

*Distinguished Lecture*

## **Productivity and Economic Growth in South Asia and China**

T. N. SRINIVASAN

This paper, begins with a discussion of the well-known issues involved in defining and measuring *total factor productivity* (TFP) and its contribution to growth (as well as the possible contribution of growth to productivity), the economic theory underpinning productivity, and policies that impact on and influence changes in productivity. It is followed by, first, a selective discussion of the studies on cross-country variation in productivity levels and growth, and then the experience of South Asia and China in a comparative perspective across the region and across the developing world. The share of South Asia in global GDP and its growth has remained stagnant since the early nineties. Disturbingly, except India, the rest of South Asia experienced a decline in TFP growth between 1989–95 and 1995–2003. The paper concludes that for achieving sustained productivity growth, well-functioning social and economic institutions are important, since through their incentive structure they influence, labour force participation, savings and accumulation of human and physical capital, risk-taking and innovation as well as efficiency of resource allocation. Public policies, particularly macro-economic, foreign trade and investment policies, matter a great deal.

### **1. INTRODUCTION**

The interaction between gains in the productivity of resources used and growth in economic output has been discussed extensively in the economic literature for a long time [see the magisterial volumes by Jorgenson (1995, 1995a); Jorgenson, *et al.* (2005); Hulten, *et al.* (2001)]. This literature, often called growth accounting, was in part driven in the 1950s by concern about what was then perceived as the

T. N. Srinivasan is Professor of Economics, Yale University, USA, and Senior Visiting Fellow, Stanford Centre for International Development, Stanford University, USA.

*Author's Note:* This is a revision of my paper [Srinivasan (2005), forthcoming] presented at the G-20 Seminar on Economic Growth, co-hosted by the South African Reserve Bank, the People's Bank of China, and Banco de Mexico in Pretoria, South Africa on August 4-5, 2005. I thank Dale Jorgenson for his valuable comments.

rapid growth of output in the Soviet Union. Whether such growth was sustainable depended partly on whether it was largely accounted for by factor accumulation or by growth in the efficiency of input use or total factor productivity (TFP). The same question came up much later in the context of the rapid growth of East Asian economies [Krugman (1994); Young (1995, 2003)]. Also, the determinants of factor accumulation could be different from those of TFP, and furthermore there could be variations across countries (particularly between developed and developing countries) in these determinants. The contribution of the information and communication technology (ICT) revolution to the recent upsurge in growth in several countries and to the world economy as a whole has attracted the attention of several economists, including most importantly Jorgenson and Vu (2005) and Jorgenson, *et al.* (2005). So it is not surprising that accounting for observed growth within and across countries has received considerable attention from analytical and policy perspectives.

The scope of the discussion in the literature has also been wide-ranging, from a narrow perspective of the productivity of a *single resource* (e.g. capital, land or labour) in the production of a *particular commodity* (e.g. food grains, apparel) at a *point in time in a given country* (or even in a region within a country) at one end of the spectrum, to a much broader perspective of productivity of *all resources* (i.e. total factor productivity or alternatively, multifactor productivity) in generating *growth* of aggregate output (i.e. gross domestic product) over a long *period of time* across a *number of countries*. The analysis has also been equally wide-ranging from the positive perspective of accounting for observed variations across commodities, regions or countries at a particular time or in growth again across different time spans in a country or across countries and from a *normative perspective* of policies to influence productivity and growth. Also, the methodology of analysis, including importantly, the econometric tools as well as the data used in the analysis, has received, and appropriately so, a great deal of attention in the literature [OECD (2001, 2001a); Jorgenson, *et al.* (2005)]. Needless to say, given the nature of the topic, the literature is characterised by controversies and disagreements, rather than consensus, despite agreement that achieving sustained productivity gains is vital, certainly from the perspective of developing countries.

This is not the occasion to assess critically the findings of the vast literature. Instead, I will briefly discuss the well-known issues involved in defining and measuring *total factor productivity* and its contribution to growth (as well as the possible contribution of growth to productivity), the economic theory underpinning productivity, and policies that impact on and influence changes in productivity (Section 2). Then I move on in Section 3 to a selective discussion of the studies on cross-country variation in productivity levels and growth. Section 4 is devoted to the experience of South Asia and China, India, Mexico. Section 5 concludes.

## 2. DEFINING AND MEASURING TOTAL FACTOR PRODUCTIVITY (TFP)

Hulten (2000:4) points out that “output per unit input, or total factor productivity, is not a deeply theoretical concept”. Clearly, given a measure of what constitutes aggregate output and input, it is a matter of pure arithmetic to define TFP as the ratio of the measure of aggregate output to the measure of input.<sup>1</sup> In a market economy, the market determines the set of goods and services produced and consumed, their prices as well as the prices of the factor inputs used in producing them. Since prices can be expected to vary over time, one needs a measure of real output and a corresponding measure of real input for productivity analysis. A *purely statistical* approach that assumes that the set of outputs and inputs do not vary over time (I shall return below to the implications of relaxing this assumption), is to weight the basket of goods and services produced at different points of time at the *same set* of prices to measure aggregate real output and similarly weight the quantities of factor inputs used at different points in time by an unvarying set of factor prices, to measure aggregate real input. Thus, using base year (*year 0*) prices as weights, real output  $O_t$  in *year t* is defined by:

$$O_t = \sum_{d=1}^J P_{0j} O_{jt} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

where  $O_{jt}$  denotes the output of good (or service)  $j$  in *year t*,  $P_{0j}$  is the price of  $j$  in *year 0*, and  $J$  is the total number of goods and services produced. Similarly, aggregate input  $I_t$  in *year t* is defined by:

$$I_t = \sum_{k=1}^K q_{0k} I_{kt} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (2)$$

where  $I_{kt}$  denotes the quantity of input  $k$  used in *year t*,  $q_{0k}$  the price of input  $k$  in *year 0*, and  $K$  the total number of inputs. With real output and input defined by (1) and (2), it is obvious that TFP,  $\pi_t$  at  $t$  is given by:<sup>2</sup>

$$\pi_t = \frac{O_t}{I_t} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3)$$

<sup>1</sup>It is important to note that in this definition the measures of inputs equal their magnitudes, as actually used in production in the period under consideration. This is particularly relevant for the measurement of capital inputs, to ensure that the services that the stock of capital in place can generate are distinguished from services that are actually generated and used, so that the productivity changes arising from short-run changes in the utilisation of a given stock of capital are not attributed to the contribution that changes in the stock of capital make to productivity in the long run.

<sup>2</sup>One can express growth in productivity  $\pi_t$  over time  $[0, t]$  in terms of growth in output  $O_t$  and input  $I_t$  during the same period. See Appendix.

Even with this purely statistical definition, (i.e. no economic theory is being invoked), one can easily identify possible sources of *changes in productivity over time*.

First, suppose input  $I$  in year  $t$  is the same as in year  $o$  so that  $I_t = I_0$ , but output  $O_t$  is greater than  $O_0$ . It follows that productivity  $\pi_t$  in year  $t$  will be greater than  $\pi_0$ . Clearly,  $O_t$  will exceed  $O_0$ , with  $I_t = I_0$  if inputs of the same total value in the base year are reallocated across goods and services in such a way that, on balance, the output of those goods which have higher prices in the base year increase and those with lower prices decrease. This is a pure resource or *input reallocation effect*. Since  $O_t > O_0$ , there is growth in output as well as gains in productivity.

Second, suppose input  $I_{kt} = \lambda I_{k0}$  for all  $k$  with  $\lambda > 1$ , so that in year  $t$ ,  $\lambda$  times as much of each input  $k$  is being used in production. Then  $I_t = \lambda I_0$ . If  $O_t = \lambda O_0$  so that output increases by a proportion larger than  $\lambda$ , then obviously  $\pi_t$  will be higher than  $\pi_0$  so that productivity increases. Since output  $O_t$  has increased by a proportion larger than the increase in input, this is due to economies of scale in aggregation production. Therefore, the productivity gain in this case arises from an *economies-of-scale effect*. Once again, growth in output is associated with a gain in productivity.

Third, suppose the output  $O_{jt}$  of each of the goods  $j = 1, \dots, J$  depends not only on the inputs used in the production of each, but also on the output  $O_{1t}$  of good 1. Concretely, suppose any increase  $O_{1t}$ , with inputs used in the production of each  $j$  unchanged will increase the output  $O_{jt}$ ,  $j = 1, \dots, J$ , so that the output of good 1 has a positive external effect on the output of other goods. Consider now the case of  $I_t = I_0$  so that the value of inputs at base-year prices is the same in year  $t$  as in year  $o$ . If the inputs are reallocated to produce more of good 1 while decreasing the inputs used in the production of other goods, as long as the external effect of the increase in output of good 1 on the output of other goods dominates the effect of the decrease in the inputs used in their production, aggregate real output  $O_t$  will increase so that productivity  $\pi_t$  will increase as well. The productivity gain and the associated growth in output in this case are due to a *positive externality effect*.

Fourth, suppose once again  $I_t = I_0$  so that the aggregate inputs used in year  $t$ , have the value at base-year prices as in year  $o$ . Assume further that the inputs used in year  $t$  in the production of each good  $j$  also remain the same, but the technology used in year  $t$  in the production of one or more goods is more productive than in year  $o$ . Then the aggregate output  $O_t$  will exceed its base-year value  $o_0$  and productivity  $\pi_t$  will exceed  $\pi_0$ . In this case, the source of the gain in productivity and associated output growth is due to the *technical progress effect*.

The above illustrations were used to derive gains in productivity and growth in output in a simple and transparent manner so as to isolate particular sources of both, such as resource reallocations, economies of scale, positive externalities and technical progress. It is clear that in any economy, all these sources could be operating to varying

degrees, but they need not all move in the same direction. For example, there could be diminishing returns to scale in the production of one or more goods, externalities could be negative as well as positive, resources might be reallocated inefficiently, and so on. Furthermore, in a purely statistical exercise, the underlying technology of production, the economic processes behind the allocation of resources at a point in and over time, as well as the institutional and policy underpinnings of the economic processes, were left unspecified. Clearly, one has to specify these for identifying the sources of growth and productivity gains empirically from economic data (an exercise in positive economics) and also for drawing policy inferences (an exercise in normative economics). Before doing so, let me briefly note the implication of the assumption that the set of goods and inputs remains the same over time.

There is no doubt that new goods are introduced over time (and some goods cease to be produced), the quality of pre-existing goods changes, new inputs and new or different uses are found for the same inputs, and so on. To take a simple example, suppose the quality of some input doubles in the sense that one unit of the new higher quality input is twice as productive as that of the old input of unchanged quality. Even if there is no change in the quantity used of that input, the outputs of one or more of the goods that use that input in production will nevertheless increase and a gain in productivity will be seen in the data. If, by contrast, along with the increase in quality of the input, there is a reduction in the quantity used of that input by a proportion no larger than the rise in its quality, while the quantities used of other inputs remain the same, the aggregate input used will go down while output remains the same or increases. This once again increases productivity. This way of describing a productivity increase due to a quality improvement in input is tautological, since quality itself is being implicitly defined by the increase in productivity!<sup>3</sup>

In (1) and (2), aggregate real output and input were defined by base year price-weighted sums of disaggregated quantities of outputs and inputs. However, aggregates such as real GDP, consumption, investment, outputs of sectors consisting of a number of goods, real inputs, etc., are often derived by deflating the corresponding nominal values by a price index.<sup>4</sup> The problems arising from quality changes and the appearance of new goods are seen more transparently in the latter procedure. For example, in the United States, the Boskin Commission Report (1996)

<sup>3</sup>Defining the productivity impact of improvements in the quality of a final output, rather than an input, is a bit more complicated. For the sake of brevity I do not go into this issue here, except implicitly in the discussion of the paper of Bils (2004) below.

<sup>4</sup>Real output as defined by (1) is the same as that obtained by deflating the value of output at current prices (i.e.  $\sum P_{ij} 0_{jt}$ ) by the Paasche price index, defined by  $\frac{\sum P_{ij} 0_{jt}}{\sum P_{0j} 0_{jt}}$ . Real input as defined by (2) can be derived by deflating the value of input at current prices by an analogous Paasche price index for inputs. In fact (1) and (2) become Laspyeres quantity indices, if we divide by base-year value  $0_0$  and  $I_0$  for output and input respectively.

concluded that the consumer price index (CPI) of the Bureau of Labour Statistics (BLS) overstated inflation by around 1 percent per year, of which unmeasured growth in the quality of goods contributed 0.6 percent [Bils (2004)]. Clearly, overstatement of inflation implies *ipso facto* an understatement of real consumption that is derived by deflating the nominal value of consumption by the CPI. Moreover, the procedure by which quality changes are derived can have a significant impact on estimates of growth and productivity. This is illustrated by Bils (2004).

He points out:

To calculate the CPI the BLS tracks a large set of prices, with each price specific to a particular product at a particular outlet. The products followed change for two principal reasons. At regular sample rotations, roughly every four years, the BLS draws a new sample of stores and products within a geographic area to better reflect current consumer spending ... In addition, a store may stop selling the particular product being priced. The BLS agent then substitutes another model of that brand or of a similar product. These (forced) substitutions occur on average about once every three years for all non-housing CPI items. They occur much more frequently, nearly once per year, for consumer durables [Bils (2004), p. 1].

He adds:

Although the price increases accompanying scheduled and forced substitutions largely reflect the same economic phenomenon—newer versions of goods sell at higher prices than old, BLS methods treat them very differently. Current methods implicitly treat the increases in the unit prices of goods, associated with sample rotations, as reflecting quality growth. Therefore, the National Income and Product Accounts (NIPA) will interpret that part of the upward trend in unit prices as real growth. By contrast, the price increases from forced substitutions *within* sample rotations have been largely attributed to price inflation, not quality growth [Bils (2004:1-2)].

The implications of the BLS procedures are clear from Bils's analysis. He notes that:

... most consumption deflators for the National Income and Product Accounts (NIPA) are based on BLS's measures of CPI inflation. The NIPA derive real growth measures by subtracting measured inflation from nominal spending growth for each category of good. Thus any measurement error in CPI inflation will lead to an opposite error in rates of real growth. If we cannot accurately attribute the price changes from model substitutions between quality growth and price inflation then it is not possible to ascertain rates of growth in real consumption or productivity. To illustrate, TFP growth for motor vehicles and other transportation sector (SIC 37), reflecting BLS price measurement, averaged 1.1 percent per year for 1987 to 2001 [from Bosworth

and Triplett (2003)]. But suppose that forced substitutions for motor vehicles should be treated the way scheduled substations are treated, with price changes across models viewed as quality upgrades. I calculate then that both quality growth and productivity growth are understated by 4.4 percent per year. If, on the other hand, the treatment of price changes for forced substitutions should actually be applied to scheduled substations then both quality and productivity growth are overstated by 1.8 percent per year. The implied range for TFP growth for motor vehicles varies dramatically from – 0.7 percent to 5.5 percent per year [Bils (2004: 2-3)].

I have gone into Bils’s (2004) analysis in some detail simply to show that quality changes in existing products as well as the introduction of new products have to be allowed for and how this is done can have significant effects on the estimates of growth in TFP as well as real output. Whether or not this phenomenon is important for the analysis of growth in developing countries is an open question since, as far as I know, their statistical agencies do not routinely adjust their inflation rates to allow for new products and quality improvement. I am not aware of any empirical study comparable to that of Bils and others on this issue.<sup>5</sup>

The post-war approach to measuring TFP based on economic theory was pioneered by Robert Solow in his seminal paper, “Technical change and the aggregate production function” [Solow (1957)]. Hulten (2000) cites a pre-war study by Tinbergen (1942) which also is founded on economic theory. Solow (1957) postulates a constant returns-to-scale aggregate production function with capital and labour as inputs and a Hicks neutral shift parameter  $A_t$  as follows:

$$O_t = A_t F(K_t, L_t) \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (4)$$

where  $O_t$  denotes aggregate real output,  $K_t$  capital input and  $L_t$  labour input. By differentiating (4) logarithmically and assuming that each input is paid its marginal product, Solow arrived at his famous residual  $R_t$  as a measure of the rate of growth of  $A_t$ :

$$R_t = g_t - s_{kt}g_{kt} - s_{lt}g_{lt} \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (5)$$

where  $g_t$  denotes the growth rate of aggregate output,  $g_{kt}$  the growth rate of capital,  $g_{lt}$  the growth rate of labour and  $s_{kt}(s_{lt})$  the share of capital (labour) in output. It is easily seen from (4) that the residual  $R_t$  equals the rate of growth of  $A_t$ . As Hulten (2000: 10) remarks:

This is the theory. In practice,  $R_t$  is a “measure of our ignorance” ... precisely because it is a residual. This ignorance covers many components, some warranted (like the effects of technical and organisational innovation), other unwarranted (measurement error, omitted variables, aggregation bias, model misspecification).

<sup>5</sup>Hedonic pricing methods are often used in developed countries to distinguish quality growth from true price increases for goods. Here again, to the best of my knowledge, such methods are rarely used in developing countries.

Solow's article spawned a vast literature which is briefly described in Hulten (2000). This is not the occasion to go into it and into the question of whether, if inputs are properly measured (including allowing for human capital effects in the measurement of labour input), the residual would be considerably reduced, as Jorgenson and Grilliches (1967) demonstrated. Their work departed radically from the measurement conventions of Kuznets and Solow. The constant quality index of labour and capital inputs of Jorgenson and Grilliches (1967) embodied the key idea of distinguishing among different types of labour and capital inputs and using appropriate prices for aggregation. For example, for different types of capital these authors used their rental rather than their prices to incorporate differences among the depreciation rates of different assets and the different tax treatment of different types of capital income. Finally, they replaced the aggregate production function used by Solow (1957) and others with the production possibility frontier that allowed joint production of consumption and investment goods from capital and labour inputs and also generalised the concept of technical change embodied in equipment [Jorgenson, *et al.* (2005, Section 2.3.4)]. Solow treated  $A_t$  as exogenous "manna from heaven". Significant theoretical developments in endogenising it had to wait until the revival of growth theory in the late 1980s. I have reproduced Solow's approach only because much of the empirical literature relating to developing countries is still based on it.<sup>6</sup>

Before turning to the influence of policy choices on productivity growth, let me note that aggregate growth could influence productivity growth. For example, to the extent that growth in aggregate output enables an increase in the scale of production, it could raise TFP if economies of scale are present. Also, growth in output may create markets for specialised inputs, including services, thereby unleashing Adam Smith's specialisation and gains in productivity. Therefore, growth in TFP not only contributes to aggregate growth but aggregate growth could also contribute to growth in TFP, in this way making both growth rates endogenous. This two-way interaction between the two might be missed if the focus is exclusively on accounting for aggregate growth.

It is easy to see how policy choices could influence the sources of productivity growth. Let me cite a few important channels. First is policy on international trade. Clearly, by enabling the economy to increase (decrease) the production of commodities in which it has a comparative advantage (disadvantage), trade liberalisation enables a more efficient allocation of an economy's revenue and so contributes to productivity gains. By the same token, an expansion of some activities following trade liberalisation could enable the exploitation of economies of scale. Moreover, if producers "learn from doing", output expansion could contribute to the

<sup>6</sup>Official estimates of multifactor productivity by the Bureau of Labour Statistics [BLS (1994)] in the US overturned the findings of earlier literature and corroborated Jorgenson's views (1990). The approach to growth accounting of Jorgenson, *et al.* (1987) and the work of BLS have been incorporated in OECD (2001).



productivity gains from the learning process. In the literature, the question has been debated whether trade liberalisation yields just once-only efficiency gains or whether it also contributes to an acceleration in growth. Theory and empirical evidence both point to the growth effect of trade liberalisation, in particular through the expansion of opportunities to acquire more productive technologies and practices, disembodied as well as embodied, for equipment and for promoting innovation.

Second, policies which address market failures and distortions could contribute to productivity gains. For example, public policy interventions which encourage the internalisation of positive externalities and discourage negative ones would generate productivity gains. Policies which improve the functioning of the financial sector also help by enabling those with productive ideas to get the credit they need to put their ideas into practice, and also by spreading and shifting the risks of innovation. Well-functioning bankruptcy laws help the resources emanating from failed enterprises to be transferred smoothly to more productive uses.

Third, in many developing countries, important markets such as product and labour markets are often distorted. There are barriers to the movement of goods and factors inside countries. Also, labour laws are typically unduly protective of a small segment of the labour force employed in the public sector and large-scale industries. Such protection inhibits the flexibility of labour markets and avoidably reduces productivity. Indeed, many analysts point to the relative rigidity of labour markets in France and Germany as an explanation for these countries' relatively poor economic performance compared with that of the US (and also the UK) with their flexible labour markets.

Fourth, broadly speaking, appropriate fiscal, monetary, exchange rate and public debt policies could contribute to productivity gains. For example, the loss in output and productivity associated with financial crises and the resulting loss in productivity which might be long lasting, would mean that productivity does not return to its pre-crisis level until long after the crisis. It can be argued that a better-functioning domestic financial system as well as public policies could well have mitigated these losses and accelerated recovery.

It is evident that almost all public policies could potentially affect the level of TFP and its growth, as well as overall GDP growth. This is recognised in the literature, particularly in the literature on what is called the "new" or "endogenous" growth theory. As noted earlier in the classic Solow (1957) model, the rate of productivity growth is constant and exogenous. By contrast, in "new" growth theory this rate is not only endogenous but also generally not constant over time. However, the process of productivity improvement has been modelled in different ways by various authors. For brevity, I will describe just two.

Lucas (1988) states that human capital accumulation by each worker plays a dual role: it raises the worker's productivity in the usual fashion, but by raising the average level of human capital in the economy, it creates an additional external

effect. The reason for this effect is that a worker with a given endowment of human capital is more productive in an economy in which the average level of human capital is higher. Therefore, there is an externality to his decision to accumulate human capital. For this reason the social marginal product of a worker's human capital is higher than its private marginal product to the worker. In the standard fashion, in the absence of a public policy intervention to internalise this externality, workers will accumulate less human capital than would be socially optimal.

Helpman (1990) models innovation as an activity which produces "blueprints" for the manufacture of a variety of final product. In the innovation industry, there is "learning by doing", so that the unit labour cost of producing a blueprint diminishes as the cumulative number of blueprints already produced increases. Therefore, there is a "learning" externality in the innovation industry, in which there is competition and free entry. The final-product industry is modelled as monopolistically competitive. The rate of growth of blueprints is the rate of innovation in the economy and the steady-state value of this innovation is endogenously determined. Helpman (1990) extends the model by including two countries, an innovating North and an imitating South, which trade with each other in varieties of final product. Interestingly, the steady-state rate of innovation when North trades with the South is faster than the rate when it is autarkic. So the model aptly illustrates the role of trade openness in innovation and growth.

### **3. VARIATION IN PRODUCTIVITY AND GROWTH ACROSS COUNTRIES**

Theorising about growth had remained dormant after the 1960s. Its revival in the late 1980s was accompanied by a significant number of empirical studies of growth in a cross-country framework. These were in part stimulated by the availability of large data sets, notably from the International Comparison Project under the leadership of Robert Summers and Alan Heston of the University of Pennsylvania. These two authors published time-series data on several countries, including income using purchasing power parity exchange rates in converting local currency values to a common "international" dollar. Variants of cross-country regressions of growth (over various time horizons) on determinants such as rates of investment in physical and human capital, variables proxying political economy, trade policy, etc. have been published. Let me summarise selectively some of the findings of the cross-country growth regression literature before turning to the important contribution of Jorgenson and Vu (2005) who analysed growth in GDP and TFP during 1989-95 and 1995-2003 using a sophisticated growth-accounting methodology and careful measurement of GDP and factor inputs.<sup>7</sup> An apparently

<sup>7</sup>I am a sceptic of the usefulness of cross-country growth regression as a means of learning about the process of development and growth. However, I do not wish my scepticism to obstruct a description of the findings from the literature, since obviously the contributors to it and possibly others do not share my scepticism!

robust conclusion in this literature is that although investment rates, savings rates and R&D expenditures vary persistently across countries, the correlation of growth rates across decades is low, suggesting that differences in growth rates across countries may be mostly transitory. This implies that the long-run growth rate is essentially the same—in other words, there is convergence over time across countries to a common growth rate. If growth rates converge to a common value in the long run, then the focus of analysis of cross-country differences has to shift to explaining the differences in levels of output per head or per worker, as in Hall and Jones (1999).

These two authors hypothesise that:

... differences in capital accumulation, productivity and therefore output per worker are fundamentally related to differences in social infrastructure across countries. By social infrastructure we mean the institutions and government policies that determine the economic environment within which individuals accumulate skills, and firms accumulate capital and produce output [Hall and Jones (1999), p. 84].

These authors recognise that feedback may occur from output per worker to social infrastructure and they control for this feedback in their empirical analysis. Their view is that “the ideal measure of social infrastructure would quantify the wedge between the private return to productive activities and the social return to such activities” [Hall and Jones (1999), p. 97]. Since in practice there is no ideal measure, these authors proxy social infrastructure by combining two indices. The first is an index of government anti-diversion policies (i.e. policies to contain and reduce the diversion of resources away from socially productive activities), created from data assembled by a firm specialising in providing an assessments of risks to international investors. The second index is a measure of trade openness. The details of these authors’ econometric specification, identification and robustness checks are not of importance for the present purposes. However, their main conclusion is very striking, namely that “the large variation in output per worker across countries is only partially explained by differences in physical capital and educational attainment ... differences in social infrastructure across countries cause large differences in capital accumulation, educational attainment, and productivity, and therefore larger differences in income across countries”. It implies in particular that institutions of governance and policies, as well as openness to external trade, are the fundamental determinants of cross-country differences in productivity and income levels. This in turn implies that if the institutions of governance are dysfunctional, and external trade is restricted by tariff and non-tariff barriers, increases in external aid are unlikely to be productive.

Senhadji (2000) takes the Hall-Jones analysis further by relaxing several of their econometric assumptions. In particular, he estimates production functions (Cobb-Douglas, constant returns to scale) for individual countries taking into account both the endogeneity of inputs and the possible non-stationarity in the data. Furthermore, unlike Hall and Jones, he does not assume that *all* countries (88 in his

sample for 1960-94) have the same production function, but only those within each of the six regions into which the countries are grouped. He estimates production functions in two ways: one using the data on levels of outputs and inputs and the other using first differences. The latter, if the first differences are of logarithms of levels, is equivalent to estimation from growth rates. It turns out that it does matter whether growth accounting is done with level-based or first-difference-based estimates of the elasticity of output with regard to capital. Finally, he also analyses the determinants of cross-country differences in TFP levels.

Without reproducing the details of Senhadji's estimates, let me summarise his conclusions. First, in the debate over accounting for East Asia's growth, Senhadji's use of *level-based* estimates of capital elasticity in his growth accounting supports Young's (1995) conclusion that most of the growth came from physical capital accumulation. Interestingly, when *first-difference-based* estimates are used, strong productivity growth as well as high levels of investment explains East Asia's growth over 1960-94, thus contradicting Young. Second, Africa had *negative* growth in TFP of between  $-0.066$  and  $-0.56$  percent, depending on which estimate of capital elasticity is used. Latin America had the second-worst record of negative TFP growth of  $-0.52$  and  $-0.39$  percent. For some inexplicable reason, Senhadji includes China in the South Asian region. Because of China's spectacular growth after 1980 (and also the less spectacular but still rapid growth of India after 1980), South Asian TFP growth, between  $0.55$  and  $0.94$  percent, was significant. Third, if the period 1960-94 is divided into three subperiods (1960-73, 1974-86 and 1987-94), growth declined steadily from the first to the third period, except for Asian countries. Fourth, although TFP growth series at country as well as regional levels vary significantly across different values of the elasticity of capital, they are still highly correlated. Fifth, real output in a developing country is far more volatile than in developed countries, and this volatility is passed on to TFP series as well.

Turning to determinants of TFP, Senhadji estimates a set of regressions of the level of TFP in a country compared to that of the United States on sets of explanatory variables, consisting of initial conditions, external shocks, macroeconomic variables, restrictions on current and capital account transactions and political stability. As in the literature on cross-country growth regressions, many of the explanatory variables are dummy variables and others are proxies for variables for which data are not available. Besides, the mechanisms through which these variables affect growth or relative level of TFP are never satisfactorily explained, as in much of the literature. These caveats have to be kept in mind in assessing Senhadji's findings, which are: there is evidence of conditional convergence of relative TFP levels, in that the explanatory variable, namely, the initial (1960-64) relative level of TFP has a significant positive coefficient which is less than one. Relative (to the US) endowments of human and physical capital are important determinants of relative TFP. However, the former is far more important in that it

has a coefficient ten times larger than that of the former. As expected, a good macroeconomic environment and exchange-rate flexibility contribute to a high relative TFP level, and political instability hurts TFP.

Klenow and Rodriguez-Clare (2004) analyse externalities from spillovers of knowledge across countries and growth. They focus on models with two features; first, in the steady state all countries grow at the same rate because of international knowledge spillovers (externalities) and second, differences in policies and other country-specific features generate differences in *TFP levels* rather than in *growth rates*. They note that there has been a slowdown in TFP growth since the 1970s around the world (their data do not cover the recent upsurges in productivity and growth, particularly in the US). They find investment rates in physical capital across all countries virtually unchanged though investments in human capital rose strongly. In their view, these facts and others point to international externalities as a possible explanation for the global slowdown in productivity. In other words, there is something other than investment rates that links growth rates across countries. They believe that something is knowledge diffusion through trade, migration and foreign direct investment, although they do not explain in what way the process of diffusion resulted in the slowdown.

The precise algebraic model used by Klenow and Rodriguez-Clare (2004), and the way they calibrate the model, are beyond the scope of the present discussion. More relevant are their findings, some of which are startling. For example, their estimates suggest that Senegal's actual productivity was 187 times higher than it would have been had Senegal been an isolated and autarkic country. Moreover, world GDP would have been only 6 percent of its current level had countries not shared ideas. Even modest barriers to technology adoption as well as differences in knowledge investment could explain a large part of income and TFP differences across countries. Although Klenow and Rodriguez-Clare (2004) leave the identification of primary channels of international knowledge spillovers to future research, they suggest that trade, joint ventures, foreign direct investment, the migration of key personnel and imitation may all play crucial roles.

Jorgenson and Vu (2005:1) "analyse the impact of information technology (ICT) equipment and software on the recent resurgence in world economic growth". The period 1985-2003 is divided into two subperiods: 1989-95 and 1995-2003, the second of which represents a period when investment in ICT and software soared. The analysis of Jorgenson and Vu (2005) shows (Table 1A) that the contribution of such investment to world (in all 110 economies) GDP growth doubled from 0.27 percent per year in 1989-95 to 0.53 percent per year in 1995-2003, though GDP growth rose only by 38 percent from 2.50 percent per year to 3.45 percent. This acceleration during 1995-2003 in the contribution of investment in ICT and software to GDP growth is seen in all the seven regions into which these authors divide the world.

Table 1A

*The World Economy by Regions GDP and Growth*

Group/Region	Period 1989–1995			Period 1995–2003		
	GDP Growth*	Average Share**		GDP Growth*	Average Share**	
		GDP	Growth		GDP	Growth
<b>World (110 Economies)</b>	<b>2.50</b>	<b>100.00</b>	<b>100.00</b>	<b>3.45</b>	<b>100.00</b>	<b>100.00</b>
G7 (7 Economies)	2.18	47.44	41.33	2.56	45.26	33.62
Developing Asia (16)	7.35	20.76	61.13	5.62	26.05	42.56
Non-G7 (15)	2.03	8.38	6.77	3.01	8.13	7.10
Latin America (19)	3.06	8.35	10.20	2.11	8.07	4.94
Eastern Europe (14)	-7.05	9.32	-26.76	2.87	6.57	5.47
Sub-sahara Africa (28)	1.21	2.13	1.03	2.88	2.01	1.68
N. Africa and Middle-East (11)	4.36	3.61	6.29	4.08	3.91	4.64

Source: Jorgenson and Vu (2005), Table 1.

\*Percent per year.

\*\*Percent.

Table 1B reveals their “most astonishing finding ... that input growth greatly predominated” [Jorgenson and Vu (2005:2)] in *both periods*. Therefore, “productivity growth contributed only one-fifth of the total during 1989–1995, while input growth accounted for almost four-fifths. Similarly, input growth contributed more than seventy percent of growth after 1995, while productivity accounted for less than thirty percent” [Jorgenson and Vu (2005: 2-3)]. However, the relative share of input growth and TFP growth varied across the seven regions in both periods. Although TFP growth was *negative* in Eastern Europe and sub-Saharan Africa, it contributed the highest share, 5.4 percent, to the fastest-growing (7.35 percent) region of developing Asia during 1989-1995. During 1995-2003, in Eastern Europe not only was TFP growth positive at 3.06 percent per year, but it also exceeded its GDP growth at 2.87 percent, due to negative growth in non-ICT capital. Sub-Saharan Africa achieved a modest positive TFP growth of 0.32 percent per year. GDP growth (5.8 percent, compared to 7.35 percent), TFP growth (1.72 percent, compared to 3.86 percent) and the contribution of TFP growth to GDP growth (34 percent compared to 52 percent) declined in developing countries in Asia during 1995–2003, compared to 1989-1995. This decline was largely due to a slowdown in the growth of China as well as Indonesia and South Korea, which experienced a severe financial crisis in 1997.

The 16 economies of developing Asia include China and India. During 1989-1995, China (India) was the third- (fifth-)largest economy in the world after the US and Japan (after US, Japan, China, and Germany) with a share of 7.64 percent (4.95 percent) of world GDP (at purchasing power parity exchange rates). Both improved their ranking, China to the second-largest and India to the third-largest, as well their shares in global GDP to 10.91 percent, in the case of China and 5.97 percent in the case of India. Remarkably, China and India together accounted for 40.25 percent of

Table 1B

*Sources of Output Growth*

Economy	Period 1989–1995						Period 1995–2003					
	GDP Growth*	Sources of Growth (% Points per Annum)					GDP Growth*	Sources of Growth (% Points per Annum)				
		Capital		Labour		TFP		Capital		Labour		TFP
		ICT	Non-ICT	Hours	Quality			ICT	Non-ICT	Hours	Quality	
<b>World (110 Economies)</b>	<b>2.50</b>	<b>0.27</b>	<b>0.91</b>	<b>0.39</b>	<b>0.40</b>	<b>0.53</b>	<b>3.45</b>	<b>0.65</b>	<b>1.03</b>	<b>0.62</b>	<b>0.27</b>	<b>0.99</b>
G7 (7 Economies)	2.18	0.38	0.90	0.07	0.42	0.42	2.58	0.69	0.74	0.28	0.18	0.67
Developing Asia (16)	7.35	0.15	1.73	1.19	0.42	3.86	5.62	0.43	2.27	0.81	0.38	1.72
Non-G7 (15)	2.03	0.32	0.68	0.21	0.21	0.61	3.01	0.49	0.77	1.06	0.20	0.49
Latin America (19)	3.06	0.16	0.58	1.20	0.37	0.75	2.11	0.39	0.61	1.10	0.34	-0.32
Eastern Europe (14)	-7.05	0.10	-0.15	-0.86	0.36	-6.50	2.87	0.23	-0.81	0.01	0.39	3.06
Sub-Sahara Africa (28)	1.21	0.13	0.24	1.66	0.56	-1.39	2.88	0.29	0.68	1.18	0.42	0.32
N. Africa and M. East (11)	4.36	0.15	0.72	1.43	0.56	1.50	4.08	0.40	0.88	2.02	0.49	0.30

Source: Jorgenson and Vu (2005), Table 1.

\* Percent per year.

Table 5

*Accounting for Growth in Pakistan*

Period	Overall GDP				Agriculture				Manufacturing			
	Growth	Capital	Labour	TFP	Growth	Capital	Labour	TFP	Growth	Capital	Labour	TFP
1960-70	7.01	2.83 (40.40)	0.78 (11.18)	3.39 (48.42)	6.13	1.88 (30.72)	0.25 (4.09)	4.00 (65.19)	8.99	2.96 (32.88)	1.78 (19.75)	4.26 (47.37)
1970-80	4.66	2.28 (49.03)	1.56 (33.40)	0.82 (17.57)	2.32	2.01 (86.36)	1.08 (46.68)	-0.77 (-33.04)	5.48	2.04 (37.30)	1.43 (26.02)	2.01 (36.68)
1980-90	6.12	2.64 (43.05)	1.04 (16.97)	2.45 (39.98)	4.10	4.48 (109.22)	0.94 (22.96)	-1.32 (32.18)	8.09	2.10 (25.97)	0.61 (7.48)	5.38 (66.54)
1990-00	4.41	2.38 (53.97)	1.25 (28.225)	0.78 (17.78)	4.54	2.21 (48.63)	0.81 (17.83)	1.52 (33.55)	3.99	2.09 (52.54)	0.25 (6.26)	1.64 (4.20)
1960-2000	5.31	2.48 (46.62)	1.17 (22.12)	1.66 (31.26)	3.89	2.70 (69.33)	0.82 (21.11)	0.37 (9.57)	6.39	2.23 (34.99)	0.94 (14.74)	3.21 (50.27)

Source: Kemal, *et al.* (2002), Tables 2.4.3, 3.2.6, 3.3.6, 3.4.6 and 3.5.6.

Figures in parentheses relate to percentage contributions to growth.



global growth during 1989-1995 and a somewhat lower, but still impressive 33.25 percent during 1995-2003 [Jorgenson and Vu (2005), Appendix Table 1]. It is no exaggeration to say that, along with the US, the two large economies of China and India have been the engines of global growth for the past two decades. I return to these two economies in the next section.

#### 4. SOUTH ASIA AND CHINA

##### 4.1. South Asia in a Comparative Perspective

Jorgenson and Vu (2005) estimate the GDP growth and its composition for the economies of South Asia other than Bhutan and Maldives. Table 2A and Table 2B report their findings. These are very useful since they are based on a common methodology and a common database. Arguably the fact that real GDP data for all countries purchasing power parity based exchange rates makes them comparable.<sup>8</sup>

Table 2A

##### *Shares in Size and Growth of South Asia in the World Economy*

	Period 1989–1995					Period 1995–2003				
	GDP Growth % per Year	GDP Share (%)		Growth Share (%)		GDP Growth	GDP Share (%)		Growth Share (%)	
		Group	World	Group	World		Group	World	Group	World
Bangladesh	4.91	7.32	0.46	7.36	0.91	4.66	7.02	0.52	5.78	0.71
India	5.03	78.82	4.95	80.43	9.95	6.15	80.57	5.97	86.81	10.66
Nepal	4.62	1.11	0.07	1.05	0.13	3.91	1.08	0.08	0.73	0.09
Pakistan	4.10	10.20	0.64	8.49	1.05	3.47	9.04	0.67	5.54	0.68
Sri Lanka	5.24	2.55	0.16	2.67	0.33	2.77	2.29	0.17	1.14	0.14
South Asia	4.01	100.00	6.28	100.00	12.37	5.70	100.00	7.41	100.00	12.28
China	9.94		7.64		30.30	7.13		10.91		22.58

Source: Jorgenson and Vu (2005), Appendix Table 1.

Table 2B

##### *Sources of Output Growth (Percent per Year)*

	Period 1989–1995						Period 1995–2003					
	GDP Growth	Capital		Labour		TFP	GDP Growth	Capital		Labour		TFP
		ICT	Non- ICT	Hour	Quality			ICT	Non- ICT	Hour	Quality	
Bangladesh	4.91	.03	1.22	1.67	0.54	1.46	4.66	0.20	2.32	1.25	0.48	0.41
India	5.03	.09	1.18	1.27	0.43	2.06	6.15	0.26	1.77	1.22	0.41	2.49
Nepal	4.62	0.11	1.18	1.31	0.50	1.51	3.91	0.43	1.35	1.62	0.45	0.06
Pakistan	4.10	0.20	1.17	1.46	0.51	0.76	3.47	0.27	0.73	1.50	0.45	0.52
Sri Lanka	5.24	0.08	1.26	1.42	0.35	2.13	2.77	0.39	1.27	1.60	0.34	-1.04
China	9.94	0.17	2.12	0.87	0.45	6.33	7.13	0.63	3.17	0.45	0.39	2.49

Source: Jorgenson and Vu (2005), Appendix Table 2.

<sup>8</sup>Guha-Khasnobis and Bari (2000) do a growth accounting exercise for South Asian countries. I do not report their results since they assume the same factor shares for all the countries of the region and also use questionable data sets (e.g. for schooling) instead of readily available national data sets.

It is evident from Table 2A that India has a very large share (nearly 80 percent) in regional GDP. It is therefore no surprise that India's growth performance dominates regional growth. It is the only country that experienced acceleration in its growth between 1989-1995 and 1995-2003. Bangladesh maintained its growth (little under 5 percent in the two periods) while Nepal, Pakistan and Sri Lanka experienced a significant decline in growth. Because of India's growth exceeded world average growth, and it accelerated between the two periods, its share (as well as South Asia's share) in global GDP and global growth increased. Still, South Asia's share in global GDP at 7.41 percent and in global GDP growth at 12.28 percent during 1995-2003 are considerably less than China's share respectively of 10.91 percent and 22.58 percent. This of course reflects the more rapid growth of China relative to South Asia in both periods.

Comparisons based on Jorgenson and Vu (2005) are interesting because they use the same methodology that is more sophisticated than the conventional Solow residual based analysis to estimate TFP. Table 2B shows that except for India, which experienced an increase in TFP growth from 2.06 percent to 2.49 percent between the two periods, in all other countries TFP growth *declined*. In fact, there was a negative TFP growth per year at 1.04 percent in Sri Lanka during 1995-2003 as compared to a robust positive growth of 2.13 percent per year during 1989-1995. The contribution of TFP growth to GDP growth declined between the two periods in all countries, though only modestly in the case of India. Moreover, the contribution was modest, ranging between 18.5 percent (Pakistan) and 41.0 percent (India) during the 1989-1995 and between -37.5 percent (Sri Lanka) and 40.4 percent (India). Interestingly, China experienced a decline both in the rate of TFP growth (from 6.33 percent per year to 2.49 percent per year), and its contribution to GDP growth (from 64.3 percent to 34.9 percent) between the two periods. I now turn to other estimates of TFP for India and Pakistan, although because of their use of different data sets and the different methodologies for estimation of TFP their comparability is not assured and one has to be cautious in making inferences.

#### 4.2. India

India followed an inward-oriented, import-substituting, state-directed and controlled development strategy for nearly four decades. Average growth during 1950-80 was a measly 3.75 percent. During the 1980s, hesitant and limited economic reforms were initiated and state control over the economy was somewhat relaxed. Coupled with these limited reforms, there was an expansionary macroeconomic policy, with increasing fiscal deficits financed by domestic and external borrowing. This combination delivered a 5.8 percent growth per year on an average during 1980-90. However, this debt-led growth was unsustainable and culminated in a severe macroeconomic and balance of payments crisis in 1991. The crisis led to systemic reforms, including trade liberalisation, floating of the exchange

rate, significant opening to foreign capital inflows as well as a number of domestic reforms. Although the average rate of growth since 1991 has remained at around 6 percent, still it is far more solidly founded and sustainable than the growth of the eighties.<sup>9</sup> It is no surprise that the issue of whether or not reforms contributed to an improvement in TFP growth in both China and India have attracted scholarly attention.

A number of estimates of TFP growth in India are available. One of the more recent and detailed is that of Virmani (2002), who refers to other estimates. Once again, I will leave out the methodology and the details of data used in the estimation except to say that they are largely conventional. What is of interest is that he estimates TFP growth separately for four periods, 1950-51 through 1964-65, 1965-66 through 1979-80, 1980-81 through 1991-92, and 1992-93 through 2003-04. The first period covers the first three five-year plans and the Prime Ministership of Jawaharlal Nehru. The second period includes two severe droughts in 1966 and 1967, two wars with Pakistan, the onset of the green revolution around 1967 and also intensification of state controls on the economy, including nationalisation of commercial banks and insurance companies, all under the Prime Ministership of Indira Gandhi. The third period is of hesitant reforms and opening of the economy, the assassination of Mrs. Gandhi, the Prime Ministership of her son Rajiv Gandhi, and the macroeconomic crisis of 1991. The last period is the period of systemic reforms under several Prime Ministers who led coalitions. He also provides TFP growth estimates at the sectoral level as well. I reproduce below TFP growth and its contribution to growth of real net domestic product (NDP) per worker drawn from Virmani's (2002) Table 2.

Table 3

Period	TFP Growth (Percent per Year)	Contribution to Growth of NDP per Worker (Percent)
1950-51-1964-65	1.9	41
1965-66-1979-80	0.1	4
1980-81-1991-92	2.5	46
1991-92-2003-04	3.6	59

Source: Virmani (2002).

The acceleration of TFP growth since the initiation of reforms hesitantly during 1980-90 and systemically in 1991 is evident. It is also striking that in the second period when the economy was insulated from the world economy significantly and state controls on the economy were intrusive and extensive, TFP growth fell to almost zero.

<sup>9</sup>Jorgenson and Vu (2005) estimate India's GDP growth at 5.03 percent per year during 1989-1995 and 6.15 percent per year during 1995-2003.

### 4.3. Comparison of China and India

The following Table 4 compares TFP growth in China and India. The effect of reforms since 1978 on China's TFP growth is evident.

Table 4

	China (Hu and Khan)		India (IMF)		India (World Bank)		India (Ahluwalia)	
1953-78	1.1		1960s	-1.0 to 1.1		1960-80	-0.5 <sup>a</sup>	
1979-94	3.9		1970s	-2.1 to 0.3	1979-80 to 1997-98	1.3 to 1.5	1980s	2.8 <sup>a</sup>
Jorgenson and Vu			1980s	0.7 to 2.9				
1989-1995	6.33		Mid-1990s	1.5 to 3.4	1994-95 to 1996-97	2.4 to 2.8	Jorgenson and Vu 1989-1995	2.06
1995-2003	2.49		Late 1990s	0.3 to 2.9			1995-2003	2.49

Sources: Hu and Khan (1997); IMF (2002); World Bank (2000); Ahluwalia (1992); Jorgenson and Vu (2005).

<sup>a</sup>Figures for manufacturing sector only.

Interestingly that by and large, China seems to have experienced a faster TFP growth than India during most of the period 1953–2003, except during 1995–2003 when their TFP growth rates were the same according to Jorgenson and Vu (2005). However, the TFP growth estimates also point to a general problem with such estimates. They are highly sensitive to the data used and above all the methodology of estimation. For example, different authors use different real GDP growth data—some using constant domestic price based values and others, including Jorgenson and Vu (2005), who use purchasing power parity based data. Also, strong maintained (i.e., untested) assumptions are made in the empirical analysis about production functions and the statistical properties of the disturbance terms that are essential components of the model used for estimation. Not all of the maintained assumptions are explicitly stated and the robustness checks of the estimates with respect to the use of alternative assumptions are sometimes omitted altogether. For all these reasons, in interpreting and using these estimates, extreme caution is called for.

#### 4.4. Pakistan

I report on estimates from two studies [Mahmood and Siddiqui (2000) and Kemal, *et al.* (2002)]. The former focus on manufacturing industries in Pakistan and uses the Solow methodology for estimating TFP during the period 1972-1997 and also analyses the determinants of TFP. It finds that the growth slow down in Pakistan's manufacturing (particularly the large scale units) since the late 1980s is explained by a slow down in TFP growth. The authors show that growth of manufacturing output fell from 9.26 percent and 6.69 percent per year respectively during 1979-85 and 1985-90, to 4.17 percent and 1.31 percent respectively during 1990-95 and 1995-97 [Mahmood and Siddiqui (2000), Table 1]. TFP growth also declined sharply from 4.84 percent and 4.29 percent respectively during 1980-85 and 1985-90 to 1.36 percent and -1.25 percent respectively during 1990-95 and 1995-97. Turning to the determinants of TFP growth, the authors find that growth in (a) scientific and technical manpower (b) R&D expenditure in industrial activity and (c) human capital, contribute positively and significantly (in a statistical sense) to TFP growth. Other variables such as openness, though associated positively with TFP growth, are not statistically significant.

The study of Kemal, *et al.* (2002) covers the period 1960-2000 (broken down by decades) and accounts for growth in overall GDP as well as value added in agriculture and manufacturing. Their findings are reproduced in Table 5. They also find TFP growth in manufacturing declined from a peak of 5.38 percent (contributing to two-thirds of the growth in value added) in the 1980s to a low of 1.64 percent (contributing to 41 percent of the growth in value added during the 1990s). For the entire economy TFP growth ranged between a peak of 3.39 percent in 1960s to a low of 0.78 percent in the 1990s. In the four decades of 1960-2000 taken as a whole, TFP growth at 1.66 percent per year contributed a modest 31 percent to GDP growth. Although the estimates of Jorgensen and Vu (2005) are not strictly comparable to those of Kemal, *et al.* (2002), they are not wildly different in that both sets of estimates show a decline in TFP growth from the late 1990s.

All TFP growth estimates without exception are highly sensitive to the data used and above all to the methodology of estimation. For example, different authors use different real GDP growth data—some using constant domestic price based values and others, including Jorgenson and Vu (2005), who use purchasing power parity based data. Also, strong maintained (i.e., untested) assumptions are made in the empirical analysis about production functions and the statistical properties of the disturbance terms that are essential components of the model used for estimation. Not all of the maintained assumptions are explicitly stated and the robustness checks of the estimates with respect to the use of alternative assumptions are sometimes omitted altogether. For all these reasons, in interpreting and using these estimates, extreme caution is called for.

Table 5

## 5. CONCLUSIONS

I will be brief. First, there are several sources of improvements in total factor productivity: the efficiency of resource allocation, the exploitation of economies of scale and positive externalities, and technological progress, to mention only the major factors.

Second, institutions matter for achieving gains in productivity. After all, institutions such as product and factor markets, social institutions influencing participation in the labour force as well as risk sharing, financial institutions which intermediate savings and investment and also allocate credit and, above all, governance, have a major influence on the efficiency of resource allocation and on factor accumulation. They affect individual incentives and those of production units such as firms for production, consumption, accumulation and trade.

Third, public policies matter a great deal. From the perspective of each of the sources of productivity growth, it is important whether or not foreign trade and investment are relatively free of barriers erected by the government, whether the government appropriates to itself a large share of investible resources and in this way crowds out private investment, and whether social (education and health) infrastructure is publicly provided.

Fourth, the cross-country empirical evidence on TFP supports the importance of institutions, including social infrastructure and the contribution of knowledge externalities and spillover across countries. Obviously, any policy restriction on foreign trade, investment or migration policies could inhibit the growth of TFP by limiting such spillover.

Fifth, the estimates of Jorgenson and Vu (2005) based on a common methodology and data base show, that unsurprisingly, India and Pakistan together accounted for nearly 80 percent of regional GDP in both 1989–95 and 1995–2003. Between the two periods India's (Pakistan's) share in global GDP rose from 4.95 percent (0.64 percent) to 5.97 percent (0.67 percent). The share of South Asia as a whole in global GDP also rose very slightly from 7.37 percent to 7.41 percent. The contribution of South Asia to global growth on the other hand fell, also very slightly from, 12.37 percent to 12.28 percent. While India's contribution to global growth *rose* from 9.95 percent to 10.66 percent, Pakistan's contribution *fell* from 1.05 percent to 0.68 percent. It is to be hoped that with the spectacular growth of GDP in Pakistan recently, its GDP growth would have risen as well. In any case, the most disturbing finding of Jorgenson and Vu (2005) is that except for India all other South Asia countries experienced a significant decline in TFP growth.

Sixth, and last, the environment for external trade, investment and technology flows has to be free of barriers to enable developing countries to grow rapidly through productivity growth. Although it is beyond the scope of this paper, I would add that a successful conclusion of the Doha Round of multilateral negotiations is extremely important from this perspective.





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