 96.9 | 99.3 |
| **All Group** | **66.9** | **72.8** | **83.0** | **73.0** | **77.6** | **85.8** | **91.7** | **93.9** | **96.7** |

**Developing Asia (16 Economies)**

| Group | Output Per Capita | | | Input Per Capita | | | Productivity | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1989 | 1995 | 2001 | 1989 | 1995 | 2001 | 1989 | 1995 | 2001 |
| Bangladesh | 3.5 | 4.1 | 5.0 | 14.2 | 16.6 | 20.4 | 24.6 | 24.8 | 24.5 |
| Cambodia | 4.5 | 5.8 | 7.0 | 16.9 | 19.6 | 23.0 | 26.5 | 29.7 | 30.4 |
| China | 4.7 | 7.9 | 12.0 | 16.9 | 20.3 | 26.5 | 27.6 | 38.9 | 45.3 |
| Hong Kong | 54.9 | 67.8 | 74.0 | 64.0 | 74.6 | 85.9 | 85.8 | 90.9 | 86.1 |
| India | 4.7 | 5.8 | 7.3 | 15.3 | 17.3 | 20.3 | 31.0 | 33.4 | 35.7 |
| Indonesia | 6.4 | 9.2 | 9.1 | 17.8 | 21.8 | 26.1 | 35.8 | 42.2 | 34.9 |
| Malaysia | 15.6 | 23.0 | 25.1 | 27.5 | 35.1 | 41.3 | 56.9 | 65.6 | 60.9 |
| Nepal | 2.9 | 3.4 | 3.9 | 16.0 | 17.6 | 19.8 | 18.3 | 19.5 | 19.9 |
| Pakistan | 5.8 | 6.6 | 6.9 | 15.5 | 17.0 | 18.4 | 37.6 | 38.7 | 37.3 |
| Philippines | 10.6 | 10.6 | 11.6 | 19.9 | 21.3 | 22.9 | 53.2 | 49.9 | 50.5 |
| Singapore | 40.7 | 56.8 | 64.1 | 65.7 | 74.8 | 84.8 | 62.0 | 76.0 | 75.6 |
| South Korea | 24.9 | 36.6 | 45.5 | 37.7 | 50.0 | 60.4 | 66.2 | 73.1 | 75.4 |
| Sri Lanka | 7.0 | 9.0 | 10.4 | 22.1 | 25.7 | 30.8 | 31.6 | 35.0 | 33.9 |
| Taiwan | 34.9 | 48.8 | 55.5 | 45.0 | 56.2 | 67.7 | 77.5 | 86.9 | 81.9 |
| Thailand | 12.1 | 19.0 | 19.0 | 28.8 | 37.0 | 41.2 | 42.0 | 51.2 | 46.1 |
| Vietnam | 3.3 | 4.5 | 6.2 | 12.3 | 14.2 | 17.5 | 26.5 | 31.7 | 35.4 |
| **All Group** | **5.8** | **8.3** | **10.7** | **17.3** | **20.4** | **24.9** | **33.7** | **40.7** | **43.1** |

**Non-G7 (15 Economies)**

| | Output Per Capita | | | Input Per Capita | | | Productivity | | |
|---|---|---|---|---|---|---|---|---|---|
| **Group** | **1989** | **1995** | **2001** | **1989** | **1995** | **2001** | **1989** | **1995** | **2001** |
| Australia | 61.2 | 66.8 | 78.0 | 68.9 | 72.4 | 81.9 | 88.9 | 92.2 | 95.3 |
| Austria | 64.2 | 71.5 | 81.6 | 71.1 | 77.3 | 84.7 | 90.4 | 92.5 | 96.3 |
| Belgium | 62.0 | 67.8 | 77.1 | 59.7 | 66.1 | 73.2 | 103.9 | 102.6 | 105.4 |
| Denmark | 68.8 | 75.1 | 84.9 | 84.5 | 89.1 | 97.4 | 81.4 | 84.4 | 87.2 |
| Finland | 62.3 | 58.6 | 73.4 | 75.8 | 71.4 | 76.5 | 82.2 | 82.0 | 96.0 |
| Greece | 39.9 | 41.0 | 49.9 | 43.1 | 45.2 | 49.1 | 92.6 | 90.7 | 101.6 |
| Ireland | 43.6 | 57.9 | 91.0 | 49.5 | 57.0 | 72.8 | 88.2 | 101.6 | 125.0 |
| Israel | 45.8 | 54.7 | 57.6 | 48.4 | 55.5 | 62.2 | 94.5 | 98.6 | 92.5 |
| Netherlands | 61.2 | 68.0 | 79.6 | 69.5 | 75.9 | 84.8 | 88.1 | 89.5 | 93.9 |
| New Zealand | 49.8 | 53.6 | 59.7 | 65.1 | 68.8 | 75.1 | 76.5 | 78.0 | 79.5 |
| Norway | 73.8 | 88.2 | 103.6 | 80.7 | 85.3 | 95.3 | 91.5 | 103.4 | 108.7 |
| Portugal | 37.1 | 41.9 | 50.6 | 48.8 | 54.1 | 63.4 | 76.1 | 77.5 | 79.8 |
| Spain | 44.8 | 49.6 | 59.2 | 45.1 | 50.3 | 60.2 | 99.4 | 98.6 | 98.3 |
| Sweden | 60.7 | 61.0 | 71.9 | 79.7 | 81.1 | 91.0 | 76.2 | 75.3 | 79.0 |
| Switzerland | 79.4 | 77.5 | 83.3 | 91.4 | 96.7 | 103.5 | 86.9 | 80.1 | 80.5 |
| **All Group** | **54.4** | **59.3** | **69.7** | **60.7** | **65.4** | **73.9** | **89.6** | **90.7** | **94.2** |

**Latin America (19 Economies)**

| Group | Output Per Capita | | | Input Per Capita | | | Productivity | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1989 | 1995 | 2001 | 1989 | 1995 | 2001 | 1989 | 1995 | 2001 |
| Argentina | 26.8 | 33.7 | 34.5 | 35.1 | 35.2 | 40.0 | 76.5 | 95.8 | 86.2 |
| Bolivia | 6.0 | 6.6 | 6.8 | 21.3 | 23.2 | 25.8 | 28.0 | 28.3 | 26.5 |
| Brazil | 19.9 | 20.3 | 21.3 | 29.8 | 31.1 | 33.4 | 66.8 | 65.4 | 63.7 |
| Chile | 16.0 | 22.9 | 26.8 | 29.0 | 34.6 | 41.0 | 55.3 | 66.1 | 65.4 |
| Colombia | 16.0 | 18.4 | 17.5 | 23.9 | 26.8 | 27.5 | 66.9 | 68.7 | 63.8 |
| Costa Rica | 19.9 | 23.3 | 26.5 | 39.3 | 44.1 | 50.7 | 50.7 | 52.8 | 52.3 |
| Ecuador | 12.8 | 13.2 | 13.2 | 25.4 | 27.4 | 28.5 | 50.5 | 48.2 | 46.1 |
| El Salvador | 9.5 | 11.9 | 12.7 | 26.2 | 30.0 | 34.7 | 36.3 | 39.8 | 36.5 |
| Guatemala | 9.9 | 10.8 | 11.5 | 23.3 | 24.7 | 27.0 | 42.6 | 43.8 | 42.5 |
| Honduras | 6.2 | 6.2 | 6.3 | 16.4 | 18.3 | 20.9 | 37.7 | 33.9 | 30.0 |
| Jamaica | 10.1 | 11.1 | 10.8 | 25.9 | 29.6 | 33.3 | 39.0 | 37.6 | 32.3 |
| Mexico | 21.1 | 21.4 | 25.5 | 26.6 | 29.8 | 34.6 | 79.1 | 71.8 | 73.7 |
| Nicaragua | 7.3 | 6.6 | 8.0 | 21.5 | 20.8 | 24.2 | 33.8 | 31.7 | 33.1 |
| Panama | 11.4 | 14.4 | 16.5 | 29.5 | 33.3 | 39.1 | 38.7 | 43.2 | 42.3 |
| Paraguay | 18.0 | 18.7 | 17.4 | 28.8 | 31.5 | 32.8 | 62.5 | 59.4 | 53.0 |
| Peru | 14.9 | 16.3 | 16.7 | 28.0 | 31.0 | 34.9 | 53.1 | 52.7 | 47.8 |
| Trinidad and Tobago | 19.3 | 20.1 | 25.8 | 35.0 | 39.6 | 49.3 | 55.0 | 50.9 | 52.3 |
| Uruguay | 22.8 | 26.6 | 27.4 | 45.7 | 48.4 | 52.0 | 49.9 | 54.8 | 52.7 |
| Venezuela | 16.1 | 17.6 | 16.6 | 19.6 | 20.3 | 20.7 | 82.2 | 87.0 | 79.9 |
| **All Group** | **18.7** | **20.0** | **21.3** | **28.0** | **29.9** | **33.0** | **66.7** | **67.0** | **64.6** |

**Eastern Europe (18 Economies)**

| | Output Per Capita | | | Input Per Capita | | | Productivity | | |
|---|---|---|---|---|---|---|---|---|---|
| **Group** | **1989** | **1995** | **2001** | **1989** | **1995** | **2001** | **1989** | **1995** | **2001** |
| Albania | 9.2 | 7.5 | 12.0 | 23.8 | 27.2 | 32.9 | 38.8 | 27.4 | 36.6 |
| Armenia | 8.9 | 5.3 | 8.0 | 26.3 | 32.2 | 32.3 | 34.0 | 16.4 | 24.7 |
| Bulgaria | 21.5 | 18.1 | 19.2 | 29.6 | 27.9 | 29.2 | 72.7 | 64.8 | 65.8 |
| Croatia | 32.0 | 24.7 | 31.5 | 41.1 | 46.5 | 55.9 | 77.9 | 53.1 | 56.2 |
| Czech Republic | 40.1 | 37.9 | 42.0 | 47.1 | 48.4 | 51.4 | 85.0 | 78.4 | 81.6 |
| Estonia | 29.3 | 21.8 | 31.1 | 57.0 | 56.4 | 59.8 | 51.4 | 38.6 | 52.0 |
| Georgia | 19.6 | 5.3 | 7.6 | 27.2 | 27.0 | 28.3 | 72.3 | 19.7 | 26.8 |
| Hungary | 33.1 | 28.8 | 36.6 | 38.3 | 39.0 | 44.3 | 86.6 | 73.9 | 82.5 |
| Kyrgyz Republic | 14.0 | 6.5 | 8.3 | 23.7 | 25.5 | 25.6 | 59.0 | 25.5 | 32.6 |
| Latvia | 29.3 | 15.2 | 22.6 | 46.2 | 45.7 | 54.1 | 63.4 | 33.2 | 41.7 |
| Lithuania | 28.2 | 17.4 | 23.7 | 49.7 | 50.8 | 56.4 | 56.8 | 34.2 | 42.0 |
| Moldova | 16.1 | 5.9 | 5.6 | 28.3 | 29.2 | 28.5 | 57.0 | 20.3 | 19.8 |
| Poland | 20.0 | 22.4 | 29.1 | 31.7 | 31.8 | 36.9 | 63.1 | 70.4 | 78.8 |
| Romania | 20.6 | 17.8 | 17.6 | 24.6 | 24.5 | 25.2 | 83.6 | 72.7 | 69.7 |
| Russian Federation | 32.2 | 19.3 | 22.5 | 35.4 | 34.6 | 34.3 | 91.0 | 55.9 | 65.5 |
| Slovakia | 33.5 | 27.7 | 34.3 | 36.2 | 36.3 | 37.2 | 92.6 | 76.1 | 92.3 |
| Slovenia | 40.0 | 38.8 | 49.8 | 47.0 | 45.6 | 49.4 | 85.3 | 85.2 | 100.8 |
| Ukraine | 39.6 | 17.6 | 18.2 | 54.3 | 53.8 | 49.1 | 72.9 | 32.7 | 37.2 |
| **All Group** | **30.0** | **19.6** | **22.9** | **37.4** | **37.2** | **37.6** | **80.2** | **52.7** | **60.9** |

## Sub-Sahara Africa (30 Economies)

| Group | Output Per Capita | | | Input Per Capita | | | Productivity | | |
|---|---|---|---|---|---|---|---|---|---|
| | 1989 | 1995 | 2001 | 1989 | 1995 | 2001 | 1989 | 1995 | 2001 |
| Benin | 2.6 | 2.7 | 3.2 | 14.8 | 14.5 | 16.9 | 17.4 | 18.8 | 18.9 |
| Botswana | 21.0 | 22.6 | 28.4 | 32.6 | 37.1 | 44.7 | 64.4 | 60.8 | 63.5 |
| Burkina Faso | 3.0 | 3.1 | 3.4 | 13.6 | 14.8 | 16.9 | 21.8 | 20.7 | 20.2 |
| Cameroon | 7.3 | 5.2 | 6.0 | 15.4 | 15.5 | 15.8 | 47.2 | 33.7 | 38.1 |
| Central African Republic | 3.8 | 3.3 | 3.4 | 17.3 | 17.7 | 18.1 | 21.7 | 18.9 | 18.7 |
| Chad | 3.3 | 2.9 | 3.0 | 16.3 | 16.1 | 18.8 | 20.5 | 18.3 | 15.9 |
| Congo, Rep. | 3.4 | 2.9 | 2.8 | 13.0 | 13.2 | 13.4 | 26.5 | 22.3 | 21.3 |
| Cote d'Ivoire | 5.8 | 5.0 | 5.1 | 19.0 | 18.0 | 17.8 | 30.3 | 27.9 | 28.7 |
| Ethiopia | 2.0 | 1.9 | 2.3 | 11.4 | 11.7 | 12.3 | 17.8 | 16.4 | 18.8 |
| Gabon | 23.3 | 23.7 | 22.7 | 36.9 | 34.6 | 34.6 | 63.2 | 68.4 | 65.7 |
| Gambia, The | 5.6 | 5.1 | 5.7 | 15.0 | 16.4 | 17.9 | 37.4 | 31.2 | 31.6 |
| Ghana | 5.0 | 5.5 | 6.3 | 16.7 | 17.8 | 21.9 | 30.1 | 30.7 | 29.0 |
| Guinea | 6.8 | 7.2 | 7.9 | 19.9 | 20.6 | 21.9 | 34.0 | 34.9 | 36.3 |
| Kenya | 3.2 | 3.0 | 2.9 | 13.2 | 14.2 | 16.3 | 23.9 | 21.3 | 17.8 |
| Madagascar | 2.8 | 2.4 | 2.6 | 14.4 | 14.7 | 15.7 | 19.3 | 16.3 | 16.3 |
| Malawi | 1.5 | 1.6 | 1.7 | 14.2 | 14.0 | 13.0 | 10.5 | 11.7 | 12.7 |
| Mali | 2.7 | 2.6 | 3.1 | 14.6 | 15.0 | 16.0 | 18.3 | 17.2 | 19.1 |
| Mauritius | 21.9 | 27.8 | 35.8 | 35.8 | 43.3 | 50.4 | 61.0 | 64.2 | 71.0 |
| Mozambique | 1.6 | 1.7 | 2.5 | 9.4 | 10.2 | 12.3 | 17.3 | 16.8 | 20.2 |
| Namibia | 19.9 | 21.2 | 21.8 | 36.4 | 34.5 | 32.3 | 54.7 | 61.4 | 67.6 |
| Niger | 2.7 | 2.2 | 2.3 | 12.5 | 11.8 | 11.6 | 21.4 | 19.0 | 19.4 |
| Nigeria | 2.4 | 2.5 | 2.5 | 9.3 | 9.9 | 11.6 | 26.1 | 25.1 | 21.8 |
| Senegal | 4.9 | 4.7 | 5.5 | 17.0 | 18.0 | 20.2 | 28.9 | 26.2 | 27.2 |
| South Africa | 29.5 | 27.1 | 27.7 | 32.3 | 34.1 | 32.7 | 91.4 | 79.4 | 84.6 |
| Swaziland | 14.8 | 15.3 | 15.5 | 26.9 | 28.7 | 31.3 | 55.0 | 53.4 | 49.3 |
| Tanzania | 1.1 | 1.1 | 1.2 | 10.9 | 11.6 | 12.0 | 9.9 | 9.1 | 9.9 |
| Togo | 5.6 | 4.9 | 4.6 | 16.7 | 16.7 | 16.6 | 33.7 | 29.6 | 27.3 |
| Uganda | 3.3 | 4.0 | 4.9 | 16.6 | 17.6 | 19.4 | 19.8 | 22.9 | 25.3 |
| Zambia | 3.7 | 2.9 | 3.1 | 18.7 | 16.7 | 16.2 | 19.6 | 17.3 | 19.0 |
| Zimbabwe | 12.6 | 12.4 | 11.2 | 24.4 | 27.8 | 28.8 | 51.7 | 44.5 | 38.8 |
| **All Group** | **5.8** | **5.4** | **5.7** | **15.0** | **15.6** | **16.6** | **38.5** | **34.8** | **34.1** |

**North Africa and Middle East (11 Economies)**

| | Output Per Capita | | | Input Per Capita | | | Productivity | | |
|---|---|---|---|---|---|---|---|---|---|
| **Group** | **1989** | **1995** | **2001** | **1989** | **1995** | **2001** | **1989** | **1995** | **2001** |
| Algeria | 17.5 | 15.6 | 17.0 | 26.2 | 26.2 | 28.6 | 67.0 | 59.4 | 59.4 |
| Egypt | 7.9 | 8.7 | 10.4 | 15.4 | 15.7 | 17.9 | 51.5 | 55.6 | 58.2 |
| Iran | 13.2 | 16.5 | 19.1 | 26.6 | 29.4 | 34.5 | 49.7 | 56.1 | 55.3 |
| Jordan | 11.0 | 11.4 | 11.6 | 22.4 | 23.6 | 25.5 | 49.1 | 48.4 | 45.4 |
| Lebanon | 4.8 | 9.6 | 9.9 | 27.0 | 26.8 | 28.9 | 17.7 | 35.6 | 34.3 |
| Mauritania | 6.3 | 6.6 | 7.6 | 17.9 | 18.1 | 20.9 | 35.2 | 36.8 | 36.1 |
| Morocco | 11.2 | 10.9 | 12.5 | 21.0 | 21.6 | 24.2 | 53.5 | 50.6 | 51.5 |
| Syrian Arab Republic | 6.4 | 8.3 | 8.6 | 23.5 | 24.3 | 25.9 | 27.3 | 34.3 | 33.3 |
| Tunisia | 14.7 | 17.0 | 21.7 | 28.6 | 31.7 | 36.3 | 51.3 | 53.8 | 59.8 |
| Turkey | 14.3 | 16.3 | 16.4 | 23.6 | 28.8 | 34.0 | 60.6 | 56.4 | 48.4 |
| Yemen, Rep. | 1.5 | 1.5 | 1.8 | 7.6 | 8.8 | 10.4 | 19.4 | 17.6 | 17.5 |
| **All Group** | **11.6** | **12.8** | **14.1** | **21.9** | **23.9** | **27.3** | **52.7** | **53.5** | **51.6** |

**Table 3.3: Sources of Output Growth: 1995-2001 vs. 1989-1995**

**Group Summaries**

| | | Period 1989-1995 | | | | | | Period 1995-2001 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sources of Growth (% points per annum) | | | | | | Sources of Growth (% points per annum) | | | | |
| | | Capital | | Labor | | | | Capital | | Labor | | |
| Economy | GDP Growth | ICT | Non-ICT | Hours | Quality | TFP | GDP Growth | ICT | Non-ICT | Hours | Quality | TFP |
| **World (116 Economies)** | **2.53** | **0.26** | **0.86** | **0.44** | **0.60** | **0.37** | **3.51** | **0.56** | **0.99** | **0.71** | **0.48** | **0.77** |
| G7 | 2.15 | 0.37 | 0.88 | 0.09 | 0.42 | 0.38 | 2.78 | 0.77 | 0.82 | 0.50 | 0.24 | 0.45 |
| Developing Asia | 7.53 | 0.16 | 1.59 | 1.19 | 0.84 | 3.75 | 5.66 | 0.40 | 1.98 | 0.94 | 0.75 | 1.58 |
| Non-G7 | 2.03 | 0.22 | 0.54 | 0.38 | 0.42 | 0.47 | 3.27 | 0.44 | 0.68 | 0.87 | 0.40 | 0.89 |
| Latin America | 2.95 | 0.15 | 0.57 | 1.18 | 0.74 | 0.31 | 2.52 | 0.34 | 0.66 | 1.22 | 0.67 | -0.36 |
| Eastern Europe | -7.13 | 0.09 | -0.18 | -0.80 | 0.75 | -7.00 | 2.09 | 0.26 | -0.81 | -0.22 | 0.73 | 2.14 |
| Sub-Saharan Africa | 1.65 | 0.15 | 0.37 | 1.67 | 1.10 | -1.63 | 3.24 | 0.29 | 0.69 | 1.08 | 0.81 | 0.36 |
| N. Africa & Middle East | 3.87 | 0.11 | 0.74 | 1.40 | 1.13 | 0.50 | 3.43 | 0.28 | 1.02 | 1.59 | 1.00 | -0.46 |

## G7 Economies (7 Economies)

| Economy | GDP Growth | Period 1989-1995 Sources of Growth (% points per annum) Capital ICT | Capital Non-ICT | Labor Hours | Labor Quality | TFP | GDP Growth | Period 1995-2001 Sources of Growth (% points per annum) Capital ICT | Capital Non-ICT | Labor Hours | Labor Quality | TFP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Canada | 1.39 | 0.49 | 0.27 | 0.08 | 0.55 | 0.00 | 3.34 | 0.86 | 0.81 | 0.91 | 0.18 | 0.58 |
| France | 1.30 | 0.19 | 0.93 | -0.17 | 0.61 | -0.26 | 2.34 | 0.42 | 0.73 | 0.40 | 0.19 | 0.60 |
| Germany | 2.34 | 0.26 | 1.05 | -0.42 | 0.33 | 1.12 | 1.18 | 0.46 | 0.65 | -0.06 | 0.23 | -0.10 |
| Italy | 1.52 | 0.26 | 0.86 | -0.35 | 0.38 | 0.37 | 1.90 | 0.49 | 0.98 | 0.57 | 0.35 | -0.49 |
| Japan | 2.56 | 0.31 | 1.16 | -0.39 | 0.54 | 0.94 | 1.85 | 0.75 | 0.35 | -0.44 | 0.21 | 0.98 |
| United Kingdom | 1.62 | 0.27 | 1.69 | -0.72 | 0.49 | -0.11 | 2.74 | 0.76 | 0.18 | 0.59 | 0.30 | 0.91 |
| United States | 2.36 | 0.47 | 0.68 | 0.62 | 0.36 | 0.23 | 3.58 | 0.93 | 1.11 | 0.89 | 0.23 | 0.42 |
| **All Group** | **2.15** | **0.37** | **0.88** | **0.09** | **0.42** | **0.38** | **2.78** | **0.77** | **0.82** | **0.50** | **0.24** | **0.45** |

## Developing Asia (16 Economies)

| Economy | Period 1989-1995 | | | | | | Period 1995-2001 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | Sources of Growth (% points per annum) | | | | | GDP Growth | Sources of Growth (% points per annum) | | | | |
| | | Capital | | Labor | | | | Capital | | Labor | | |
| | | ICT | Non-ICT | Hours | Quality | TFP | | ICT | Non-ICT | Hours | Quality | TFP |
| Bangladesh | 4.54 | 0.03 | 1.64 | 1.67 | 1.07 | 0.13 | 5.09 | 0.06 | 2.57 | 1.66 | 0.96 | -0.17 |
| Cambodia | 7.48 | 0.05 | 2.61 | 1.77 | 1.11 | 1.94 | 6.27 | 0.17 | 3.16 | 1.60 | 0.95 | 0.39 |
| China | 10.14 | 0.17 | 1.74 | 0.87 | 0.89 | 6.46 | 7.79 | 0.59 | 2.46 | 0.56 | 0.79 | 3.38 |
| Hong Kong | 4.90 | 0.37 | 1.54 | 0.78 | 0.44 | 1.76 | 3.22 | 0.58 | 1.45 | 1.11 | 0.35 | -0.27 |
| India | 5.13 | 0.08 | 1.17 | 1.27 | 0.89 | 1.72 | 5.66 | 0.22 | 1.66 | 1.35 | 0.84 | 1.58 |
| Indonesia | 7.75 | 0.11 | 1.60 | 1.64 | 0.85 | 3.54 | 1.14 | 0.10 | 1.71 | 1.48 | 0.81 | -2.97 |
| Malaysia | 8.98 | 0.32 | 2.14 | 2.11 | 0.81 | 3.60 | 3.89 | 0.47 | 1.78 | 1.88 | 0.52 | -0.76 |
| Nepal | 4.99 | 0.10 | 1.52 | 1.31 | 1.00 | 1.06 | 4.70 | 0.16 | 1.79 | 1.53 | 0.89 | 0.33 |
| Pakistan | 4.50 | 0.13 | 1.42 | 1.46 | 1.02 | 0.47 | 3.09 | 0.09 | 1.10 | 1.59 | 0.91 | -0.60 |
| Philippines | 2.28 | 0.12 | 0.65 | 1.60 | 0.70 | -0.79 | 3.49 | 0.21 | 0.79 | 1.38 | 0.65 | 0.47 |
| Singapore | 8.70 | 0.47 | 1.58 | 1.81 | 0.54 | 4.30 | 4.77 | 0.71 | 1.79 | 1.15 | 0.35 | 0.75 |
| South Korea | 7.42 | 0.33 | 2.13 | 1.45 | 0.63 | 2.89 | 4.47 | 0.49 | 1.70 | 0.82 | 0.52 | 0.95 |
| Sri Lanka | 5.41 | 0.03 | 1.56 | 1.42 | 0.70 | 1.70 | 3.83 | 0.15 | 1.69 | 1.81 | 0.68 | -0.50 |
| Taiwan | 6.58 | 0.23 | 1.92 | 0.91 | 0.53 | 2.98 | 3.05 | 0.45 | 2.11 | 0.37 | 0.50 | -0.38 |
| Thailand | 8.68 | 0.12 | 2.22 | 1.19 | 0.67 | 4.47 | 0.64 | 0.14 | 0.93 | 0.55 | 0.62 | -1.61 |
| Vietnam | 7.35 | 0.19 | 1.05 | 1.27 | 1.29 | 3.55 | 7.14 | 0.51 | 2.21 | 1.03 | 0.92 | 2.47 |
| **All Group** | **7.53** | **0.16** | **1.59** | **1.19** | **0.84** | **3.75** | **5.66** | **0.40** | **1.98** | **0.94** | **0.75** | **1.58** |

## Non-G7 (15 Economies)

| Economy | GDP Growth | Period 1989-1995 Sources of Growth (% points per annum) Capital ICT | Capital Non-ICT | Labor Hours | Labor Quality | TFP | GDP Growth | Period 1995-2001 Sources of Growth (% points per annum) Capital ICT | Capital Non-ICT | Labor Hours | Labor Quality | TFP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Australia | 2.74 | 0.32 | 0.43 | 0.69 | 0.39 | 0.92 | 3.70 | 0.61 | 0.77 | 0.99 | 0.38 | 0.96 |
| Austria | 2.46 | 0.15 | 0.70 | 0.52 | 0.36 | 0.72 | 2.29 | 0.26 | 0.66 | 0.11 | 0.37 | 0.89 |
| Belgium | 1.69 | 0.24 | 0.63 | 0.29 | 0.38 | 0.14 | 2.53 | 0.35 | 0.63 | 0.46 | 0.37 | 0.72 |
| Denmark | 1.79 | 0.18 | 0.25 | 0.32 | 0.32 | 0.72 | 2.34 | 0.41 | 0.64 | 0.13 | 0.34 | 0.82 |
| Finland | -0.56 | 0.14 | 0.08 | -1.17 | 0.40 | -0.01 | 4.23 | 0.54 | 0.04 | 0.64 | 0.36 | 2.65 |
| Greece | 1.03 | 0.10 | 0.19 | 0.48 | 0.55 | -0.28 | 3.47 | 0.25 | 0.44 | 0.17 | 0.52 | 2.08 |
| Ireland | 5.15 | 0.30 | 0.54 | 1.27 | 0.42 | 2.62 | 8.85 | 0.65 | 1.43 | 2.14 | 0.39 | 4.24 |
| Israel | 6.40 | 0.37 | 1.31 | 2.85 | 0.42 | 1.44 | 3.34 | 0.56 | 1.14 | 1.72 | 0.42 | -0.50 |
| Netherlands | 2.41 | 0.30 | 0.43 | 0.77 | 0.37 | 0.53 | 3.20 | 0.59 | 0.51 | 0.68 | 0.35 | 1.07 |
| New Zealand | 2.40 | 0.32 | 0.13 | 1.16 | 0.35 | 0.43 | 2.78 | 0.53 | 0.52 | 0.71 | 0.36 | 0.67 |
| Norway | 3.34 | 0.18 | 0.07 | 0.57 | 0.45 | 2.07 | 2.74 | 0.40 | 0.38 | 0.61 | 0.32 | 1.03 |
| Portugal | 2.17 | 0.19 | 0.77 | 0.06 | 0.47 | 0.67 | 3.38 | 0.47 | 0.98 | 0.61 | 0.46 | 0.86 |
| Spain | 1.72 | 0.14 | 0.83 | -0.05 | 0.51 | 0.30 | 3.56 | 0.25 | 0.96 | 1.63 | 0.49 | 0.24 |
| Sweden | 0.67 | 0.22 | 0.28 | -0.32 | 0.48 | 0.01 | 2.63 | 0.70 | 0.19 | 0.46 | 0.34 | 0.94 |
| Switzerland | 0.55 | 0.25 | 0.54 | 0.46 | 0.32 | -1.01 | 1.70 | 0.44 | 0.31 | 0.40 | 0.31 | 0.25 |
| **All Group** | **2.03** | **0.22** | **0.54** | **0.38** | **0.42** | **0.47** | **3.27** | **0.44** | **0.68** | **0.87** | **0.40** | **0.89** |

## Latin America (19 Economies)

| Economy | Period 1989-1995 | | | | | | Period 1995-2001 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | Sources of Growth (% points per annum) | | | | | GDP Growth | Sources of Growth (% points per annum) | | | | |
| | | Capital | | Labor | | | | Capital | | Labor | | |
| | | ICT | Non-ICT | Hours | Quality | TFP | | ICT | Non-ICT | Hours | Quality | TFP |
| Argentina | 4.88 | 0.20 | 0.41 | -0.19 | 0.61 | 3.86 | 1.37 | 0.21 | 0.26 | 1.99 | 0.56 | -1.65 |
| Bolivia | 4.10 | 0.05 | 0.76 | 2.35 | 0.77 | 0.17 | 3.03 | 0.43 | 1.58 | 1.45 | 0.70 | -1.12 |
| Brazil | 1.84 | 0.10 | 0.25 | 0.99 | 0.79 | -0.29 | 2.09 | 0.44 | 0.47 | 0.69 | 0.72 | -0.23 |
| Chile | 7.55 | 0.28 | 1.53 | 1.52 | 0.52 | 3.69 | 4.01 | 0.51 | 1.91 | 0.65 | 0.47 | 0.47 |
| Colombia | 4.35 | 0.16 | 0.87 | 1.79 | 0.75 | 0.78 | 0.96 | 0.53 | 0.42 | 0.28 | 0.70 | -0.97 |
| Costa Rica | 5.02 | 0.35 | 1.75 | 1.62 | 0.60 | 0.70 | 4.19 | 0.81 | 1.53 | 1.47 | 0.56 | -0.17 |
| Ecuador | 2.64 | 0.07 | 0.52 | 2.01 | 0.84 | -0.79 | 1.61 | 0.11 | 0.26 | 1.21 | 0.76 | -0.73 |
| El Salvador | 5.78 | 0.08 | 1.27 | 2.17 | 0.76 | 1.52 | 2.79 | 0.23 | 1.38 | 1.90 | 0.71 | -1.44 |
| Guatemala | 4.00 | 0.04 | 0.65 | 1.97 | 0.88 | 0.46 | 3.61 | 0.14 | 1.34 | 1.81 | 0.84 | -0.52 |
| Honduras | 2.92 | 0.05 | 1.31 | 2.35 | 1.00 | -1.79 | 2.92 | 0.14 | 1.76 | 2.16 | 0.91 | -2.05 |
| Jamaica | 2.29 | 0.10 | 1.11 | 0.98 | 0.73 | -0.62 | 0.22 | 0.32 | 0.91 | 0.83 | 0.67 | -2.52 |
| Mexico | 2.09 | 0.20 | 0.88 | 1.48 | 0.74 | -1.21 | 4.37 | 0.19 | 0.87 | 1.85 | 0.64 | 0.81 |
| Nicaragua | 1.20 | 0.18 | -0.24 | 1.32 | 1.00 | -1.06 | 5.95 | 0.28 | 1.07 | 2.97 | 0.91 | 0.73 |
| Panama | 5.76 | 0.05 | 1.23 | 1.95 | 0.66 | 1.85 | 3.88 | 0.14 | 2.07 | 1.46 | 0.58 | -0.38 |
| Paraguay | 3.16 | 0.04 | 1.38 | 1.88 | 0.71 | -0.84 | 1.03 | 0.26 | 0.66 | 1.38 | 0.64 | -1.91 |
| Peru | 3.56 | 0.08 | 0.94 | 1.86 | 0.80 | -0.12 | 2.06 | 0.21 | 1.18 | 1.63 | 0.67 | -1.62 |
| Trinidad and Tobago | 1.40 | 0.05 | 0.39 | 1.60 | 0.67 | -1.31 | 4.58 | 0.17 | 1.78 | 1.57 | 0.62 | 0.45 |
| Uruguay | 3.27 | 0.13 | 0.50 | 0.52 | 0.55 | 1.57 | 1.17 | 0.42 | 0.83 | 0.04 | 0.55 | -0.66 |
| Venezuela | 3.87 | 0.13 | 0.03 | 1.91 | 0.86 | 0.94 | 0.97 | 0.27 | 0.05 | 1.26 | 0.78 | -1.39 |
| **All Group** | **2.95** | **0.15** | **0.57** | **1.18** | **0.74** | **0.31** | **2.52** | **0.34** | **0.66** | **1.22** | **0.67** | **-0.36** |

## Eastern Europe (18 Economies)

| Economy | GDP Growth | Period 1989-1995 Sources of Growth (% points per annum) Capital ICT | Capital Non-ICT | Labor Hours | Labor Quality | TFP | GDP Growth | Period 1995-2001 Sources of Growth (% points per annum) Capital ICT | Capital Non-ICT | Labor Hours | Labor Quality | TFP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Albania | -3.83 | 0.03 | 1.58 | -0.44 | 0.78 | -5.78 | 7.69 | 0.45 | 2.82 | -1.16 | 0.78 | 4.80 |
| Armenia | -10.76 | 0.00 | 1.13 | -0.54 | 0.85 | -12.21 | 5.71 | 0.04 | -1.70 | -0.47 | 0.95 | 6.89 |
| Bulgaria | -3.80 | 0.11 | -0.36 | -2.24 | 0.79 | -2.10 | -0.04 | 0.26 | -0.63 | -0.40 | 0.69 | 0.04 |
| Croatia | -5.18 | 0.20 | 1.29 | -1.08 | 0.80 | -6.40 | 3.41 | 0.83 | 1.31 | -0.43 | 0.73 | 0.97 |
| Czech Republic | -0.97 | 0.18 | -0.17 | 0.00 | 0.47 | -1.44 | 1.52 | 0.44 | 0.15 | -0.35 | 0.48 | 0.79 |
| Estonia | -6.38 | 0.19 | -0.48 | -1.82 | 0.50 | -4.76 | 5.06 | 0.77 | -0.60 | -0.61 | 0.55 | 4.96 |
| Georgia | -22.03 | 0.12 | -1.11 | -0.25 | 0.85 | -21.64 | 5.48 | 0.55 | -1.03 | 0.01 | 0.85 | 5.09 |
| Hungary | -2.59 | 0.25 | 0.07 | -0.84 | 0.53 | -2.60 | 3.90 | 0.48 | 0.36 | 0.45 | 0.55 | 2.05 |
| Kyrgyz Republic | -11.79 | 0.09 | 0.63 | 0.65 | 0.81 | -13.98 | 5.41 | 0.20 | -0.67 | 0.97 | 0.81 | 4.10 |
| Latvia | -12.06 | 0.09 | 0.03 | -1.95 | 0.56 | -10.79 | 5.56 | 1.11 | -0.22 | 0.20 | 0.66 | 3.81 |
| Lithuania | -9.45 | 0.10 | 0.33 | -2.05 | 0.61 | -8.44 | 4.46 | 0.55 | 0.09 | -0.27 | 0.70 | 3.40 |
| Moldova | -16.70 | 0.10 | -0.19 | -0.09 | 0.67 | -17.18 | -1.11 | 0.58 | -1.45 | -0.48 | 0.71 | -0.46 |
| Poland | 2.17 | 0.12 | 0.09 | -0.50 | 0.61 | 1.86 | 4.33 | 0.48 | 1.00 | -0.07 | 0.56 | 2.36 |
| Romania | -2.77 | 0.03 | -0.55 | -0.60 | 0.88 | -2.53 | -0.45 | 0.12 | -0.32 | -0.19 | 0.76 | -0.82 |
| Russian Federation | -8.44 | 0.08 | -0.12 | -1.02 | 0.80 | -8.18 | 1.86 | 0.11 | -1.44 | -0.14 | 0.80 | 2.53 |
| Slovakia | -2.98 | 0.16 | -0.13 | -0.29 | 0.60 | -3.31 | 4.31 | 0.42 | 0.18 | -0.21 | 0.61 | 3.31 |
| Slovenia | -0.59 | 0.13 | -0.63 | -0.40 | 0.58 | -0.26 | 4.02 | 0.35 | 0.17 | 0.11 | 0.53 | 2.87 |
| Ukraine | -13.59 | 0.05 | -0.59 | -0.52 | 0.82 | -13.36 | -0.22 | 0.19 | -2.56 | -0.88 | 0.92 | 2.12 |
| **All Group** | **-7.13** | **0.09** | **-0.18** | **-0.80** | **0.75** | **-7.00** | **2.09** | **0.26** | **-0.81** | **-0.22** | **0.73** | **2.14** |

## Sub-Sahara Africa (30 Economies)

| Economy | Period 1989-1995 | | | | | | Period 1995-2001 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | Sources of Growth (% points per annum) | | | | | GDP Growth | Sources of Growth (% points per annum) | | | | |
| | | Capital | | Labor | | | | Capital | | Labor | | |
| | | ICT | Non-ICT | Hours | Quality | TFP | | ICT | Non-ICT | Hours | Quality | TFP |
| Benin | 3.99 | 0.03 | 0.15 | 1.68 | 0.84 | 1.30 | 5.15 | 0.10 | 2.60 | 1.69 | 0.72 | 0.04 |
| Botswana | 4.40 | 0.04 | 2.66 | 2.01 | 0.65 | -0.96 | 5.93 | 0.18 | 2.30 | 2.09 | 0.61 | 0.75 |
| Burkina Faso | 2.85 | 0.03 | 1.49 | 1.11 | 1.07 | -0.86 | 4.25 | 0.06 | 2.42 | 1.20 | 0.97 | -0.41 |
| Cameroon | -2.64 | 0.03 | -0.17 | 1.72 | 1.39 | -5.61 | 4.72 | 0.08 | -0.12 | 1.51 | 1.23 | 2.02 |
| Central African Republic | 0.45 | 0.03 | 0.56 | 1.28 | 0.90 | -2.32 | 2.16 | 0.06 | 0.33 | 1.10 | 0.82 | -0.14 |
| Chad | 0.83 | 0.04 | 0.18 | 1.62 | 0.88 | -1.89 | 3.36 | 0.07 | 2.82 | 1.91 | 0.84 | -2.28 |
| Congo, Rep. | 0.69 | 0.02 | 0.40 | 1.84 | 1.32 | -2.88 | 2.60 | 0.09 | 0.26 | 1.91 | 1.17 | -0.82 |
| Cote d'Ivoire | 1.03 | 0.02 | -0.85 | 2.31 | 0.91 | -1.36 | 2.84 | 0.16 | -0.36 | 1.74 | 0.85 | 0.46 |
| Ethiopia | 1.41 | 0.05 | 0.37 | 1.16 | 1.18 | -1.35 | 5.64 | 0.10 | 1.01 | 1.34 | 0.96 | 2.22 |
| Gabon | 3.36 | 0.01 | -0.51 | 1.47 | 1.06 | 1.32 | 1.79 | 0.09 | 0.25 | 1.10 | 1.01 | -0.67 |
| Gambia, The | 2.31 | 0.10 | 1.68 | 2.35 | 1.17 | -2.99 | 4.84 | 0.50 | 1.26 | 1.84 | 1.06 | 0.18 |
| Ghana | 4.04 | 0.06 | 1.20 | 1.62 | 0.89 | 0.28 | 4.21 | 0.14 | 2.73 | 1.47 | 0.78 | -0.91 |
| Guinea | 3.76 | 0.03 | 0.99 | 1.39 | 0.95 | 0.40 | 4.03 | 0.08 | 1.02 | 1.28 | 0.95 | 0.70 |
| Kenya | 2.00 | 0.05 | 0.67 | 2.06 | 1.15 | -1.93 | 1.66 | 0.19 | 0.72 | 2.67 | 1.02 | -2.93 |
| Madagascar | 0.24 | 0.06 | 0.47 | 1.55 | 0.98 | -2.82 | 4.11 | 0.14 | 1.06 | 1.96 | 0.94 | 0.01 |
| Malawi | 3.37 | 0.03 | -0.27 | 0.93 | 0.90 | 1.78 | 2.47 | 0.08 | -1.14 | 1.25 | 0.82 | 1.46 |
| Mali | 2.08 | 0.02 | 0.84 | 1.32 | 0.90 | -1.01 | 5.19 | 0.06 | 1.20 | 1.36 | 0.82 | 1.74 |
| Mauritius | 5.11 | 0.24 | 2.36 | 1.00 | 0.65 | 0.85 | 5.36 | 0.46 | 1.95 | 0.64 | 0.61 | 1.69 |
| Mozambique | 2.85 | 0.13 | 0.65 | 0.99 | 1.54 | -0.45 | 8.38 | 0.22 | 2.47 | 1.30 | 1.33 | 3.06 |
| Namibia | 4.39 | 0.08 | -0.01 | 1.84 | 0.55 | 1.93 | 3.25 | 0.26 | 1.16 | -0.31 | 0.55 | 1.59 |
| Niger | 0.40 | 0.02 | -0.83 | 1.74 | 1.45 | -1.98 | 3.48 | 0.03 | -0.09 | 1.94 | 1.27 | 0.34 |
| Nigeria | 3.36 | 0.26 | 0.54 | 1.60 | 1.63 | -0.67 | 2.80 | 0.18 | 0.93 | 2.63 | 1.42 | -2.35 |

*Continued next page*

**Sub-Sahara Africa (30 Economies) (continued)**

| | Period 1989-1995 | | | | | | Period 1995-2001 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Sources of Growth (% points per annum) | | | | | | Sources of Growth (% points per annum) | | | | |
| | | Capital | | Labor | | | | Capital | | Labor | | |
| Economy | GDP Growth | ICT | Non-ICT | Hours | Quality | TFP | GDP Growth | ICT | Non-ICT | Hours | Quality | TFP |
| Senegal | 1.87 | 0.09 | 0.98 | 1.52 | 0.91 | -1.63 | 5.21 | 0.57 | 1.71 | 1.46 | 0.86 | 0.60 |
| South Africa | 0.66 | 0.22 | -0.02 | 1.74 | 1.04 | -2.32 | 2.64 | 0.44 | 0.20 | 0.28 | 0.54 | 1.18 |
| Swaziland | 3.74 | 0.04 | 1.19 | 2.25 | 0.77 | -0.51 | 2.98 | 0.18 | 1.34 | 2.09 | 0.69 | -1.31 |
| Tanzania | 2.62 | 0.09 | 1.08 | 1.81 | 1.06 | -1.42 | 4.43 | 0.17 | 0.40 | 1.53 | 0.97 | 1.36 |
| Togo | 0.02 | 0.06 | -0.04 | 1.19 | 1.00 | -2.20 | 1.79 | 0.59 | -0.26 | 1.88 | 0.87 | -1.30 |
| Uganda | 6.69 | 0.06 | 1.51 | 1.72 | 0.95 | 2.45 | 6.05 | 0.18 | 2.47 | 0.92 | 0.86 | 1.63 |
| Zambia | -1.26 | 0.07 | -1.68 | 1.43 | 0.98 | -2.06 | 3.10 | 0.14 | -0.79 | 1.56 | 0.66 | 1.53 |
| Zimbabwe | 2.12 | 0.05 | 1.79 | 1.66 | 1.11 | -2.49 | 0.14 | 0.38 | 0.01 | 1.07 | 0.98 | -2.30 |
| **All Group** | **1.65** | **0.15** | **0.37** | **1.67** | **1.10** | **-1.63** | **3.24** | **0.29** | **0.69** | **1.08** | **0.81** | **0.36** |

## North Africa and Middle-East (11 Economies)

| Economy | Period 1989-1995 | | | | | | Period 1995-2001 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GDP Growth | Sources of Growth (% points per annum) | | | | | GDP Growth | Sources of Growth (% points per annum) | | | | |
| | | Capital | | Labor | | | | Capital | | Labor | | |
| | | ICT | Non-ICT | Hours | Quality | TFP | | ICT | Non-ICT | Hours | Quality | TFP |
| Algeria | 0.35 | 0.03 | 0.11 | 0.97 | 1.24 | -2.00 | 3.03 | 0.03 | 0.17 | 1.75 | 1.09 | -0.01 |
| Egypt | 3.70 | 0.11 | 0.21 | 1.15 | 0.90 | 1.33 | 4.87 | 0.26 | 0.62 | 2.10 | 0.85 | 1.03 |
| Iran | 5.41 | 0.19 | 0.19 | 1.26 | 1.74 | 2.04 | 3.93 | 0.40 | 0.80 | 1.48 | 1.50 | -0.24 |
| Jordan | 5.88 | 0.05 | 1.28 | 3.93 | 0.89 | -0.26 | 3.27 | 0.23 | 0.77 | 2.55 | 0.79 | -1.07 |
| Lebanon | 13.51 | 0.17 | -1.08 | 1.89 | 0.85 | 11.67 | 2.10 | 0.32 | 0.12 | 1.57 | 0.73 | -0.64 |
| Mauritania | 3.38 | 0.04 | -0.09 | 1.51 | 1.17 | 0.75 | 3.98 | 0.27 | 1.20 | 1.76 | 1.04 | -0.29 |
| Morocco | 1.42 | 0.06 | 0.84 | 0.65 | 0.81 | -0.94 | 3.94 | 0.28 | 1.00 | 1.59 | 0.76 | 0.31 |
| Syrian Arab Rep. | 7.60 | 0.10 | 0.14 | 2.19 | 1.34 | 3.84 | 3.14 | 0.20 | 0.17 | 2.17 | 1.10 | -0.49 |
| Tunisia | 4.45 | 0.03 | 0.97 | 1.80 | 0.83 | 0.81 | 5.33 | 0.09 | 1.22 | 1.48 | 0.78 | 1.76 |
| Turkey | 4.10 | 0.11 | 1.83 | 1.77 | 0.75 | -0.36 | 1.86 | 0.34 | 1.93 | 1.23 | 0.64 | -2.28 |
| Yemen, Rep. | 5.45 | 0.08 | 2.19 | 3.41 | 1.39 | -1.62 | 5.57 | 0.12 | 2.65 | 1.73 | 1.21 | -0.14 |
| **All Group** | **3.87** | **0.11** | **0.74** | **1.40** | **1.13** | **0.50** | **3.43** | **0.28** | **1.02** | **1.59** | **1.00** | **-0.46** |
| **The World (116 Economies)** | **2.53** | **0.26** | **0.86** | **0.44** | **0.60** | **0.37** | **3.51** | **0.56** | **0.99** | **0.71** | **0.48** | **0.77** |

**Figure 3.1A Sources of Output Growth by Group of Economies**

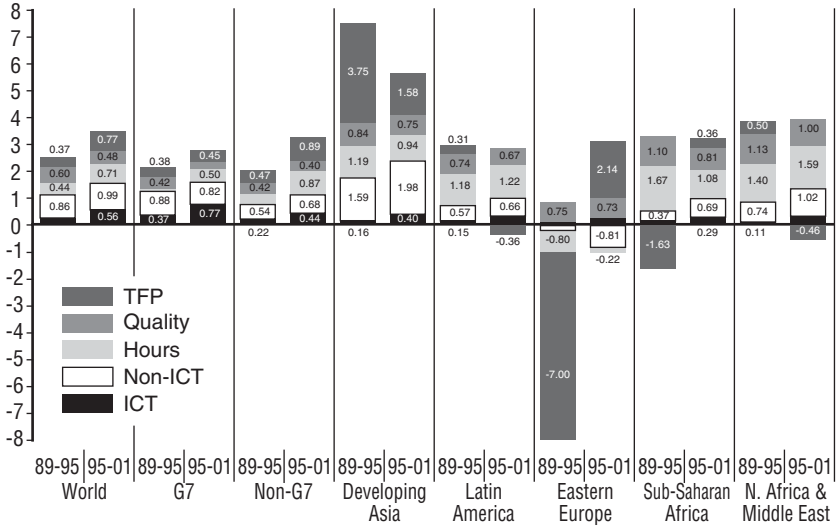
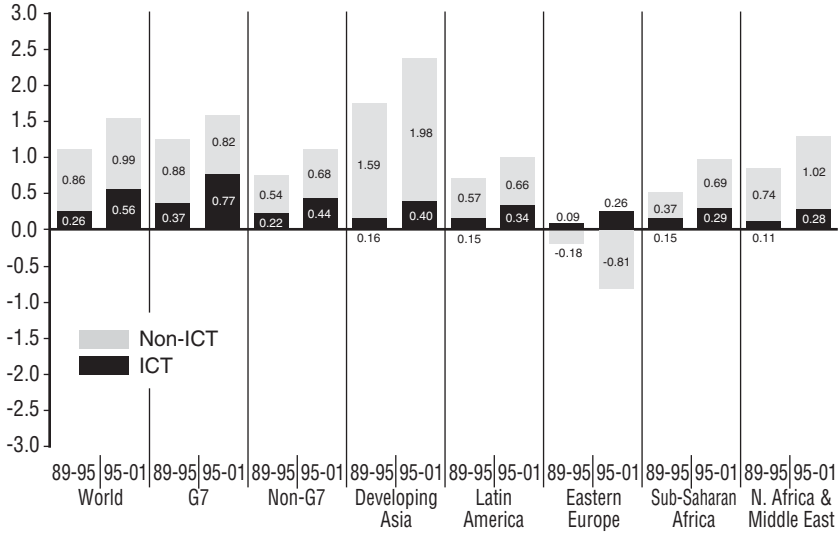


**Figure 3.1B Capital Input Contribution to Growth by Group of Economies**



## References

Ahmad, Nadim, Paul Schreyer, and Anita Wolfl (2004), "ICT Investment in OECD Countries and Its Economic Impact," Chapter 4 in OECD, The Economic Impact of ICT: Measurement, Evidence, and Implications, Paris: Organization for Economic Co-operation and Development.

Baldwin, John R., and Tarek M. Harchaoui (2003), Productivity Growth in Canada—2002, Ottawa: Statistics Canada.

Barro, Robert J., and Jong-Wha Lee (2001), "International Data on Educational Attainment: Updates and Implications," Oxford Economic Papers, Vol. 53, No. 4, July, pp. 541-563.

Business Software Alliance (2003), Global Software Piracy Study: Trends in Piracy, 1994-2002, Washington, DC: Business Software Alliance USA, June. See:

http://www.bsa.org/usa/research/loader.cfm?url=/commonspot/utilities/handle-link.cfm&thelink=CP___PAGEID=16808,index.cfm,443.

Daveri, Francesco (2002), "The New Economy in Europe: 1992-2001," Oxford Review of Economic Policy, Vol. 18, No. 4, September, pp. 345-362.

Grimm, Bruce, Brent Moulton, and David Wasshausen (2004), "Information Processing Equipment and Software in the National Accounts," in Carol Corrado, John Haltiwanger, and Daniel Sichel, eds., Measuring Capital in the New Economy, Chicago, IL: University of Chicago Press, forthcoming. See: http://www.nber.org/books/CRIW02/grimm-et-al7-22-04.pdf.

Heston, Alan, Robert Summers, and Bettina Aten (2002), Penn World Table Version 6.1, Philadelphia, PA: Center for International Comparisons at the University of Pennsylvania (CICUP), October. See: http://pwt.econ.upenn.edu/aboutpwt.html.

International Telecommunications Union (2004), World Telecommunications Indicators, Geneva: International Telecommunications Union, October. See: http://www.itu.int/ITUD/ict/publications/world/world.html.

Jorgenson, Dale W. (2001), "Information Technology and the U.S. Economy," American Economic Review, Vol. 91, No. 1, March, pp. 1-32.

_____ (2003), "Information Technology and the G7 Economies," World Economics, Vol. 4, No. 4, October-December, pp. 139-170.

Jorgenson, Dale W., and Kazuyuki Motohashi (2004), "Information Technology and the Japanese Economy," Tokyo: 17th Annual Trio Conference, December. See:

http://www.nber.org/~confer/2004/triof04/motohashi.pdf.

Jorgenson, Dale W., and Kevin J. Stiroh (2000), "Raising the Speed Limit: U.S. Economic Growth in the Information Age," Brookings Papers on Economic Activity, 1, pp. 125-211.

Jorgenson, Dale W., and Eric Yip (2000), "Whatever Happened to Productivity Growth?" in Charles R. Hulten, Edwin R. Dean, and Michael J. Harper, eds., New Developments in Productivity Analysis, Chicago, IL: University of Chicago Press, pp. 509-540.

Kaufmann, Daniel, Aart Kray, and Massimo Mastruzzi (2004), "Governance Matters III: Governance Indicators for 1996-2002," Washington, DC: World Bank, April. See: http://www.worldbank.org/wbi/governance/pdf/govmatters3_wber.pdf.

Krugman, Paul (1994), "The Myth of Asia's Miracle," Foreign Affairs, Vol. 73, No. 6, November/December, pp. 62-78.

Lau, Lawrence J. (1999), "The Sources of East Asian Economic Growth," in Gustav Ranis, Sheng-Cheng Hu, and Yun-Peng Chu, The Political Economy of Comparative Development in the 21st Century, Northampton, MA: Edward Elgar, pp. 45-75.

Maddison, Angus (2001), The World Economy: A Millenial Perspective, Paris, Organization for Economic Co-operation and Development.

Organization for Economic Co-operation and Development (2002), Purchasing Power Parities and Real Expenditures, 1999 Benchmark Year, Paris, Organization for Economic Co-operation and Development. See: http://www.sourceoecd.org.

Oliner, Stephen D., and Daniel J. Sichel (2000), "The Resurgence of Growth in the Late 1990's: Is Information Technology the Story?" Journal of Economic Perspectives, Vol. 14, No. 4, Fall, pp. 3-22.

Piatkowski, Marcin (2004), "Information Society in Poland: A Prospective Analysis," Warsaw: Transformation, Integration, and Globalization Economic Research, August. See:

http://www.tiger.edu.pl/onas/piatkowski/Information_Society_in_Poland_A_Prospective_Analysis.pdf.

van Ark, Bart, Johanna Melka, Nanno Mulder, Marcel Timmer, and Gerard Ypma (2003), ICT Investment and Growth Accounts for the European Union, 1980-2000, Brussels, European Commission, March. See: http://www.ggdc.net/pub/online/gd56-2(online).pdf.

United Nations (2004), Human Development Report 2004, New York, NY: United Nations. See: http://hdr.undp.org/.

World Bank (2004), World Development Indicators 2004, Washington, DC: World Bank. See: http://www.worldbank.org/data/wdi2004/index.htm.

World Information Technology and Services Alliance, Digital Planet Report (2002, 2004), Washington, DC, World Information Technology and Services Alliance. See: http://www.witsa.org/.

Young, Alwyn (1995), The Tyranny of Numbers: Confronting the Statistical Realities of the East Asian Growth Experience," Quarterly Journal of Economics, Vol. 106, No. 1, August, pp. 641-680.

_____ (2003), "Gold into Base Metals: Productivity Growth in the People's Republic of China during the Reform Period," Journal of Political Economy, Vol. 111, No. 6, December, pp. 1220-1261.

# *Chapter 5*

# Innovation, Technology and Productivity: Why Europe Lags Behind the United States and Why Various European Economies Differ in Innovation and Productivity[1]

Luc Soete

## Introduction

It seems particularly appropriate to discuss in more detail the core of what has become known in the European debate as the Lisbon challenge. As the most recent Economist Intelligence Unit report[2] argues, "The new economy story linked with ICT appears to come nearest to explaining divergent trends in the US and euro zone, although it is not definitive and important issues remain unclear, including the precise relationship between ICT and the overall policy framework." Following Dale Jorgenson's detailed overview of the evidence on international comparisons among the G-7 nations in productivity growth, I will focus here on some of the underlying main underlying policy issues for the European economies.

If there is any general policy slogan that might be appropriate in describing the challenge European countries face today in trying to achieve the Lisbon knowledge agenda[3] it would be, I submit, the need for policies "*activating knowledge*." The most relevant comparison to

---

[1] Paper presented at the Conference: "The Network Society and the Knowledge Economy: Portugal in the global context" Lisbon, March 5-6, 2005.

[2] EIU executive briefing, *US/EU economy: Is it a "new economy" story after all?* February 22, 2005, http://eb.eiu.com/index.asp?layout=show_article_print&article_id=6

[3] In the following paragraphs, I limit myself to that part of the Lisbon agenda dealing with policies aimed at strengthening incentives for knowledge investments, not the social dimension.

be made here is with policies for "activating labor," which rose to popularity in Europe, and the UK in particular, in the early 1990s and were instrumental in reducing long term, structural unemployment.[4] Such policies focused on the many "passive" features of the highly regulated European labor markets, and the way these features had contributed to a rise in the structural component of long-term unemployment. "Active labor" market reforms aimed in the first instance at reducing labor market entry barriers, and in particular low wage unemployment traps, and increasing labor market flexibility, without putting in jeopardy the essence of the social security protection model typical of most European countries' welfare systems. In countries which went furthest ahead in such "active labor" market reforms such as the UK, the Scandinavian countries and The Netherlands, the result was not only a significant reduction in unemployment, but also sometimes impressive increases in employment participation rates of particular, underrepresented groups in the labor market which had become "activated" such as women and youngsters. Over time and with the formal assessment at the European level of such labor market reform policies—the so-called Luxembourg process—active labor market policies became a full and integral part of employment policies in most European countries.

The challenge today appears more or less similar, but this time with respect to the need for "activating knowledge," the essential ingredient for any policy aimed at increasing growth incentives in Europe.

As noted in the Sapir report,[5] since Lisbon (March 2000) European growth performance has been, contrary to expectations, weak, highlighting in particular the failure of the current European Union policy framework to provide sufficient national as well as EU-wide growth inducing incentives. This holds both for the Growth and Stability Pact as well as for structural, sector specific EU policies such as the Common Agricultural Policy or Social Cohesion Policy, which have been poor in bringing about structural growth enhancing reform. Also with respect to ICT use, research and development, innovation and

[4] See in particular the OECD's so-called *Job Study* (1994), which became a staunch defender of the need for such policies in Europe.

[5] See Sapir, A. et al. *An Agenda for a Growing Europe, The Sapir Report*, Oxford University Press, 2004.

knowledge more generally, policies pursued both in member countries and at the EU level seem to have been dominated by the old scale intensive industrial type, too much based on strengthening the competitiveness of existing firms and sectors and too little of the growth enhancing, innovation and creative destruction type.

Without such specific growth enhancing policies, the restrictive macro-economic policies introduced within the framework of the Growth and Stability pact in the euro zone countries have, if anything, exacerbated the "*non-active*" nature of knowledge activities. Under this low growth, restrictive fiscal scenario, public knowledge funding activities such as the delivery of (highly) skilled youngsters from universities, professional and technical high schools, or the research carried out within universities and public research laboratories, have remained by and large passive. Because of the lack of growth opportunities, public research output has remained by and large unused and unexploited in the rest of the economy and in particular the private sector. In the best (some might say worst) case they have only contributed to efforts abroad, i.e. to other countries through migration or through the transfer of knowledge to foreign firms and universities. Private knowledge funding activities on the other hand, due to lack of domestic growth opportunities, have been cut, rationalized, outsourced to foreign countries, or simply frozen. The Lisbon knowledge growth challenge is more than ever a real one: many countries particularly in continental Europe are in danger of a long term downward adjustment to a low knowledge intensive, low growth economy.[6]

Notwithstanding what was noted above about the particular need in continental Europe for innovative, creative destruction renewal, a policy of "*activating knowledge*" should, and probably first, build on existing strengths in knowledge creation and use. At the same time it should, however, aim at activating competencies, risk taking and readiness to innovate. In short, a policy aimed at activating knowledge should be directed towards the activation of unexploited forms of knowledge.

---

[6] In a recent Dutch article, two civil servants from the Ministry of Finance actually made the claim that the Dutch economy has, and I quote: "no comparative advantage in high tech goods." Furthermore, by importing high tech goods, the Dutch economy would actually benefit much more from those foreign productivity gains. See Donders, J. en N. Nahuis "De risico's van kiezen," ESB, 5 maart 2004, p.207. Similar arguments have been made at the EU level by John Kay.

The claim made here is that there are many of such forms, covering the full spectrum of knowledge creation, knowledge application and knowledge diffusion. ICT plays a crucial role in each of these areas. Furthermore, such policies should be directed towards public knowledge institutions, including higher education institutions; financial institutions not just venture capital providers; private firms in manufacturing as well as services; and last but not least individuals, as entrepreneurs, employee or employer, producer or consumer.

In this short contribution, the focus is very much on the first of these areas, the one governments have actually the biggest latitude for intervention and attempting at least to activate knowledge: public knowledge institutions. Five aspects of such knowledge investments, which are at the heart of the Lisbon agenda, will be discussed.

First is the issue of public investments in research and development. In most member countries public research institutions including universities have become increasingly under funded. "Activating" national budgets so as to free more money for public investment in such knowledge investments appears the easiest and most straightforward policy measure to be implemented given the commitment EU member countries already took in Barcelona.

Second, there is the need for improving the matching between private and public knowledge investment efforts. Increasingly, I would argue, European countries are confronted with a growing mismatch between private and public research investments.

Third, there appears also an urgent need for activating research in universities and other public research institutions in Europe. If there is one reservoir of unused knowledge potential it is likely to be found in those institutions.

Fourth, policies should be designed to activate human capital and knowledge workers. Shortages of research personnel loom large on the European horizon.

Fifth and foremost, there is in Europe a need for policies activating innovation.

Maybe there is a trade-off between innovation and creative destruction on the one hand and social security and stability on the other

hand. But maybe existing social security policies can also become "activated" towards innovation, creative destruction, and entrepreneurship.

## *1. "Activating Lisbon": beyond the simple Barcelona targets*

It was the growing awareness of Europe's falling behind in knowledge creation and knowledge diffusion which induced European heads of state to set the objective at the Lisbon summit in March 2000 to become the world's most competitive and dynamic knowledge economy by 2010. The Lisbon knowledge objective were translated into the so-called Barcelona target in the spring of 2002, whereby European countries would aim to spend approximately 3% of their Gross Domestic Product on investment in research, development, and innovation by 2010, a figure comparable to the current investment percentages in the United States and Japan.

It is unfortunate that the European Lisbon target was so explicitly translated into the Barcelona objective of 3%, an investment cost objective. Equally important, if not more so, is the question what the results—in terms of efficiency and effectiveness—of these investments would be. Furthermore, the separation of the 3% norm into a public component set at 1% of GDP, and a private component set at 2% of GDP, ignored some of the more fundamental differences between the United States (on which this separation was based) and most European countries' taxing regimes (neutral versus progressive) and the implications thereof for private and public parties, and in particular the role of public authorities in the funding of research and development. Particularly in continental European countries, it can be expected that both enterprises and individual citizens will, given the progressiveness of their income taxes, expect a higher contribution of public authorities in the financing of higher education and research. Their relatively "passive" attitude towards private investments in knowledge (most European citizens are perfectly happy to increase their indebtedness to acquire private property, and have large parts of their income spent most of their working life on mortgage repayments, but not to invest in their or their children's education and schooling) is to some extent the direct consequence of the progressive tax regimes most middle and high income families are confronted with over their working and family life.

To aim for a double effort of the private sector compared to the public one in knowledge investment is to ignore the different role of public authorities in Europe as opposed to the U.S. Furthermore, given the relatively limited leeway European public authorities have in inducing private firms to increase their R&D investments (the only feasible instrument: national R&D tax advantages contains substantial beggar-thy-neighbour elements in it and is likely to become increasingly challenged at the European court level), the Barcelona target appears ultimately a rather weak policy "focusing device" on the road to Lisbon.

Nevertheless, attainment of the public funding target of 1% of GDP in so far as it is something practical governments can do, could be elevated to an absolute minimum policy priority. How to achieve this within the current, highly restrictive budgetary framework conditions of most EU member countries? By "activating national budgets" in a growth enhancing direction, one could argue, redirecting government expenditures towards such knowledge investments, just as the Sapir report forcefully argued with respect to the EU budget.

But as will also be clear from what was said before, the setting of simplistic target objectives in the area of knowledge dynamics and innovation, even limited to the public sector, raises many questions.

First and foremost, there are factual questions. How real is the knowledge gap? The Barcelona target only addressed one highly imperfect, knowledge input indicator: R&D expenditures. Firms are not interested in increasing R&D expenditures just for the sake of it but because they expect new production technology concepts, new products responding to market needs, to improve their own efficiency or strengthen their competitiveness. If at all possible, firms will actually try to license such technologies or alternatively outsource at least part of the most expensive knowledge investments to suppliers of machinery, rather than have to forego themselves those costly investments. Today most firms are actually keen on increasing the efficiency of R&D by rationalizing, or reducing the risks involved in carrying out R&D, outsourcing it to separate small high tech companies which operate at arms length but can be taken over, once successful. Furthermore industrial R&D investment on which the Barcelona tar-

gets are based is heavily biased in favour of industrial production. Service sectors but also more engineering based activities are likely to be strongly underrepresented. As a result, the question about the "real" knowledge gap of Europe with respect to the U.S. remains very much subject to debate.

Central in this debate is the extent to which the commercial benefits of knowledge investments can be appropriated and by whom—the firm within the sector having made the R&D efforts, or a firm upstream or downstream? Or the final consumer, imitation taking place so quickly that none of the new product rents could be appropriated by the innovator?

It might well be that sectors and activities with little registered R&D-effort have a complex and actually deep knowledge base. Some of the most competitive European industries e.g., the offshore and dredge industry, the food processing, finance or insurance industry, carry out little if no R&D. According to OECD classifications, these are typically medium to low-technology industries. The knowledge bases appropriate to these industries display, however, great technical depth and variety. The list of institutions providing support and development of these different knowledge bases is similarly long and diverse. Thus a low-R&D industry may well be a major user of knowledge generated elsewhere. The same holds of course for many service sectors, where the introduction of new process or organizational structures as well as new product innovations, is unlikely to involve much formal R&D investment. But here too, the crucial question will be the extent to which such innovations can be easily imitated or can be formally protected through trademarks, copyrights or other forms of intellectual property, or kept secret.

The same argument holds at the international level. Again the central question will be whether the commercial benefits of knowledge investments can be appropriated domestically or are "leaking" elsewhere, to other countries. In the economic growth literature, the phenomenon of catching-up growth is typically characterized by lagging countries benefiting from the import, transfer of technology and knowledge, formally and particularly informally. In the current, increasingly global world economy, increasing R&D investment is hence unlikely to benefit only the domestic economy. This holds *a forteriori* for the EU with its twenty five independent member countries.

Thus, as highlighted by Meister and Verspagen (2003), achieving the 3% Barcelona target by 2010 is not really going to reduce the income gap with the U.S., the benefits of the increased R&D efforts not only accruing to Europe but also to the U.S. and the rest of the world.

In a similar vein, Griffith, Harrison and Van Reenen (2004) have illustrated how the U.S. innovation boom of the 1990s had major benefits for the UK economy, and in particular for UK firms that had shifted their R&D to the U.S. A UK firm shifting 10% of its innovative activity to the U.S. from the UK while keeping its overall level the same, would be associated with an additional increase in productivity of about 3%. "This effect is of the same order of magnitude as that of a doubling in its R&D stock" (Griffith et al. 2004, p.25).

In short, the link between the location of "national" firms' private R&D activities and national productivity gains is, in the current, increasingly global R&D world, at best tenuous.

To conclude this first section: achieving the Barcelona target should be brought back to what governments can practically achieve in the area of knowledge investment. Setting a common European target, such as the Barcelona one, can be useful if, but only if, it sharpens policy priorities. The current translation of those targets in public and private targets does anything but sharpen policy priorities. On the contrary, the debate on government expenditures in the euro zone countries is completely dominated by the other European 3% fiscal norm. That norm provides, however, no incentive to redirect public funding in the direction of knowledge enhancing investments. The most immediate measure policy makers should take is to reform their budget priorities in the direction of knowledge enhancing growth activities by raising as a minimum the public funding of R&D to the 1% of GDP level.

## *2. Activating the "joint production" of knowledge: attracting private R&D*

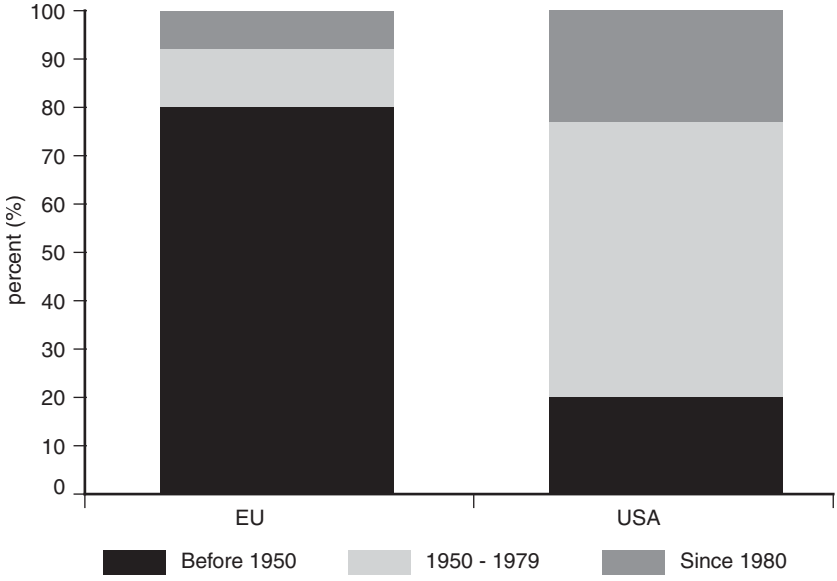
Knowledge production is typically characterized by so-called "joint production" features: what modern growth economists have described as the increasing returns features of knowledge growth accumulation. In more down to earth terminology, knowledge investments by both

private and public authorities have been characterized by strong complementarities and from a geographical perspective strong agglomeration features. In most continental European countries this led over the postwar period to a rapid catching up in public and private R&D[7] investments, particularly by large domestic firms in their home country. Such investments were often rather closely in line with national public R&D investments. In the late 1970s and early 1980s most European countries had actually caught up with the U.S. in private R&D investment. Technical high schools and universities were often closely integrated in this privately led knowledge investment growth path. This "national champion" led R&D catching up process led actually to a strong "over-concentration" of domestic R&D investments of such firms in their country of origin, certainly when compared to their international production activities. Along with the further internationalization (and 'Europeanization' in the running up to the 1992 European single market) of production, R&D investments became also more subject to internationalization. Initially, this was limited to R&D activities strongly linked to the maintenance and adjustment of production processes and product technology to the foreign market conditions, later on it involved also more fundamental research activities.

In short, a sheer natural trend towards the international spread of private R&D of the large European multinationals took place, on which much of individual member countries' knowledge strength had been built. By the same token, many of the close domestic connections between private and local public research institutions became weaker. This process is far from over, given the still wide disparities in the concentration of domestic R&D versus international sales. At the same time the renewal rate of R&D intensive firms in Europe was particularly poor. The rapid growth in the gap in the 1990s between the total amount of R&D spent by private firms in Europe and by private firms in the U.S., is a reflection of this lack in renewal of high growth firms in Europe as compared to the U.S., as illustrated in Figure 4.1 below.

[7] The UK's R&D spending remained in the early postwar period at a much higher level, more or less in line with that of the U.S., than that of most continental European countries primarily as a result of the large government spending in the military, aerospace industries and other public utilities sectors.

**Figure 4.1 EU and US firms' renewal in the post-war period**

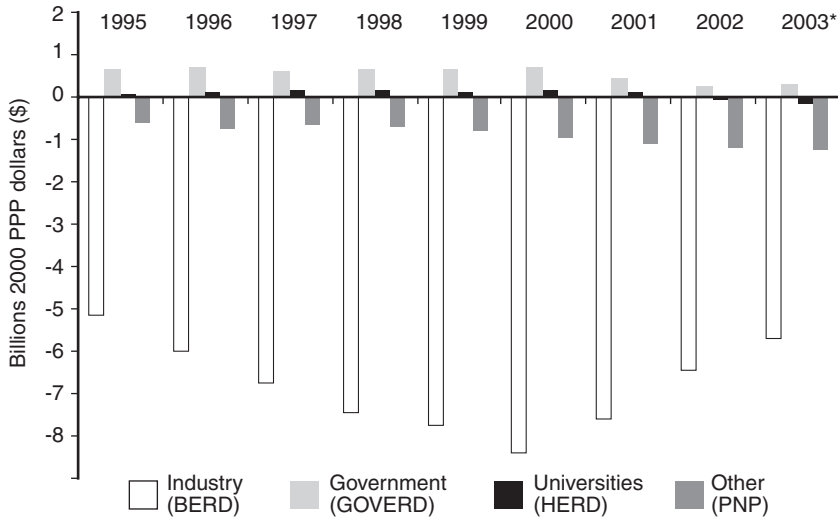



It is worthwhile noting that the gap between Europe and the U.S. in privately *financed* R&D, as illustrated in Figure 4.2a, is first and foremost a gap in R&D *performed* in the private sector (Figure 4.2b), i.e. R&D carried out in the private sector but funded both by private as well as public funds (including in the latter case in the U.S. primarily military R&D). Actually with respect to R&D *performed* in the public sector, there is no gap between Europe and the U.S., yet there remains a substantial gap in publicly *financed* R&D. The widening of the EU-U.S. gap over the 1990s between privately *performed* R&D suggests that firms under the pressure of internationalization increasingly turned their back on national European public research institutes and concentrated rather their R&D activities elsewhere in the world, and particularly in the U.S. Surprisingly since 2000, the gap between the U.S. and the EU has actually declined significantly. However, this decline is first and foremost the result of a decline in the R&D performed in the business sector in the U.S.

Universities and other public research institutes in Europe, under funded, failed by and large, and in contrast to their counterparts in the U.S., to provide the attractor pole to European (and foreign) firms for

joint knowledge production—a role they actually fulfilled for many years within their secure national "cocooning" borders. It seems hence reasonable to conclude that Europe suffered from the fragmentation of what were relatively closed national, joint production R&D systems, with national R&D champions internationalizing their R&D activities due to both internal EU pressures in the late 1980s and external competition pressures in the 1990s, while public research institutions remained incapable of providing sufficient private R&D renewal.

**Figure 4.2A Gap in EU25—US R&D spending**




Source: OECD-MSTI. 2003* MERIT estimate

## *3. Activating university and fundamental research*

The internationalization process described above has also been accompanied by a process of "*crowding out*" of fundamental, basic research from private firms' R&D activities. This process took place in most large firms in the 1980s and found its most explicit expression in the reorganization of R&D activities, from often autonomous laboratories directly under the responsibility of the Board of Directors in the 1960s to more decentralized R&D activities integrated and fully part of separate business units. Today only firms in the pharmaceutical sector