Economic Growth in the Information Age:
From Physical Capital to Weightless Economy

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Introduction

The defining feature of economic growth in the information age is the increasing weightlessness of output. Production and consumption is shifting away from objects towards information and services. Good examples of weightless goods are computer software, financial products, telecommunications, the Internet, entertainment, and even management consulting. These goods accounted for about 23 percent of US Gross Domestic Product between 1987 and 1994. Their key characteristic is that they are often infinitely expansible, that is, that they can be used by many people at the same time. Another way to think of this is that once the good has been produced once, it can be replicated at very low cost.\(^1\)

It is currently fashionable for some economic pundits to prophesy that the information age is dramatically changing the structure of the world economy; reducing the power of governments to raise taxes or to undertake independent economic policies. Furthermore, it is argued, new technologies will lead to an inexorable rise in unemployment in the West. This view is also often linked to belief in the death of inflation. As stated, these views are nonsense. There is little evidence that unemployment, at the aggregate level at least, is caused by technological change.\(^2\)

This paper argues that while globalized and weightless activities have become increasingly important, they do not pose insuperable threats to the world economy. The overall message of this essay is an optimistic one: inequality and unemployment need not rise in the face of competition from the developing world or in response to technological change. However, government policy can play a major role in promoting adjustment to change, especially in terms of adjustment to the increasing importance of weightless technologies.

In fact, three economic phenomena are at work. First, production has become increasingly globalized, and foreign competition (especially from the Newly Industrializing Economies) has become increasingly intense. Second, deregulation and liberalization of domestic and world markets have reduced the power of trade unions and increased levels of competition. Third, the pace of technological change has accelerated, and that it has become increasingly biased towards skilled workers and weightless goods. To some extent these phenomena are not independent, since it is easy to see why they might cause each other in turn. In particular, this essay concentrates on the implications of globalisation and weightlessness.

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This essay is structured as follows. Section one describes the neo-classical view of economic growth, trade, and inequality, and contrasts them with the theoretical developments of the past decade. These theoretical developments make an important contribution to our understanding of the economics effects of increasing globalization and weightlessness. Section two addresses two particular aspects of the information age: the collapse in demand for the unskilled, and the rise of foreign direct investment (FDI). Section three looks at the East Asian growth miracle, a major recent economic development which has potential implications for how other emerging nations should manage their development. Section four examines the experience of the United Kingdom, an open economy that has experienced deindustrialization and has increasingly switched towards services and other weightless goods. The paper concludes by reviewing the implications of the information age for government policy in developing and industrial countries.

The Economics of The Information Age

A Neo-Classical View

The measurement of economic growth raises a number of interesting and difficult problems. One obvious way to measure the material progress made by any economy is to measure labour productivity, that is, output per worker. However, to compare different industries or countries on such a basis is more contentious, since differences in the quantities of other inputs (such as capital or materials) will also affect output per worker. In consequence, economists prefer to look at measures of total factor productivity (TFP), which is usually thought to measure technological progress.

Total factor productivity growth is the rate at which output would increase if all inputs were held the same, and is calculated as the difference between the rate of growth of output and the rate of growth of total inputs. The rate of growth of total inputs is a weighted average of the rates of growth of individual inputs. It is usual to weight inputs according to their shares in output, a practice that makes certain assumptions, notably that product and factor markets are competitive.

Although economic growth had been an important interest of earlier economists, it is to the work of Robert Solow that we owe the foundations of the modern study of economic growth. The startling conclusion of his 1957 paper was that technical change was responsible for the majority of economic growth in the United States between 1909 and 1949. Later work by researchers in the growth accounting tradition, such as Zvi Griliches, who adjusted for changes in labour quality and for various measurement errors, reduced the residual effect of TFP to around one-third of economic growth. An important

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drawback with this early literature was that it considered technological progress (TFP growth) to be generated exogenously.

To a traditional economist, raised in the neoclassical tradition, technological change is not at all worrying. Even if different countries grow at different rates, the theories of international trade of Ricardo and Heckscher-Ohlin suggest that countries will tend to specialize in the goods in which they have a comparative advantage, and that all countries gain from trade, except under certain unlikely theoretical conditions. The standard view of international trade, however, has trouble explaining the fact that the majority of trade is between nations with similar resource and factor endowments, rather than between the world’s most dissimilar countries.

Even within the neoclassical theory of trade, there are reasons that specific factors of production may not gain from trade even when the country as a whole does gain. For example, the Stolper-Samuelson theory predicts that the move to free trade will result in a decrease in the real returns to the factor used intensively in the import-competing industry. This is often taken to mean that scarce unskilled labour in the North will lose out in the face of competition from plentiful unskilled labour in the South.

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5 For example, if a number of developing countries specialized in the same products, there is the possibility that they would flood the world market and hence reduce their terms of trade to such an extent that they suffer ‘immiserizing growth’. This argument dates back to Jagdish Bhagwati, “Immiserizing Growth: A Geometrical Note”, Review of Economic Studies, 25 (June 1958) p. 201-5.

Endogenous Growth Theory & Other Developments

The new theory of economic growth has developed in the past ten or so years, after the pathbreaking work of Paul Romer. He showed that it was possible to produce consistent economic models that did not rely upon exogenous technical progress to generate increases in living standards. Instead, he argued that investments in capital produce externalities through learning by doing, which raise the productivity of other firms. A larger capital stock in the whole economy thereby provides an external benefit and improves the technology level for all producers. While this sounds reasonable, learning by doing is not the only possible source of endogenous growth. Other researchers have suggested human capital, research and development, infrastructure, and more recently, fertility.

Endogenous growth theory has many applications. First, let us consider the implications for the distribution of income within a country. New inventions increase the return to skills and ability, but as the technology matures and become more familiar, the return to skills falls. In this view, the early stages of a invention would be accompanied by increases in the skills gap (i.e. the wage differential between the skilled and the unskilled), followed later by convergence in wages. To take this argument a little further would suggest that the most high technology sectors of the economy should have the highest wage differentials between the skilled and the unskilled. Furthermore, faster growth may increase the skills ratio, since it can only be supported by a high stock of human capital and thus requires a high degree of wage inequality. A low wage ratio does not provide a large enough incentive for education and thus too few people become educated, and so the economy remains in a poverty trap.

This discussion leads naturally onto the so-called the ‘superstar’ economy. On the supply side, Sherwin Rosen has argued that imperfect substitution between people means that earnings distributions should be skewed to the right, with a small number receiving much greater rewards than the average. This is possibly due to the winner-takes-all nature of

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11 Sherwin Rosen, “The Economics of Superstars”, American Economic Review, 71 (December 1981) p. 845-858. Rosen pointed out the phenomenon whereby small numbers of people earn enormous amounts of money and dominate their respective sectors of the economy, whether it is bond-trading, movie acting, or baseball. The economics of superstars means that not only are they large differences in earnings between sectors, but that within sectors there are very large differences too.
their business. If a baseball player scores ten percent more home runs than his peers he will receive more than ten percent higher wages.

On the demand side, high quality sellers have a competitive advantage. It would be very costly for one person to have a private concert from Pavarotti, but not so difficult when the audience numbers hundreds, thousands, or even millions. Alfred Marshall wrote that as long as the number of people who can be reached by a human voice is strictly limited, there must be a limit on how much any one performer could command. The advances in communications embodied in radios, cable television, mobile telephones, home computers and the Internet have certainly raised this ceiling.

It should be clear that the question of why some individuals or families remain poor over time is related to the question of why some countries stay poor over time. Turning to the distribution of income between countries, in the neo-classical growth model, poor countries should grow more rapidly than rich ones through capital deepening, conditional on their having the same determinants of steady states such as preferences and the same levels of technology. Levels and growth rates of income per capita should therefore converge over time for countries, for regions, and for individuals.

However, intuition suggests that this is not a very good description of the real world. Economists even find it difficult to agree on how convergence should be measured. Many would agree that there is some kind of conditional convergence process at work in the world economy, which means little more than that countries with similar characteristics will converge to similar levels of income per capita. Danny Quah is a notable critic of much of the convergence literature. He argues that the key issue is not whether a single economy is tending towards its own steady-state but what happens to the entire cross-sectional distribution of economies. He goes on to argue that the distribution is polarizing into twin peaks of rich and poor countries. We will see later that openness to trade appears to be playing a role in the development of this bimodality and that more open economies are more likely to be in the higher income convergence club.

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12 Alfred Marshall, *Principles of Economics* (New York: Macmillan, 1920) used the example of Elizabeth Billington who earned between £10,000 and £15,000 (in 1801 prices) in the 1801 season singing opera at Covent Garden.


14 A huge number of different characteristics have been examined in this literature, ranging from the average number of years of schooling to the distance from the equator. A good summary of the variables is provided in a humorously titled paper by Xavier Sala-I-Martin, “I Just Ran Two Million Regressions”, *American Economic Review*, 87 (May 1997) p. 178-183. Among the most robust of these variables are the share of physical investment in output, the level of human capital, and the degree of openness to trade. Most studies have major problems because they do not adequately allow for endogeneity, that is, fast growth may cause high investment, rather than vice-versa.


There are several theoretical reasons to expect such a bimodal distribution to exist, such as the existence of a poverty trap. For example, if capital and skills are complementary, it might be possible for a country to become trapped in a ‘low-skills’ equilibrium. Mancur Olson has argued that it is the structure of incentives in poor countries that prevents a growth breakout, while Alwyn Young has suggested that market size effects are important.\(^{17}\)

Despite these pessimistic arguments, however, many other authors have suggested that we are likely to observe convergence, rather than divergence, in practice.\(^{18}\) This may be because leaders eventually stumble, allowing their rivals to catch-up, or because international knowledge spillovers are sufficiently large. Olson suggests a rather more complex sociological analysis whereby successful nations eventually accumulate so many institutional rigidities that other nations can catch-up and surpass them.\(^{19}\)

**Openness and Growth, Geography and Trade**

Lots of attention has recently been given to the links between growth and trade.\(^{20}\) There are three kinds of international openness: the international transmission of ideas, the international flow of goods and services, and international movements of factors of production, such as capital. In the Heckscher-Ohlin model discussed earlier, increased openness affects income by encouraging resource reallocation into sectors with a comparative advantage. In addition to this static effect of resource reallocation, openness has five potential dynamic effects on growth. These arise through the direct transfer of technology; the spillover of ideas; the elimination of the duplication of research; the increased size of the market; and increased competition.

Internationally, Jeffrey Sachs and Andrew Warner suggest that trade openness is an important determinant of cross-country growth. They use a number of indicators to separate economies into those which are closed and open.\(^{21}\) On this basis they find that open economies converge to one level of income, while closed economies converge to another, following the twin peaks result discussed above. This suggests that openness is

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\(^{21}\) They define a closed economy as one where non-tariff barriers cover over 40 percent of trade; or average tariff rates are over 40 percent; or which has a black market exchange rate which depreciated by more than 20 percent relative to the official rate; or a socialist economic system; or a state monopoly on exports.
important because it allows poor countries to catch up with the rich, while being closed to trade suggests stagnation at the lower income level.  

The most important benefit to a country of participating in international trade might be the access that such trade affords to the technological knowledge of the rest of the world. Although agents in an economically isolated country might acquire information by reading professional journals, speaking to foreign experts, or inspecting prototype products, the contacts that develop through commercial exchange play an important role in the diffusion of knowledge. This argument can be justified in a number of ways. First, the larger the volume of trade, the greater the number of personal contacts between domestic and foreign individuals. These contacts may lead to the exchange of information. Second, imports may embody innovations that are not available in the local economy, and that local researchers may gain insights from these innovations. Third, when local goods are exported, foreign purchasing agents may suggest ways to improve the production process. It seems likely therefore that the extent of knowledge spillovers will increase with the extent of trade. 

In terms of convergence of productivity, openness to spillovers will have three main effects. First, it may affect the domestic rate of innovation and hence the growth rate. Second, it may affect the amount of technical information that may be transferred from the leading country to the less advanced economy. Third, it may affect the speed of that transfer. It is difficult to separate out these effects empirically, but for the United Kingdom there is evidence that more open sectors catch-up faster with US productivity levels. 

Of course, knowledge spillovers across countries are not perfect. This is suggested by the work of David Coe and Elhanan Helpman, who investigate the role of international trade in R&D spillovers, and find that the benefits of R&D are shared across national borders. They found that small countries tend to benefit more from R&D undertaken abroad. Each 1 per cent increase in trading partners R&D capital stock leads to a 0.07 per cent increase in UK total factor productivity, while a 1 per cent increase in the UK R&D capital stock leads to a 0.23 per cent increase in UK productivity. In contrast, a 1 per cent increase in the R&D capital stock of its trading partners raises the productivity of the Republic of Ireland by 0.15 per cent, while a 1 per cent rise in its own R&D capital stock raises its productivity by less. 

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23 This analysis could apply to geographically distinct regions just as much as to politically distinct countries, although some writers, such as Mancur Olson, would argue that the institutional structure of a country is more important in determining its learning capabilities than its geography.


productivity by 0.07 per cent. Their estimates imply large international R&D spillovers, with about one-quarter of the benefits of R&D in a G7 country accruing to its trading partners. Furthermore, Coe and Helpman have shown that the countries that gain the most from foreign R&D are those whose economies are most open to foreign trade. Overall, openness to ideas is probably at least as important as openness to trade, although the two are difficult to separate. One important channel for knowledge spillovers is foreign direct investment (FDI), which has played an increasing role in world trade over the past twenty years. The pattern of FDI in East Asia suggests strongly that it is an important source of technical knowledge to recipient countries.

Symptoms of the information age

The Rise of foreign direct investment

The volume of foreign direct investment (FDI) and the share of world trade undertaken by multinational enterprises has risen considerably over the past twenty years. The aggregate stock of FDI in the OECD is estimated to have risen from about 5 percent of output in 1975 to about 10 percent in 1995, and the value of sales by foreign affiliates is thought to exceed the value of world exports by about a quarter. In some countries, the level of foreign participation has reached very high levels, for example, in 1988 about 53 percent of Singaporean manufacturing sales were accounted for by foreign owned firms.

In the neoclassical growth model, capital should flow from capital-rich countries to capital-poor countries since it should earn higher returns. This does not explain why the majority of FDI takes place within developed countries rather than flowing from the OECD to the developing world. At one level at least, the choice for a firm of producing

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26 Coe, Helpman and Hofmaister extend the analysis to look at the effect of R&D and trade on growth in the developing world. Since reliable R&D data are rarely available for such countries, they construct a proxy variable by weighting the R&D stocks in the OECD nations according to their trade flows with each developing country. They find that this variable, showing the joint influence of technology and trade, has a significant effect on growth in developing countries. David Coe, Elhanan Helpman, and Alexander Hofmaister, “North-South R&D Spillovers”, Economic Journal, 107 (January 1997) p. 134-149.


31 In 1980, the OECD had received about 74 percent of the global stock of FDI and was the source of about 98 percent. In 1995, it had received about 72 percent and was the source of about 92 percent. Throughout the period, the EU-15 was both the location and the source of about forty percent of the global stock. See Ray Barrell and Nigel Pain, “Foreign Direct Investment, Technological Change and Economic
either at home or abroad through FDI is a simple one: which option will produce the most profits. However, the factors that affect profits are themselves very complex. The most significant factors appear to be those of ownership, location, and internalisation. A firm must have some knowledge, management, or other assets that other firms do not. In addition, there must be some reason, such as market access, lower labour costs, transport costs, or trade barriers, that make foreign production more suitable than domestic production. Lastly, there must be some reason that the firm prefers to undertake production itself rather than license production to a local firm.

New growth theory suggests that FDI will benefit the host economy through the transfer of technical knowledge and best-practice managerial techniques. The benefits of FDI will spill over into the wider economy and lead to learning by watching. In addition, many developing countries lack the necessary human capital to undertake R&D to generate new knowledge. FDI helps to transfer knowledge, without requiring the hosts to invest more resources in R&D. However, these benefits will usually only accrue where the host has a suitably conducive economic environment.  

An important development in the last ten years has been the emergence of Japan as a source of FDI. The Japanese share of the world stock of FDI has risen rapidly, from less than 4 percent in 1980 to about 12 percent in 1994. Interestingly, around two-thirds of Japanese FDI is in the tertiary sector, that is, mostly the retail and wholesale trade. This has often been designed to help Japanese producers to gain access to foreign markets. Japan was one of the first major foreign investors in the other Asian economies, first in primary sectors and then in manufacturing. Its manufacturing FDI has slowly shifted to the less developed economies in the region. As this has happened, the first-tier NIEs have started to invest abroad as well, and now account for a larger share of the FDI stock in the ASEAN-4 than Japan. China has also attracted substantial amounts of regional FDI, most especially from Hong Kong.

The Collapse in demand for the unskilled - rising unemployment and rising inequality

It is worth spelling out the conventional wisdom on the labour market effects of the information age. First, that it has generated increased inequality in the United States where aggregate unemployment has been little affected. Second, that it has generated increased unemployment in Europe where inequality has been little affected, except for the United Kingdom which has experienced higher levels of both inequality and

32 Barrell and Pain (1997) argue that the spillover effects of FDI also accrue within developed countries.
34 The ASEAN-4 consists of the second-tier Asian developing countries of Malaysia, Indonesia, and Thailand and in addition, the Philippines.
unemployment. Third, that even where unemployment has remained stable in aggregate, there is now more unemployment amongst the low skilled.

It is easy to find statistics that are cause for concern. For example, in 1973, average hourly real earnings in the United States, measured in 1982 dollars by the consumer price index (CPI), were $8.55. By 1996, they had declined to $7.43. This fall in average hourly real earnings was accompanied by a significant increase in the inequality of earnings in the United States. In 1979, the median full-time worker with at least a bachelor's degree earned 38 percent more per week than the median full-time worker with only a high school degree; by 1994, this had risen to 74 percent.

There is a number of mechanisms by which the rate of growth could affect aggregate unemployment. In the standard non-accelerating inflation rate of unemployment (NAIRU) model, the rate of technological progress does not affect the level of unemployment. In search models of unemployment, technical progress can have effects on unemployment through labour reallocation. An increase in the growth rate raises the return to firms of job creation and so lowers unemployment, but it also reduces the duration of any job and so raises unemployment. The interaction between these effects suggests that unemployment increases as growth rises at first, but later falls when growth reaches high levels, so giving a hump-shaped relationship. In practice, evidence on the link between growth and unemployment is unclear and scarce, suggesting that it is not important empirically.

It is less contentious to suggest that technological change could influence the composition of unemployment. In times of rapid technological change some workers are bound to lose out as their industries become less important. These workers may not have appropriate skills to find jobs in the new industries, and so join the ranks of the long-term unemployed. There is much less variation between countries in short-term unemployment levels than in levels of long-term unemployment. This is because long-term unemployment does very little to hold down wage pressure and inflation. Microeconomic policies should therefore be concentrated on the long-term unemployed.

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38 If certain technical assumptions are relaxed (e.g. that the production function is Cobb-Douglas and that technical progress is neutral between labour and capital), it is possible that equilibrium unemployment will be higher for faster rates of technical progress. See Richard Layard, Stephen Nickell, and Richard Jackman, Unemployment: Macroeconomic Performance and the Labour Market (Oxford: Oxford University Press, 1991) p. 107.


It is often asserted that income distribution in the countries of the OECD has become much more unequal in the past twenty or so years, especially in the USA. The overall degree of income inequality in the US is certainly higher than that in any of the European countries. However, the difference between the US and the European average, is less than the range found within the EU. According to Tony Atkinson, the gap between the US and Europe widened in the 1970s when inequality fell in most of the EU countries and rose in the United States. By the second half of the 1980s, inequality had stopped falling in most European countries, and had begun to rise in some, most particularly the United Kingdom.

A number of papers have examined whether the widening of the wage structure in the 1980s is due to the impact of skill-biased technical change (where technical change raises the returns to skilled labour relative to unskilled labour). For the United States, between 1963 and 1989, average weekly wages for the least skilled (as measured by years of schooling and labour market experience) male workers declined by about 5 per cent, while wages for the most skilled rose by about 40 percent. Even within groups with similar skill levels, there were significant rises in wage inequality. This suggests that much of the increase in male wage inequality is due to increased returns to skills other than years of schooling and labour market experience. Looking across countries, most of the shift towards the use of skilled workers has occurred within industries, rather than because of shifts in employment between industries.

**East Asian Growth - miracle or mirage?**

Over the past thirty years, a small group of East Asian countries have industrialized rapidly (South Korea, Taiwan, Hong Kong, Singapore). Growth rates of per capita income in this first-tier of newly industrializing economies (NIEs) averaged about seven per cent per annum over this period. This first group has now been joined by a second group (Indonesia, Malaysia, and Thailand) which have averaged six per cent growth over the last decade. A third tier is now starting to emerge, including China, with equally high growth rates.

As table 1 shows, the first-tier NIEs have been very successful exporters, raising their share of world manufactured trade from 2 per cent in 1965-69 to 9 per cent in 1991-93. Nonetheless, even though the 1st tier NIEs now account for around nine percent of world

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manufactured trade, this still represents a small proportion of world GDP. In 1970, imports from the NIEs amounted to about one quarter of one percent of the GDP of the EU and US. In 1990, they accounted for 1.30% and 1.91% respectively.\footnote{Paul Krugman, “Growing World Trade: Causes and Consequences”, \textit{Brookings Papers on Economic Activity} (1995) p. 327-362.}

\begin{table}[h]
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\caption{Shares in World Exports of Manufactures 1965-1993}
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\hline
 & US & UK & Germany & Japan & 1st tier NIEs \\
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1965-69 & 19.1 & 10.6 & 17.1 & 8.5 & 2.0 \\
1970-74 & 15.4 & 8.3 & 17.7 & 10.3 & 3.4 \\
1975-79 & 14.4 & 7.9 & 16.9 & 11.1 & 4.8 \\
1986-90 & 11.9 & 6.2 & 15.6 & 13.3 & 8.6 \\
1991-93 & 13.0 & 5.9 & 14.2 & 12.9 & 9.0 \\
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Note: Germany includes East Germany after 1991

Another indication of the scale of the economic success of these countries is that in 1960 South Korea was poorer than many sub-Saharan African countries, and Taiwan not much richer.\footnote{Dani Rodrik, “Getting Interventions Right: How South Korea and Taiwan Grew Rich”, \textit{Economic Policy} 20 (April 1995) p. 53-97.} There is a number of popular explanations of this success. One theme is that of openness and export orientation, since the countries have been successful exporters and have also imitated foreign technologies. The second theme is that of investment and coordination. The NIEs typically have high saving and investment rates, and low taxes and social costs, as well as relatively high quality education systems and institutions. Some commentators have also suggested that the NIEs have used protectionism and import substitution as well as investment subsidies.

As mentioned above, the NIEs have attracted substantial amounts of FDI which has enabled them to adopt and to adapt foreign technologies. In general, the ability of developing countries to attract FDI seems to depend upon whether they pursue export promoting (EP) or import substituting (IS) strategies for development. Jagdish Bhagwati has argued that EP countries attract more FDI and that this FDI yields higher social returns.\footnote{Jagdish Bhagwati, \textit{Anatomy and Consequences of Exchange Control Regimes}, (New York: NBER, 1978). For recent evidence, see Balasubramanyam, V., Salisu, M., and Sapsford, D. “Foreign Direct Investment and Growth in EP and IS countries”, \textit{Economic Journal}, 106 (January 1996) p. 92-105.} It is commonly thought that IS policies induce inefficiency by inducing distortions in factor and product markets; encouraging the adoption of production techniques at variance with factor endowments; and promoting directly unproductive profit seeking activities and resource misallocation.\footnote{Dominick Salvatore and Thomas Hatcher, “Inward oriented and outward oriented trade strategies”, \textit{Journal of Development Studies}, 27 (April 1991) p. 7-25, find that countries with higher ratios of exports to output also grow faster.}
There has been considerable recent controversy about whether the astonishing growth rates of the East Asian NIEs were due to factor accumulation (high levels of capital investment) or TFP growth (technological progress). This debate has called into question whether there has been an Asian growth miracle. For example, Alwyn Young has argued that the TFP performances of Hong Kong, Singapore, South Korea, and Taiwan have not been exceptional, once account is taken of the dramatic rise in factor inputs. Young argues that all these countries were able to expand output very rapidly through increasing levels of participation, education, and investment, and through the transfer of labour into manufacturing. He estimates that between 1966 and 1985, TFP rose at around 1.5 per cent per annum in South Korea and Taiwan, at about 2.5 percent in Hong Kong, and at only 0.1 per cent per annum in Singapore. This scarcely constitutes a TFP growth miracle.

Table 2

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<th>The Sources of East Asian Growth (p.a. average) 1960-85</th>
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In contrast, Nirvikar Singh and Hung Trieu calculate rates of TFP growth for Japan, South Korea, and Taiwan and argue that their experience is not simply explained by factor accumulation. Using a similar method to Young, they estimated that all three countries show similar TFP growth rates (around 2.5 per cent). They argue that while these growth rates are not miraculous, they are high compared with those of Latin America.

Dani Rodrik has argued that it is impossible to understand the East Asian growth miracle without appreciating the important role that government policy played in stimulating private investment. He shows there is a strong correlation between government expenditures and exposure to trade: countries that are more exposed to trade have bigger governments. He also argues that certain government interventions are required to turn poor countries into rich ones. Good institutions make this easier, bad ones make it more difficult. Markets and states can be complements especially where social insurance is

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51 Nirvikar Singh, and Hung Trieu, “Total Factor Productivity Growth in Japan, South Korea, and Taiwan”, (Santa Cruz: University of California at Santa Cruz, working paper no. 361, July 1996).
concerned. Rodrik identifies four dimensions to good institutions: the quality of bureaucracy, with autonomy from political pressure and good recruitment and training; the rule of law, with strong political institutions and courts and an orderly succession of power; low risk of expropriation, with little risk of nationalization or confiscation; and low risk of repudiation of government contracts.

Overall, productivity growth rates in Taiwan, Hong Kong, and South Korea, although not miraculous, compare favourably with those of other developing countries and with the OECD. Singapore stands out as an exception, seemingly having experienced little TFP growth along with very high rates of capital accumulation. The task of explaining these growth rates is made harder by the striking differences between the four countries. On the basis of cross-country regressions, East Asian growth does not seem to be due solely to the accumulation of inputs, but also to activist policy, initial conditions, and institutional quality. Even so, none of the standard explanations of the East Asian miracle provide completely satisfactory explanations of why the East Asian countries have grown so fast while other developing countries have not.53

Regardless of the sources of East Asian growth, such growth rates cannot be maintained indefinitely. The most pertinent example is that of Japan, which industrialized earlier than the other East Asian countries and is now a mature economy, even a deindustrializing one. In 1952, Japan had a per capita GNP of $188 in the prices of the day, below that of Brazil, Malaysia, and Chile. Like many present-day low income countries, Japan then had a high proportion of its labour force in agriculture; a relatively small capital stock; and a relatively low level of technology. However, it also possessed a highly educated and skilled workforce in manufacturing; large productivity differences between well developed sectors and under-developed sectors; and significant strengths in management and organization. By 1995, Japan had the fourth highest GNP per capita in the world, ranking only behind Luxembourg, Switzerland and the USA.54

Much of this growth in labour productivity was driven by total factor productivity growth. TFP levels in Japanese manufacturing caught up with levels in the United States by about 1980 and have since grown at a similar rate. Given the social capability to imitate and import technology from abroad, Japan shows that it is possible to catch-up, but that it is much more difficult to forge ahead.55

A great deal of attention has been focused on the recent macroeconomic problems of the East Asian Tigers and of Japan. While these problems may have macroeconomic

54 A good introduction to the phenomenon of Japanese economic growth is provided by Bela Balassa and Marcus Noland, Japan in the World Economy (Washington, DC: Institute for International Economics, 1988).
55 In 1955, average TFP in Japanese manufacturing was about 61 percent of that in the USA. In 1973, it was 87 percent, and since 1980 it has been about the same, with some sectors (such as electrical engineering) moving ahead and some still lagging the USA. Gavin Cameron, Innovation and Economic Growth (Oxford: unpublished DPhil thesis, 1996) chapter 5.
implications for the rest of the world, they are unlikely to herald the end of rapid growth in
the region. Regardless of the macroeconomic policies adopted by the Tigers, they remain
an attractive place to do business, with forward-looking and innovative companies, and
well-educated and productive workers. Fundamentally, it is the productivity of those
workers and those companies that will determine their economic future, rather than
currency crises and bank failures.

The UK Experience

In some ways the United Kingdom is the flagbearer for deindustrialization. Having been
the first country to industrialize, the United Kingdom remained the world technological
leader until it was overtaken by the United States in the late 19th century. It has
subsequently undergone a century of relative decline. Nonetheless, its growth rate has
delivered sustained and rapid improvements in living standards, especially since World
War II.\textsuperscript{56} As shown below, this has been accompanied by a substantial shifts towards
service-based weightless industries.

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<td>64</td>
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<td>80</td>
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<td>58</td>
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<td>79</td>
<td>83</td>
<td>92</td>
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</tbody>
</table>

Note: Labour Productivity is defined as GDP per work-hour.

The UK currently occupies an interesting role in the world economy. It has undergone
deindustrialization and structural change over the past twenty years and now has the
highest ratio of trade to GDP of any medium sized OECD economy, accompanied by high
levels of foreign direct investment. The proximate cause of much of the
deindustrialization in the UK was the macroeconomic effect of the two oil shocks,
especially the second in 1979, when the UK’s position as a major oil producer and its tight
monetary policy led to a rise in the exchange rate which crowded out manufacturing and
led to a 14 percent fall in manufacturing output between 1979 and 1981.

\textsuperscript{56} See O’Rourke, K. and Williamson, J., “Around the European Periphery 1870-1913: Globalization,
Schooling and Growth”, (Cambridge, MA: NBER Working Paper No. 5392, 1995), and Nick Crafts,
1333, 1996).
To get an idea of the size of the shift away from manufacturing, consider table 4. In 1979, manufacturing accounted for around 25 percent of value added and 28 percent of employment, while services accounted for around 58 percent of value added and 61 percent of employment. By 1990, manufacturing had fallen to 21 percent of value added and 24 percent of employment, and services had risen to 66 percent of output and 69 percent of employment. The decline of manufacturing over the 1980s was mirrored by the rise of services, especially the financial services sector. It is not possible to get good data on the contribution of weightless goods to the economy, since they include some high-technology manufacturing activities as well as services. However, the rise of the UK service sector does suggest that the UK economy has become more weightless.

Although services are often regarded as being difficult to trade, the data tell a different story. While services accounted for only 32 percent of export gross output in 1990, they accounted for 42 percent of export value added. This is because the ratio of value added to gross output is considerably higher in services than in manufacturing, that is, manufacturing uses more intermediate inputs.
### Table 4

**Shares of Sectors in UK Output**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Share in Gross Output</th>
<th>Share in Value Added</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1979</td>
<td>1990</td>
</tr>
<tr>
<td>Primary</td>
<td>0.17</td>
<td>0.19</td>
</tr>
<tr>
<td>High Tech Manufacturing</td>
<td>0.17</td>
<td>0.15</td>
</tr>
<tr>
<td>Other Manufacturing</td>
<td>0.23</td>
<td>0.16</td>
</tr>
<tr>
<td>Fin Services</td>
<td>0.06</td>
<td>0.16</td>
</tr>
<tr>
<td>Trade Services</td>
<td>0.06</td>
<td>0.05</td>
</tr>
<tr>
<td>Non-Trade Services</td>
<td>0.32</td>
<td>0.30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sector</th>
<th>Share in export value added</th>
<th>Share in export gross output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1979</td>
<td>1990</td>
</tr>
<tr>
<td>Primary</td>
<td>0.16</td>
<td>0.10</td>
</tr>
<tr>
<td>High Tech Manufacturing</td>
<td>0.27</td>
<td>0.31</td>
</tr>
<tr>
<td>Other Manufacturing</td>
<td>0.18</td>
<td>0.18</td>
</tr>
<tr>
<td>Fin Services</td>
<td>0.08</td>
<td>0.15</td>
</tr>
<tr>
<td>Trade Services</td>
<td>0.09</td>
<td>0.08</td>
</tr>
<tr>
<td>Non-Trade Services</td>
<td>0.23</td>
<td>0.19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sector</th>
<th>Share in employment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1979</td>
</tr>
<tr>
<td>Primary</td>
<td>0.10</td>
</tr>
<tr>
<td>High Tech Manufacturing</td>
<td>0.15</td>
</tr>
<tr>
<td>Other Manufacturing</td>
<td>0.13</td>
</tr>
<tr>
<td>Fin Services</td>
<td>0.09</td>
</tr>
<tr>
<td>Trade Services</td>
<td>0.05</td>
</tr>
<tr>
<td>Non-Trade Services</td>
<td>0.47</td>
</tr>
</tbody>
</table>


It is possible to calculate the effect on productivity growth of these sectoral shifts. Productivity growth in the whole economy can be decomposed into that contribution made by productivity growth within sectors and that contribution made by switches in factor resources between sectors with differing levels of productivity. If the globalization story were correct, we might expect to observe large changes in industrial structure and hence that productivity is being strongly driven by sectoral shifts. In fact, for the UK between 1970 and 1992, sectoral shifts were responsible for 4 percent of whole economy labour productivity growth and 3 percent of manufacturing labour productivity growth. The remainder was due to within sector growth. For total factor productivity (TFP), sectoral shifts were more important, accounting for 17 percent of whole economy TFP growth and 10 per cent of manufacturing TFP growth. These figures suggest that despite
evidence for substantial changes in industrial structure in the UK, within sector productivity growth remains by far the most important source of productivity growth.\textsuperscript{57}

\begin{table}
\centering
\caption{Decomposition of productivity growth in the UK, 1970-1992}
\begin{tabular}{lcccc}
\hline
Shares of total growth & Between & Within & Total \\
\hline
TFP & Whole economy & 17.1 & 82.9 & 100.0 \\
 & Manufacturing & 10.2 & 89.8 & 100.0 \\
Labour Productivity & Whole economy & 4.4 & 95.6 & 100.0 \\
 & Manufacturing & 3.0 & 97.0 & 100.0 \\
\hline
\end{tabular}
\end{table}

The growth of foreign direct investment has also heralded major changes in the UK economy. In 1994, the UK had attracted around forty percent of the stock of US and Japanese investment in Europe. By 1992, foreign owned firms employed 18 of the UK manufacturing workforce, produced 23.5 percent of the output, and were responsible for about 30 percent of capital investment, as table 6 shows.

Table 6

Share of Foreign Owned Firms in UK Manufacturing, 1981-1992

<table>
<thead>
<tr>
<th></th>
<th>Value Added</th>
<th>Investment</th>
<th>Employment</th>
<th>Relative Labour Productivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1981</td>
<td>18.3</td>
<td>25.5</td>
<td>14.8</td>
<td>1.28</td>
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<tr>
<td>1983</td>
<td>18.6</td>
<td>23.1</td>
<td>14.5</td>
<td>1.35</td>
</tr>
<tr>
<td>1984</td>
<td>19.3</td>
<td>20.4</td>
<td>14.2</td>
<td>1.45</td>
</tr>
<tr>
<td>1985</td>
<td>18.1</td>
<td>21.1</td>
<td>13.6</td>
<td>1.41</td>
</tr>
<tr>
<td>1986</td>
<td>17.0</td>
<td>19.7</td>
<td>12.7</td>
<td>1.40</td>
</tr>
<tr>
<td>1987</td>
<td>17.9</td>
<td>20.4</td>
<td>12.8</td>
<td>1.49</td>
</tr>
<tr>
<td>1988</td>
<td>17.8</td>
<td>20.8</td>
<td>12.9</td>
<td>1.46</td>
</tr>
<tr>
<td>1989</td>
<td>20.6</td>
<td>26.7</td>
<td>14.6</td>
<td>1.51</td>
</tr>
<tr>
<td>1990</td>
<td>21.7</td>
<td>26.9</td>
<td>16.0</td>
<td>1.45</td>
</tr>
<tr>
<td>1991</td>
<td>21.6</td>
<td>33.4</td>
<td>17.1</td>
<td>1.34</td>
</tr>
<tr>
<td>1992</td>
<td>23.4</td>
<td>31.6</td>
<td>18.1</td>
<td>1.38</td>
</tr>
</tbody>
</table>


Between 1983 and 1990, the years for which there is the best information, the share of foreign owned firms in UK manufacturing output rose from 19 percent to 22 percent. In 1983, foreign owned firms had a 35 percent labour productivity advantage (value added per worker), rising to 45 percent in 1990. However, foreign firms tend to be located in the higher productivity sectors of UK manufacturing. If they had the same employment mix as UK owned manufacturing, foreign firms would have been 24 percent more productive in 1983, rising to 31 percent more productive in 1990. It is not clear whether this labour productivity advantage arises because of foreign firms having more capital per worker or higher levels of technology.

Just as we can decompose the productivity change in UK manufacturing as a whole into the contributions of within and between sector growth, we can also calculated how fast the productivity of UK manufacturing would have risen if the foreign share of output had not risen. Between 1981 and 1991, real labour productivity rose by 3.7% pa on average, with 3.63% pa of the rise accounted for by within sector growth, and only 0.06% pa accounted for by employment shifts from UK-owned to foreign-owned firms.\(^{58}\)

Lest we think that these capital flows have all been in one direction, the rise of FDI into the UK has been broadly matched by rising outward investment (as measured by net acquisition of share and loan capital). For example, in the 1970s, outward investment was about 0.5 percent of GDP and inward about 0.3 percent. In the 1980s, outward investment rose to about 1.1 percent of GDP, and inward remained stable at about 0.4 percent. In the 1990s, both inward and outward direct investment have equaled about 1.1 percent of GDP in the UK.

\(^{58}\) This makes sense since the foreign employment share rises by about 2 percentage points over the period, and foreign firms are 1.31 times as productive in 1991 as UK owned firms, so the shift should raise productivity by around (2*0.31)%=0.62% in total, which is approximately what 0.06% pa growth does.
After several decades of poor performance, the UK’s growth performance over the past decade has been similar to those of its major competitors. Although growth has been faster than in the 1970s, it has not surpassed that of the 1950s and 1960s (the ‘Golden Age’ of economic growth), and there is little reason to believe that the long-run rate of growth of UK GDP per capita is higher than about 2.5 percent per annum.59

The evidence on the performance of UK manufacturing is more clear-cut. Manufacturing TFP rose more rapidly in the 1980s than in the 1970s. There is no evidence that this has slowed in the 1990s. Within manufacturing, sectors that were relatively open in 1970, tended to have higher rates of productivity growth between 1970 and 1992. UK manufacturing also caught up somewhat with US productivity levels over the period. In 1970, UK manufacturing TFP was about 52 percent of the US level. By 1979, this was pretty much unchanged at 53 percent. This rose to about 60 percent in 1992. In general, the sectors that caught up faster were more open, undertook more R&D, and had higher levels of human capital.60

**Conclusions - Implications of the information age**

This essay has attempted to review the theory and evidence on the effect of the information age on economic growth. Recent theoretical developments in economics, such as endogenous growth theory, have drawn attention to the role of learning and knowledge in economic growth. At the same time, the increasing globalization and weightlessness of economic activity has emphasized that such considerations are not just theoretical.

The developing world faces great economic problems. It is hard to believe that although the mean income per capita in the world was about $4,880 in 1995, the median was closer to $620.61 In 1995, the 902 million people of the high income economies (16 percent of world population) produced 22 trillion dollars of output (81 percent of world output). However, since India has grown faster than the world average since 1985 and China faster yet, the picture is at least much rosier than it was in 1985.

This essay has argued that there appear to be at least two important conclusions for successful economic development. First, institutions matter. Second, openness matters. Good quality government institutions are good for economic growth. As discussed above in the context of the success of the East Asian economies, there are at least four dimensions to these institutions: the quality of bureaucracy; the rule of law; low risk of

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61 World Bank (1997) table 1. China is taken to contain the world’s median person. These data are at market exchange rates.
expropriation; and low risk of repudiation of government contracts. What is less obvious is how these dimensions may be translated into practical advice.

There is also strong evidence that openness is good for growth. Openness to ideas is probably as important as openness to trade, but it is difficult to have one without the other. Foreign direct investment has played an increasing role in world trade over the past twenty years, and that pattern of FDI in East Asia suggests that it is an important source of technical knowledge to recipient countries.

The amount of FDI received, and its effects appear to vary in turn with the trade policy adopted by the host country. Countries that adopt export promoting policies appear to receive more FDI and to benefit from it more than countries that adopt import-substituting policies. Given that the social capability to adopt ideas and technologies from abroad is important to growth, and that low government capability is associated with low social capability, the need to improve government capability is re-emphasized.

The OECD is currently negotiating an international agreement on cross-border investment, the Multilateral Agreement on Investment (MAI). Although the MAI is being developed by the OECD, non-OECD countries will be able to sign the final agreement. The MAI aims to create a level playing field, whereby foreign and domestic investors will be treated equally, and will therefore reduce distortions to investment flows. The particular benefit to a developing country of joining will be that the acceptance of high standards of protection, treatment, and legal security for foreign investment will encourage FDI. It is important that the final version of the MAI does not interfere with the freedom of governments to implement their own policies concerning labor and environmental standards.

One further important lesson for the growth of developing countries is that not all lessons can be learnt from East Asia. Indeed, while the East Asian Tigers have a good deal in common with each other, they all adopted different growth strategies, ranging from the interventionism of South Korea to the laissez-faire of Hong Kong. Each country has to choose its own path to development, rather than try to copy a generalized East Asian model.

For the industrial world, the information age may seem threatening, but it must be remembered that living standards have risen rapidly since World War II and that they continue to rise. Economic leadership has changed in the past and may do so in future. The experience of the United Kingdom shows that while it may be disappointing to be overtaken by other countries, it is rarely disastrous.

Fundamentally, competition between countries is not like competition between firms. If one firm seizes an advantage over a rival, that rival may go bankrupt. If one country becomes more productive than another, living standards in the other country should not

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fall. Indeed, rich countries will tend to import more and so raise living standards in their trading partners. According to this view of the world, unemployment and economic growth are largely independent of the rapid development of the NIEs.

Twin problems face the OECD. The first is that unemployment remains high by post War standards. The second is how to increase or maintain growth rates. It would be trite to say that the answers to these questions are independent, but not a bad approximation in the long-run. Unemployment is a social ill that is a major source of discontent. The current evidence suggests that the secular rise in OECD unemployment since the 1970s was not caused by either increasing foreign competition or skills-biased technical change. Instead, high unemployment seems to be associated with certain labour market features. These include high unemployment benefits that are not of limited duration; high unionization with collective bargaining and little coordination between employers and unions; high overall taxes on labour; high minimum wages for young people coupled with high payroll taxes; and poor educational standards at the lower end of the labour market.

In contrast, there are labour market features that do not appear to be correlated with unemployment, but which may help to alleviate social injustice and inequality. These include employment protection and labour market standards; high levels of unemployment benefits when accompanied by pressure to accept jobs; and high unionization when bargaining is coordinated, especially among employers. In addition, active labour market policies should be targeted on the long-term unemployed in order to make them effective participants in the labour market.63

Turning to the growth rate, there are no foolproof recipes for fast growth. However, it is clear that a well-educated and adaptable population will also be a high productivity population. In addition, openness to trade and ideas from abroad is also important for growth. Openness has static benefits in that resources are reallocated to their most productive uses, as well as dynamic benefits from increased access to foreign knowledge and from increased competition.

A more controversial suggestion would be subsidies for domestic R&D and capital investment. A number of studies have found that high levels of domestic investment are correlated with high growth rates, but this could be due to reverse causation. The consensus among economists seems to be that capital accumulation plays at most a passive role in long-run growth, and that increased investment might raise the level of output but not its growth rate. However, while it is difficult to see capital investment raising output per capita in the long-run in the absence of technical progress, it is also difficult to see why technical progress could raise output per capita in the long-run in the absence of capital investment. If capital investment and R&D are complements, a subsidy to one or the other might have an effect on the growth rate.64

63 This summary draws heavily on Nickell (1997).
64 This is a contentious issue. See Philippe Aghion and Peter Howitt, Endogenous Growth Theory (Cambridge, MA: MIT Press, 1997, forthcoming).
Governments face difficulties in designing subsidies to either capital investment or R&D. The case for such subsidies rests upon the social rate of return to capital investment or R&D being higher than the private rate of return. The main problem is to design a scheme that affects only marginal investments, rather than investments that would take place anyway. In addition, subsidies to R&D encourage firms to reclassify other expenditures as R&D. A successful subsidy has to overcome these problems.\textsuperscript{65} Since human capital and R&D are also likely to be complements, subsidies to human capital formation (such as education) may a further indirect way to raise R&D spending.

Lastly, there is an important policy that the developed world could adopt to promote growth in the developing world. That is to continue efforts to reduce trade barriers. To take the example of textiles, under the current Multi-Fibre Arrangement (MFA), tariffs on clothing imports into developed countries are due to be phased out by 2005. If this and other tariff reductions are accelerated, there is great scope for developing countries to increase their exports of labour-intensive manufactures without affecting their terms of trade.\textsuperscript{66} While, employment in those industries in the North would fall, consumers in developed countries would benefit from cheaper goods and firms in developed countries would be able to export more products of other kinds to the South.

It is tempting to focus on removing trade barriers in high-technology and other weightless industries. Such measures, while beneficial to the developed world, can do little to help the developing world. It is therefore appropriate to finish this essay by suggesting that even in this increasingly weightless and globalized world, the removal of trade barriers on textiles and other such prosaic items would lead to substantial improvements in living standards for those who live in comparative poverty.
