

LATIN AMERICA AND THE WORLD ECONOMY (revised October 29, 2007)

Authors: Dale W. Jorgenson

Harvard University

djorgenson@harvard.edu

and

Khuong Vu

National University of Singapore

sppkmv@nus.edu.sg

Abstract: This paper analyzes the impact of investment in information technology (IT) on the recent resurgence of growth in Latin America and the world economy. We describe the growth of the world economy, seven regions, including Latin America, and fourteen major economies during the period 1989-2005. We allocate the growth of world output between input growth and productivity and find, surprisingly, that input growth greatly predominates! Moreover, differences in per capita output levels are explained by differences in per capita input, rather than variations in productivity. The contributions of IT investment have increased in all regions, but especially in industrialized economies and Developing Asia.

Key words: growth, information technology, investment, Latin America, productivity.

JEL classification: O47.

LATIN AMERICA AND THE WORLD ECONOMY*

by

Dale W. Jorgenson and Khuong Vu

1. Introduction.

The purpose of this paper is to analyze the impact of investment in information technology (IT) equipment and software on the recent revival of growth in Latin America and the world economy. The crucial role of IT investment in the growth of the U.S. economy has been thoroughly documented and widely discussed.¹ Jorgenson (2001) has shown that the remarkable behavior of IT prices is the key to understanding the American growth resurgence since 1995. This behavior can be traced to developments in semiconductor technology that are understood by both 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 These economies account for nearly half of world output and a much larger share of world IT investment. The surge of IT investment resulted

*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. Alessandra Colecchia, Mun S. Ho, Kazuyuki Motohashi, Koji Nomura, Jon Samuels, Kevin J. Stiroh, Marcel Timmer, Gerard Ypma, 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 final responsibility for any remaining deficiencies.

¹See Jorgenson and Stiroh (2000) and Oliner and Sichel (2000). The growth accounting methodology employed in this literature is discussed by Jorgenson, Mun Ho, and Stiroh (2005) and summarized by Jorgenson (2005).

² Ahmad, Schreyer, and Wolfl (2004) have analyzed the impact of IT investment in OECD countries. Timmer, et al., (2003, 2005) and Daveri (2002) have presented comparisons among European economies. Piatkowski and van Ark (2005) have compared the impact of IT investment on the economies of Eastern Europe and the former Soviet Union.

from a sharp acceleration in the rate of decline of prices of IT equipment and software. Jorgenson (2001) has traced this to a drastic shortening of the product cycle for semiconductors from three years to two years, beginning in 1995.

Our methodology for analyzing the sources of growth is based on the production possibility frontier (PPF)³, which describes efficient combinations of outputs and inputs for the economy as a whole, which takes the form:

$$(1) Y = A.f(K,L),$$

where Y is aggregate output, K and L are inputs of capital services and labor services, and A is a "Hick-neutral" augmentation of aggregate inputs. The standard framework can be extended to highlight compositions of the capital and labor inputs as:

$$(2) Y = A.f(K(K_{IT}, K_n), L(H, L_Q)),$$

where K_{IT} and K_n are capital services from IT assets and non-IT assets, respectively, H is total hours worked, and L_Q is labor quality, defined as the ratio of labor input to hour worked.

Under the assumption that product and factor markets are competitive, the extended framework (2) implies the following decomposition:

$$(3) \Delta \ln Y = \bar{v}_{K_{IT}} \Delta \ln K_{IT} + \bar{v}_{K_n} \Delta \ln K_n + \bar{v}_L \Delta \ln H + \bar{v}_{L_Q} \Delta \ln L_Q + \Delta \ln A$$

Where each v represents the input share of the subscripted input; a bar over the shares indicates a two-period average. That is, the output growth ($\Delta \ln Y$) can be decomposed into contributions of IT capital ($\bar{v}_{K_{IT}} \Delta \ln K_{IT}$), non-IT capital ($\bar{v}_{K_n} \Delta \ln K_n$), labor hour worked ($\bar{v}_L \Delta \ln H$), labor quality ($\bar{v}_{L_Q} \Delta \ln L_Q$), and total factor productivity growth ($\Delta \ln A$).

³ This model is introduced in Jorgenson (1996, pp. 27-28).

We have compiled the data for economic indicators from WDIO(2007) and data on capital and labor services for the EU countries and Japan from EUKLEMS(2007). We have constructed estimates of labor quality and ICT investment as follows:

- We updated the data from Jorgenson (2003) for the US and Canada and used the data from EUKLEMS(2007) for Japan and the 14 European countries: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Netherlands, Slovenia, Spain, Sweden, United Kingdom.
- For all other economies we estimate ICT capital stock from data on ICT expenditures from WITSA(2006) and data on ICT penetration from WDI(2007). In estimating IT capital services we assume the hedonic price indices for computer hardware, computer software, and telecommunication equipment in these countries follow the same patterns observed for the U.S. Further details on our methodology for estimating ICT capital stocks and labor quality can be found in the electronic version of Jorgenson and Vu (2005, http://post.economics.harvard.edu/faculty/jorgenson/papers/handbook_worldgrowthresurgenc_appendix_050810.pdf.)

Our data sample consists of 110 economies accounting for over 95% of the world GDP and ICT expenditures. We allocate the 110 economies into seven economic regions:

1. G7 (seven largest industrialized economies): Canada, France, Germany, Italy, Japan, United Kingdom, United States.
2. Non-G7 (15 non-G7 industrialized economies): Australia, Austria, Belgium, Denmark, Finland, Greece, Ireland, Israel, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland.
3. Developing Asia (16 economies):: Bangladesh, Cambodia, China, Hong Kong, India, Indonesia, Malaysia, Nepal, Pakistan, Philippines, Singapore, South Korea, Sri Lanka, Taiwan, Thailand, Vietnam.

4. Latin America (19 economies): Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Trinidad and Tobago, Uruguay, Venezuela.
5. Eastern Europe and the former Soviet Union (14 economies): Albania, Bulgaria, Croatia, Czech Rep., Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia, Ukraine.
6. Sub-Saharan Africa (28 economies): Benin, Botswana, Burkina Faso, Cameroon, Central African Rep., Chad, Congo Rep., Cote d'Ivoire, Ethiopia, Gabon, Ghana, Guinea, Kenya, Madagascar, Malawi, Mali, Mauritius, Mozambique, Namibia, Niger, Nigeria, Senegal, South Africa, Swaziland, Tanzania, Togo, Uganda, Zambia.
7. North Africa and Middle-East (11 economies): Algeria, Egypt, Iran, Jordan, Lebanon, Mauritania, Morocco, Syria, Tunisia, Turkey, Yemen.

In Section 2 we describe the growth of the world economy, the seven economic regions, the G7 economies, China and India, which belong to the Developing Asia group, and the seven major economies of Latin America during the period 1989-2005. We have sub-divided the period 1989-2005 into 1989-1995, 1995-2000, and 2000-2005 in order to focus on the response of IT investment to the accelerated decline in IT prices in 1995 and the impact of the dot-com crash of 2000.

World economic growth has undergone a powerful revival since 1995. The GDP growth rate jumped more than a full percentage point from 2.67 percent during 1989-1995 to 3.80 percent in 1995-2000 and 3.82 percent in 2000-2005. We can underscore the significance of more rapid growth by pointing out that GDP growth of 2.67 percent doubles world output by four times in a century, while 3.80 percent doubles output more than five times per century.

In Section 3 we allocate the growth of world output between input growth and productivity. Our most astonishing finding is that input growth greatly predominates! Productivity growth accounted for less than one-fifth of the total during 1989-1995, while input growth accounted for more than four-fifths. Similarly, input growth contributed almost three-quarters of

growth from 1995-2000 and almost two thirds from 2000-2005. The only departure from this world-wide trend was the revival of economic growth in Eastern Europe after 1995, driven by a rebound from the productivity collapse of 1989-1995.

In Section 3 we distribute economic growth between investments in human capital and tangible assets, especially IT equipment and software. The world economy and all seven regions experienced a surge in investment in IT after 1995. The soaring level of U.S. IT investment after 1995 was paralleled by jumps in IT investment throughout the industrialized world. The contributions of IT investment to growth in Developing Asia, Latin America, Eastern Europe, North Africa and the Middle East, and Sub-Saharan Africa doubled after 1995, beginning from much lower levels.

The contribution of IT investment to growth of the world economy has moderated substantially since the dot-com crash of 2000. However, the contribution of IT investment has continued to rise for Developing Asia, Latin America, Eastern Europe, North Africa and the Middle East, and Sub-Saharan Africa. The contributions of Non-IT investment and labor input to world growth declined after the dot-com crash, but total factor productivity growth rose substantially, reflecting considerable increases in four groups: Developing Asia, Eastern Europe and the former Soviet Union, Sub-Saharan Africa, and North Africa and the Middle East.

In Section 4 we present levels of output per capita, input per capita, and productivity for the world economy, the seven economic regions, the G7 economies, and the seven major economies of Latin America. We find that differences in per capita output levels are explained more by differences in per capita input than variations in productivity. Taking U.S. output per capita in 2000 as 100.0, world output per capita was 25.8 in 2005. Using similar scales for input and productivity, world input per capita in 2005 was 49.8 and world productivity was 51.9. Section 5 concludes the paper.

2. World Economic Growth, 1989-2005.

In order to set the stage for analyzing the impact of IT investment on the growth of the world economy, we first consider the shares of world product and growth for the seven regions, the G7 economies, and seven major economies of Latin America presented in Table 1. Following Jorgenson (2001), we have chosen GDP as a measure of output.

The G7 economies accounted for slightly under half of world product from 1989-1995. The GDP growth rates of these economies - 2.14 percent for 1989-1995, 3.11 percent from 1995-2000, and 2.06 percent during 2000-2005 - lagged considerably behind world growth rates for these periods. The G7 shares in world growth were 40.0 percent during 1989-1995 and 39.1 percent from 1995-2000, but only a meager 24.2 percent during 2000-2005. This led to a decline of almost five percentage points in the G7 share of world product from 49.7 percent in 1989-1995 to 44.9 percent during 2000-2005.

During 1989-1995 the U.S. accounted for 22.2 percent of world product and 44.7 percent of G7 product. The U.S. share of G7 output rose to 46.3 percent from 1995-2000 and 48.1 percent during 2000-2005. After 1995 Japan fell from its ranking as the world's second largest economy to third largest after China, but remained second among the G7 economies. Germany dropped from fourth place before 1995, following the U.S., China, and Japan, to fifth place after 1995, ranking behind India as well. However, Germany retained its position as the leading European economy. France, Italy and the U.K. were considerably smaller, but similar in size. Canada was the smallest of the G7 economies.

The share of the entire G7 group in world growth is much lower than its share in the world product for the three periods 1989-1995, 1995-2000, and 2000-2005. This observation holds for each G7 economy, except for the U.S. and Canada during the period 1995-2000 and Germany during 1989-1995. The U.S. growth rate jumped from 2.44 percent during 1989-1995 to 4.29

percent in 1995-2000, before subsiding to 2.76 percent from 2000-2005. The period 2000-2005 includes the dot-com crash of 2000, the shallow U.S. recession of 2001, and the recovery that followed, while the period 1995-2000 encompasses the IT-generated investment boom of the last half of the 1990's.

The 16 economies of Developing Asia generated only about a fifth of world output before 1995, but 23.9 percent from 1995-2000 and a stunning 27.6 percent after 2000! The burgeoning economies of China and India accounted for 61.1 percent of Asian output during 1989-1995, 64.5 percent in 1995-2000, and 68.7 percent after 2000.⁴ The economies of Developing Asia grew at 7.64 percent before 1995, 5.97 percent from 1995-2000, and 7.15 percent after 2000. These economies generated an astounding 56.7 percent of world growth during the remarkable revival of 1989-1995! Developing Asia's share in world growth declined to 37.6 percent during 1995-2000, below the G7 share of 39.1 percent, but recovered to 51.8 percent during 2000-2005. China alone accounted for more than a quarter of world growth during the period 1989-2005.

The 15 Non-G7 industrialized economies generated 9.3 percent of world output during 1989-1995. However, these economies had lower shares in world growth than world product throughout the period 1989-2005. Their shares in world output dropped to nine percent during 1995-2000 and 8.7 percent after 2000.

All of the economies of the Eastern Europe group experienced a decline in output during 1989-1995 after initiating the transition from socialism to a market economy. Collectively, these economies reduced world growth by 19 percent during the period 1989-1995, lowering their share of world product

⁴The growth rates for China may be exaggerated, as pointed out by Maddison (1998) and Young (2003). For extensive references to the debate over Chinese growth rates and a review of the issues, see the recent critique of Maddison by Holz (2006) and Maddison's (2006) reply.

by more than two percentage points from 7.6 percent during 1989-1995 to 5.5 percent in 1995-2000 and in 2000-2005. However, the growth share of this group has tended to rise, from 2.8 percent in 1995-2000 to 7.5% in 2000-2005.

The Sub-Saharan Africa, which includes 28 economies, has a world output share of about 2 percent, which ranked with Canada. Growth shares in the economies of Sub-Saharan Africa lagged behind their shares in world product before 2000 but showed an increasing trend, from 1.2 percent in 1989-1995 to 1.9 percent in 1995-2000, to 2.3 percent in 2000-2005.

The 11 economies of North Africa and the Middle East, taken together, were comparable in size to France, Italy, or the U.K. The economies of North Africa and the Middle East had a share in world growth of 4.6 percent during 1989-1995, well above their 3.2 percent share in world product. During 1995-2000 their share in world growth fell to 3.5 percent, still above the corresponding share in world product of 3.3 percent. This trend continued with a growth share of 4.0 percent and a product share of 3.4 percent after 2000.

Now we examine the output and growth shares of the Latin American group in greater detail. During 1989-1995 the 9.2 percent share of the Latin American economies in world growth exceeded their 8.4 percent share in world product. However, their growth shares were below their output shares after 1995, and both shares experienced declining trends: The growth share declined to 6.4 percent during 1995-2000, and to 4.9 after 2000, while their output shares dropped to 8.2 percent during 1995-2000, and to 7.8 percent after 2000.

The subgroup of the seven largest Latin American economies, which together account for more than 87 percent of the group output, experienced declining trends similar to those observed for the entire group. Brazil and Mexico were responsible for more than sixty percent of Latin American GDP

throughout the period 1989-2005. However, the shares of these two major Latin American economies in world growth fell below their product shares after 1995, leading to gradual declines in their product shares from 5.1 percent in 1989-1995, to 5.0 during 1995-2000, and 4.7 percent after 2000. It is worth noting that the growth of Mexico was more closely correlated with the performance of the US economy, when compared to other major Latin American economies. During 1995-2000, Mexico's growth surged to 5.31 percents from 2.09 percent during 1989-1995, and fell to 1.8 percent after 2000.

During the periods 1995-2000 and 2000-2005, the share of the Latin America share in world growth was far below its world product share. This observation was also true for the subgroup of the seven major Latin American economies and for each of these individual economies, except for Chile and Mexico in 1995-2000, and Chile in 2000-2005.

3. Sources of World Economic Growth.

In this section we allocate the sources of world economic growth among the contributions of capital and labor inputs and the growth of productivity. About 40-50 percent of world growth between 1989 and 2005 can be attributed to the accumulation and deployment of capital and another 25-33 percents to the use of labor input. We find that productivity, frequently described as the primary engine of economic growth, accounted for only 20-35 percent of growth.

Our second objective is to explore the determinants of the growth of capital input, emphasizing the role of investment in information technology, and to analyze the determinants of the growth of labor input, focusing on the role of investment in human capital. 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. Labor quality growth captures the impact of changes in the composition of labor input. These

arise, for example, through increases in the education and experience of the labor force. The contribution of labor input is the sum of the two components, weighted by the share of labor in output. Finally, productivity growth is the difference between the rate of growth of output and the contributions of capital and labor inputs.

We present the results of our analysis in Table 2 and Figures 1, 2, and 3. The contribution of capital input to world economic growth before 1995 was 1.31 percent, 49.2 percent of the growth rate of 2.66 percent. Labor input contributed 0.88 percent or 33 percent of growth, while productivity growth was 0.47 percent per year or 17.7 percent of growth. During 1995-2000 the contribution of capital input climbed to 1.73 percent, 45.5 percent of output growth of 3.80 percent, while the contribution of labor input rose to 1.19 percent, 31 percent. Productivity increased to 0.89 percent per year or 23.4 percent of growth.

After 2000 world growth continued at an accelerated rate of 3.82 percent. The contribution of capital slightly declined to 1.59 percent or 41.6 percent of growth. The contribution of labor fell to 0.93 percent or 24.2 percent of growth. More rapid growth was maintained by a jump in productivity growth to 1.31 percent per year or 34.2 percent of the growth of output. We arrive at the astonishing conclusion that the contributions of capital and labor inputs greatly predominate over productivity as sources of world economic growth throughout the period 1989-2005, although the share of productivity has been rising.

We have divided the contribution of capital input to world economic growth between IT capital and Non-IT capital inputs. The contribution of IT almost doubled after 1995 from less than a quarter of the contribution of capital input during 1989-1995 to about a third from 1995-2000. The share of IT in the contribution of capital input receded to slightly more than one quarter after the dot-com crash of 2000. However, it is important to

emphasize that the contribution of Non-IT investment was more important throughout the period 1989-2005.

We have divided the contribution of labor input between hours worked and labor quality. Hours worked was the major source of the contribution of labor input to economic growth throughout the period 1989-2005. The contribution of hours rose from 0.47 percent before 1995 to 0.85 percent during 1995-2000, but fell back to 0.58 percent after 2000. The contribution of labor quality declined from 0.41 percent before 1995 to 0.34 percent during 1995-2000 and to 0.35 percent after 2000.

After 1995 world economic growth jumped by a more than one full percentage point. The contribution of capital explained 36.9 percent of this acceleration, while productivity growth accounted for 36.6 percent share, and labor contributed 26.5 percent. The jump in IT investment of 0.27 percent was by far the most important source of the increase in capital. This can be traced to the more rapid rate of decline of IT prices after 1995 analyzed by Jorgenson (2001). The substantial increase of 0.37 percent in the contribution of hours worked offset the decline in the contribution of labor quality.

The contribution of capital input to economic growth for the G7 economies, divided between IT and Non-IT. Capital input was the most important source of growth before and after 1995. The contribution of capital input before 1995 was 1.29 or three-fifths of the G7 growth rate of 2.14 percent. The capital contribution of 1.66 percent from 1995-2000 was 53 percent of the higher growth rate of 3.11 percent. After 2000 the capital contribution fell to 1.11 percent or 54 percent of the substantially lower G7 growth rate of 2.06 percent.

Labor input growth contributed 0.44 percent to growth of the G7 economies before 1995, 0.85 percent in 1995-2000, but only 0.36 percent after 2000. Hours worked predominated during 1995-2000, contributing 0.58

percent, while labor quality rose at 0.27 percent. Growth contribution of hours was only 0.08 percent before 1995 and 0.07 percent after 2000, while the labor quality contribution was 0.36 percent and 0.29 percent, respectively. Productivity accounted for 0.42 percent before 1995, 0.60 percent during 1995-2000, and 0.59 percent after 2000. Productivity share ranged from less than 20 percent before 1995 to 29 percent after 2000.

The powerful surge of IT investment in the U.S. after 1995 is mirrored in jumps in the growth rates of IT capital through the G7. The contribution of IT capital input for the G7 nearly doubled from 0.39 during the period 1989-1995 to 0.74 percent during 1995-2000, before receding to 0.39 percent after 2000. The contribution of Non-IT capital input predominated in all three sub-periods, but fell slightly throughout 1989-2005. This reflected more rapid substitution of IT capital input for Non-IT capital input in response to swiftly declining prices of IT equipment and software after 1995.

In Developing Asia the contribution of capital input steadily increased from 2.41 percent before 1995 to 2.79 percent in 1995-2000, and to 2.94 percent after 2000. The contribution of labor input fell from 2.1 percent during 1989-1995 to 1.5 percent during 1995-2000, and to 1.46 after 2000. The significant slowdown in the Asian growth rate from 7.64 percent before 1995 to 5.97 percent during 1995-2000 can be traced almost entirely to a sharp decline in productivity growth from 3.12 to 1.68 percent. Similarly, the revival of growth to 7.15 percent during 2000-2005 can be attributed to higher productivity growth of 2.76 percent. Productivity explained 40.9 percent of Asian growth before 1995, 28.2 percent in 1995-2000, and 38.6 percent after 2000.

For China productivity accounted for a major share in growth, 44.4 percent in 1989-1995, 40.7 percent in 1995-2000, and 42.2 in 2000-2005; the contribution of capital growth surpassed productivity after 1995, rising

from 27.3 percent in 1989-1995 to 44.4 percent in 1995-2000, to 44.5 percent in 2000-2005. For India productivity also played an important role at around 40 percent in 1989-1995 and 2000-2005, and 30% in 1995-2000. However, relative to China, labor accounted for a larger share in growth after 1995.

The first half of the 1990's was a continuation of the Asian Miracle, analyzed by Krugman (1994), 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, Singapore, South Korea, and Taiwan. However, all Asian economies, except The Philippines, had growth rates in excess of the world average of 3.80 percent. The second half of the 1990's was dominated by the Asian financial crisis but, surprisingly, conforms much more closely to the "Krugman thesis" attributing Asian growth to input growth more than productivity.

The "Krugman thesis" was originally propounded to distinguish the Asian Miracle from growth in industrialized countries. According to this thesis, Asian growth was differentiated by high growth rates and a great predominance of inputs over productivity as the sources of growth. In fact, the peak of productivity growth in Developing Asia, absolutely and relatively, was during the Asian Miracle of the early 1990's! Moreover, growth in the world economy and the G7 economies was dominated by growth of capital and labor inputs, not productivity.

The pattern of economic growth in the fifteen Non-G7 industrialized economies was similar to G7 growth before 2000 with a surge during 1995-2000 and a sharp slowdown in 2000-2005. However, the average growth rate of the Non-G7 economies was still higher in 2000-2005 than in 1989-1995. The contribution of capital and labor inputs are major sources of growth throughout the period 1989-2005. Non-G7 productivity growth climbed from 0.44 percent before 1995 to 0.53 percent in 1995-2000, before falling to

-0.01 percent after 2000. Productivity accounted for 21 percent of growth before 1995, 15 percent from 1995-2000 and nearly zero after 2000.

The impact of investment in IT equipment and software in the Non-G7 economies nearly doubled from 0.29 percent before 1995 to 0.56 percent during 1995-2000, before receding to 0.39 percent after 2000. This provided a substantial impetus to the acceleration in Non-G7 growth rate in the period 1995-2000. However, non-IT investment and hours worked were major sources of Non-G7 growth after 1995. Non-IT investment accounted for 26.5 percent of growth during 1995-2000 and 44.6 percent for 2000-2005, while the shares of hours worked were 36.5 percent and 33.6 percents for the two periods, respectively.

The collapse of economic growth in Eastern Europe and the former Soviet Union during 1989-1995 can be attributed to a steep decline in productivity during the initial transition from socialism. This was followed by a modest revival in both economic growth and productivity growth from 1995-2000, bringing many of the transition economies back to 1989 levels of output per capita. The contribution of capital input declined until 2000 even as the contribution of IT investment jumped from 0.10 percent before 1995 to 0.27 percent in 1995-2000 and 0.41 percent after 2000. Hours worked declined sharply during 1989-1995 and continued to fall during 1995-2000 before showing a negligible growth in 2000-2005, while labor quality steadily improved throughout 1989-2005.

Latin America's growth was rather stable during 1989-1995 and 1995-2000 (2.94 and 2.97 percent, respectively) before falling to 2.39 percent after 2000. The contribution of labor input was 1.70 percent before 1995, 1.79 from 1995-2000 and 1.66 percent after 2000, accounting for the lion's share of regional growth. The contribution of capital input shifted toward IT, but remained relatively weak. Nonetheless, the contribution of IT investment in Latin America more than doubled, jumping from 0.12 percent

before 1995 to 0.30 percent in 1995-2000 and 0.35 after 2000. Productivity collapsed after 1995, falling from 0.50 in 1989-1995 to 0.09 in 1995-2000, to a negative 0.22 percent after in 1995-2000.

Chile was the only Latin American economy to experience growth that exceeded the world average in all the three periods from 1989 to 2005. Economic growth in Brazil and Mexico, the two largest Latin American economies, languished below the world average throughout in 1989-2005, except that Mexico's growth surged above the world average during 1995-2000, which coincided with the boom of the U.S. economy.

Labor input greatly predominated as a source of economic growth for all major Latin American countries except for Chile, which had substantial contributions from capital input until 2000. All the seven major Latin American countries except for Chile experienced productivity growth collapse in at least one of the three periods: Argentina and Venezuela in 1995-2000 and 2000-2005; Mexico in 1989-1995 and 2000-2005; Colombia and Peru in 1995-2000; Brazil in 2000-2005. For the entire Latin America group as well as its subgroup of seven major economies, there was a declining trend of productivity growth!

Productivity in Sub-Saharan Africa collapsed during 1989-1995, running at -1.44 percent, before recovering to 0.25 percent in 1995-2000 and rising sharply to 1.06 percent after 2000. As in Latin America, the contribution of labor input predominated throughout the period 1989-2005. Productivity in North Africa and the Middle East rose from 0.26 percent before 1995 to 0.41 percent in 1995-2000 and 0.89 percent after 2000. In Sub-Saharan Africa and North Africa and the Middle East, growth of capital and labor inputs greatly predominated over productivity as a source of economic growth.

4. World Output, Input, and Productivity.

The final step in analyzing the world growth resurgence is to characterize the evolution of levels of output, input, and productivity for the world economy, the seven economic regions, the G7 economies, the seven major Latin American economies, and China and India. We construct the levels of output, input, and productivity for each economy based on the production possibility frontier (1) presented in section 1.

Productivity, defined as output per unit of input, $A = Y/f(K,L)$, is the amount of output produced by a unit of combined labor and capital inputs and measures the efficiency of the economy⁵. The levels of per capita output, per capita input, and productivity are computed using the following guidelines:

- Output is measured in terms of Purchasing Power Parities (PPP) in U.S. dollars of 2000.
- Total input $f(K,L)$ is computed as $f(K,L) = K^{s_K} * L^{s_L}$, where s_K and s_L are the shares in current output of capital and labor input, respectively. Capital input K is converted from its value in current U.S. dollars to constant U.S. dollars of 2000 by using the U.S. investment deflator and the PPP for 2000. The labor input L is estimated as the product of hours worked and the labor quality index and a similar constant for all countries.
- The level of productivity is computed as the ratio between the levels of per capita output and per capita input.

⁵Labor productivity, measured as Y/L , is much higher in a rich country than in a poor one because the rich country has more capital per worker (K/L) in production. The concept of productivity takes into account the quantity and quality of both L and K; and hence the variation in productivity between rich and poor countries is not as large as the variation in labor productivity.

Taking the U.S. levels of output, input, and productivity in 2000 as 100.0, we compute the levels of output, input, and productivity for each of the 110 economies in the years of interest. In Table 3 we present levels of output per capita when the transition from socialism began in 1989, at the start of the worldwide IT investment boom in 1995, at the beginning of the dot-com crash in 2000, and at the end of the period covered by our study in 2005. We also present input per capita and productivity for these years.

Differences in per capita output levels are mainly due to differences in per capita input, rather than disparities in productivity. Taking U.S. output per capita in 2000 as 100.0, world output per capita was a relatively modest 18.5 in 1989. Using similar scales for input and productivity, world input per capita in 1989 was a considerable 41.4 and world productivity a more substantial 44.8. The level of world output advanced to 20.0 in 1995, jumped to 22.6 in 2000, and leapt again to 25.8 in 2005, reflecting impressive progress in mobilizing world inputs. World productivity edged upward modestly to 46.1 in 1995, 48.1 in 2000 and then 51.9 in 2004.

It is not surprising that world productivity is closer to U.S. levels than world input per capita. As globalization has proceeded, technologies have been transferred with relative ease from industrialized economies to the developing world. Mobilization of inputs in developing economies has been remarkable, but has required far more time and effort. Institutional barriers to accumulation of human and non-human capital must be overcome and networks among the co-operating activities must be established and enhanced. Obsolete methods for organizing production must be displaced by up-to-date techniques that employ information technology equipment and software.

The output gap between the U.S. and the other G7 economies has widened since the American growth resurgence began in 1995. The G7 economies led the seven economic regions in output per capita, input per capita, and productivity throughout the period 1989-2005. Output per capita in the G7

was, nonetheless, well below U.S. levels. Taking U.S. output per capita in 2000 as 100.0, G7 output per capita was 69.2 in 1989, 75.3 in 1995, 85.2 in 2000, and 91.7 in 2005. By comparison U.S. output per capita was 79.7, 85.5, 100.0, and 109.4 in these years.

Canada was close to the U.S. in output per capita in 1989 (66.9 vs. 79.7), but the U.S.-Canada gap widened over the period 1989-2005 due to lower growth rates of Canada compared to the U.S. throughout this period. Germany, Japan, Italy, and the U.K. had similar levels of output per capita throughout 1989-2005, but remained considerably behind the two North American economies. Italy lagged the rest of the G7 in output per capita in 1989 and failed to gain ground during the period 1989-2005.

The U.S. was the leader among the G7 economies in input per capita throughout the period 1989-2005. Taking the U.S. as 100.0 in 2000, G7 input per capita was 77.6 in 1989, 82.1 in 1995, 90.2 in 2000, and 94.5 in 2005, while U.S. input per capita was 84.5, 89.3, 100.0, and 104.0 in these years. Canada, Germany, and Japan were closest to U.S. levels of input per capita in 1989, with Japan ranking second in 1995 and 2000, and Canada ranking second in 2005. Italy lagged behind the rest of the G7 in input per capita throughout 1989-2005. The U.K. made substantial progress toward achieving input levels surpassing those of Germany and Japan in 2005.

Productivity in the G7 has remained close to U.S. levels, rising from 89.2 in 1989 to 91.6 in 1995, and 94.4 in 2000, and 97.1 in 2005 with the U.S. equal to 100.0 in 2000. Differences among the G7 economies in output per capita can be explained by both differences in input per capita and productivity gaps. For example, in 2005, Italy's output level was 73.4 compared to 109.4 for the U.S., while the Italy-U.S. gap was 69.5-10-4.0 on input and 95.1-105.2 on productivity.

In the economies of Developing Asia output per capita rose spectacularly from 5.7 in 1989 to 8.1 in 1995, 10.2 in 2000, and 13.8 in

2005 with the U.S. equal to 100.0 in 2000. These vast shortfalls in output per capita, relative to the industrialized economies, are due primarily to differences in input per capita, rather than productivity gaps. Developing Asia's levels of input per capita were 20.7 in 1989, 24.8 in 1995, 28.8 in 2000, and 34.1 in 2005, while Asian productivity levels were 27.3, 32.8, 35.5, and 40.6, respectively.

China started with very low levels of output, input, and productivity in 1989, which were comparable only with the poorest group of Sub-Saharan Africa. Its rapid growth in both input and productivity throughout 1989-2005, however, had driven China's output per capita to the level in 2005 far above Sub-Saharan Africa, Developing Asia, and North Africa and Middle-East, although still well below Latin America. India started from the same output level of output as China in 1989 and also achieved impressive growth. However, India's output level in 2005 was only half that of China.

The output level of the group of 15 non-G7 industrialized economies was below the G7 economies throughout 1989-2000 but surpassed Germany and Italy in 2005. The main drivers of this group's catch-up were its substantial increase in input level and a moderate rise in productivity.

For the Latin American region output per capita rose from 18.4 to 22.2 during 1989-2005, input per capita rose from 30.0 to 35.8, but productivity was essentially unchanged throughout the period at about two-thirds of the U.S. level in 2000. The stall in productivity from 1989 to 2005 was pervasive, contrasting sharply with the rise in productivity in the G7 economies, the Non-G7 industrialized economies, and Developing Asia. Nonetheless, Latin America's lagging output per capita was due chiefly to insufficient input per capita, rather than a shortfall in productivity.

Brazil's economic performance has been anemic at best and has acted as a drag on the growth of Latin America and the world economy. Despite productivity levels comparable to the rest of Latin America, Brazil was

unable to generate substantial growth in input per capita. Mexico lost ground in productivity between 1989 and 2005, but has made steady gains in input per capita and expanded output per capita substantially after 1995. Argentina also increased its output per capita from 27 to 37% between 1989 and 2000, after which its relative level stagnated.

The shortfall in output per capita in Latin American economies was due almost entirely to low levels of input per capita, rather than productivity. Argentina began the period 1989-2005 with a relatively high level of productivity and increased productivity in 1995 to a stunning 80.9, relative to U.S. productivity of 100.0 in 2000! By 2000 Chile had become the leader in input per capita among Latin American economies with a level of 45.6 in 2000, and 51.0 in 2005.

Before the beginning of the transition from socialism in 1989, output per capita in Eastern Europe and the former Soviet Union was 27.0, well above the world economy level of 18.5, with the U.S. equal to 100.0 in 2000. The economic collapse that accompanied the transition reduced output per capita to 19.3 by 1995, slightly below the world economy level of 20.0. A recovery between 1995 and 2005 brought the region back to 28.9 in 2005, well above the world economy average of 25.8.

Input in Eastern Europe and the former Soviet Union remained stagnant at around 34.0 during 1989-2000, and slightly rose to 35.8 in 2005. Productivity collapsed along with output per capita, declining from 80.1 in 1989 to 56.7 in 1995, before climbing back to 63.5 in 2000 and, finally, surpassing the 1989 level at 80.7 in 2005.

Output and input per capita and productivity in Sub-Saharan Africa was the lowest in the world throughout the period 1989-2005. All the economies of North Africa and the Middle East fell short of world average levels of output and input per capita. Output per capita grew slowly but steadily for

the region as a whole during 1989-2005, powered by significant gains in input per capita and productivity.

5. Summary and Conclusions.

World economic growth, led by the industrialized economies and Developing Asia, experienced a strong resurgence after 1995. Developing Asia accounted for almost half of world economic growth during 1989-2005 but remained well below the world average in output per capita. Sub-Saharan Africa and North Africa and the Middle East also languished below the world average. Eastern Europe and the former Soviet Union lost enormous ground during the transition from socialism but have started recovering since 1995.

Growth trends apparent in the U.S. have counterparts throughout the world. Investment in tangible assets, including IT equipment and software, was the most important source of growth. However, Non-IT investment predominated. The contribution of labor input was next in magnitude with hours worked outweighing labor quality. Finally, productivity was the dominant source of growth only in Eastern Europe and the former Soviet Union during the recovery from the output and productivity collapse of 1989-1995 that accompanied the beginning of the transition from socialism to a market economy.

The leading role of IT investment in the acceleration of growth in the G7 economies is especially pronounced in the U.S. The contribution of labor input predominated 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 an important source of growth in Developing Asia during the Asian Miracle before 1995, contrary to the "Krugman thesis, but growth of capital and labor inputs rose in importance 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 experienced a surge in investment in IT equipment and software after 1995. The impact of IT investment on economic growth was most striking in the G7 economies. The rush in IT investment was especially conspicuous in the U.S., but jumps 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. IT investment subsided among the G7 economies after the dot-com crash of 2000, while the contribution of Non-IT investment varied considerably and explains important differences among growth rates of the G7 economies.

The surge in investment in IT equipment and software is a global phenomenon, but the variation in the contribution of this investment has grown considerably since 1995. The moderation in IT investment in the industrialized countries after the dot-com crash of 2000 was accompanied by continued expansion in the contribution of IT in the developing world, especially in Asia. The contribution of IT investment more than doubled after 1995 in Developing Asia, Latin America, Eastern Europe, and North Africa and the Middle East, and Sub-Saharan Africa.

Finally, despite spectacular growth rates in Developing Asia, levels of output per capita remain below world averages. Differences in per capita output levels are mainly due to input per capita rather than productivity. This reflects the fact that technology is relatively easy to transfer from industrialized economies to developing economies, while mobilization of capital and labor inputs requires much more time and considerably greater effort. Outmoded techniques of production must give way to newer methods that incorporate the latest technologies, especially those that utilize information technology equipment and software.

Despite stagnant productivity growth in Latin American through the period 1989-2005, Latin American productivity remained above world levels.

Productivity in the leading Latin American economies, Argentina and Venezuela, had achieved North American or Western European levels by 1995. However, all Latin American economies had a substantial shortfall in GDP per capita, relative to world levels, due to large gaps in input per capita and stagnation in productivity growth. Argentina, Chile and Mexico made substantial progress in reducing this gap during the period 1989-2005, largely through investment in Non-ICT assets.

References

Ahmad, Nadim, Paul Schreyer, and Anita Wölfl (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 (2006), Global Software Piracy Study: Washington, DC: Business Software Alliance USA, May. 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 (2005), "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, pp. 363-402.

EUKLEMS. 2007. KLEMS project dataset, European Commission, Research Directorate General (available at <http://www.euklems.net/>, accessed June 15, 2007).

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>.

Holz, Carsten A. (2006), "China's Reform Period Economic Growth: How Reliable Are Angus Maddison's Estimates?" Review of Income and Wealth, Series 52, No. 1, March, pp. 85-120.

International Telecommunications Union (2006), World Telecommunications Indicators Database, 9th edition, Geneva: International Telecommunications Union, April. See: <http://www.itu.int/ITU-D/ict/publications/world/world.html>.

Jorgenson, Dale W. (1996), "The Embodiment Hypothesis," In Postwar U.S. Economic Growth, Cambridge, MA: The MIT Press, 1996.

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.

_____. (2005), "Accounting for Growth in the Information Age," in Philippe Aghion and Steven Durlauf, Handbook of Economic Growth, Amsterdam, North-Holland, pp. 743-815.

Jorgenson, Dale W., and Kazuyuki Motohashi (2005), "Information Technology and the Japanese Economy," Journal of the Japanese and International Economies, Vol. 19, No. 4, December, pp. 460-481.

Jorgenson, Dale W., and Khuong Vu (2005), "Information technology and the World Economy", Scandinavian Journal of Economics, Vol. 107, No. 4, December, pp. 631-650.

Jorgenson, Dale W. and Kevin J. Stiroh (2000), "Raising the Speed Limit: US Economic Growth in the Information Age," OECD Economics Department Working Papers 261, OECD Economics Department.

Jorgenson, Dale W., Mun S. Ho, and Kevin J. Stiroh (2005), Information Technology and the American Growth Resurgence, Cambridge, The MIT Press.

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 (1998) Chinese Economic Performance in the Long Run, Development Centre of the Organisation for Economic Co-operation and Development, Paris.

_____ (2006), "Do Official Statistics Exaggerate China's GDP Growth? A Reply to Carsten Holz," Review of Income and Wealth, Series 52, No. 1, March, pp. 121-126.

Oliner, Stephen and Daniel Sichel (2000) "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?", Journal of Economic Perspectives, Vol. 14, Number 4, Fall 2000, pp. 3-22

Piatkowski, Marcin, and Bart van Ark (2005), "ICT and Productivity Growth in Transition Economies: Two-Phase Convergence and Structural Reforms," TIGER Working Paper Series No. 72, Warsaw, January 2005. See: <http://www.tiger.edu.pl/publikacje/TWPNo72.pdf>.

Timmer, Marcel P., Gerard Ypma, and Bart van Ark (2003, updated 2005), IT in the European Union: Driving Productivity Divergence? GGDC Research Memorandum GD-67, Groningen, University of Groningen, October. March. See: <http://www.ggdc.net/workpap.html>.

WDIO. 2007. The World Development Indicators online database (accessed June 15, 2007).

WITSA (2006). World Information Technology and Services Alliance, Digital Planet Report, Washington, DC, World Information Technology and Services Alliance; various issues published during 1998-2006; 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.

Young, Alwyn (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.

Table 1: The world economy: shares in size and growth by group, region, and major economies

Group	Period 1989-1995			Period 1995-2000			Period 2000-2005		
	GDP Growth	Average Share		GDP Growth	Average Share		GDP Growth	Average Share	
		GDP	Growth		GDP	Growth		GDP	Growth
World (110 Economies)	2.67	100.0	100.0	3.80	100.0	100.0	3.82	100.0	100.0
G7 (7)	2.14	49.7	40.0	3.11	47.9	39.1	2.06	44.9	24.2
Developing Asia (16)	7.64	19.7	56.7	5.97	23.9	37.6	7.15	27.6	51.8
Non-G7 (15)	2.06	9.3	7.2	3.65	9.1	8.7	2.32	8.7	5.3
Latin America (19)	2.94	8.4	9.2	2.97	8.2	6.4	2.39	7.8	4.9
Eastern Europe (14)	-6.44	7.6	-19.0	1.96	5.5	2.8	5.23	5.5	7.5
Sub-Sahara Africa (28)	1.51	2.1	1.2	3.44	2.0	1.9	4.23	2.1	2.3
N. Africa and M. East (11)	3.80	3.2	4.6	3.96	3.3	3.5	4.51	3.4	4.0

Economy	Period 1989-1995						Period 1995-2000						Period 2000-2005					
	GDP Growth	GDP Share		Growth Share		GDP Growth	GDP Share		Growth Share		GDP Growth	GDP Share		Growth Share				
		Group	World	Group	World		Group	World	Group	World		Group	World	Group	World			
G7																		
Canada	1.44	4.0	2.0	2.7	1.1	4.07	4.0	1.9	5.2	2.1	2.50	4.2	1.9	5.1	1.2			
France	1.46	7.7	3.8	5.2	2.1	2.76	7.5	3.6	6.6	2.6	1.48	7.4	3.3	5.3	1.3			
Germany	2.74	10.5	5.2	13.4	5.3	1.99	10.4	5.0	6.7	2.6	0.74	9.8	4.4	3.5	0.9			
Italy	1.39	7.6	3.8	4.9	2.0	1.89	7.2	3.5	4.4	1.7	0.64	6.8	3.1	2.1	0.5			
Japan	2.09	17.8	8.9	17.4	7.0	0.96	17.0	8.1	5.3	2.1	1.42	15.9	7.1	11.0	2.7			
United Kingdom	1.53	7.8	3.9	5.5	2.2	3.18	7.7	3.7	7.9	3.1	2.31	7.8	3.5	8.7	2.1			
United States	2.44	44.7	22.2	50.9	20.4	4.29	46.3	22.1	63.9	25.0	2.76	48.1	21.6	64.3	15.6			
G7	2.14	100.0	49.7	100.0	40.0	3.11	100.0	47.9	100.0	39.1	2.06	100.0	44.9	100.0	24.2			
Seven Major Latin America Economies (LA7)																		
Argentina	4.88	12.2	1.0	20.2	1.9	2.54	12.7	1.1	10.9	0.7	1.97	12.5	1.0	10.3	0.5			
Brazil	1.84	37.9	3.2	23.7	2.2	2.22	36.0	3.0	26.8	1.7	2.16	35.1	2.7	31.8	1.6			
Chile	7.55	3.3	0.3	8.5	0.8	4.07	3.9	0.3	5.3	0.3	4.29	4.2	0.3	7.5	0.4			
Colombia	4.35	7.5	0.6	11.1	1.0	0.91	7.5	0.6	2.3	0.1	3.37	7.3	0.6	10.2	0.5			
Mexico	2.09	23.2	1.9	16.5	1.5	5.31	24.0	2.0	42.9	2.8	1.80	25.1	2.0	18.9	0.9			
Peru	3.57	3.5	0.3	4.2	0.4	2.46	3.5	0.3	2.9	0.2	4.08	3.6	0.3	6.2	0.3			
Venezuela	3.87	4.3	0.4	5.6	0.5	0.75	4.2	0.3	1.1	0.1	2.28	3.9	0.3	3.8	0.2			
LA7	2.88	87.7	7.3	84.1	7.8	2.99	87.6	7.2	91.1	5.9	2.31	87.7	6.9	84.8	4.2			
Latin America	2.94	100.0	8.4	100.0	9.2	2.97	100.0	8.2	100.0	6.4	2.39	100.0	7.8	100.0	4.9			
China and India in the Developing Asia Group																		
China	10.26	37.2	7.4	50.0	28.6	8.27	42.6	10.2	58.9	22.2	9.11	47.2	13.1	60.2	31.2			
India	5.17	23.9	4.7	16.2	9.0	5.63	21.9	5.2	20.7	7.8	6.72	21.5	5.9	20.2	10.4			
China and India		61.1	12.1	66.2	37.6		64.5	15.5	79.6	29.9		68.7	19.0	80.4	41.7			

Table 2. Sources of output growth

Group	Period 1989-1995						Period 1995-2000						Period 2000-2005					
	GDP Growth	Sources of Growth (% ppa)				TFP	GDP Growth	Sources of Growth (% ppa)				TFP	GDP Growth	Sources of Growth (% ppa)				TFP
		Capital		Labor				Capital		Labor				Capital		Labor		
	ICT	Non-ICT	Hours	Quality		ICT	Non-ICT	Hours	Quality		ICT	Non-ICT	Hours	Quality				
World	2.66	0.28	1.03	0.47	0.41	0.47	3.80	0.54	1.19	0.85	0.34	0.89	3.82	0.42	1.17	0.58	0.35	1.31
<i>Growth share*</i>	100.0	10.5	38.8	17.8	15.3	17.7	100.0	14.3	31.2	22.2	8.8	23.4	100.0	11.0	30.6	15.1	9.1	34.2
G7	2.14	0.39	0.90	0.08	0.36	0.42	3.11	0.74	0.92	0.58	0.27	0.60	2.06	0.39	0.73	0.07	0.29	0.59
<i>G7</i>	100.0	18.1	41.8	4.0	16.6	19.6	100.0	24.0	29.5	18.6	8.7	19.3	100.0	18.7	35.2	3.3	14.1	28.7
Developing Asia	7.64	0.18	2.24	1.62	0.48	3.12	5.97	0.35	2.44	1.07	0.43	1.68	7.15	0.52	2.41	1.03	0.42	2.76
<i>Developing Asia</i>	100.0	2.3	29.3	21.3	6.2	40.9	100.0	5.9	40.8	17.9	7.1	28.2	100.0	7.3	33.8	14.4	5.9	38.6
Non-G7	2.06	0.29	0.76	0.21	0.37	0.44	3.65	0.56	0.97	1.33	0.26	0.53	2.32	0.39	1.04	0.78	0.12	-0.01
<i>Non-G7</i>	100.0	14.1	36.6	10.3	17.9	21.1	100.0	15.3	26.5	36.5	7.1	14.6	100.0	16.8	44.6	33.6	5.3	-0.4
Latin America	2.94	0.12	0.63	1.27	0.43	0.50	2.97	0.30	0.80	1.41	0.38	0.09	2.39	0.35	0.60	1.28	0.38	-0.22
<i>Latin America</i>	100.0	4.0	21.4	43.1	14.6	16.9	100.0	10.1	26.8	47.4	12.8	2.9	100.0	14.8	25.2	53.5	15.7	-9.2
Eastern Europe	-6.44	0.10	-0.17	-1.54	0.41	-5.24	1.96	0.27	-0.62	-0.37	0.40	2.27	5.23	0.41	-0.28	0.08	0.57	4.45
<i>Eastern Europe</i>	100.0	-1.5	2.7	23.8	-6.3	81.3	100.0	13.9	-31.5	-18.9	20.2	116.2	100.0	7.9	-5.4	1.5	11.0	85.0
Sub-Saharan Africa	1.51	0.18	0.26	1.89	0.62	-1.44	3.44	0.33	0.60	1.81	0.46	0.25	4.23	0.49	1.03	1.19	0.45	1.06
<i>Sub-Saharan Africa</i>	100.0	12.0	17.4	125.0	40.8	-95.1	100.0	9.5	17.4	52.6	13.3	7.2	100.0	11.7	24.4	28.1	10.7	25.1
N. Africa & M. East	3.80	0.11	0.92	1.87	0.64	0.26	3.96	0.19	1.01	1.79	0.56	0.41	4.51	0.26	0.93	1.88	0.56	0.89
<i>N. Africa & M. East</i>	100.0	2.8	24.2	49.1	16.9	7.0	100.0	4.9	25.4	45.3	14.1	10.3	100.0	5.8	20.6	41.6	12.3	19.7
G7																		
Canada	1.44	0.49	0.27	0.08	0.55	0.05	4.07	0.94	0.77	1.08	0.21	1.07	2.50	0.44	1.15	1.22	0.18	-0.50
<i>Canada</i>	100.0	34.0	18.7	5.5	38.1	3.6	100.0	23.1	18.9	26.6	5.2	26.2	100.0	17.8	46.1	48.8	7.2	-19.9
France	1.46	0.22	0.62	-0.32	0.64	0.31	2.76	0.44	0.53	0.43	0.49	0.88	1.48	0.24	0.63	0.06	0.29	0.27
<i>France</i>	100.0	14.9	42.2	-22.3	43.7	21.5	100.0	15.8	19.1	15.5	17.6	32.0	100.0	16.0	42.3	4.3	19.3	18.0
Germany	2.74	0.23	1.08	-0.05	-0.01	1.49	1.99	0.50	0.88	0.00	-0.10	0.71	0.74	0.24	0.44	-0.36	0.26	0.15
<i>Germany</i>	100.0	8.5	39.6	-1.9	-0.5	54.3	100.0	25.2	44.3	0.0	-5.1	35.5	100.0	32.2	59.9	-48.6	35.9	20.6
Italy	1.39	0.18	0.68	-0.53	0.21	0.85	1.89	0.35	0.81	0.51	0.18	0.04	0.64	0.06	0.83	0.54	-0.06	-0.74
<i>Italy</i>	100.0	12.7	48.5	-37.9	15.4	61.3	100.0	18.7	43.0	26.9	9.4	2.2	100.0	9.7	130.2	84.8	-9.1	-115.6
Japan	2.09	0.28	1.68	-0.28	0.37	0.04	0.96	0.39	0.72	-0.64	0.57	-0.08	1.42	0.16	0.41	-0.19	0.22	0.83
<i>Japan</i>	100.0	13.3	80.2	-13.2	17.7	1.9	100.0	40.0	74.6	-66.1	59.6	-8.0	100.0	11.4	28.4	-13.4	15.3	58.3
United Kingdom	1.53	0.48	0.61	-0.78	0.51	0.70	3.18	0.93	0.77	0.68	0.51	0.30	2.31	0.52	0.58	0.59	0.52	0.11
<i>United Kingdom</i>	100.0	31.5	40.0	-50.9	33.7	45.7	100.0	29.3	24.1	21.3	15.9	9.5	100.0	22.5	25.0	25.5	22.4	4.6
United States	2.44	0.50	0.73	0.58	0.37	0.25	4.29	0.99	1.11	1.13	0.19	0.87	2.76	0.53	0.88	-0.01	0.34	1.01
<i>United States</i>	100.0	20.7	29.9	24.0	15.0	10.3	100.0	23.1	25.9	26.3	4.4	20.3	100.0	19.3	31.9	-0.4	12.4	36.7

* The italic number below each growth source is its percentage share in output growth

Table 2. Sources of output growth (Cont')

Group	Period 1989-1995						Period 1995-2000						Period 2000-2005					
	GDP Growth	Sources of Growth (% ppa)					GDP Growth	Sources of Growth (% ppa)					GDP Growth	Sources of Growth (% ppa)				
		Capital		Labor				Capital		Labor				Capital		Labor		
		ICT	Non-ICT	Hours	Quality	TFP		ICT	Non-ICT	Hours	Quality	TFP		ICT	Non-ICT	Hours	Quality	TFP
Seven Major Latin America Economies (LA7)																		
Argentina	4.88	0.17	0.18	0.02	0.36	4.16	2.54	0.22	0.66	1.60	0.32	-0.26	1.97	0.17	0.15	1.89	0.31	-0.55
	100.0	3.4	3.8	0.4	7.3	85.2	100.0	8.8	26.1	62.8	12.4	-10.1	100.0	8.8	7.5	95.7	15.7	-27.7
Brazil	1.84	0.08	0.42	0.79	0.45	0.09	2.22	0.42	0.43	0.84	0.41	0.11	2.16	0.56	0.31	0.94	0.41	-0.05
	100.0	4.6	23.1	42.9	24.4	5.0	100.0	19.0	19.2	38.0	18.7	5.1	100.0	25.7	14.4	43.5	18.8	-2.3
Chile	7.55	0.26	1.94	1.71	0.29	3.35	4.07	0.41	1.94	1.36	0.27	0.10	4.29	0.43	1.24	1.66	0.26	0.69
	100.0	3.5	25.7	22.7	3.8	44.3	100.0	10.0	47.7	33.3	6.6	2.4	100.0	10.1	28.9	38.7	6.1	16.2
Colombia	4.35	0.15	1.18	2.19	0.44	0.40	0.91	0.41	0.74	0.60	0.40	-1.24	3.37	0.48	0.27	1.27	0.39	0.95
	100.0	3.4	27.0	50.4	10.1	9.1	100.0	44.4	81.3	66.2	44.0	-135.9	100.0	14.4	8.2	37.7	11.5	28.2
Mexico	2.09	0.11	0.82	1.81	0.44	-1.09	5.31	0.13	1.03	2.28	0.36	1.50	1.80	0.18	1.09	1.31	0.36	-1.14
	100.0	5.5	39.1	86.6	21.0	-52.1	100.0	2.5	19.5	43.0	6.8	28.3	100.0	10.0	60.5	72.6	19.9	-63.0
Peru	3.57	0.24	0.77	1.85	0.45	0.27	2.46	0.33	1.21	1.78	0.38	-1.24	4.08	0.31	0.75	1.01	0.38	1.63
	100.0	6.8	21.4	51.7	12.6	7.5	100.0	13.5	49.3	72.3	15.3	-50.4	100.0	7.7	18.4	24.7	9.2	39.9
Venezuela	3.87	0.16	0.13	2.31	0.50	0.77	0.75	0.29	0.94	1.56	0.45	-2.49	2.28	0.16	0.79	1.10	0.45	-0.23
	100.0	4.1	3.5	59.8	12.8	19.8	100.0	39.0	125.8	208.2	60.3	-333.2	100.0	7.1	34.7	48.5	19.7	-10.0
LA7	2.88	0.12	0.61	1.20	0.43	0.51	2.99	0.31	0.76	1.39	0.38	0.14	2.31	0.36	0.58	1.24	0.37	-0.24
	100.0	4.3	21.1	41.8	14.9	17.8	100.0	10.3	25.5	46.7	12.7	4.8	100.0	15.7	25.1	53.6	16.1	-10.5

Table 3: Levels of output and input per capita and productivity (U.S. =100 in 2000)

* The levels for group and the world are averages weighted by population share

Group	Output Per Capita				Input Per Capita				Productivity			
	1989	1995	2000	2005	1989	1995	2000	2005	1989	1995	2000	2005
World	18.5	20.0	22.6	25.8	41.4	43.3	47.1	49.8	44.8	46.1	48.1	51.9
G7	69.2	75.3	85.2	91.7	77.6	82.1	90.2	94.5	89.2	91.6	94.4	97.1
Developing Asia	5.7	8.1	10.2	13.8	20.7	24.8	28.8	34.1	27.3	32.8	35.5	40.6
Non-G7	56.5	61.5	71.4	76.7	64.5	68.9	78.1	84.0	87.6	89.3	91.4	91.3
Latin America	18.4	19.8	21.3	22.2	30.0	31.5	34.0	35.8	61.5	62.8	62.6	62.1
Eastern Europe	27.0	19.3	21.7	28.9	33.8	34.1	34.2	35.8	80.1	56.7	63.5	80.7
Sub-Saharan Africa	5.2	4.8	5.1	5.5	20.1	20.2	20.9	22.1	25.9	23.9	24.2	25.1
N. Africa & M. East	11.3	12.4	13.8	15.7	23.3	25.3	27.6	30.4	48.5	49.0	49.9	51.6
G7												
Canada	66.9	68.0	79.5	85.8	79.0	80.1	88.8	98.2	84.6	84.9	89.5	87.3
France	62.4	66.5	75.0	78.1	68.2	71.3	76.9	79.0	91.6	93.3	97.5	98.8
Germany	58.7	66.8	73.2	75.7	77.8	80.9	85.6	87.8	75.5	82.6	85.6	86.2
Italy	61.5	66.2	72.2	73.4	59.3	60.6	73.2	69.5	93.5	98.4	98.6	95.1
Japan	65.3	72.7	75.4	80.3	77.7	86.2	89.8	91.7	84.1	84.3	84.0	87.5
United Kingdom	62.2	67.1	77.9	85.5	75.5	78.1	89.3	97.5	82.4	85.9	87.2	87.7
United States	79.7	85.5	100.0	109.4	84.5	89.3	100.0	104.0	94.3	95.7	100.0	105.2
G7	69.2	75.3	85.2	91.7	77.6	82.1	90.2	94.5	89.2	91.6	94.4	97.1
Seven Major Latin America Economies (LA7)												
Argentina	26.5	33.3	36.0	36.8	42.1	41.1	45.0	47.3	63.0	80.9	79.8	77.7
Brazil	19.9	20.3	21.2	21.7	30.9	31.3	32.6	33.3	64.5	64.8	65.2	65.0
Chile	16.4	23.3	26.7	30.9	34.3	40.0	45.6	51.0	47.7	58.3	58.6	60.7
Colombia	15.5	17.9	17.1	18.8	24.3	27.4	27.8	29.1	63.9	65.4	61.5	64.5
Mexico	21.6	21.9	26.6	27.7	32.0	34.7	39.0	43.0	67.4	63.2	68.1	64.3
Peru	12.0	13.1	13.7	15.5	24.7	26.7	29.5	30.9	48.5	49.3	46.3	50.2
Venezuela	16.3	17.7	16.6	17.0	23.3	24.2	25.7	26.7	69.9	73.2	64.6	63.9
LA7	19.7	21.1	22.8	23.7	30.9	32.2	34.6	36.4	63.7	65.2	65.3	64.8
China and India												
China	4.6	7.9	11.4	17.4	20.4	26.7	32.5	41.1	22.5	29.6	35.0	42.4
India	4.6	5.6	6.8	8.9	17.7	19.0	21.2	24.2	26.1	29.6	32.2	36.8

Figure 1. Contribution of Capital Inputs to Economic Growth: World and Regions

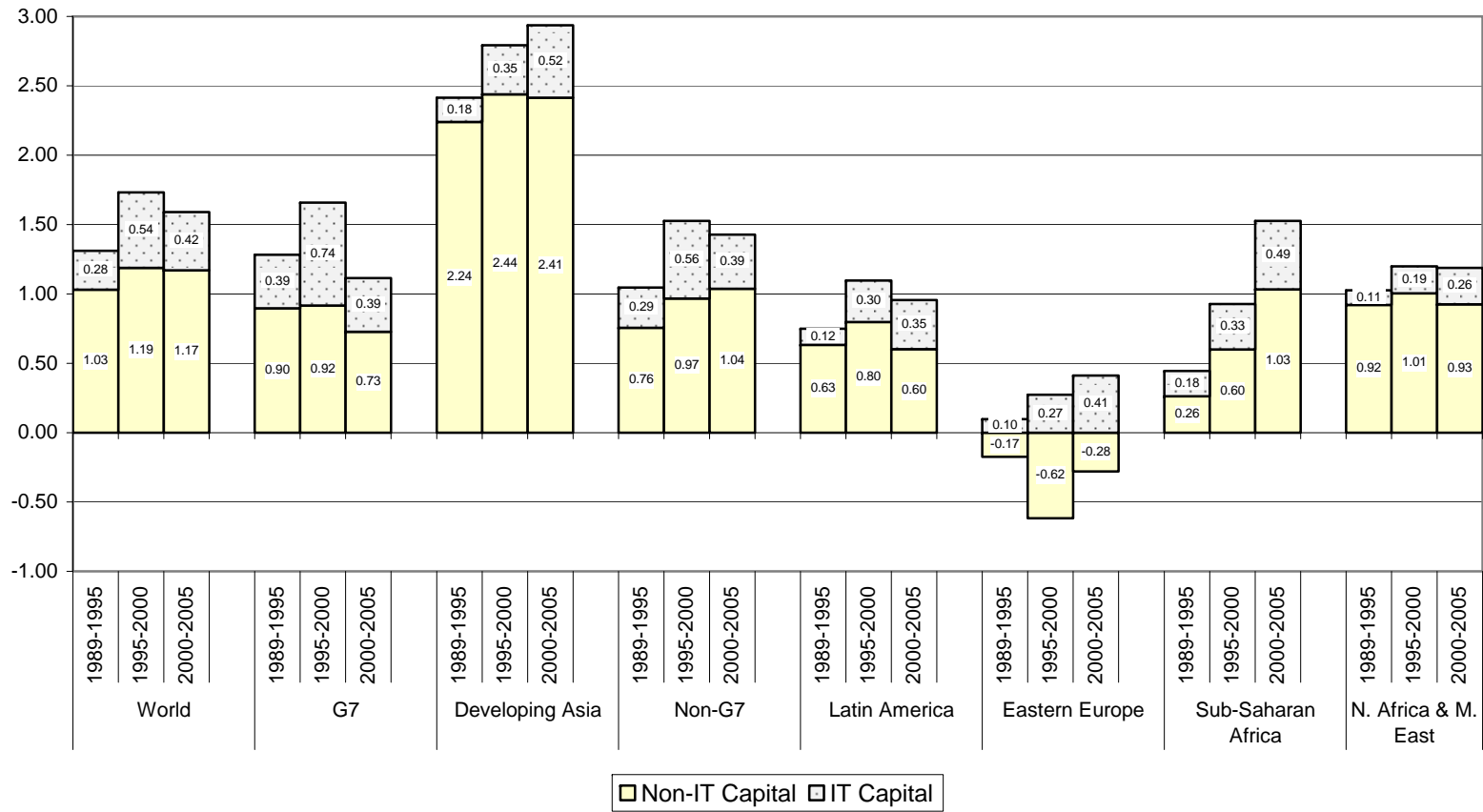


Figure 2. Sources of Economic Growth: World and Regions

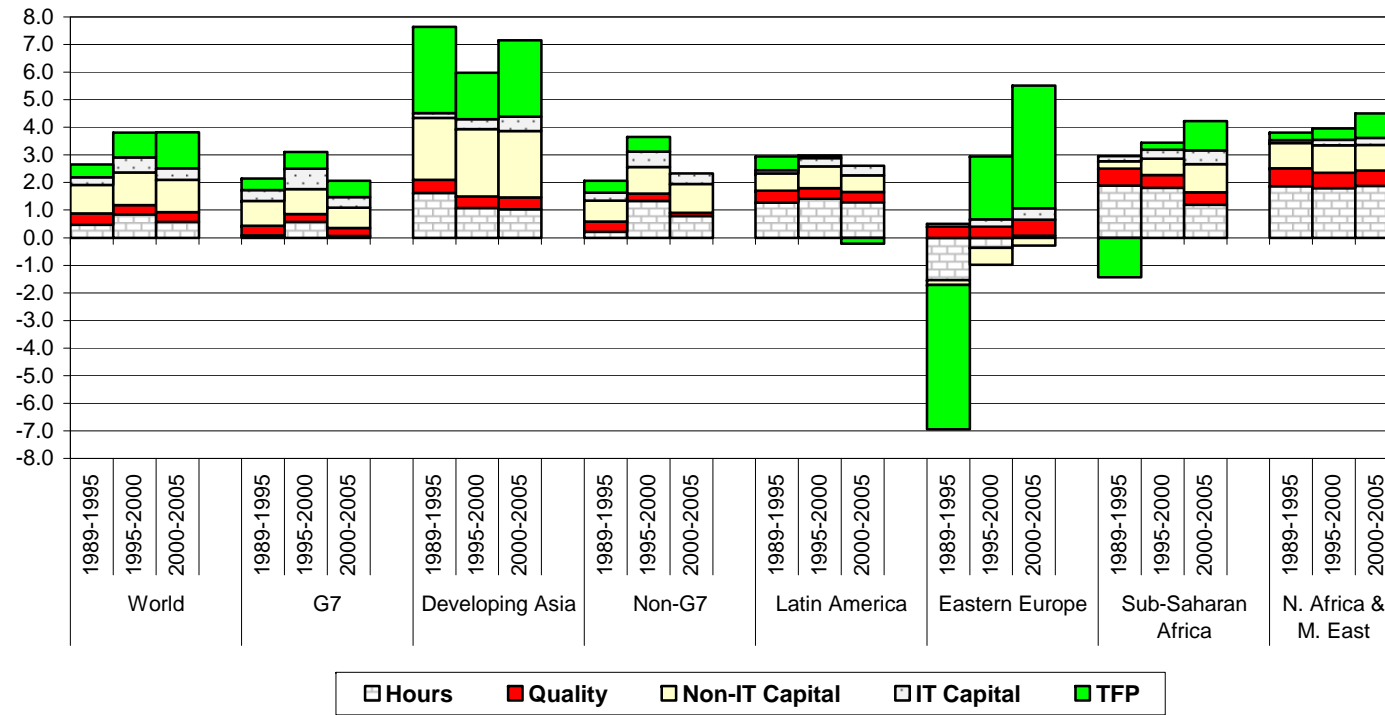


Figure 3. Sources of Economic Growth: The Seven Major Latin American Countries (LA7)

