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Demography, Education, and the Future of Total Factor Productivity Growth

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Contents

Abstract

In this paper we present new data on total factor productivity for eight world regions over the period 1970 to 2001. The regions are North America, Western Europe, Japan/Oceania, the China Region, South Asia, Other Pacific Asia, Latin America and the Caribbean, and Sub-Saharan Africa. We propose and estimate a new model of the determinants of total factor productivity based on the framework of conditional convergence. The model allows us to distinguish between factors that influence the level of the conditional productivity frontier and the speed of catching up to that frontier. We show that productivity stagnation in Latin America and the Caribbean and in Sub-Saharan Africa are not because they are trapped far below their potential, but rather that they are fully utilizing the low potential that they have. We found that education and age structure have independent and joint effects on productivity. The rate of capital formation, the quality of institutions, openness, and corruption also affect total factor productivity. The effects of specific variables on total productivity differ by context. They can be different depending on whether a country is catching up to its conditional productivity frontier or not. This provides the possibility of resolving some of the puzzles with respect to the effects of age structure and education that appear in the literature. The paper is based on the new IIASA/VID database on education.

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Demography, Education, and the Future of Total Factor Productivity Growth

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1 Introduction

This paper considers the relationship between the age and education structures of populations and total factor productivity. Our goal is to produce a comparatively simple parameterized model that can be used in long-run economic growth forecasting exercises. Demographic and education variables make good candidates for exogenous variables in long-run forecasting for three reasons. First, they are relatively easy to forecast because they are based on comparatively simple structures. Second, they are unlikely to suffer from endogeneity. Today's age and education distributions of populations are the result of events that happened, on average, decades ago and so are exogenous with respect to today's level of total factor productivity. Third, previous studies have shown that demography and education influence total factor productivity. Demographic and educational variables are not the only or possibly even the main variables that influence total factor productivity. Economic policies and institutional arrangements also play important roles and we take them into account in our analysis.

The analysis that we present here is made possible because of a new and detailed dataset on education and demography constructed at the International Institute for Applied Systems Analysis (IIASA) and the Vienna Institute of Demography (VID), which provides detailed reconstructions and projections of education distributions of the population.[1]

The work on total factor productivity presented here is part of a broader research project, whose purpose is to ascertain the interacting effects of education and demographic change on economic growth.[2] One motivation for this is to address the group of people who forecast greenhouse gas emissions. Two driving forces of greenhouse gas emissions are population size and gross domestic product per capita.

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[1] The new IIASA/VID dataset contains a detailed reconstruction of the populations of 120 countries from 1960 to 2000. The data include joint distributions of the population by age, gender, and level of educational attainment. A description of the data and how they were created appears in Lutz et al. (2007) which can be accessed at http://www.oeaw.ac.at/vid/publications/VYPR2007/Yearbook2007_Lutz-at-al-Education_pp193-235.pdf. The data are available online at http://www.iiasa.ac.at/Research/POP/edu07/index.html?sb=11. The details of the education projections can be found in KC et al. (2008). A brief description of the education projections can also be found at http://www.iiasa.ac.at/Research/POP/pub/Asia_datasheets08.html. The projections themselves will soon be available at http://www.iiasa.ac.at/Research/POP/index.html.

[2] For that purpose, we have constructed the SEDIM model of which total factor productivity is a part. For more on the SEDIM model, see Sanderson (2004).

These two are normally forecasted independently (see, for example, Nakicenovic et al. 2000). This paper shows that age and education structures are important drivers of economic growth and argues that population change and economic growth need to be forecasted in a consistent way. In order to make our work ultimately relevant for the forecasting of greenhouse gas emissions, we use the regional breakdown in Nakicenovic et al. (2000).[3] That report distinguishes eleven regions. We have been able to reconstruct data back to 1970 for nine of those regions. Data for Eastern Europe and the European portion of the former Soviet Union can only be reconstructed back to the 1990s. Out of the nine regions with the required data, we left out the North Africa and Middle East Area. In this area, the export of oil is such a large contributor to gross domestic product that measures of total factor productivity growth are distorted.

In Section 2, we review the literature connecting demography and education to total factor productivity. In Section 3, we describe the data to be studied, newly created total factor productivity levels from 8 major regions of the world. In Section 4, we discuss the new structural model used in our estimation and show how it can capture conditional divergence as well as conditional convergence. In Section 5, we present a brief discussion of the independent variables that we use. All the regionally aggregated data have been created for this paper. A more complete discussion can be found in the Appendix. In Section 6, we present our findings and show that a parsimonious specification fits the data quite well. In Section 7, we make conditional projections of future total factor productivity growth based on new consistent forecasts of educational attainments and age structures. Section 8 contains our concluding thoughts.

2 Literature Review

Most of the empirical work on economic growth has not focused directly on the links between education, age structure and total factor productivity growth. One reason for this is that until recently total factor productivity has not been measured consistently for a large group of countries.[4] So in this review we will also consider studies that deal with the interconnections between education, age structure and economic growth. While the empirical research on economic growth does not address total factor productivity directly it has clear implications for it. In addition, the age structure of education itself is rarely considered in the literature because until recently appropriate data on it have not been available.

The current empirical framework for most of this empirical work is called conditional convergence. Conditional convergence is not a theory. It is a well-established empirical regularity about economic growth from the 1960s onward. The rate of growth of GDP depends on how far a country is from its conditional frontier.

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[3] The scenarios in Nakicenovic et al. (2000) are one of the major building blocks of the Third Assessment of the Intergovernmental Panel on Climate Change. A list of the countries in each region can be found in Appendix III of that report and is available on the web at http://www.grida.no/publications/other/ipcc_sr/?src=/climate/ipcc/emission/.

[4] Recently, UNIDO produced a consistently measured set of total factor productivity rates from 1960 to 2000 for many of the countries of the world (Isakkson 2007). Our total factor productivity estimates were produced prior to the publication of the UNIDO numbers. In any case, we would not have used the UNIDO estimates because in producing their figures working-age populations were not adjusted for age and educational attainment.

Countries that are farther from their conditional frontiers grow more rapidly because they are catching up to their conditional frontiers faster. Countries that are already near their conditional frontiers grow more slowly. Once a country is on its conditional frontier, it can only grow as fast as the conditional frontier moves. The conditional frontier depends on a host of factors including possibly corruption, the rule of law, education, health, and geographic location. The conditional convergence framework decomposed economic growth into two parts. One has to do with catching up and the other has to do with the path to which countries catch up.

A new era in the investigation of the relationship between economic growth and demography began with Bloom and Williamson (1998), Bloom and Sachs (1998) and Bloom et al. (2000) who showed that between one quarter and two-fifths of the extraordinary growth of the East Asian tiger economies from 1950s to the mid-1990s could be attributed to changes in age structure. Because of prior rapid decreases in fertility in these countries, the growth rates of their working-age populations were substantially in excess of the growth rates of their entire populations. This raised the growth rate of output per capita relative to output per person of working age, an effect that subsequently became known as the "demographic dividend."[5]

Those three articles were the final link in a process that was changing the focus of research on interactions of demography and economic growth from a concentration on the growth rate of population size to one that emphasized the effects of age structure (see also Bloom and Freeman (1988) and Kelley and Schmidt (1995) which were part of this process).

Kelley and Schmidt (2005) went one step further and decomposed age structure effects into those that affect the ratio people of working age to the total population and those that influence the growth rate of output per person of working age. In their preferred specification, they find that the youth dependency ratio[6] is significantly negatively related to the rate of growth of output per worker. Kögel (2005), in one of the few studies that consider the effects of age structure on total factor productivity, also finds that the youth dependency ratio has a negative and significant effect.

The Kögel (2005) finding goes beyond just being consistent with Kelley and Schmidt (2005). One reason cited for the negative effect of the youth dependency ratio is that a large youth cohort requires spending on items like schooling and health care that can take resources away from investments with a quicker return. If this were the only effect of a high youth dependency ratio, then there would be no effect on total factor productivity, because measured total factor productivity already takes into account changes in capital formation.

A second finding in the literature is about the effects of changes in the structures of working-age populations. Lindh and Malmberg, in a series of papers that include Malmberg (1994), Lindh and Malmberg (1999), Lindh (2004), and Lindh and Malmberg (2007) among others, show that increases in the proportion of the population

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[5] Coale and Hoover (1958) showed theoretically how age structure effects could influence economic growth, but that aspect of their research did not influence research on the relationship between demography and economic growth for the subsequent four decades.

[6] The youth dependency ratio is usually defined as the ratio of the number of people 0 to 14 years old to those 15 to 64 years old.

in the age group 50-64 have a greater positive impact on the rate of GDP growth per capita than increases in any other age group.

Feyrer (2007) studies total factor productivity change and finds a powerful effect of increases in the proportion of the labor force in the age group 40 to 49 on total factor productivity. This age group is slightly younger than Lindh and Malmberg find in their research on GDP per capita. If the two studies are consistent, it suggests that the effect of age structure on total factor productivity provides part of the explanation of the Lindh and Malmberg results.

One puzzling aspect of these studies is their treatment of education. Kelley and Schmidt (2005) use the average number of years of post-primary education among males 25 or more years old published in Barro and Lee (2001). When age structure is taken into account in explaining economic growth per worker they find that the education variable has a positive but statistically insignificant effect. Kögel (2005) and Lindh and Malmberg (2007) do not take education into account at all. Feyrer (2007) takes education into account in computing total factor productivity, but does not allow education to be a factor explaining changes in total factor productivity. Bloom and Canning (2008) study the effects of age structure on the growth of output per capita. Like Kelley and Schmidt (2005) they use the Barro and Lee (2001) data on education. The variable that they use is the average number of years of schooling of the population 15+ years old. Like Kelley and Schmidt (2005), they also find the average years of schooling have a statistically insignificant effect on output growth.

Empirical studies on the effect on education on economic growth show mixed results. Barro and Sala-i-Martin (2003, Table 12.3, p. 522) present a regression analysis of economic growth rates over three time periods 1965-75, 1975-85, and 1985-95.[7] The variables that characterize the conditional productivity frontier are male secondary schooling, the reciprocal of life expectancy at age 1, the log of the total fertility rate, the government consumption ratio, an index of the rule of law, an index of democracy, the democracy index squared, the openness ratio, the change in the terms of trade, the investment ratio, the rate of inflation, a constant term, and two period dummy variables. Male secondary education, however, has a positive coefficient in all three regressions, but is only statistically significant in the regression that combines the rich and the poor countries. However, no age structure variables are included.

In another sort of analysis, Sali-i-Martin et al. (2004) assembled a list of 67 independent variables and the rate of growth of GDP per capita over the period 1960 to 1996. For each of the 67 variables, they performed regressions with all the possible combinations of the remaining 66 and tabulated how frequently the variable was statistically significant. The variable that was statistically significant the greatest percentage of times was a dummy variable for East Asian countries. The second variable in terms of the proportion of regressions in which it was statistically significant was a human capital variable, the primary school enrollment rate in 1960. Again, no age structure variables are included.

The vast majority of studies on the effects of education on economic growth have used the dataset on average years of education produced in Barro and Lee (2001).

[7] The specification has an unbalanced panel structure with 72 observations of countries in the first period, 86 in the second, and 83 in the third.

Now, however, an improved and much more detailed dataset on educational attainments has recently been produced by researchers at IIASA and the VID (see footnote 1).

Lutz et al. (2008, Supplementary Material) make use of the more detailed and consistent IIASA/VID education data. They take into account both the age structure of the population and its education structure. They show that the level of educational attainment and age interact in influencing total factor productivity. In particular, increases in the fraction of young people with tertiary education have the largest positive impact on total factor productivity. This is the first paper to study the interactions between age and educational attainment on total factor productivity.

This paper also uses the new IIASA/VID dataset on education, but uses quite a different methodology from that in Lutz et al. (2008). The new data are one of the elements of new regional level estimates of total factor productivity from 1970 to 2001 that are presented in the next section. In addition, we follow Lutz et al. (2008) in making use of the explanatory power of age and education interactions, newly made possible by the IIASA/VID data.

3 Region-Specific Total Factor Productivies

The level of total factor productivity (*TFP*) in region *i* at time *t* (*TFP(i,t))* is computed using a Cobb-Douglas production function.

$$TFP(i,t) = \frac{GDP(i,t)}{H(i,t)^{\alpha} \cdot K(i,t)^{1-\alpha}}, \tag{1}$$

where *H(i,t)*, the stock of human capital, is the size of the working-age population in region *i* in time *t* adjusted for productivity differences due to age and education, *K(i,t)* is the physical capital stock[8] in region *i* in time *t*, and *GDP(i,t)* is the gross domestic product of the *i*-th region in year *t*[9]. A discussion of the calculation of the *H(i,t)* and the *K(i,t)* appears in Section 5. We use output elasticities of two-thirds for labor and one-third for physical capital, which is a common assumption in the literature. Plausible alternatives change the patterns of *TFP* growth very little.

The problems with this formulation are well known. *TFP* is measured as a residual. Any errors in measuring labor and capital inputs are included in *TFP*. Moreover, errors are built into the measures of labor and capital by necessity. The Cobb-Douglas production function requires input flows not input stocks. In a recession unemployment rates go up and factories are shut down or work at reduced capacity. Neither of these is captured in the measures of *H* and *K* that we have. Therefore, recessions cause *TFP* to grow more slowly or even decrease and conversely booms cause more rapid increases in *TFP*. Because *H* and *K* are measured as stocks, not as flows, it is inappropriate to think about *TFP* as if it represented a "technology" in the sense of a recipe for creating outputs from a set of inputs. Such a recipe would not change just because a country was in a recession. *TFP* is best thought of as the productivity of the resources available to a country or region. If the country is in a

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[8] The physical capital stock is built up using data on gross investment. Gross investment can include investment in non-tangible assets.

[9] GDP data are taken from the Penn World Tables (Heston et al. 2006) and are in purchasing power parity. They are based on international dollars of the year 2000.

recession or if it has dysfunctional economic institutions then less output is produced with the available inputs and productivity would be low.

Figures 1a, 1b, and 1c show the natural logarithms of *TFP* levels from 1970 to 2001. Logarithms are used here because the slopes of these lines are growth rates. So in these figures, it is easy to see both differences in levels of *TFP* and differences in their growth rates. The three figures are plotted on the same scale and show different patterns of *TFP* growth.

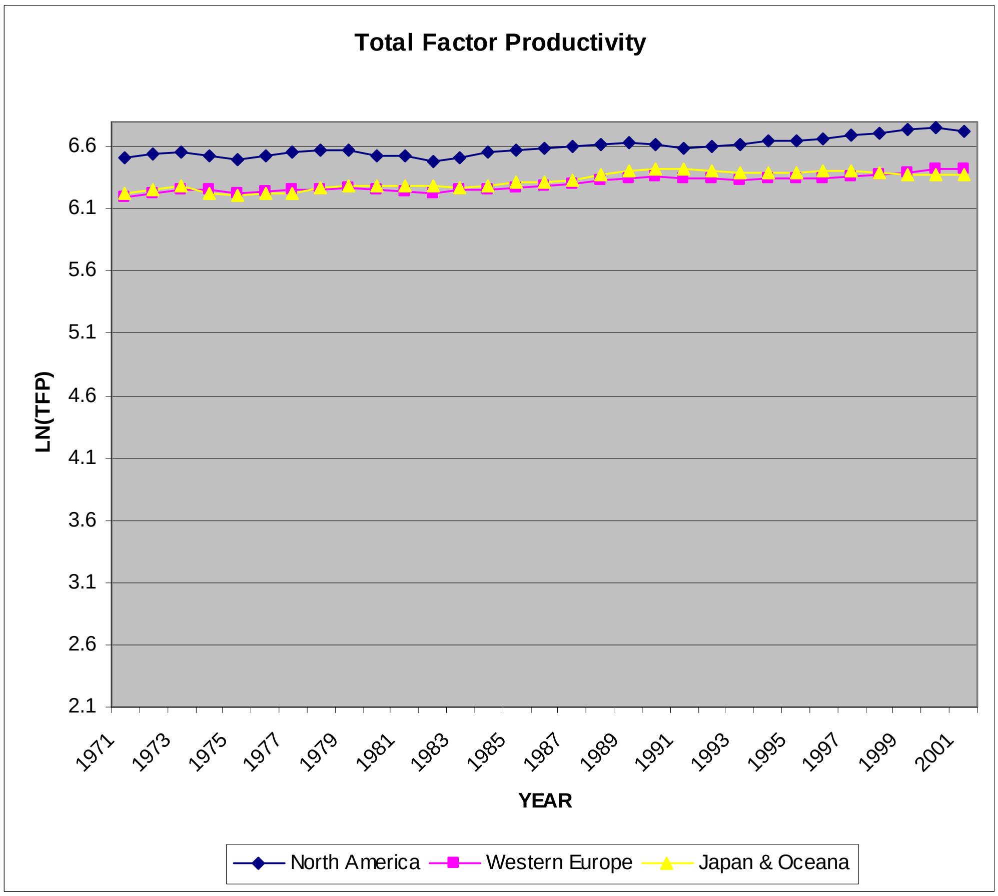

Figure 1a. Natural logarithms of levels of total factor productivity for North America, Western Europe, and Japan/Oceania, 1971-2001.

Figure 1a shows the data for the three more developed regions, North America, Western Europe, and Japan/Oceania, a region dominated by the economy of Japan. Over the entire period, the relative levels of productivity remained remarkably stable. In 1970, *TFP* in Western Europe was 73.9 percent of the productivity in North America. The comparable figure for Japan/Oceania was 76.3 percent. In 2001, *TFP* in Western Europe was 73.2 percent of the North American level, virtually identical to the ratio in 1970. By that time, the ratio had decreased in Japan/Oceania to 69.9 percent.

Figure 1a has immediate lessons for conditional convergence modeling. From 1970 to 2001, there was no evidence that levels of total factor productivity in Western Europe and Japan/Oceania were catching up to the level in North America. This has to be taken into account in designing our empirical specification.

The similarities in the relative productivities over the entire period mask an interesting pattern within the period. From 1970 to 1991, both Western Europe and Japan/Oceania were catching up to the productivity in North America. In 1991, Western European productivity was at 78.8 percent of the North American level, up from 73.9 percent in 1970. The productivity in Japan/Oceania in 1991 rose to 84.9 percent of the North American level, up from 76.3 percent in 1970. Most of this catching up came in the 1980s, which was a period of relatively rapid productivity growth in Western Europe and Japan and a period of relatively slow productivity growth in North America. After 1991, the effects of Japan's "lost decade" are clearly evident in the productivity series for Japan/Oceania, which is actually lower in 2001 than it was a decade earlier. The recovery of productivity growth in North America after 1991 can also be clearly seen in the figure.

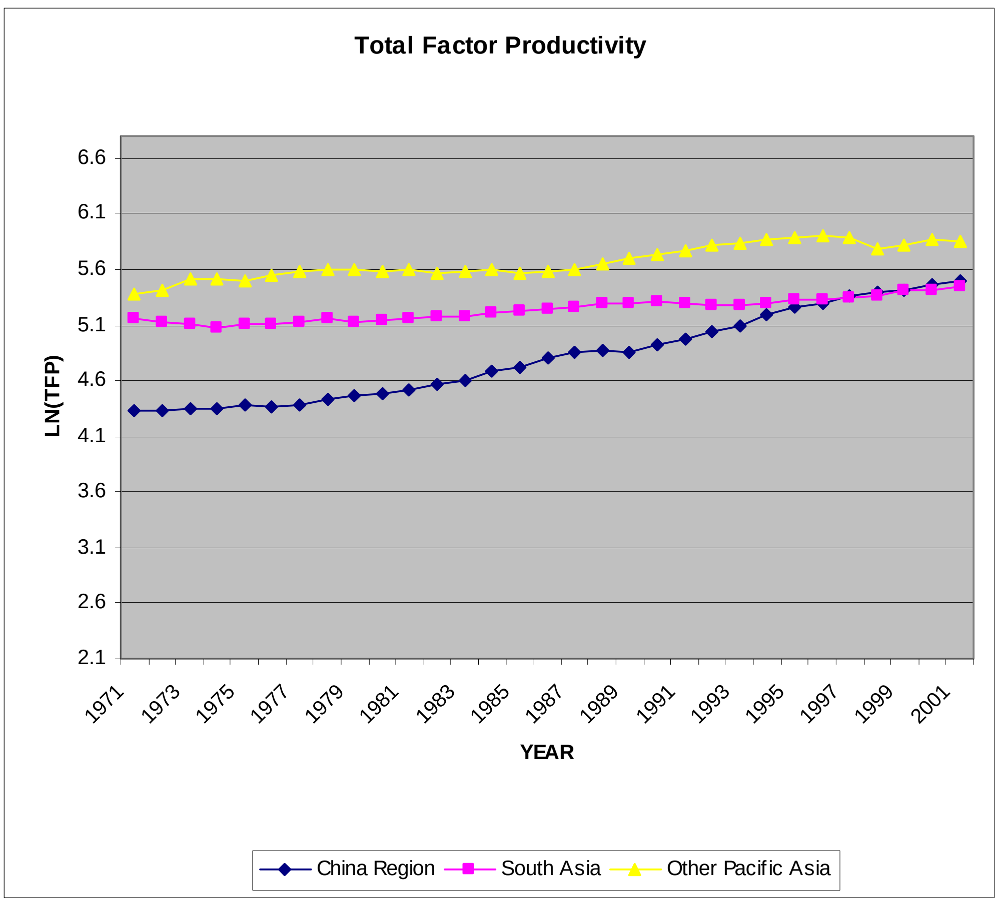

Figure 1b. Natural logarithms of levels of total factor productivity for the China Region, South Asia, and Other Pacific Asia, 1971-2001.

Figure 1b shows the logarithms of total factor productivity for three developing regions that exhibit various degrees of catching up to the total factor productivity leaders, the China Region, South Asia, and Other Pacific Asia. The graph for the China Region is striking. In 1970, total factor productivity there was by far the lowest among our regions. There is initially a period of slow productivity growth. After Mao Zedong died in September, 1976, there was a clear break in the productivity trend. In 1978, the economic reforms associated with Deng Xiaoping began and productivity started rising quite quickly and quite steadily.

Other Pacific Asia, the home of the Asian tiger economies, has a *TFP* path that is catching up to the productivity leaders. Even there, however, productivity growth has been uneven. From 1970 to 1978 productivity grew rapidly. From 1979 to 1986 productivity growth has almost been nonexistent. It is only after 1986 that productivity growth takes off again. The effects of the Asian financial crisis at the end of the 1990s are plainly visible in the productivity figures. This is certainly the effect of the recession caused by that crisis and not the effect of physical technologies becoming less efficient.

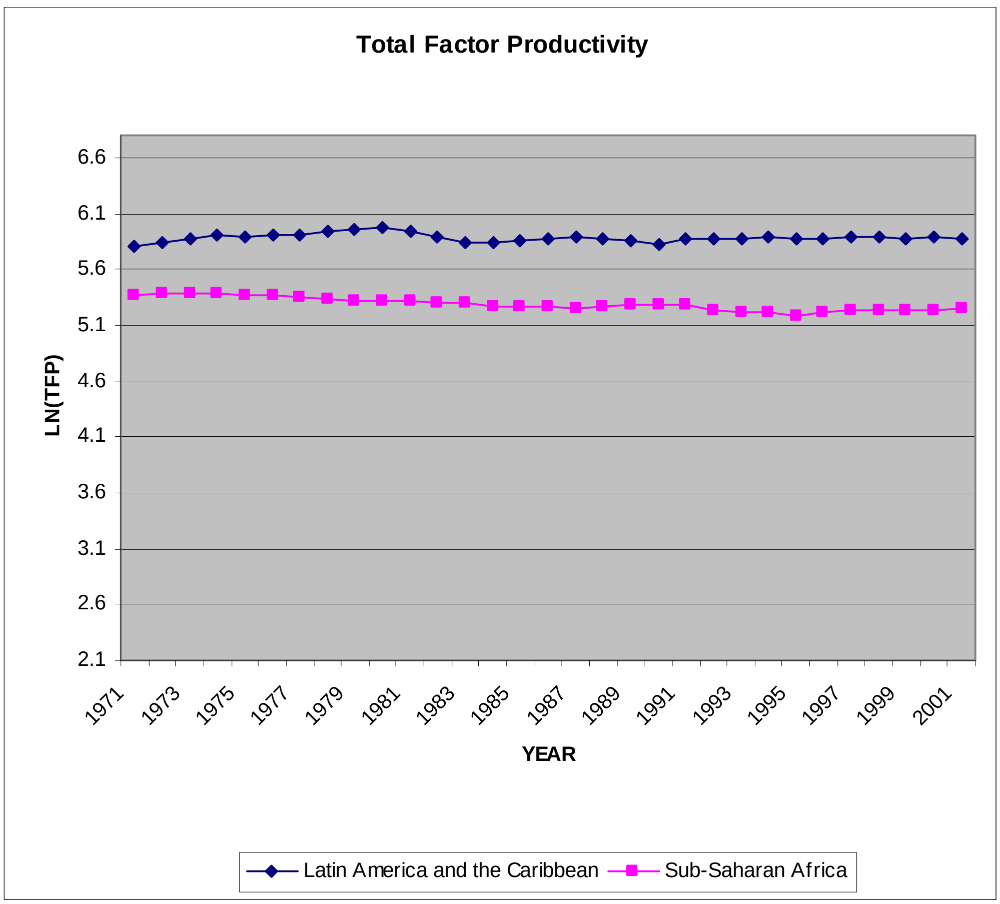

Figure 1c. Natural logarithms of levels of total factor productivity for Latin America and the Caribbean and Sub-Saharan Africa, 1971-2001.

South Asia has had the slowest productivity growth of the three regions in the graph. In 1971, total factor productivity there was almost the same as in Other Pacific Asia, but it grew much more slowly. *TFP* in South Asia decreased from 1970 to 1974 and then began a slow upward climb, sometimes growing more rapidly and sometimes a bit more slowly. In 1970, the *TFP* in South Asia was 26.0 percent of its level in North America. In 2001, it was 27.7 percent of the North American level. Over the entire period, the catch-up to the productivity leader has been modest.

Figure 1c shows regions where total factor productivity either fell or was stagnant. *TFP* in Latin America and the Caribbean grew from 1970 to 1980 and then went through a three-year period of decline. From 1983 to 2001, *TFP* growth in Latin America and the Caribbean has been essentially zero. Latin America and the Caribbean is an example of a developing region that is not catching up to the productivity leaders. Indeed, with zero *TFP* growth from 1983 to 2001, it has been falling further and further behind.

Total factor productivity in Sub-Saharan Africa fell throughout the period. In 1970, productivity in Sub-Saharan Africa was much higher than in the China Region. Indeed, productivity in the China Region in 1970 was only around one-third of what it was in Sub-Saharan Africa. By 2001, productivity in the China Region was around 30 percent higher. The level of total factor productivity was higher in Sub-Saharan Africa than it was in South Asia at that time. But in contrast to other regions with comparatively low initial levels of total factor productivity, productivity in Sub-Saharan Africa persistently declined. This also has a lesson to teach us about our modeling strategy. Our empirical specification must be consistent with persistent periods of negative total factor productivity growth.

We have learned two main lessons from these three figures. First, our *TFP* numbers capture the major economic events of the late 20th century. We can see the productivity slowdown in North America in the 1980s, Japan's lost decade in the 1990s, the effects of the Asian financial crisis at the end of the 1990s, and the effects of Deng Xiaoping's economic reforms in China. This gives us confidence that our *TFP* numbers are plausible. Second, we have learned that regions exhibit a wide variety of levels and growth rates of *TFP*. Our model will have to be able to make sense of similar growth rates of *TFP* for developed regions with persistent differences in *TFP* levels, stagnation and even long-run decreases in *TFP* levels in some developing regions, and examples of rapid *TFP* growth in other developing regions. We turn next to describing a model that can do this.

4 The Model

To be consistent with the empirical evidence our structural model is one of conditional convergence. It assumes a global productivity frontier that advances at a fixed rate per year.

$$GF(t) = GF(0) \cdot (1 + gf_{gth})^t \quad , \tag{2}$$

where $GF(t)$ is the level of the global productivity frontier at time t and gf_{gth} is the exogenous rate of growth of the global frontier.

The data in Section 3 suggest that the *TFP*s of regions should not be expected to converge to the global frontier. Region-specific factors such as differences in labor force participation rates, the average number of hours worked per year and corruption could and, indeed, do keep the region's conditional productivity frontier below the global one.

The conditional productivity frontier for region *i* in year *t* (*CF(i,t)*) depends on the global frontier, a region-specific constant, *c(i),* to capture region-specific fixed effects, and a set of other variables. The *c(i)* coefficients must always lie between 0 and 1.

$$CF(i,t) = c(i) \cdot \frac{\exp(X_{cf}(i,t)\gamma_{cf})}{1+\exp((X_{cf}(i,t)\gamma_{cf}))} \cdot GF(t), \tag{3}$$

where $X_{cf}(i,t)$ is a matrix of independent variables affecting the position of the conditional productivity frontier and γ_{cf} is the associated coefficient vector. It should be noted here that if the X_{cf} variables are constant or if $\frac{\exp(X_{cf}(i,t)\gamma_{cf})}{1+\exp((X_{cf}(i,t)\gamma_{cf}))} \approx 1$, the rate of growth of the conditional frontier is the same as the rate of growth of the global frontier.

The value of total factor productivity produced by the model may or may not be on the conditional frontier, but it can never be above it. In symbols, $TFP_p(i,t) \leq CF(i,t)$, for all possible values of *i* and *t*. The subscript in the total factor productivity term indicates that it is the value of total factor productivity predicted by the model. In year 0, the initial year of the model, $TFP_p(i,0) = ic(i) \cdot CF(i,0)$, where the *ic(i)* are region-specific initial conditions that specify where total factor productivity is initially relative to the conditional frontier. These initial conditions are a subset of the parameters that have to be estimated in the model. Clearly, $0 < ic(i) \leq 1$.

An important variable in driving the process of catching up to the conditional frontier is the relationship between the current level of total factor productivity and its conditional frontier value. We specify this relationship as:

$$r(i,t) = \frac{TFP_p(i,t)}{CF(i,t)},$$

where the *r(i,t)* are just the ratios of the predicted value of total factor productivity to the maximum value that it can attain, the value on its conditional frontier. Clearly, $0 < r(i,t) \leq 1$.

The rate of growth of total factor productivity in the model then may be expressed as:

$$tfp_{gth}(i,t) = \beta \cdot (r(i,t) - \alpha(i,t)) \cdot (1 - r(i,t)) + cf_{gth}(i,t), \tag{4}$$

where $tfp_{gth}(i,t)$ is the growth rate of total factor productivity in the model in region *i* from year *t* to year *t+1*, β is a parameter, $\alpha(i,t)$ is an endogenous region- and period-specific threshold value, and $cf_{gth}(i,t)$ is the growth rate of the conditional frontier in region *i* between year *t* and *t+1*.

Several features of this specification deserve comment here. First, if $r(i,t)=1$, then $tfp_{gth}(i,t)=cf_{gth}(i,t)$. In other words, if a country is on its conditional frontier, then its rate of total factor productivity growth in the model would be equal to the rate of growth of its conditional frontier. Second, there are two mechanisms through which total factor productivity could decline. If $r(i,t)<\alpha(i,t)$, then total factor productivity will grow more slowly than the growth of the conditional frontier. If $r(i,t)$ is much smaller than $\alpha(i,t)$ it is possible that total factor productivity could decline even when the conditional frontier was growing. In addition, it is possible for the conditional frontier to decrease because of increases in corruption or other factors that increasingly inhibit productivity. In this case, it is possible for total factor productivity to decrease even if $r(i,t)>\alpha(i,t)$.

The threshold function is an important part of the model because it influences that rate at which countries catch up to their conditional frontiers. The higher the value of $\alpha(i,t)$ the slower a country catches up to its conditional frontier or the faster it diverges from it. We specify the threshold function as follows:

$$\alpha(i,t)=a\cdot\frac{\exp\left(X_{thres}(i,t)\cdot\delta_{thres}\right)}{1+\exp\left(X_{thres}(i,t)\cdot\delta_{thres}\right)}, \qquad (5)$$

where α and the parameter vector δ_{thres} are to be estimated, and $X_{thres}(i,t)$ is a matrix of independent variables that enter the threshold function.

Now we can compute the total factor productivity in any year using Eq. (4).

The model above has eight region-specific fixed effects to estimate, the $c(i)$, eight region-specific initial conditions, the $ic(i)$, two structural parameters β and a, and the parameters associated with the independent variables, the γ_{cf} and the δ_{thres}.

This framework has two strengths. First, it is structured so that it cannot produce forecasts that are implausible. Regions can catch up to their conditional frontiers and then grow at the rate at which their conditional frontiers grow. Conditional frontiers, in turn, can grow, but ultimately their growth must slow to the growth rate of the global productivity frontier. Second, the structure provides a way of distinguishing factors that influence the rate of which regions catch up to their conditional frontiers from factors that influence the levels of those frontiers. Most empirical studies using the conditional convergence framework do not allow this distinction.

The strengths of the framework come with an important drawback. Parametric constraints and the logistic forms in Eqs. (3) and (5) sometimes produce numerical problems that can make the estimation of the model difficult.

5 The Data

As described above, *TFP* was calculated as the residual from a Cobb-Douglas production function, accounting for the influence of physical capital, as well as a labor force incorporating both an age structure of the underlying population and a distribution of education across different age groups.

The GDP data used in this exercise was taken from the Penn World Tables (6.2 edition) (Heston et al. 2006) where data are available for all selected countries within the eight regions in the full range of the observation period (1971-2001) in all but one case. GDP per capita for Bangladesh in 1971 was assumed to be equal to Pakistan in the same year.

In contrast, consistent measures on the capital stocks of countries over the period 1970 to 2001 are not readily available. The Penn World Tables provide data on investment which we used to calculate capital stocks. Starting from the average of the first five years of each individual country's investment series, we back-projected investment until 1900, assuming an annual growth rate of 4 percent in investment. The sum of all previous investments, discounted by the number of years since they were made, was then taken as the initial year's capital stock. Applying the perpetual inventory method, assuming a rate of depreciation of 4 percent, and aggregating countries we obtained regional physical capital stocks for the whole period.[10]

The population data taken for computing the age-structured and education-specific human capital stock are taken from *The UN World Population Prospects: The 2006 Revision* (United Nations 2007). Whether an age group actually becomes part of the human capital stock or not is dependent on its average education, since both entry- as well as exit-age are assumed to depend on an age group's educational attainment level. Regional data on mean years of schooling by age were derived from the new IIASA/VID education database (Lutz et al. 2007; KC et al. 2008) and were translated into age- and education-dependent individual productivity weights.[11]

Once we had calculated *TFP* using these data, we created a number of consistently aggregated measures of variables that could potentially influence *TFP* growth in different regions. Besides the variables we eventually ended up using in our model (Education of 35-49 Year Olds, Shares of 35-49 Year Olds, Domestic Capital Formation, Openness, Corruption) we have also aggregated data for a whole set of additional variables that are commonly assumed to influence *TFP* growth. The ones that are used in the current specification shall be introduced here; for a description on additional variables, go to the Appendix.

The average education of 20-59 year olds is calculated from the IIASA education database cited above. The original was provided for 5-year age groups, so in order to get mean years of schooling we had to interpolate using Sprague multipliers. Afterwards the education of each individual age group was weighted by its share in total population of that age.

Data on investment are available from the Penn World Tables 6.2 edition. In order to obtain domestic savings, we had to adjust for capital that comes from another region or is invested elsewhere. We used data on foreign direct investment (FDI) inflows and outflows from the *UNCTAD Handbook of Statistics 2005* (UNCTAD 2005). In order to find out what proportion of inflows and outflows come from or go to somewhere inside the region, respectively – and can therefore not be considered "inflows" or "outflows" – we used data from the *UNCTAD Country Factsheets*[12] where

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[10] In order to check the quality of our physical capital series, we calculated each country's capital-output ratio for year 2000, using average capital and GDP from 1998-2002. These K/Y-ratios turned out to look reasonable.

[11] See the Appendix for full detail on our assumptions.

12 http://www.unctad.org/Templates/Page.asp?intItemID=3198&lang=1

at least for some countries there is detailed information on FDI in- and outflow's origins and destinations. With the help of these data, we were able to calculate inflow and outflow shares for some big countries inside every region except for China in at least a few years. In all other years we had to estimate shares according to what we had reconstructed. These shares for individual countries where then weighted by the amount of total inflow to that country in the respective year relative to the total inflow of the whole region in that year. "Region" in this case of course means only those countries for which we actually found data.

Once we had these flow shares, we could calculate the estimated regional flows. After we had brought the UNCTAD numbers to the same base year as the Penn World Table data on savings, we could calculate domestic savings[13] which were ultimately divided by the regional capital stocks to yield rates of domestic capital formation.

Our data on corruption stems from the *Corruption Perceptions Index* compiled by *Transparency International.*[14] The index numbers from individual countries were weighted by their respective share in the total population of their region. Again, the total region was taken as the sum of all countries in that region for which there were data.

Data on Rule of Law is taken from Kaufmann et al. (2008). We averaged 1996-2007 to get one index number for each country. After that we once again weighted each country's individual number by its share in the regional population, before adding the shares up to the regional Rule of Law index, which is used as a constant in our estimation.

6 Estimation Results

The model that we estimate is:

$$\ln(TFP(i,t)) = \ln(TFP_p(i,t)) + \mu(i,t), \tag{6}$$

where the predicted values of total factor productivity as generated using the model described in Section 4 and the $\mu(i,t)$ are assumed independent realizations of a normally distributed random variable with mean 0 and a constant standard deviation. We estimated Eq.(6) by maximum likelihood over the period 1971-2000.

The resulting coefficients and confidence intervals are shown in Table 1. The *c* coefficients reflect conditions that are fixed over the estimation period. For example, as we saw in Figure 1, levels of total factor productivity in Western Europe and Japan/Oceania are persistently below its level in North America but grow at about the same pace. This is exactly the phenomenon that different values of the *c* coefficients were meant to capture. Different regions have different levels of their conditional frontiers for many reasons. The difference between Western Europe and North America, for example, could be due mainly to differences in hours of work and labor force participation rates. But there are undoubtedly many other factors at play, such as economic policies and the nature of economic institutions.

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13 Again Bangladesh 1971 was missing and had to be replaced by the Pakistan value in the same year.
14 http://www.transparency.org/policy_research/surveys_indices/cpi

Table 1. Estimation results.

Coefficient	Estimate	Std. Error	z value	Pr(z)	Signif.
c-coefficients					
North America	0.9999	0.0769	12.985	< 2.2e-16	***
Western Europe	0.7206	0.0563	12.781	< 2.2e-16	***
Japan & Oceana	0.6877	0.0479	14.334	< 2.2e-16	***
China Region	0.5099	0.0725	7.026	2.13E-12	***
South Asia	0.5970	0.0686	8.695	< 2.2e-16	***
Other Pacific Asia	0.4985	0.0470	10.602	< 2.2e-16	***
Latin America	0.5528	0.0457	12.081	< 2.2e-16	***
Sub-Saharan Africa	0.2805	0.0292	9.582	< 2.2e-16	***
ic-coefficients					
North America	0.9999	0.0278	35.960	< 2.2e-16	***
Western Europe	0.9999	0.0399	25.085	< 2.2e-16	***
Japan & Oceana	0.9843	0.0264	37.302	< 2.2e-16	***
China Region	0.2546	0.0136	18.736	< 2.2e-16	***
South Asia	0.4248	0.0242	17.563	< 2.2e-16	***
Other Pacific Asia	0.6325	0.0123	51.386	< 2.2e-16	***
Latin America	0.9145	0.0223	40.960	< 2.2e-16	***
Sub-Saharan Africa	0.9999	0.0210	47.725	< 2.2e-16	***
conditional frontier (γ)					
Constant	0.4851	0.2234	2.171	2.99E-02	*
Capital formation (lagged)	0.1156	0.0189	6.108	1.01E-09	***
Share 20-39 in 20-59	-0.4698	0.0827	-5.678	1.36E-08	***
Sh. ed yrs 20-39 in 20-59	0.6587	0.1235	5.333	9.64E-08	***
Ave. ed X sh. 25-59 in pop.	0.1079	0.0261	4.138	3.49E-05	***
Openness	0.0749	0.0359	2.086	3.69E-02	*
Voice	0.4703	0.1143	4.114	3.89E-05	***
threshold function (δ)					
Constant	-5.6719	0.5261	-10.781	< 2.2e-16	***
Corruption	5.2856	0.7630	6.927	4.28E-12	***
Ave. ed. 20-59	-1.1583	0.3005	-3.854	1.16E-04	***
Share 20-39 in 20-59	-3.5135	0.8755	-4.013	5.99E-05	***
Openness	-2.7455	0.5347	-5.134	2.83E-07	***
Rule of Law	-2.9375	0.8030	-3.658	2.54E-04	***
other parameters					
a (in threshold function)	0.4995	0.0216	23.129	< 2.2e-16	***
β	0.2266	0.0087	26.076	< 2.2e-16	***
Signif. Codes	0 '***'	0.001 '**'	0.01 '*'	0.05 '.'	0.1 ' ' 1
-2 log L:	-1142.021		No. Obs.	248	

The *ic* coefficients for North America, Western Europe and Japan/Oceania are close to unity, indicating that in 1971 they were essentially on their conditional frontiers. Much more surprising, however, is the observation that Latin America and the Caribbean and Sub-Saharan Africa were initially on their conditional frontiers. The observed reduction in the level of total factor productivity in Sub-Saharan Africa, then, could only have occurred because of a decrease in its conditional frontier. With their present economic and institutional structures, there is virtually no catching up for them to do. Significant further growth in total factor productivity in those regions has to come for increases in their conditional frontiers. We see significant catching up only in the three Asian regions, the China Region, Other Pacific Asia, and South Asia.

Increases in the threshold decrease the rate of total factor productivity growth, so a positive coefficient of a variable in the threshold function indicates that it has a negative effect on *TFP* growth. Two variables are included in both the conditional frontier and the threshold function, openness and the share of 20-39 year olds among those 20-59. Openness has a positive sign in the conditional frontier function and a negative sign in the threshold function, indicating that openness both raises the level of productivity that a region could obtain, but also increases the speed at which the region catches up to its frontier.

The share of 20-39 year olds in the 20-59 year old population is meant to capture the effect of a younger labor force. It has a negative sign in both functions. The negative sign in the conditional frontier function indicates that an older labor force increases productivity. This is consistent with the work of Lindh and Malmberg and the work of Feyrer discussed above. The negative coefficient in the threshold function indicates that a younger labor force speeds the process of catching up to a region's conditional frontier. Thus, the age structure of the labor force has two effects which operate differently depending on whether there is a significant amount of catching up occurring. For example, in Sub-Saharan Africa, where there has been little catching up going on, the positive effect of a younger labor force is lost. One advantage of the present model is that it allows us to study separately the effects of variables on the conditional frontier and on the threshold function. The conflicting influences of a young labor force could only be seen in such a framework.

The pure age structure effects are modified by the variable that measures the age structure of the person-years of education. This variable is labeled "Share ed 20-39 among 20-59". The variable is the ratio of the number of person-years of education among those 20-39 among all the person-years of education among those 20-59. This variable has a positive coefficient. It indicates that, keeping the age structure of the labor force constant, the conditional productivity frontier is higher if more of the education is concentrated among the young. Our results indicate that both the age structure of the population and the age structure of person-years of education matter.

We have one other variable that is influenced by the interaction of age and education. We experimented with introducing the share of the population that was 25-59 in order to test whether there was a demographic dividend effect on *TFP.* We could not find such an effect, but we found that the interaction of the average education of 25-59 years olds and their share in the population had a positive and significant effect on the level of the conditional frontier. This suggests that the change in the level of education plays a role in the demographic dividend.

The variable labeled "Domestic capital formation" in Table 1 is the rate at which the capital stock would have grown on the basis of domestic investment. It omits the effects of direct foreign investment on capital stock growth. Its coefficient is positive in the conditional frontier function. We could not find a significant effect of the fraction of total investment that came from direct foreign investment.

The specification includes two time invariant institutional quality effects, “Voice” and “Rule of Law”. “Voice” is akin to a variable for democracy. It indicates the extent to which governments listen to the voice of the populace. “Voice” has a positive and significant effect on the level of the conditional frontier. Another institutional quality variable is the “Rule of Law”. That variable enters the threshold function with a negative sign, which indicates that regions where the rule of law is more consistent catch up to their conditional frontiers faster.

“Corruption” is a time varying quantity and it has a positive sign in the threshold function. More corruption lowers the rate of catching up. The last variable in the threshold function is the average years of education of 20-59 year olds. This has a negative sign in the threshold function, indicating that increasing the average years of education leads regions to catch up more quickly.

These results help us understand some of the previous findings in the literature. Because they are on or close to their conditional frontiers, the average number of years of education by itself does not have an influence on total factor productivity in North America, Western Europe, Japan/Oceania, Latin America and the Caribbean and Sub-Saharan Africa. This may be one reason why previous studies using that variable found statistically insignificant results. The average level of education of 25-59 year olds does matter, however, in all regions when interacted with the share of the population 25-59.

We did not find a statistically significant effect of the youth dependency ratio on total factor productivity, but this could be because the share of the population 25-59 is negatively correlated with the youth dependency ratio. We do find qualified support for the finding that an older labor force increases productivity. This support is qualified because the age distribution of the person-years of education also matters and works in the opposite direction. In the following section of the paper, we will see how age and education interactions are expected to play out over the next decades. These projections will throw further light on the effects of changing age and education structures.

The predicted and the actual values of total factor productivities in our eight regions are shown in Figures 2a and b through 9a and b. The first of each pair of graphs shows the natural logarithm of the observed and fitted level of total factor productivity. The second shows predicted and actual total factor productivity growth rates over five year periods. Clearly, the fit both to levels and to the growth rates of productivity is quite good. Over the period of decades, the model is able to explain both examples of rapid productivity increase and sustained periods of productivity decrease.

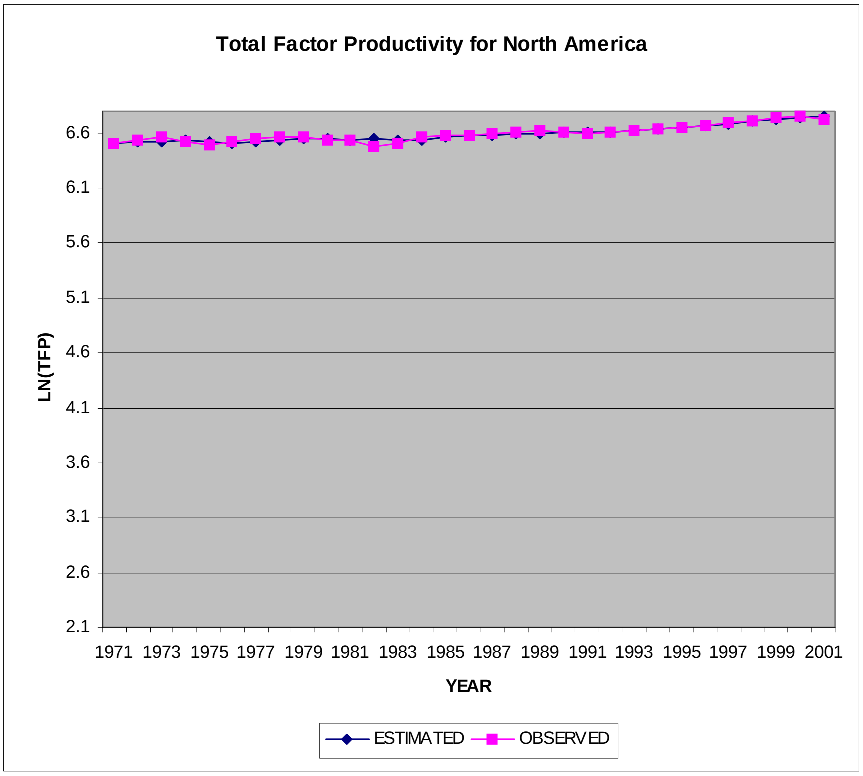

Figure 2a. Total factor productivity for North America.

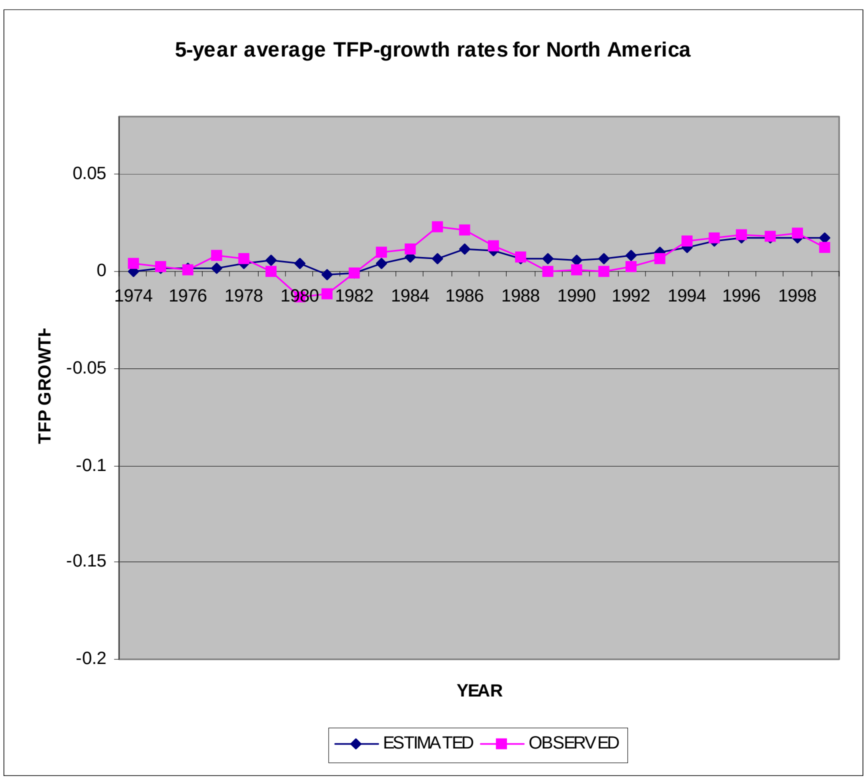

Figure 2b. Five-year *TFP*-growth rates for North America.

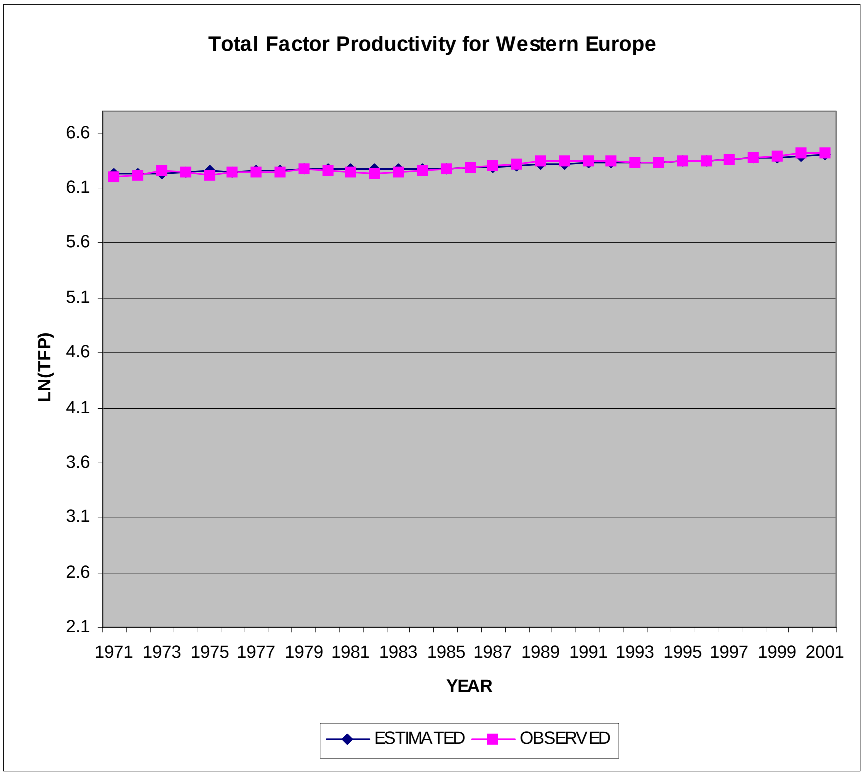

Figure 3a. Total factor productivity for Western Europe.

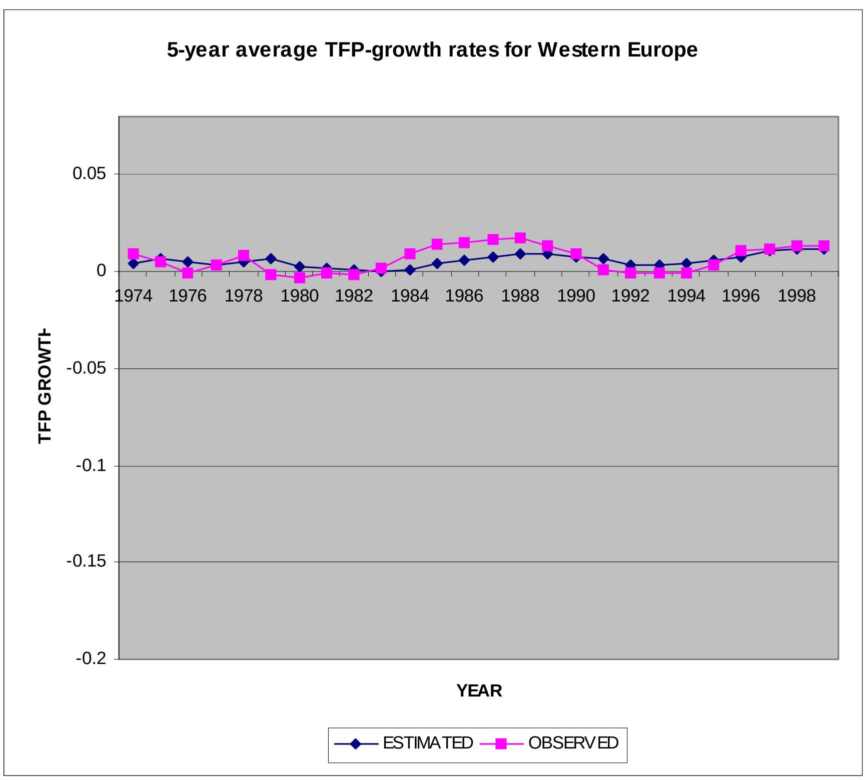

Figure 3b. Five-year average *TFP*-growth rates for Western Europe.

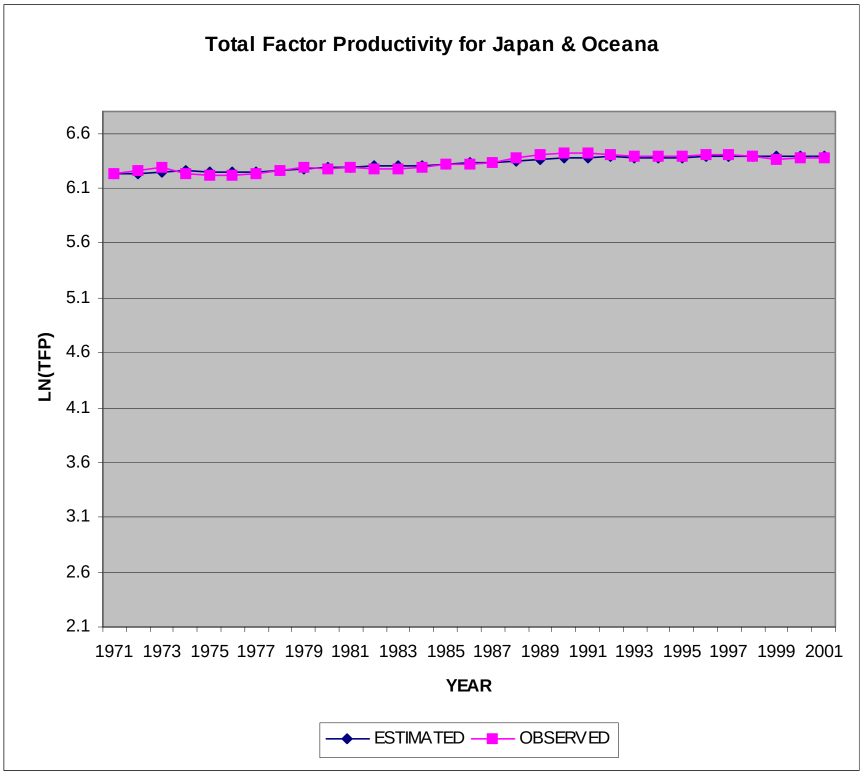

Figure 4a. Total factor productivity for Japan and Oceana.

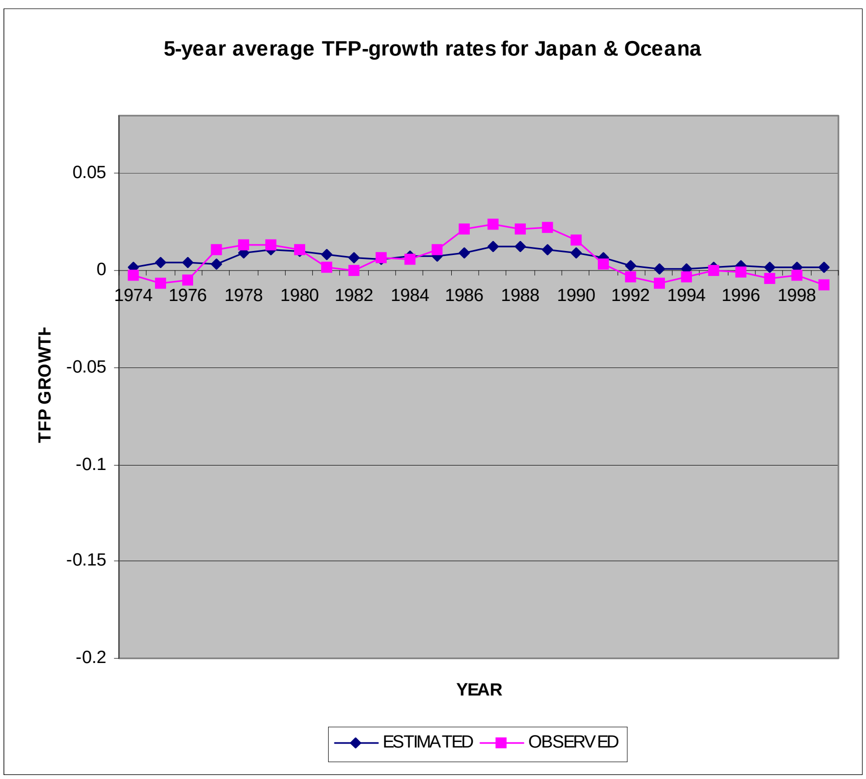

Figure 4b. Five-year *TFP*-growth rates for Japan and Oceana.

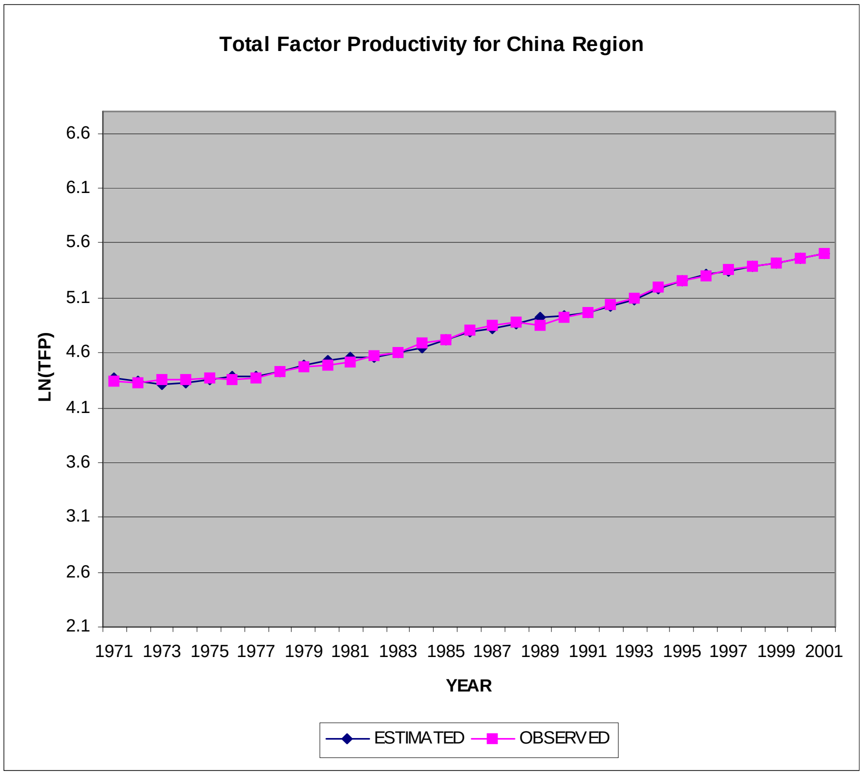

Figure 5a. Total factor productivity for China Region.

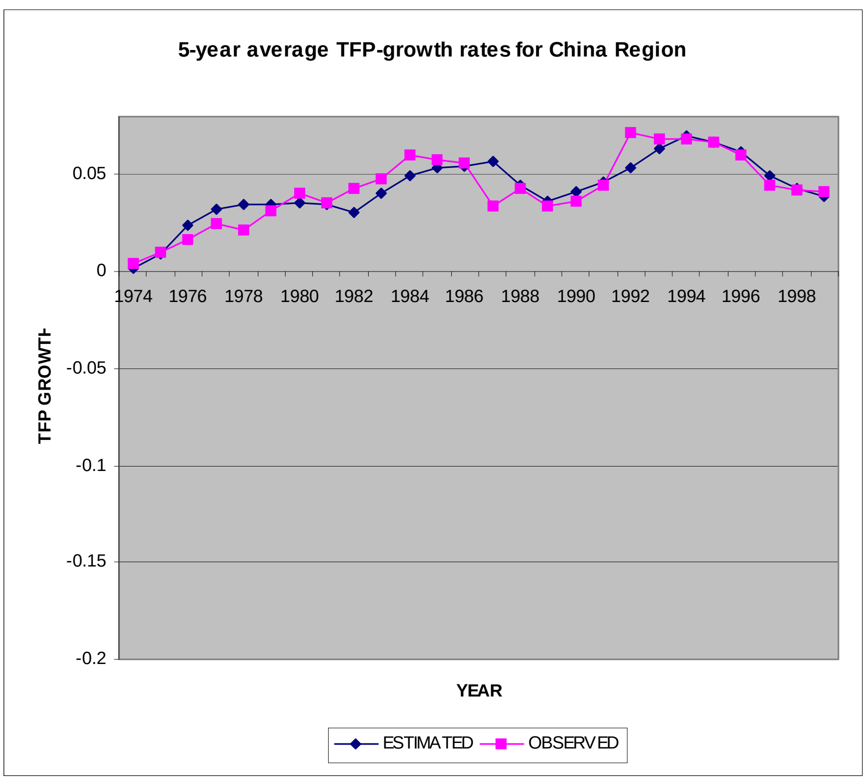

Figure 5b. Five-year average *TFP*-growth rates for China Region.

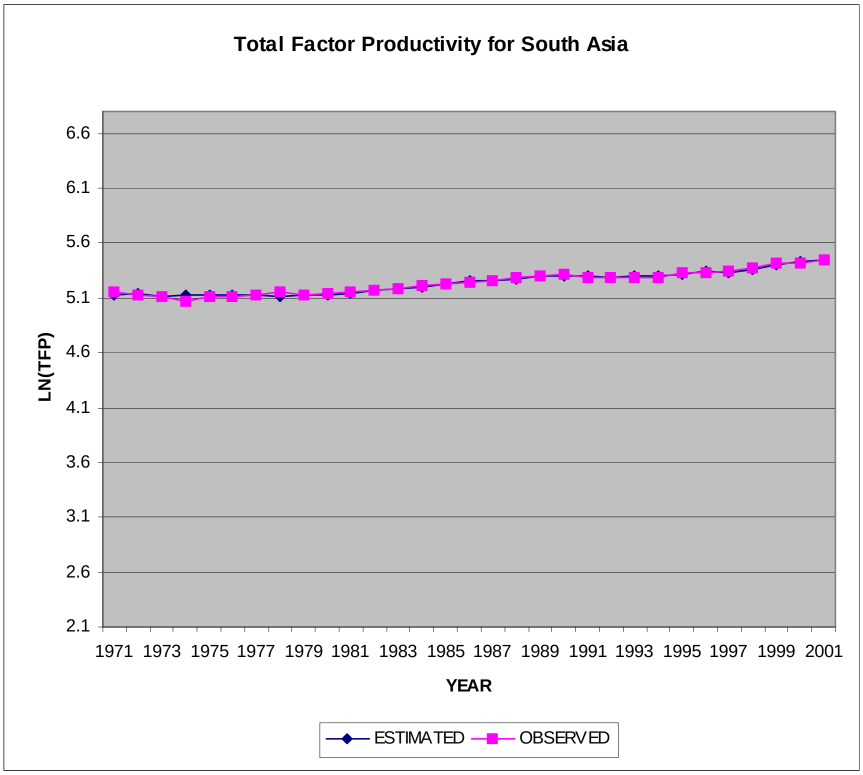

Figure 6a. Total factor productivity for South Asia.

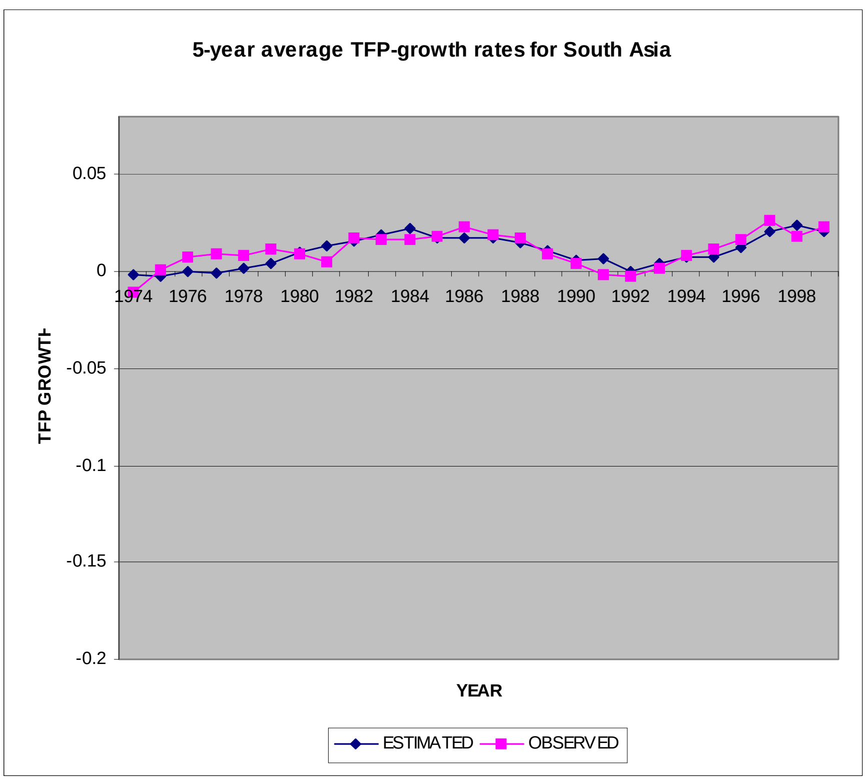

Figure 6b. Five-year average *TFP*-growth rates for South Asia.

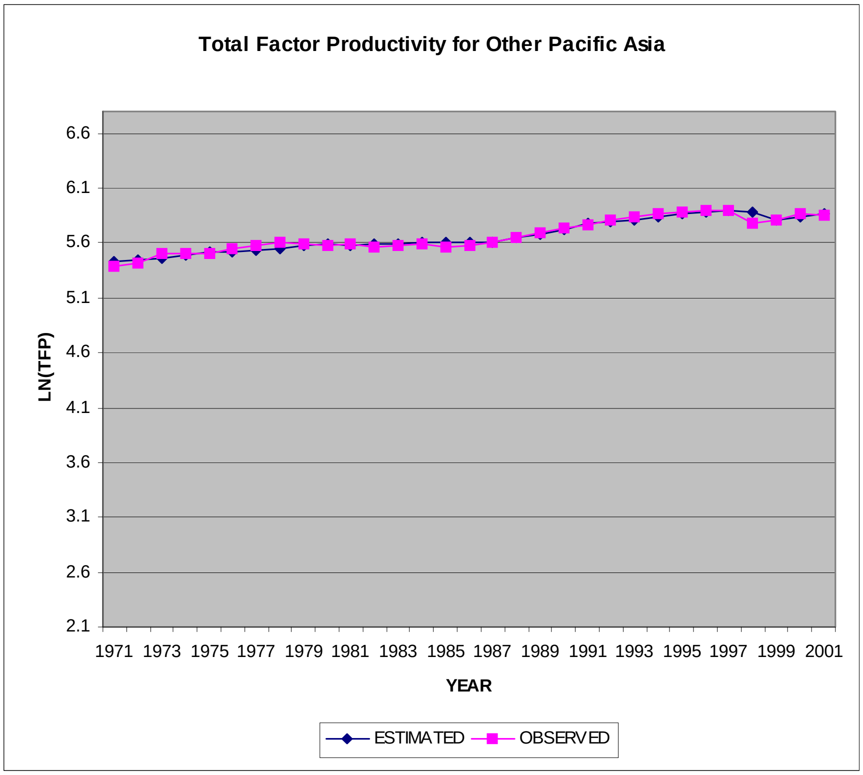

Figure 7a. Total factor productivity for Other Pacific Asia.

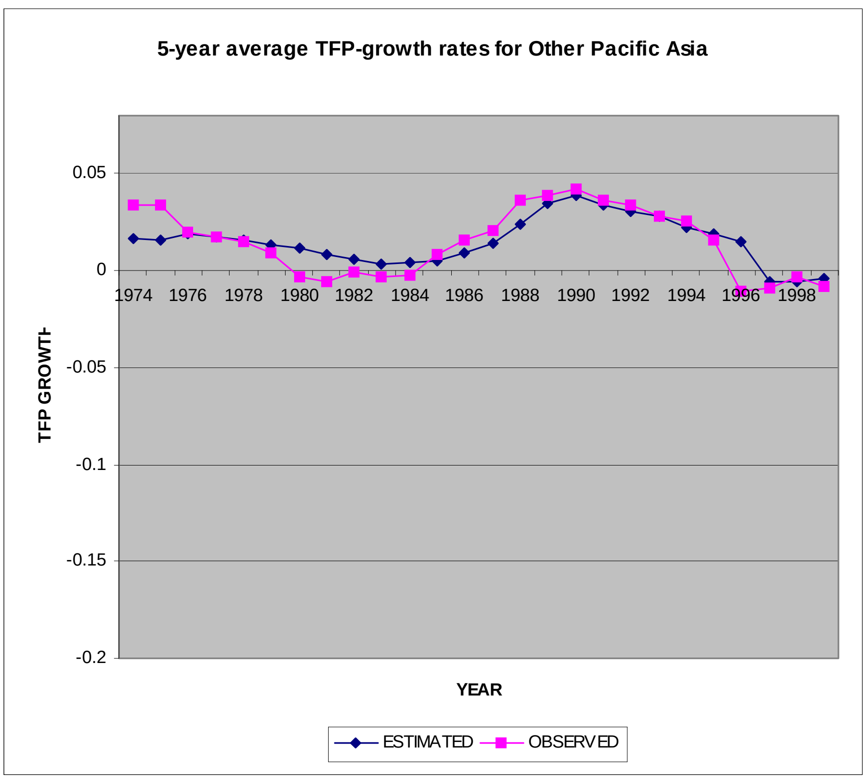

Figure 7b. Five-year average *TFP*-growth rates for Other Pacific Asia.

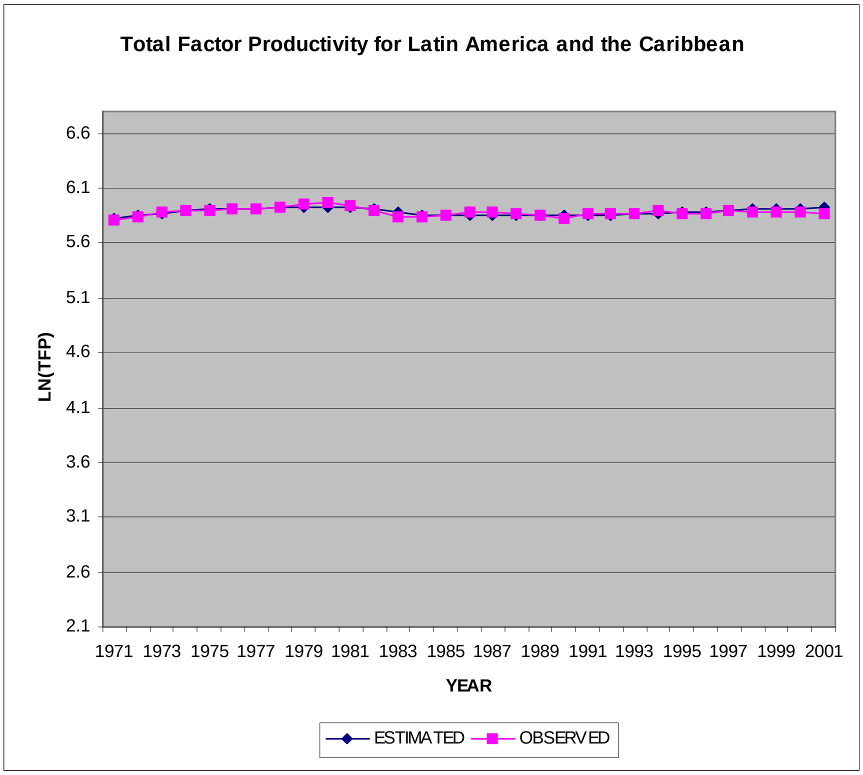

Figure 8a. Total factor productivity for Latin America and the Carribean.

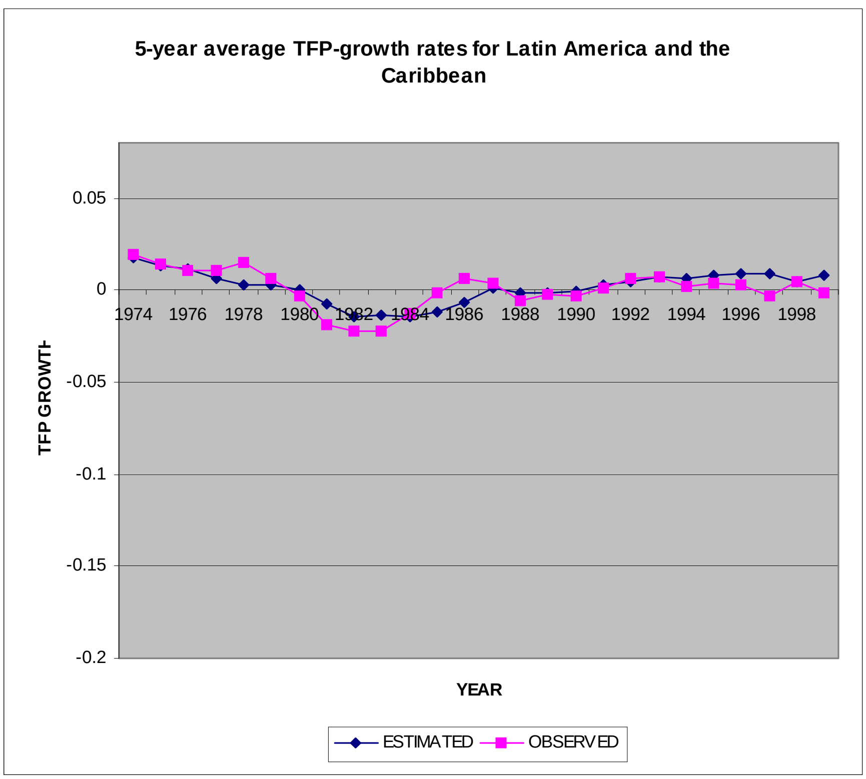

Figure 8b. Five-year average *TFP*-growth rates for Latin America and the Caribbean.

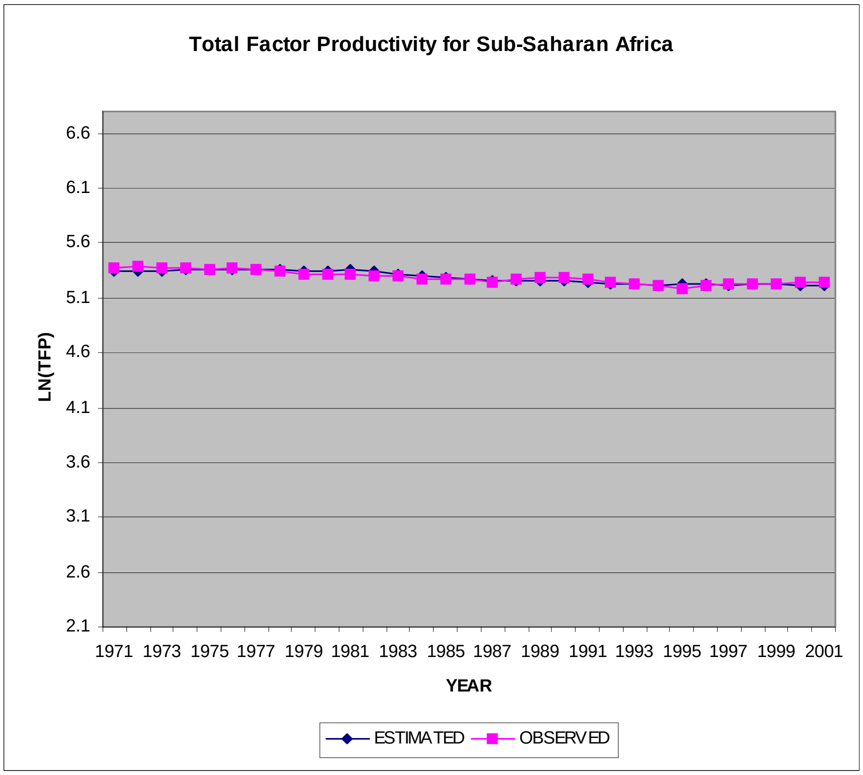

Figure 9a. Total factor productivity for Sub-Saharan Africa.

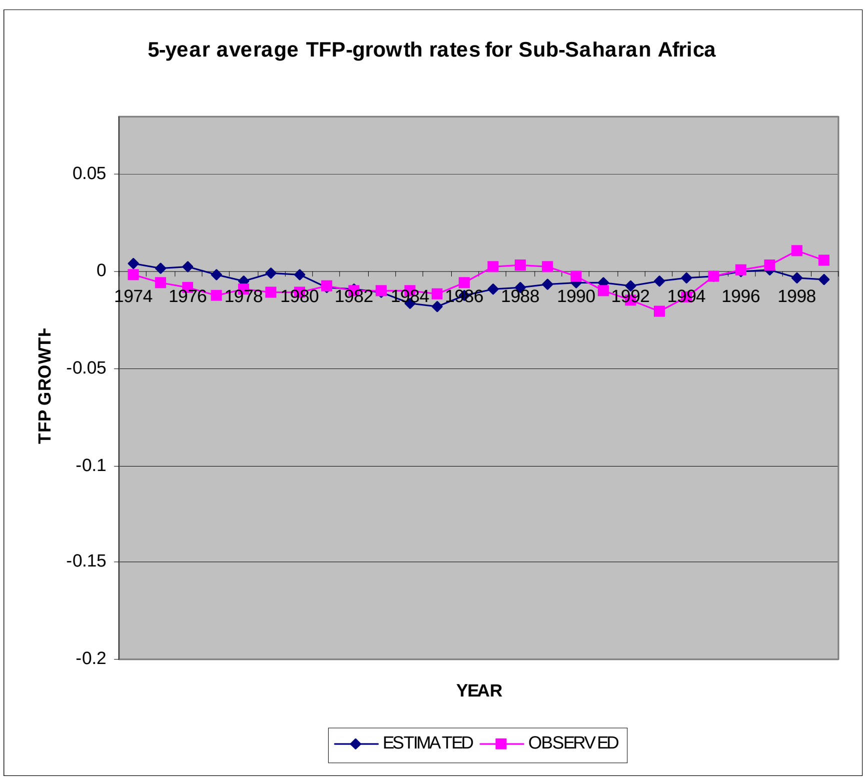

Figure 9b. Five-year average *TFP*-growth rates for Sub-Saharan Africa.

7 Projecting Future Levels and Growth Rates of TFP

In this Section, we make two sorts of total factor productivity forecasts. In the first, we show what we would expect to happen if nothing but the age and education structures changed as forecasted using the global trend scenario in the IIASA/VID age and education structure projections (KC et al. 2008). The results are shown in Figures 10a and b through 17a and b.

In North America, productivity growth slows to around 2020 and then picks up a bit. This is caused by the aging of the baby boomers. There are two important factors here. The first is the proportion of the population 20-59 who are 20-39. The coefficient of this variable is negative, indicating that other things being equal an older labor force leads to higher conditional frontiers. This effect is more than offset by the proportion of education years among those who are 20-39. The coefficient of this variable is positive and that means that a distribution of the human capital stock in favor of the young increases the frontier. The net effect of these and the other age and education variables in the model is a temporary depressing effect on total factor productivity caused by the aging of the baby boomers. During the period 2010-2020, demographic and education structure change will favor Western Europe and Japan/Oceania as compared with North America.

In the China Region, our projections show declining rates of total factor productivity in the future from quite high levels in the past. In contrast, total productivity rates stay fairly high to 2030 in South Asia (see also Prskawetz et al. 2007 on this point). Our projections show that South Asia will receive a demographic dividend from its forthcoming age and education structure changes.

Our forecasts also show a bit of a turnaround for Sub-Saharan Africa in the near-term future. While the projected rates of total factor productivity growth will not be large enough for Sub-Saharan Africa to start catching up to the productivity leaders, at least they will be positive.

The second set of forecasts shows what would happen if, in addition to the changes in age and education structures, we assumed that the two institutional quality variables “Voice” and “Rule of Law” in addition to “Corruption” changed linearly reaching the level observed in Western Europe in 2001 by 2031. The results are shown in Figures 18a and b through 22a and b.

The differences in the extent to which different regions can make use of these improvements are striking. South Asia would be the largest gainer with rates of total factor productivity increase rising quickly by around 4 percentage points over what they otherwise would have been. This is an enormous increase. In the China Region, the maximum increase in the rate of total factor productivity growth is around two percentage points. In the other regions, the effects are smaller.

It is striking that in Sub-Saharan Africa, the maximum increase in the rate of total factor productivity growth is around 1 percentage point. In the long-run, a one percentage point increase in total factor productivity growth would allow Sub-Saharan Africa to catch up slowly to the productivity leaders. Nevertheless, these results should give pause to those who think that better governance alone would turn the economies of Sub-Saharan Africa into tigers.

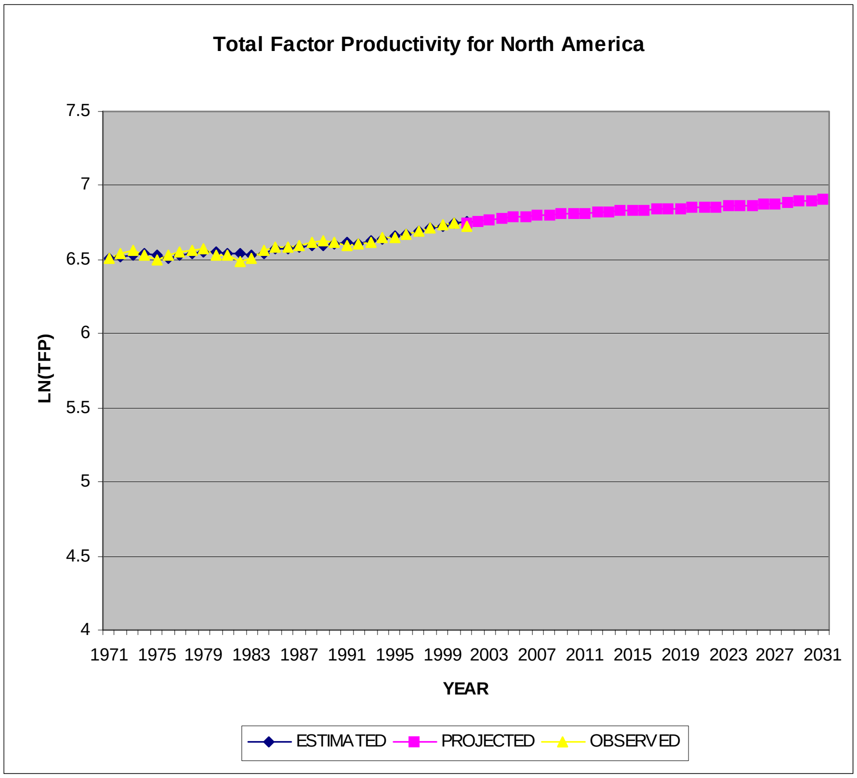

Figure 10a. Total factor productivity for North America.

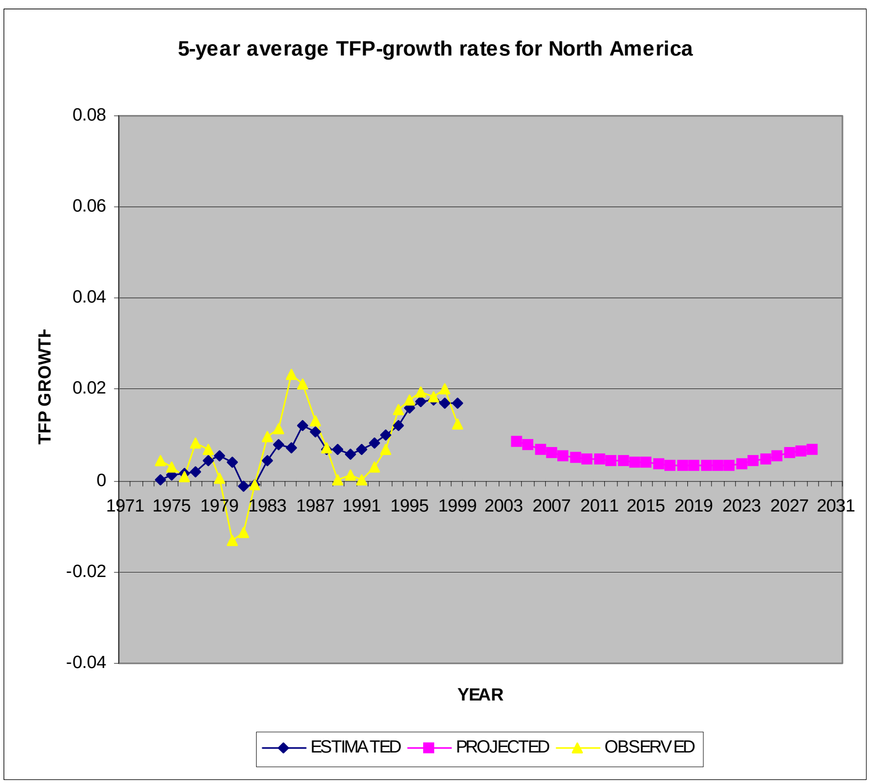

Figure 10b. Five-year average *TFP*-growth rates for North America.

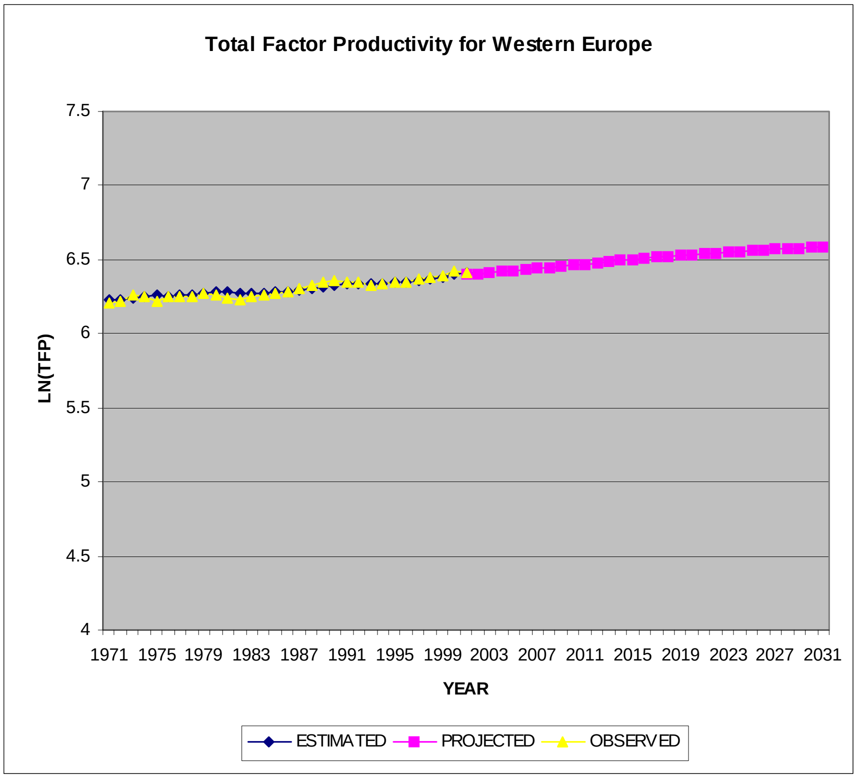

Figure 11a. Total factor productivity for Western Europe.

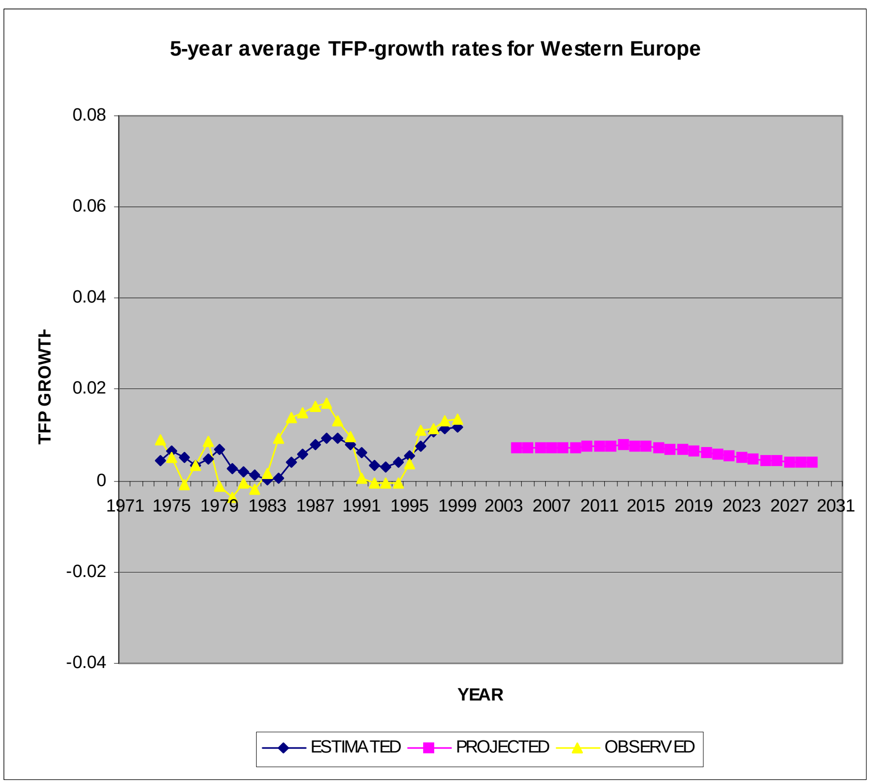

Figure 11b. Five-year average *TFP*-growth rates for Western Europe.

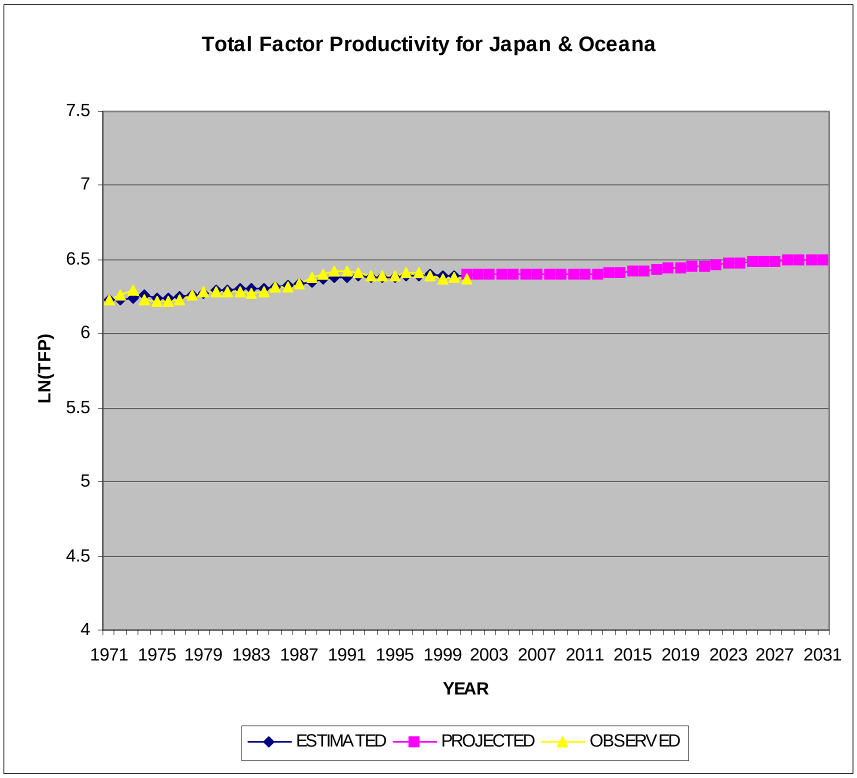

Figure 12a. Total factor productivity for Japan and Oceana.

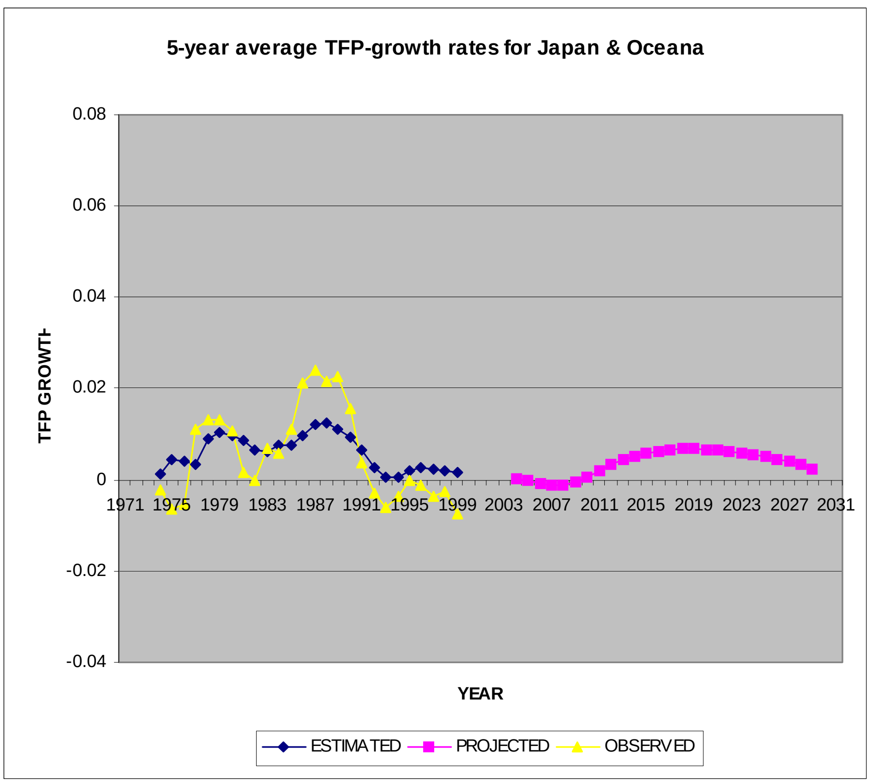

Figure 12b. Five-year average TFP-growth rates for Japan and Oceana.

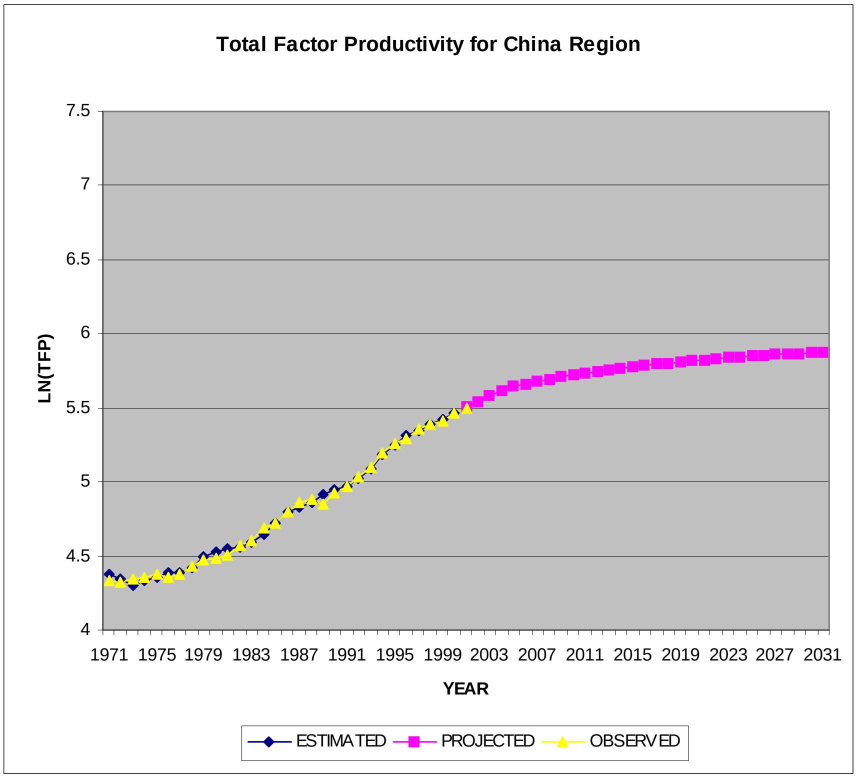

Figure 13a. Total factor productivity for China Region.

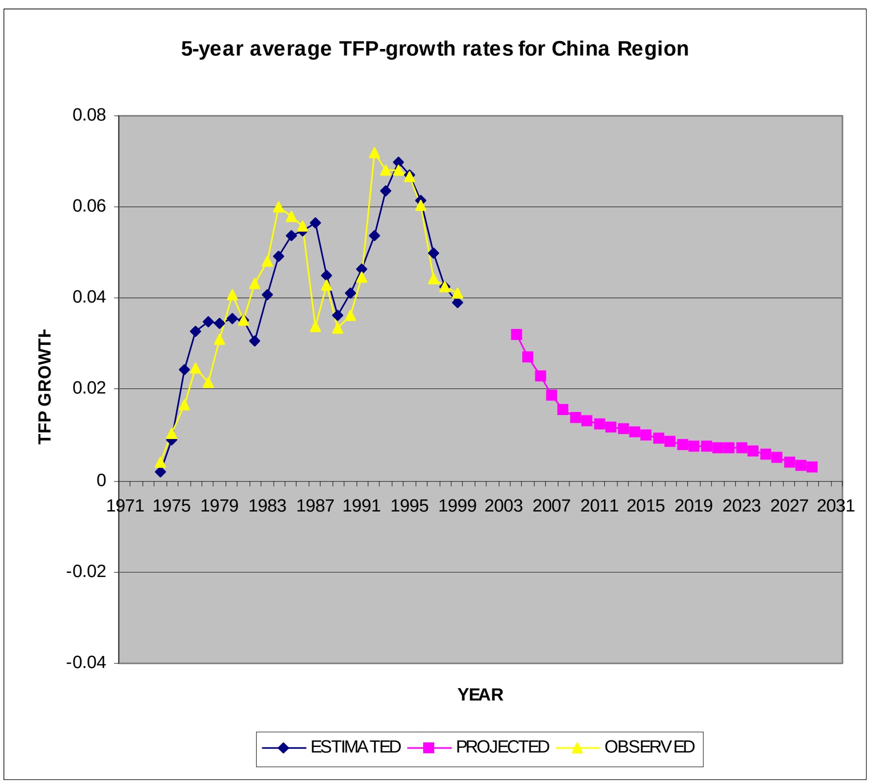

Figure 13b. Five-year average *TFP*-growth rates for China Region.

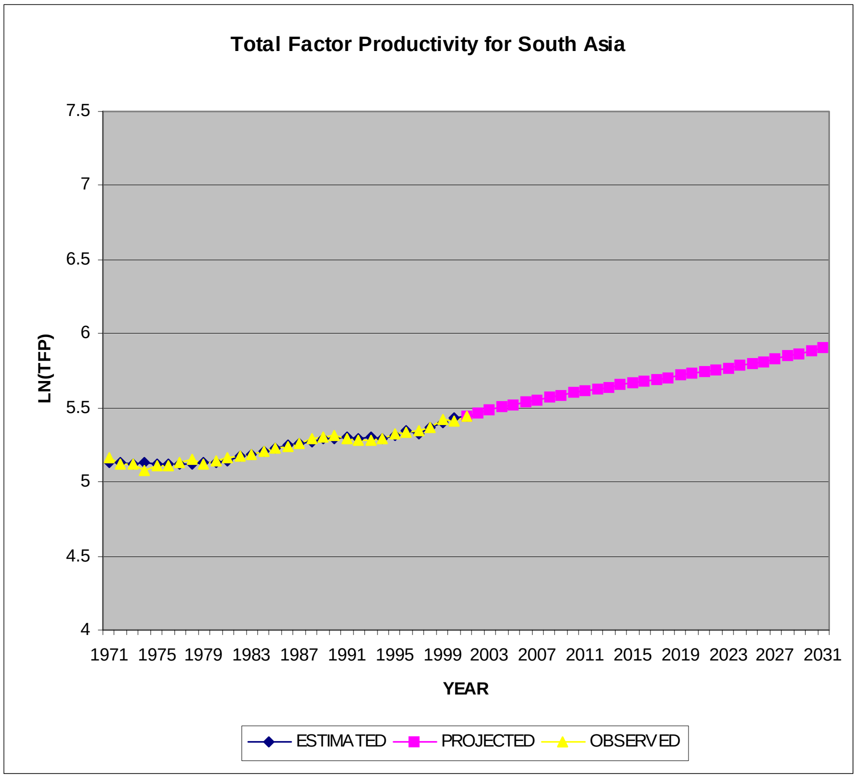

Figure 14a. Total factor productivity for South Asia.

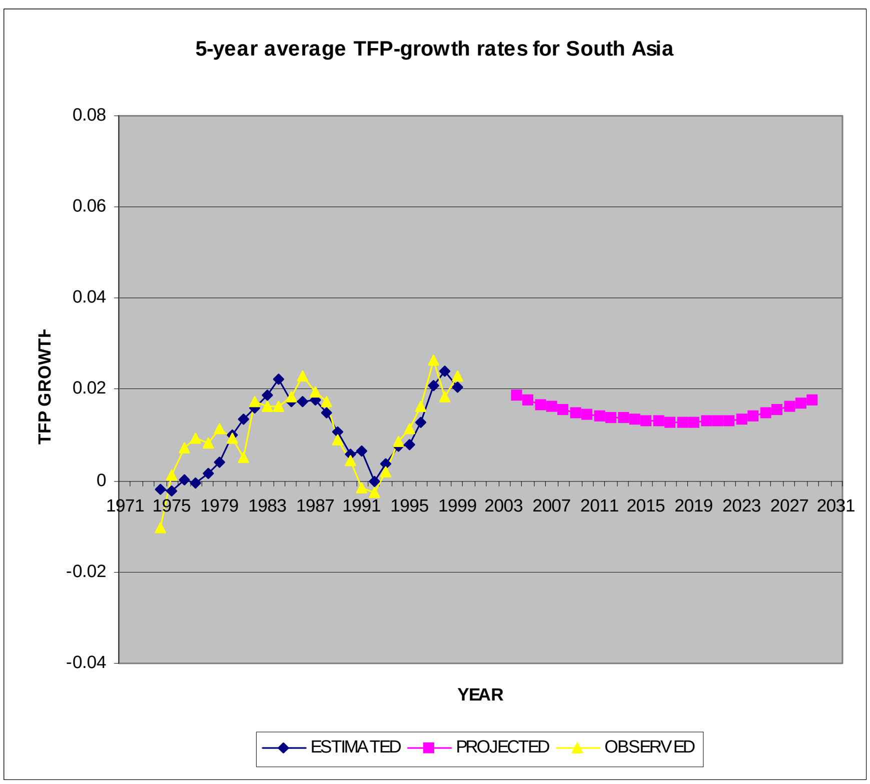

Figure 14b. Five-year average *TFP*-growth rates for South Asia.

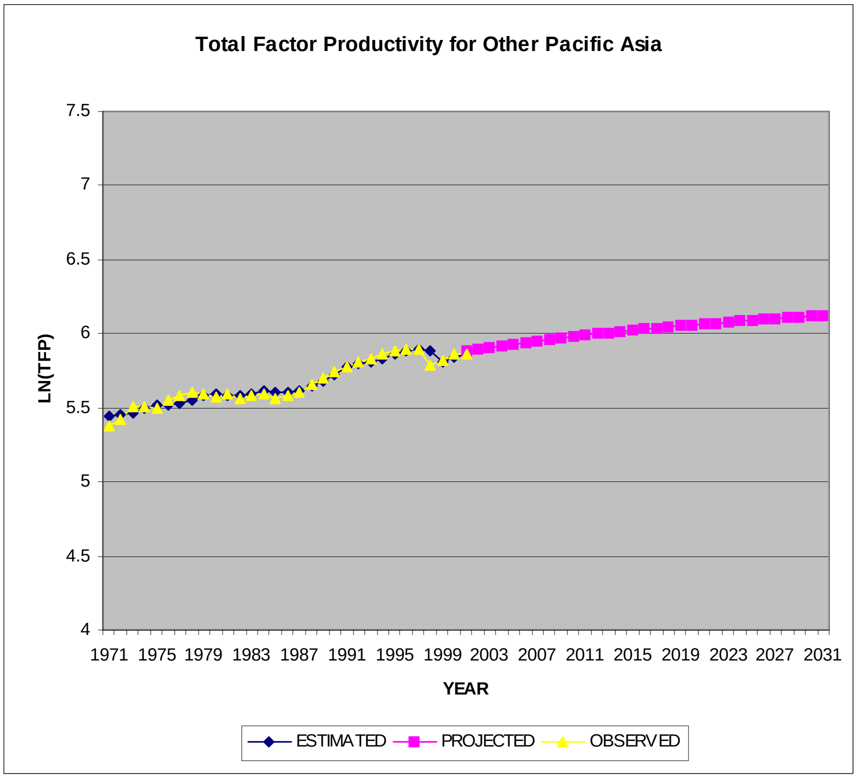

Figure 15a. Total factor productivity for Other Pacific Asia.

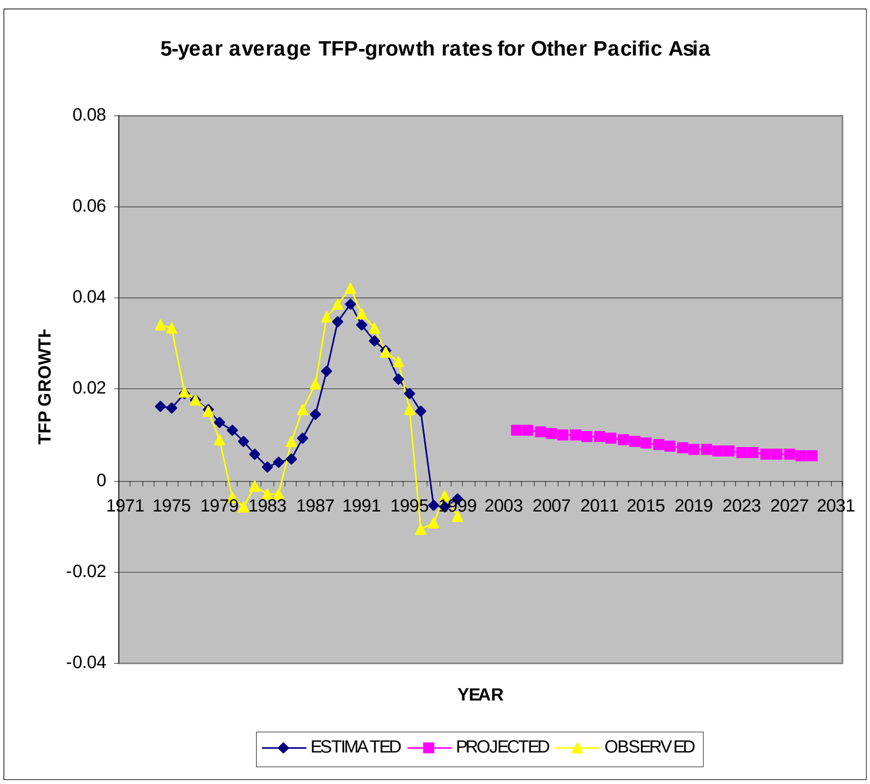

Figure 15b. Five-year average *TFP*-growth rates for Other Pacific Asia.

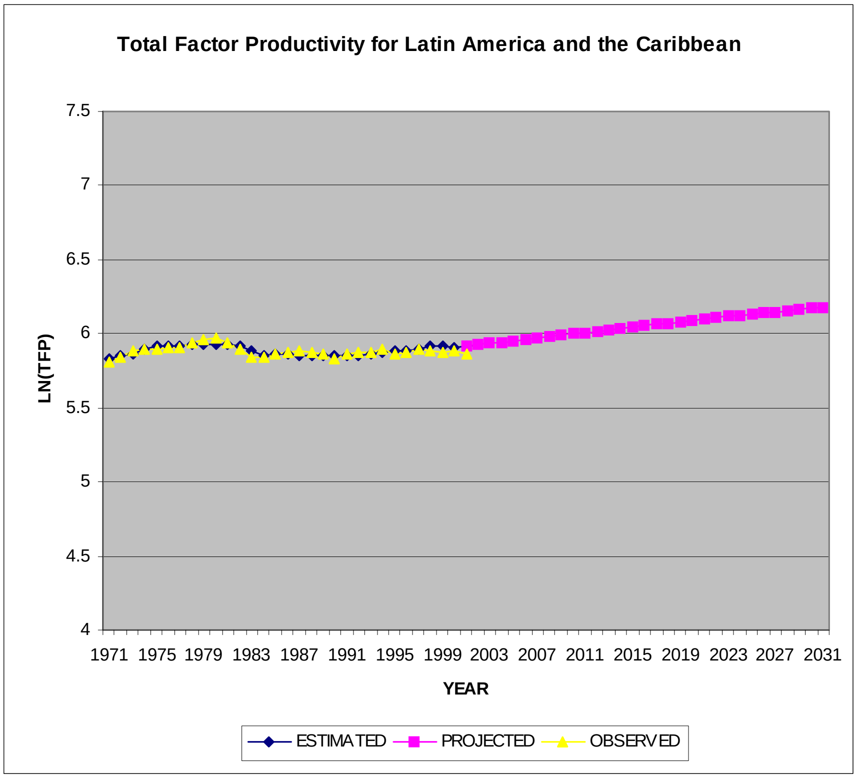

Figure 16a. Total factor productivity for Latin America and the Caribbean.

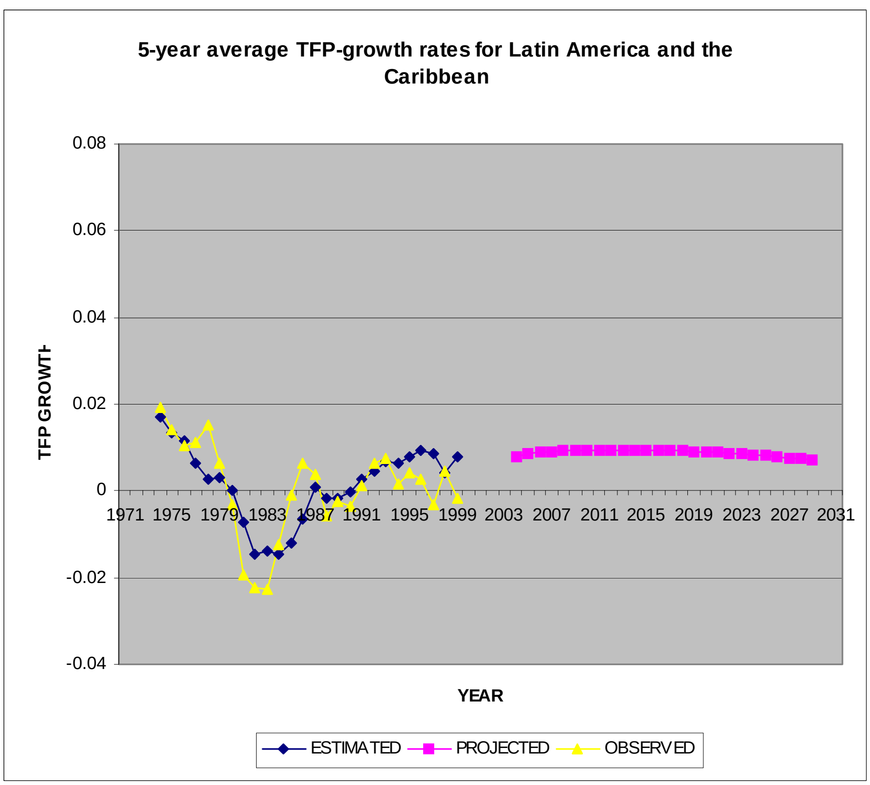

Figure 16b. Five-year average *TFP*-growth rates for Latin America and the Caribbean.

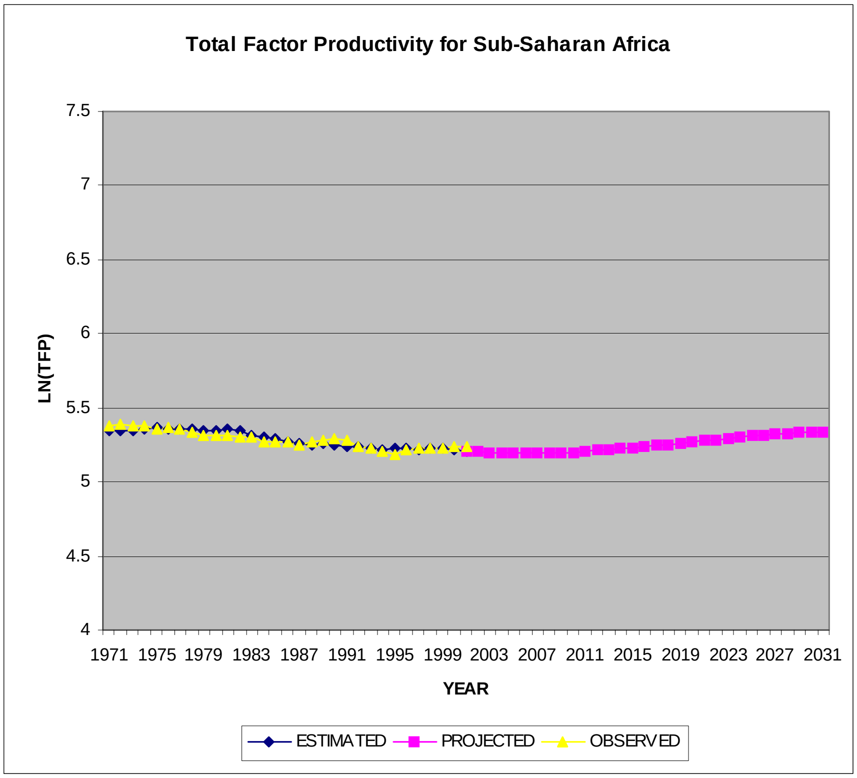

Figure 17a. Total factor productivity for Sub-Saharan Africa.

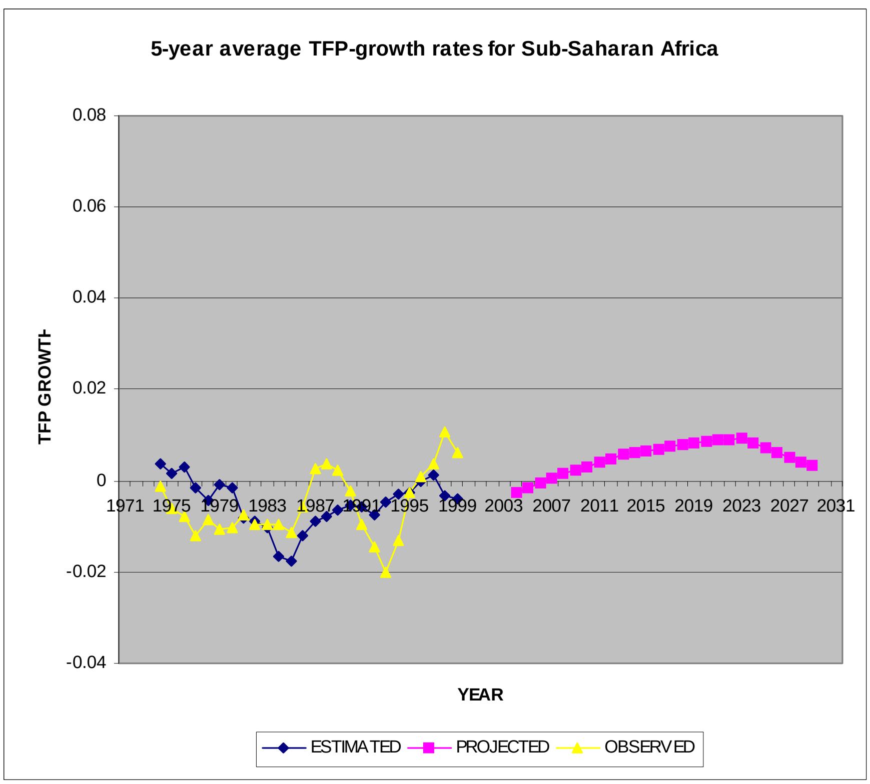

Figure 17b. Five-year average *TFP*-growth rates for Sub-Saharan Africa.

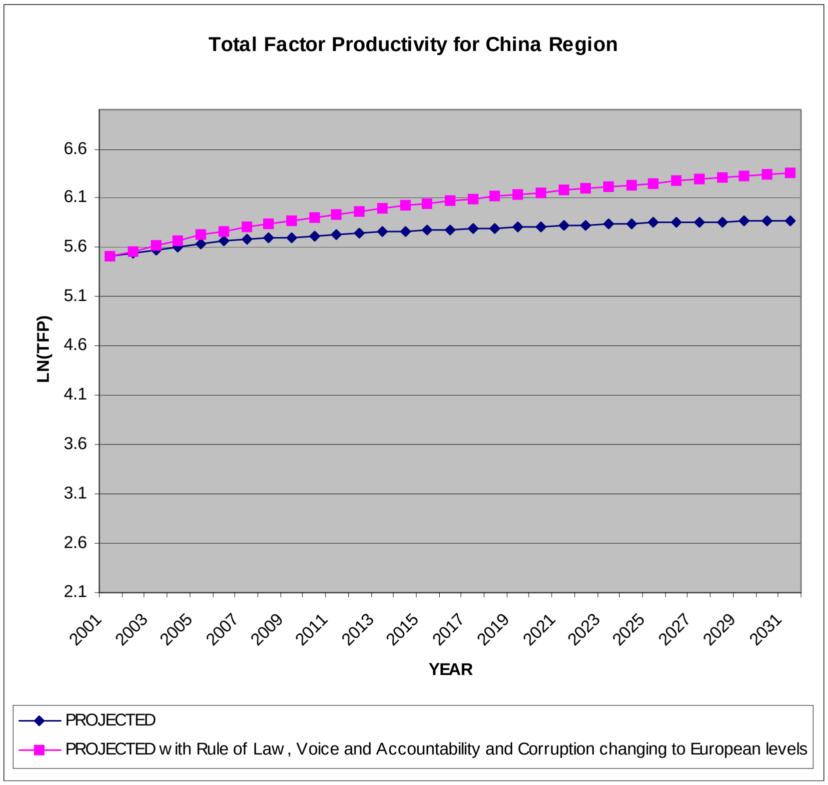

Figure 18a. Total factor productivity for China Region.

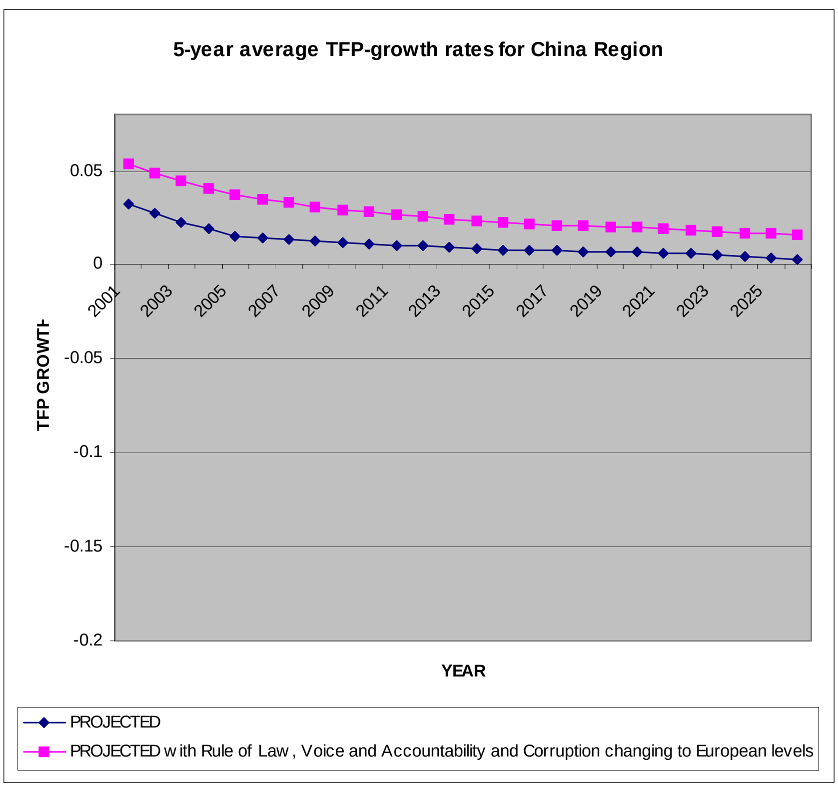

Figure 18b. Five-year average *TFP*-growth rates for China Region.

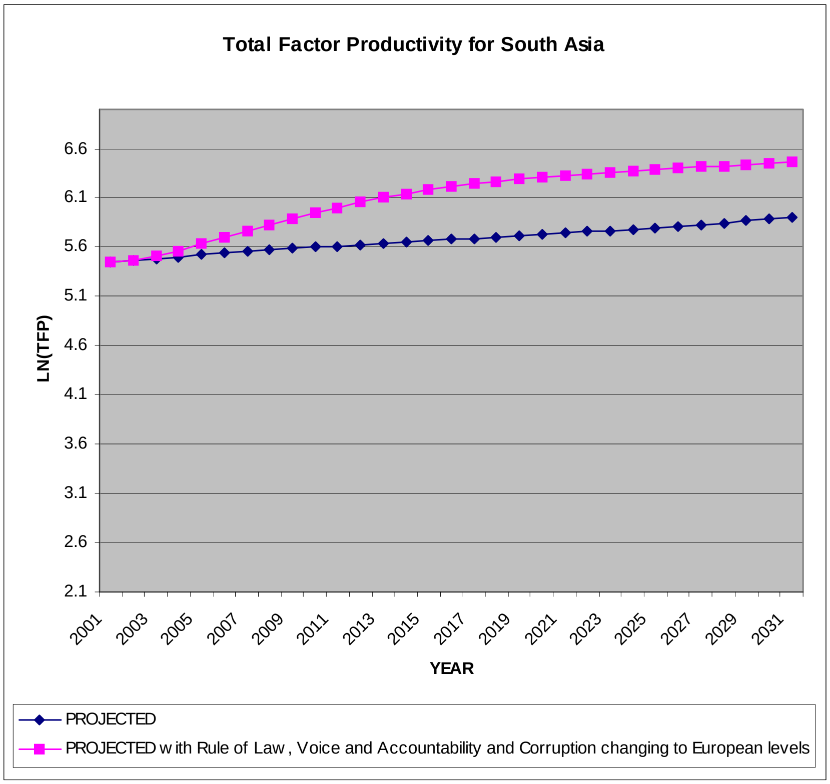

Figure 19a. Total factor productivity for South Asia.

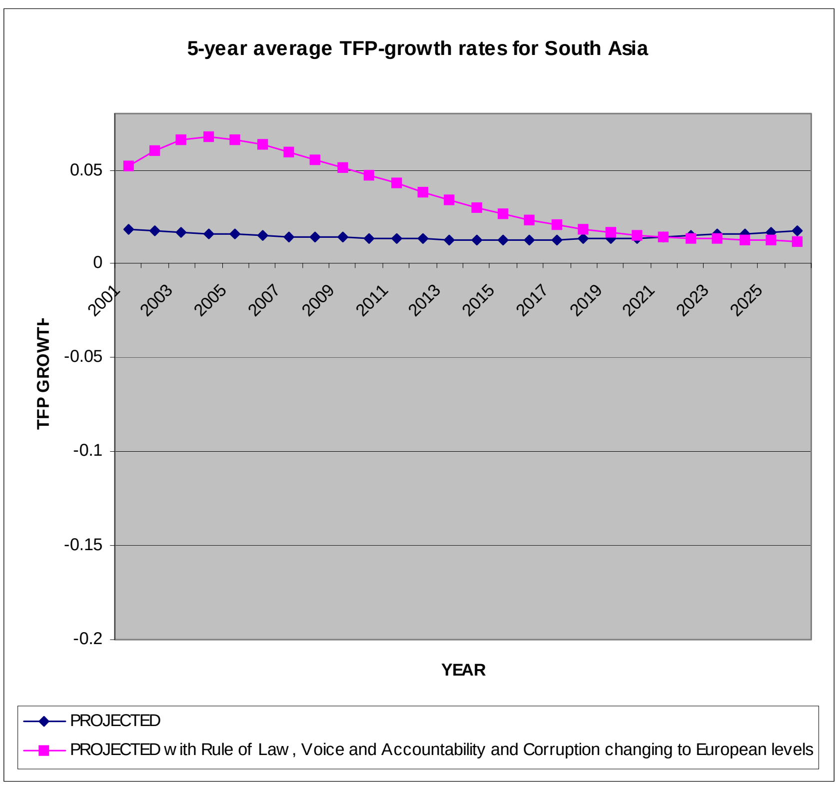

Figure 19b. Five-year average *TFP*-growth rates for South Asia.

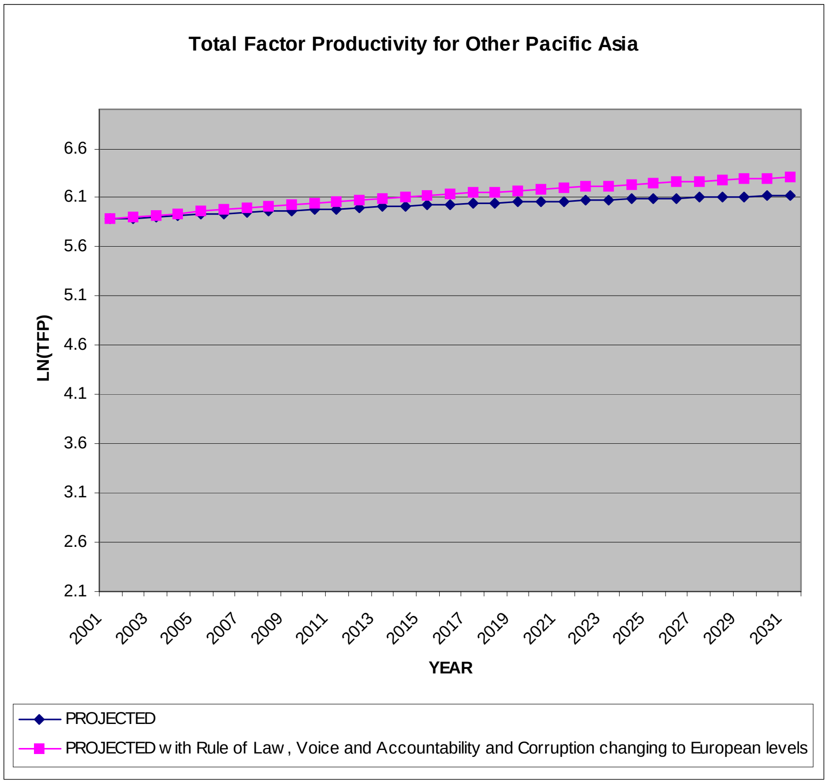

Figure 20a. Total factor productivity for Other Pacific Asia.

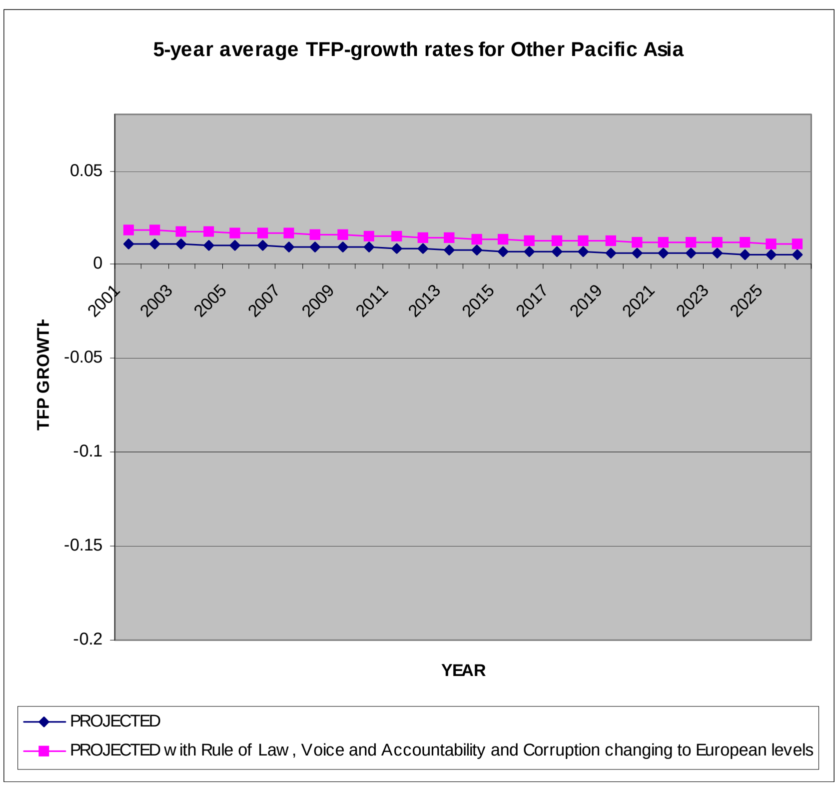

Figure 20b. Five-year average *TFP*-growth rates for Other Pacific Asia.

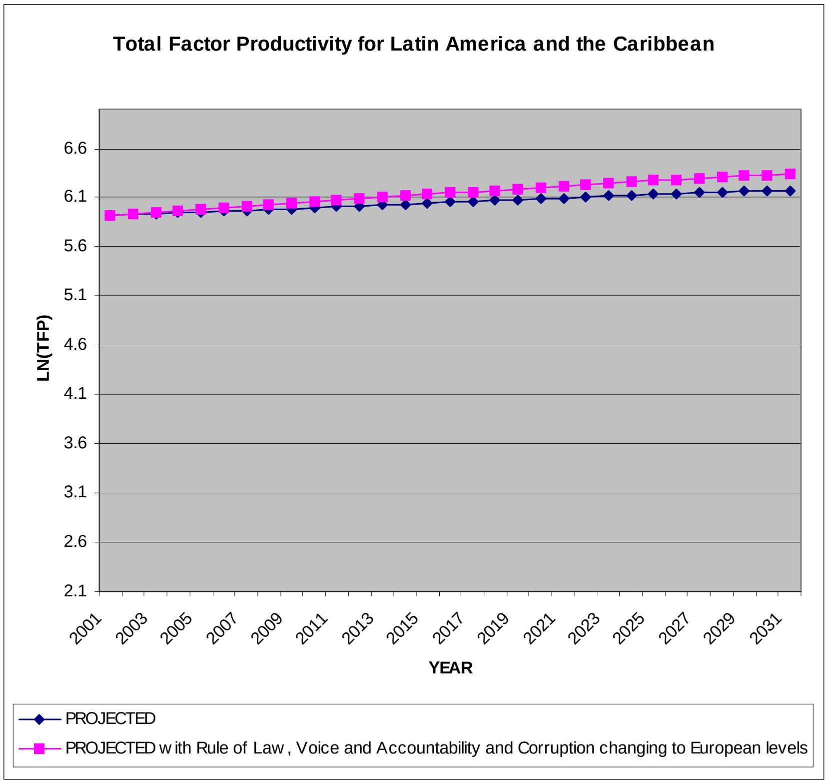

Figure 21a. Total factor productivity for Latin America and the Carribean.

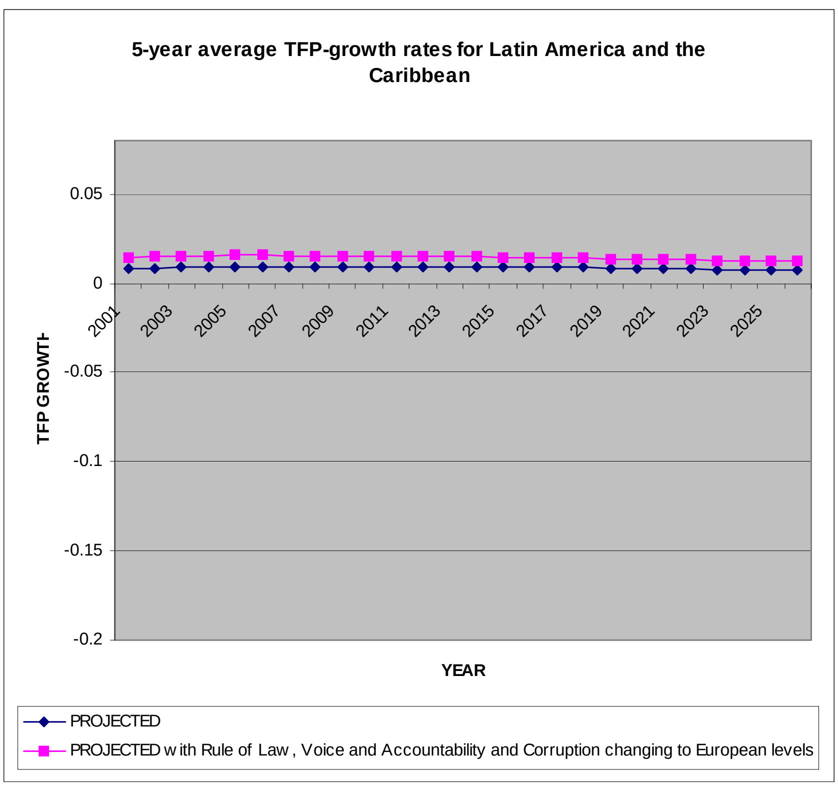

Figure 21b. Five-year average *TFP*-growth rates for Latin America and the Carribean.

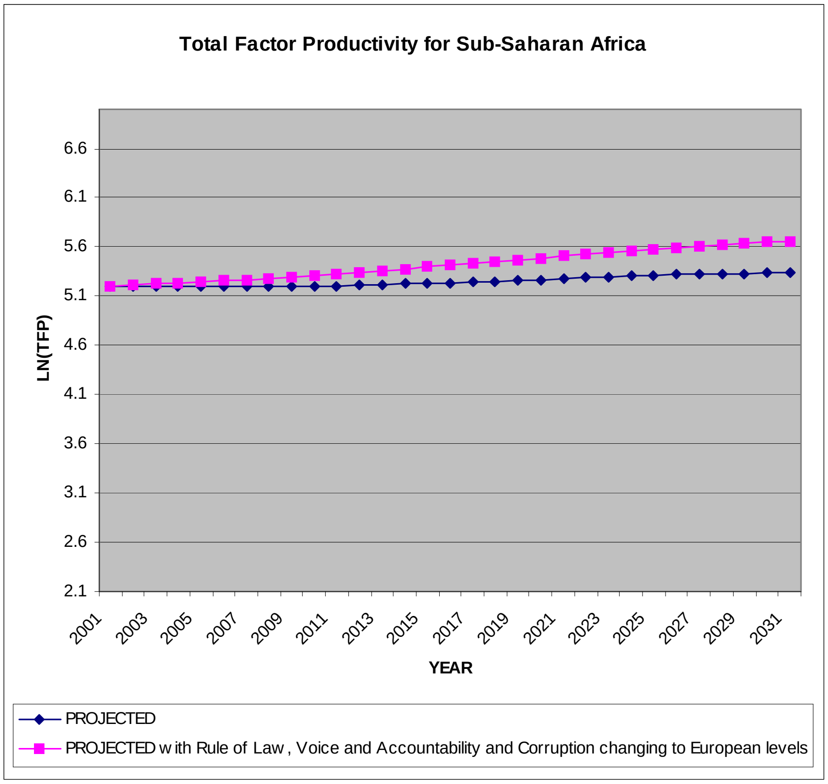

Figure 22a. Total factor productivity for Sub-Saharan Africa.

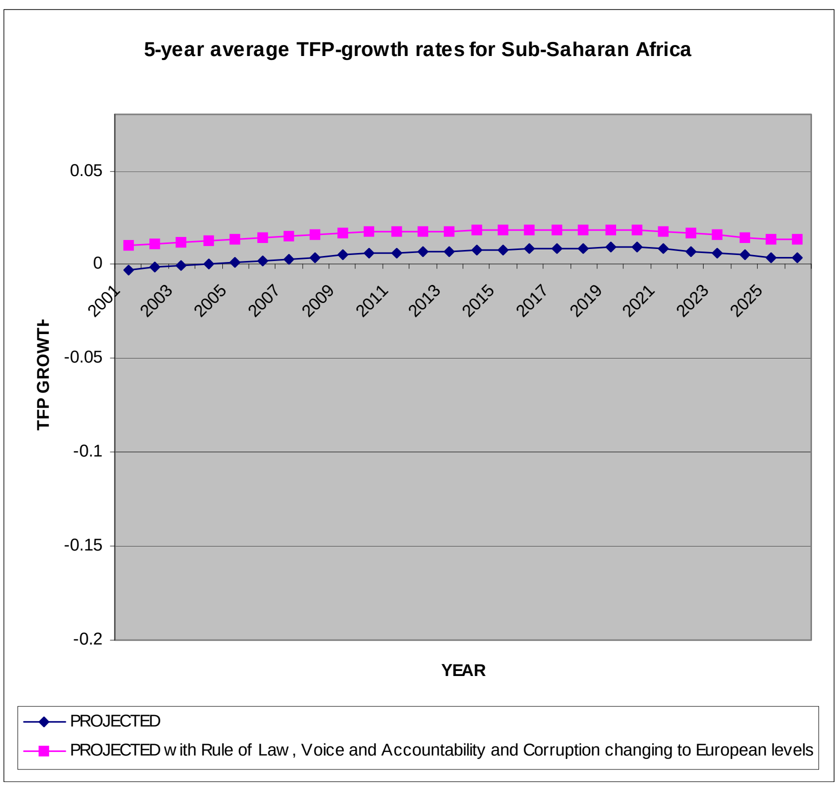

Figure 22b. Five-year average *TFP*-growth rates for Sub-Saharan Africa.

8 Conclusions

This paper presents new data and a new analysis of the determinants of the level of total factor productivity in eight regions of the world. The model that we estimated is based on the idea of conditional convergence and allows the separation of factors to influence the speed of catching up from those that influence the level to which total factor productivity will converge. We find statistically significant effects of age structure, education structure, and age-education interactions.

We find that now some variables have effects that depend on their contexts. Particularly, Latin America and the Caribbean and Sub-Saharan Africa are already on their conditional frontiers and variables that influence the speed to catching up to their conditional frontier play very little role there now. For example, the average years of schooling influences the speed of catching up in regions that are catching up, but not in Latin America and the Caribbean and Sub-Saharan Africa.

Our findings are consistent with increases in total factor productivity associated with an older labor force, but not with the negative effect of a higher youth dependency ratio. We also find some evidence linking education and the demographic dividend.

In our model there are still quite significant differences between regions as expressed in their c parameters even after institutional quality is taken into account. For example, the c parameter for Western Europe is 0.720 and that for Sub-Saharan Africa is 0.281. Why the c parameter for Sub-Saharan Africa is so low remains to be explained. If it is a durable feature of those countries, then there is little additional productivity growth that is possible. If the low value of c is caused by factors not included in the analysis and can increase, then the economic future there is potentially rosier.

By providing explicit projections based in part on age and education structure changes, we produced the means by which our understanding of the determinants of future levels of total factor productivity can be judged. If the projections prove to be accurate, they will help in integrating demographic and economic forecasts and help us to understand better what kind of economic future awaits us.

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Appendix

@Age of entry and exit: The earliest age possible at which a cohort can enter the labor market was assumed to be 15, which corresponds to a cohort with ≤ 7 years of schooling. Each additional year of education was assumed to postpone entry by exactly one year.

Further, it is assumed that labor market exit is between age 60 (≤ 7 years of schooling) and 70 (20 years of schooling).

@Individual productivity weights: A cohort with years of schooling ≤ 4 is assumed to have a productivity of 1 as it enters the labor market at age 15. This weight steadily increases to 1.1 for 8 years of schooling; somebody with 12 years of schooling has an initial productivity of 1.2, which can be as high as 1.4 for somebody who spent 20 years at school before entering the labor market.

Each cohort is assumed to raise its productivity due to gaining experience over the first 10 years of its professional life, whereas the increase again depends on the level of education. The lowest education group increases its productivity weight by 10 percent a year. This rate goes up to 30 percent for a person with 12 years of schooling; a person with 20 or more years of schooling is assumed to have increased its productivity by 60 percent within the first 10 years of its working life.

Education is assumed to make a difference in the steady decline of productivity towards the end of one's labor force participation. Productivity starts to decline 10 years ahead of retirement and causes less educated people to reach 70 percent of their previous productivity when they retire. For people with a medium educational attainment, this level is assumed to be 80 percent, and for highly educated it is assumed 90 percent of their previous level of productivity by the time they retire.

@Additional variables: Data on Freedom were taken from Freedom House[15] where data is available for many countries back until 1972.[16] To get our Freedom indicator we used the combined average rating from "Political Rights" and "Civil Liberty" reported by Freedom House. Following the idea that it is people rather than goods suffering from restrictions to their rights and liberties, we weighted the individual country's average index number by the country's share in total regional population, rather than regional GDP.

Data on Openness was also taken from the Penn World Tables (Heston et al. 2006). It represents a country's total trade as a percentage of its GDP. We calculated each country's share in regional GDP and used these shares as weights for each country's value of Openness to compute the regional Openness index.

Data on Inflation was taken from the *World Development Indicators 2007* (World Bank 2007). Before aggregating based on the population shares, we took 5-year moving averages of individual country's inflation to decrease volatility. Since the series

[15] http://www.freedomhouse.org/template.cfm?page=1

[16] 1971 is assumed to be equal to 1972. In countries whose series do not go back until 1972, the initial year's observation is taken for prior years. Eritrea is supposed to be equal to Ethiopia before they split up into two separate countries. Germany before the reunion is the weighted sum (65:15) of the two indicators. Namibia between 1975 and 1988 comes from linear interpolation.

still showed big differences across regions, we decided to take the square root of their absolute values minus 1 (Japan had a few years of deflation!).

Terms of Trade were also taken from the *World Development Indicators 2007*. The main adaptation of the original data was to complete France (data available only from 1990 onward) by assigning to it the average of its neighboring countries between 1970-1990. Regional aggregation of the country data is again based on population shares in the region.

To get our measure of Capital Formation from Foreign Source we divided the regionally adjusted UNCTAD FDI-flows by total investment taken from Penn World Tables.

Total Population Shares Working in Agriculture were also taken from the *World Development Indicators 2007*. Since data were only available after 1980 we assumed a decrease in agricultural employment at a constant rate equal to the average rate of decrease observed between 1980-1990 for the 1970s.

Both Life Expectancy and Infant Mortality Rates were taken from *World Population Prospects: The 2006 Revision* (United Nations 2007). Regional aggregation is based on the population shares.

All data, except for *TFP,* were adjusted to have a mean of zero and a standard deviation of unity before being used in nonlinear estimation procedure.

Government Shares were taken from Heston et al (2006).

VARIABLE NAME, TOTAL FACTOR PRODUCTIVITY								
YEAR	North America	Western Europe	Japan/ Oceania	China Region	South Asia	Other Pacific Asia	Latin America and the Caribbean	Sub-Saharan Africa
1971	670.21	494.00	508.60	76.52	173.83	217.67	334.94	215.72
1972	689.73	504.43	522.20	75.48	167.50	225.10	344.16	218.39
1973	709.39	522.31	539.24	77.46	166.92	247.41	358.25	216.47
1974	683.77	519.64	507.53	77.59	159.88	247.04	365.31	216.98
1975	662.76	502.45	499.88	79.35	164.82	245.01	363.98	213.06
1976	685.21	516.42	502.57	78.04	165.09	257.64	368.40	214.32
1977	699.85	517.24	505.71	79.48	168.44	265.54	369.07	212.02
1978	712.21	520.25	525.28	84.08	173.11	272.60	377.65	208.06
1979	712.47	528.30	536.42	87.67	167.42	269.79	385.85	204.15
1980	686.24	524.81	533.89	88.30	171.72	264.29	392.59	203.97
1981	686.86	513.11	536.65	90.94	174.64	269.20	380.06	203.04
1982	655.42	508.33	533.07	97.03	176.45	260.93	363.51	201.42
1983	673.39	518.95	529.62	100.01	177.62	264.76	342.71	200.59
1984	710.03	523.50	536.05	108.34	182.53	268.38	344.64	194.64
1985	720.62	528.89	552.74	111.78	186.25	260.43	350.18	194.40
1986	726.76	537.26	552.92	121.75	189.36	265.51	356.77	193.64
1987	734.94	544.65	563.37	128.59	193.30	272.17	361.40	190.40
1988	748.02	558.62	588.29	131.36	199.05	285.89	353.96	194.77
1989	757.57	568.11	603.84	127.91	200.88	297.94	351.07	197.21
1990	746.91	575.63	615.51	137.91	202.93	310.93	339.94	198.08
1991	728.06	574.03	618.16	143.55	197.98	321.04	352.63	195.80
1992	739.79	571.22	609.22	153.75	197.45	334.81	355.15	188.44
1993	748.92	560.27	598.93	163.49	197.49	342.10	356.27	185.53
1994	768.63	566.71	594.84	181.15	198.48	351.35	362.10	183.34
1995	772.91	574.25	596.90	191.83	205.06	357.55	352.54	178.93
1996	786.39	572.21	607.54	199.54	206.80	365.10	355.38	183.43
1997	807.81	581.63	608.86	212.25	209.08	361.61	362.49	186.13
1998	824.31	592.21	595.79	219.27	214.20	324.61	360.82	186.35
1999	842.35	599.36	583.71	224.93	226.17	335.41	356.39	186.72
2000	853.87	613.33	589.10	236.14	224.61	351.85	360.57	188.90
2001	837.06	612.36	585.39	244.16	231.67	350.83	352.50	189.09
MEAN	734.92	546.60	560.70	133.21	189.38	292.40	359.07	198.19
(std.)	(55.03)	(34.19)	(39.2)	(54.81)	(20.01)	(44.06)	(12.81)	(11.63)

Note: The GDP numbers that are used to derive *TFP* are in thousands. Accordingly *TFP* is in thousands.

VARIABLE NAME, CORRUPTION								
YEAR	North America	Western Europe	Japan/ Oceania	China Region	South Asia	Other Pacific Asia	Latin America and the Caribbean	Sub-Saharan Africa
1971	-1.6566	-1.0471	-1.3857	-0.1117	0.5771	1.4265	0.4014	0.8627
1972	-1.6574	-1.0447	-1.3856	-0.1145	0.5778	1.4267	0.4032	0.8623
1973	-1.6577	-1.0424	-1.3877	-0.1179	0.5785	1.4269	0.4048	0.8617
1974	-1.6576	-1.0400	-1.3913	-0.1217	0.5793	1.4273	0.4064	0.8614
1975	-1.6574	-1.0376	-1.3955	-0.1256	0.5800	1.4279	0.4078	0.8616
1976	-1.6571	-1.0348	-1.3991	-0.1290	0.5807	1.4287	0.4091	0.8627
1977	-1.6567	-1.0318	-1.4021	-0.1314	0.5813	1.4297	0.4102	0.8645
1978	-1.6564	-1.0287	-1.4040	-0.1326	0.5820	1.4309	0.4110	0.8668
1979	-1.6560	-1.0255	-1.4052	-0.1328	0.5829	1.4319	0.4114	0.8690
1980	-1.6556	-1.0224	-1.4062	-0.1330	0.5838	1.4328	0.4115	0.8707
1981	-1.6551	-1.0192	-1.4075	-0.1330	0.5848	1.4335	0.4113	0.8717
1982	-1.6546	-1.0158	-1.4089	-0.1324	0.5860	1.4340	0.4108	0.8721
1983	-1.6542	-1.0121	-1.4105	-0.1309	0.5871	1.4344	0.4100	0.8721
1984	-1.5943	-0.9804	-1.3635	-0.0870	0.6576	1.4185	0.4568	0.8906
1985	-1.5641	-0.9630	-1.3409	-0.0639	0.6931	1.4104	0.4801	0.9003
1986	-1.5341	-0.9463	-1.3182	-0.0412	0.7285	1.4022	0.5035	0.9106
1987	-1.5042	-0.9299	-1.2954	-0.0197	0.7636	1.3938	0.5272	0.9215
1988	-1.4745	-0.9138	-1.2724	0.0004	0.7983	1.3852	0.5510	0.9326
1989	-1.4450	-0.8979	-1.2493	0.0196	0.8328	1.3764	0.5751	0.9435
1990	-1.4155	-0.8819	-1.2263	0.0385	0.8670	1.3673	0.5992	0.9541
1991	-1.4003	-1.0953	-1.2072	0.3996	0.9201	1.1038	0.6178	0.9541
1992	-1.3954	-1.0885	-1.2019	0.5194	0.9376	1.0156	0.6238	0.9282
1993	-1.3906	-1.0824	-1.1967	0.6397	0.9552	0.9276	0.6297	0.9015
1994	-1.3859	-1.0768	-1.1916	0.7603	0.9729	0.8397	0.6356	0.8744
1995	-1.3811	-1.0713	-1.1865	0.8809	0.9907	0.7519	0.6415	0.8472
1996	-1.3764	-0.7682	-1.1813	1.0014	1.0087	0.6643	0.6472	1.0171
1997	-1.3626	-0.8697	-1.0119	0.8117	0.8859	0.6820	0.6698	0.9266
1998	-1.3227	-0.8600	-0.7129	0.5579	0.8203	0.8212	0.5248	0.9011
1999	-1.3226	-0.8904	-0.7908	0.5967	0.8455	0.8748	0.4597	0.9821
2000	-1.4432	-0.8898	-0.9217	0.7248	0.8798	0.9352	0.4630	1.0126
2001	-1.3497	-0.8723	-1.2005	0.5533	0.9142	0.8671	0.3951	1.0789
MEAN	-1.52	-0.98	-1.26	0.18	0.74	1.22	0.49	0.91
(std.)	(0.13)	(0.084)	(0.183)	(0.389)	(0.159)	(0.281)	(0.096)	(0.056)

Note: The data in this table has been centered around its mean. Some of the years, however, were omitted afterwards and the data was not centered again.

VARIABLE NAME, DOMESTIC CAPITAL FORMATION								
YEAR	North America	Western Europe	Japan/ Oceania	China Region	South Asia	Other Pacific Asia	Latin America and the Caribbean	Sub-Saharan Africa
1970	-0.6867	0.0472	2.7251	0.6310	0.2554	1.2068	-0.0202	0.3188
1971	-0.5399	-0.1531	2.0546	0.7287	0.2724	1.2139	-0.0620	0.4573
1972	-0.3560	-0.1981	1.9316	0.2957	-0.3102	0.9250	-0.0174	-0.0021
1973	-0.1863	-0.0598	2.0344	0.5680	-0.0155	1.5262	0.2734	0.1197
1974	-0.4853	-0.2311	1.1371	0.4117	-0.1246	1.8348	0.6018	0.3596
1975	-0.9862	-0.7476	0.5290	0.5835	-0.0079	1.5007	0.5026	0.2186
1976	-0.6840	-0.6188	0.4147	0.1189	0.0890	1.5276	0.3173	-0.2340
1977	-0.4876	-0.7614	0.2550	0.2600	0.0011	1.8425	0.3048	-0.2020
1978	-0.3003	-0.8600	0.3067	0.8807	0.2845	2.2006	0.1555	-0.3972
1979	-0.3185	-0.7830	0.2924	0.7315	-0.0230	2.0495	0.0804	-0.5834
1980	-0.7225	-0.8524	0.0663	0.6905	-0.2251	1.5076	0.3037	-0.1006
1981	-0.6123	-1.1441	-0.0255	0.3190	0.1022	1.3787	-0.0065	-0.0511
1982	-1.1088	-1.2098	-0.2770	0.3672	-0.1283	1.3006	-0.6596	-0.7718
1983	-0.9623	-1.2406	-0.4988	0.4786	-0.2785	1.3336	-1.3822	-1.0583
1984	-0.4219	-1.2256	-0.5086	0.8812	-0.3351	0.9917	-1.3234	-1.2163
1985	-0.5072	-1.2122	-0.3965	1.6221	0.0693	0.6211	-1.2232	-1.3580
1986	-0.6023	-1.1450	-0.4178	1.4982	-0.1507	0.4676	-1.1050	-1.4579
1987	-0.6177	-1.0886	-0.3489	1.3537	-0.2327	0.6045	-1.0530	-1.5547
1988	-0.6558	-0.9342	-0.0482	1.4564	0.0781	0.7768	-1.0964	-1.3519
1989	-0.6182	-0.8384	0.0374	1.0693	-0.0283	1.0915	-1.2712	-1.3680
1990	-0.7948	-0.8207	0.0180	0.7275	0.1125	1.5486	-1.3704	-1.3725
1991	-1.0533	-0.9454	-0.1071	0.7528	-0.3085	1.6374	-1.2726	-1.4331
1992	-0.9707	-1.0338	-0.3604	0.9579	-0.1343	1.3344	-1.0631	-1.5435
1993	-0.8719	-1.2557	-0.5653	1.5874	-0.3750	1.2811	-1.0122	-1.5493
1994	-0.6611	-1.2026	-0.6970	1.9732	-0.0284	1.4875	-0.8847	-1.2978
1995	-0.6686	-1.1237	-0.7145	2.1755	0.3922	1.6161	-1.0397	-1.2415
1996	-0.5631	-1.1910	-0.6141	2.0189	-0.1339	1.5120	-0.9769	-1.2734
1997	-0.3329	-1.1382	-0.6835	1.9999	0.0133	0.9252	-0.7102	-1.1310
1998	-0.2192	-1.0013	-0.8983	1.8045	-0.0771	-0.8891	-0.7082	-1.0176
1999	-0.1301	-0.9671	-1.0048	1.5166	0.2666	-0.7762	-1.0366	-1.2419
2000	-0.1162	-0.9177	-1.0369	1.3357	0.0843	-0.5346	-0.9242	-1.3070
MEAN	-0.59	-0.87	0.08	1.03	-0.03	1.13	-0.57	-0.79
(std.)	(0.269)	(0.376)	(0.958)	(0.603)	(0.2)	(0.74)	(0.66)	(0.682)

Note: The data in this table has been centered around its mean. Some of the years, however, were omitted afterwards and the data was not centered again.

VARIABLE NAME, OPENNESS								
YEAR	North America	Western Europe	Japan/ Oceania	China Region	South Asia	Other Pacific Asia	Latin America and the Caribbean	Sub-Saharan Africa
1971	-1.4112	-0.5980	-1.4194	-1.4525	-1.0334	-0.3629	0.1552	1.1726
1972	-1.3826	-0.5407	-1.4290	-1.3972	-1.1435	-0.1993	0.1688	0.9992
1973	-1.3546	-0.4693	-1.3865	-1.3328	-1.1479	-0.0081	0.0735	1.0437
1974	-1.3398	-0.4194	-1.3052	-1.3110	-1.1510	0.0993	0.1215	1.1878
1975	-1.3763	-0.4802	-1.3641	-1.3729	-1.1967	-0.0425	0.0740	1.2432
1976	-1.3414	-0.3846	-1.3173	-1.3623	-1.1511	0.1380	-0.0402	1.1992
1977	-1.3329	-0.3584	-1.3008	-1.3703	-1.1242	0.1751	-0.0509	1.5626
1978	-1.3083	-0.3495	-1.3099	-1.3115	-1.1123	0.1393	0.0727	1.3183
1979	-1.2959	-0.2984	-1.2891	-1.1756	-0.9359	0.2061	0.0990	1.0624
1980	-1.2821	-0.2834	-1.2856	-1.0889	-0.8827	0.1958	0.3118	1.1528
1981	-1.2800	-0.2595	-1.2537	-1.0175	-0.9554	0.1019	0.0717	1.2423
1982	-1.2998	-0.2460	-1.2833	-1.0826	-1.0272	0.0110	-0.0371	0.8541
1983	-1.2879	-0.2480	-1.2824	-1.0524	-1.0224	0.0141	-0.0568	0.5552
1984	-1.2172	-0.1752	-1.2072	-0.8716	-1.0028	-0.0062	-0.1876	0.5728
1985	-1.2042	-0.1410	-1.2266	-0.3129	-0.9917	-0.1356	0.0860	0.5445
1986	-1.1669	-0.1403	-1.2603	-0.4920	-0.9842	-0.0495	-0.0020	0.3914
1987	-1.1344	-0.1054	-1.2526	-0.4866	-1.0042	0.1299	-0.1379	0.2690
1988	-1.0861	-0.0730	-1.2132	-0.2630	-1.0079	0.1762	-0.2146	0.3456
1989	-1.0556	0.0209	-1.1704	-0.0515	-1.0212	0.2988	-0.1705	0.3359
1990	-1.0143	0.0739	-1.1594	-0.0140	-1.0021	0.3938	0.0824	0.3560
1991	-0.9722	0.0866	-1.1597	0.1028	-1.0286	0.5808	0.2257	0.3864
1992	-0.9366	0.1376	-1.1431	0.2491	-0.9295	0.6408	0.2031	0.4943
1993	-0.8905	0.1320	-1.1366	0.3358	-0.8396	0.7277	0.2033	0.5951
1994	-0.8203	0.2438	-1.0848	0.4610	-0.8002	0.9487	0.2657	0.6856
1995	-0.7468	0.3544	-1.0277	0.4442	-0.6554	1.2182	0.3174	0.8050
1996	-0.6917	0.4211	-0.9655	0.4096	-0.6419	1.2003	0.3854	0.9280
1997	-0.5830	0.6058	-0.9190	0.5863	-0.5809	1.3300	0.5066	0.9667
1998	-0.5365	0.7397	-0.9421	0.5084	-0.6451	1.4703	0.5459	1.0089
1999	-0.4885	0.8183	-0.9020	0.7195	-0.6810	1.2667	0.5190	1.0631
2000	-0.3880	1.0484	-0.8278	1.1338	-0.6715	1.6875	0.5542	1.2106
2001	-0.3020	1.2288	-0.7902	1.3513	-0.6780	1.8278	0.5988	1.2856
MEAN	-1.05	0.01	-1.18	-0.40	-0.94	0.46	0.15	0.87
(std.)	(0.328)	(0.473)	(0.172)	(0.859)	(0.182)	(0.606)	(0.228)	(0.364)

Note: The data in this table has been centered around its mean. Some of the years, however, were omitted afterwards and the data was not centered again.

VARIABLE NAME, AVERAGE EDUCATION OF 35-49 YEAR OLDS								
YEAR	North America	Western Europe	Japan/ Oceania	China Region	South Asia	Other Pacific Asia	Latin America and the Caribbean	Sub-Saharan Africa
1971	1.2950	0.2621	0.5796	-1.0072	-1.3249	-0.8806	-0.7432	-1.5239
1972	1.3260	0.2918	0.6118	-0.9595	-1.3138	-0.8355	-0.7114	-1.5034
1973	1.3577	0.3222	0.6442	-0.9122	-1.3026	-0.7907	-0.6794	-1.4830
1974	1.3898	0.3528	0.6770	-0.8654	-1.2916	-0.7461	-0.6472	-1.4626
1975	1.4224	0.3833	0.7105	-0.8189	-1.2806	-0.7020	-0.6149	-1.4421
1976	1.4526	0.4175	0.7459	-0.7610	-1.2546	-0.6520	-0.5797	-1.4140
1977	1.4832	0.4514	0.7817	-0.7033	-1.2286	-0.6024	-0.5444	-1.3857
1978	1.5141	0.4853	0.8180	-0.6453	-1.2027	-0.5529	-0.5089	-1.3575
1979	1.5450	0.5197	0.8550	-0.5864	-1.1768	-0.5035	-0.4732	-1.3292
1980	1.5758	0.5545	0.8927	-0.5259	-1.1508	-0.4538	-0.4375	-1.3010
1981	1.6056	0.6040	0.9442	-0.4698	-1.1214	-0.4013	-0.3969	-1.2699
1982	1.6351	0.6538	0.9966	-0.4128	-1.0920	-0.3485	-0.3563	-1.2388
1983	1.6643	0.7036	1.0491	-0.3554	-1.0624	-0.2952	-0.3156	-1.2076
1984	1.6930	0.7532	1.1006	-0.2978	-1.0323	-0.2413	-0.2748	-1.1763
1985	1.7211	0.8026	1.1503	-0.2402	-1.0017	-0.1864	-0.2338	-1.1448
1986	1.7381	0.8353	1.2031	-0.1878	-0.9666	-0.1359	-0.1927	-1.1077
1987	1.7547	0.8679	1.2543	-0.1356	-0.9311	-0.0848	-0.1515	-1.0704
1988	1.7713	0.9002	1.3042	-0.0846	-0.8957	-0.0335	-0.1106	-1.0330
1989	1.7880	0.9321	1.3536	-0.0358	-0.8608	0.0176	-0.0699	-0.9956
1990	1.8048	0.9637	1.4026	0.0103	-0.8265	0.0683	-0.0297	-0.9583
1991	1.8058	0.9902	1.4535	0.0477	-0.8028	0.1135	0.0062	-0.9222
1992	1.8070	1.0164	1.5042	0.0836	-0.7794	0.1583	0.0418	-0.8862
1993	1.8086	1.0425	1.5555	0.1186	-0.7563	0.2025	0.0772	-0.8503
1994	1.8107	1.0688	1.6087	0.1539	-0.7334	0.2461	0.1126	-0.8145
1995	1.8132	1.0955	1.6643	0.1901	-0.7106	0.2888	0.1481	-0.7788
1996	1.8099	1.1186	1.7076	0.2253	-0.6926	0.3291	0.1794	-0.7441
1997	1.8065	1.1419	1.7529	0.2613	-0.6748	0.3688	0.2108	-0.7095
1998	1.8031	1.1652	1.7992	0.2981	-0.6568	0.4082	0.2422	-0.6749
1999	1.7995	1.1884	1.8453	0.3360	-0.6385	0.4473	0.2736	-0.6403
2000	1.7960	1.2111	1.8908	0.3750	-0.6200	0.4864	0.3050	-0.6055
2001	1.7958	1.2333	1.9324	0.3914	-0.5999	0.5182	0.3285	-0.5793
MEAN	1.66	0.78	1.22	-0.24	-0.97	-0.15	-0.20	-1.08
(std.)	(0.172)	(0.313)	(0.429)	(0.443)	(0.244)	(0.439)	(0.339)	(0.299)

Note: The data in this table has been centered around its mean. Some of the years, however, were omitted afterwards and the data was not centered again.

VARIABLE NAME, SHARE OF 35-49 YEAR OLDS								
YEAR	North America	Western Europe	Japan/ Oceania	China Region	South Asia	Other Pacific Asia	Latin America and the Caribbean	Sub-Saharan Africa
1971	0.2052	0.7380	1.2441	-0.3942	-0.5214	-0.7236	-0.8545	-1.0213
1972	0.1228	0.7225	1.2862	-0.4220	-0.5282	-0.6937	-0.8650	-1.0411
1973	0.0454	0.6914	1.3153	-0.4499	-0.5360	-0.6659	-0.8759	-1.0610
1974	-0.0193	0.6545	1.3372	-0.4752	-0.5467	-0.6435	-0.8880	-1.0806
1975	-0.0652	0.6194	1.3566	-0.4958	-0.5615	-0.6284	-0.9014	-1.0997
1976	-0.0911	0.5866	1.3727	-0.5106	-0.5798	-0.6209	-0.9163	-1.1176
1977	-0.0974	0.5552	1.3859	-0.5192	-0.6005	-0.6195	-0.9311	-1.1346
1978	-0.0823	0.5294	1.4039	-0.5217	-0.6231	-0.6216	-0.9428	-1.1515
1979	-0.0445	0.5141	1.4358	-0.5183	-0.6471	-0.6238	-0.9476	-1.1694
1980	0.0162	0.5125	1.4873	-0.5088	-0.6715	-0.6235	-0.9431	-1.1888
1981	0.0999	0.5273	1.5609	-0.4947	-0.6966	-0.6198	-0.9288	-1.2098
1982	0.2049	0.5571	1.6521	-0.4743	-0.7209	-0.6124	-0.9056	-1.2315
1983	0.3271	0.5965	1.7502	-0.4412	-0.7399	-0.6009	-0.8734	-1.2518
1984	0.4610	0.6374	1.8410	-0.3873	-0.7481	-0.5849	-0.8326	-1.2686
1985	0.6022	0.6744	1.9139	-0.3081	-0.7422	-0.5640	-0.7839	-1.2803
1986	0.7481	0.7051	1.9660	-0.2014	-0.7213	-0.5384	-0.7273	-1.2870
1987	0.8973	0.7319	1.9990	-0.0720	-0.6875	-0.5069	-0.6634	-1.2894
1988	1.0479	0.7592	2.0136	0.0688	-0.6444	-0.4669	-0.5936	-1.2877
1989	1.1983	0.7935	2.0118	0.2067	-0.5966	-0.4149	-0.5197	-1.2824
1990	1.3466	0.8391	1.9951	0.3326	-0.5474	-0.3492	-0.4430	-1.2743
1991	1.4912	0.8970	1.9648	0.4434	-0.4981	-0.2700	-0.3646	-1.2634
1992	1.6295	0.9648	1.9208	0.5430	-0.4484	-0.1790	-0.2848	-1.2504
1993	1.7577	1.0389	1.8613	0.6379	-0.3973	-0.0777	-0.2034	-1.2364
1994	1.8711	1.1146	1.7840	0.7371	-0.3436	0.0317	-0.1199	-1.2226
1995	1.9664	1.1884	1.6885	0.8469	-0.2867	0.1471	-0.0342	-1.2099
1996	2.0426	1.2586	1.5745	0.9680	-0.2262	0.2681	0.0536	-1.1983
1997	2.0995	1.3260	1.4467	1.0976	-0.1639	0.3928	0.1423	-1.1879
1998	2.1362	1.3917	1.3165	1.2332	-0.1031	0.5165	0.2291	-1.1800
1999	2.1519	1.4577	1.1987	1.3711	-0.0482	0.6336	0.3106	-1.1757
2000	2.1466	1.5249	1.1043	1.5087	-0.0020	0.7399	0.3848	-1.1758
2001	2.1207	1.5931	1.0355	1.6431	0.0350	0.8342	0.4509	-1.1802
MEAN	0.91	0.86	1.59	0.14	-0.49	-0.28	-0.51	-1.19
(std.)	(0.873)	(0.332)	(0.303)	(0.719)	(0.234)	(0.478)	(0.467)	(0.076)

Note: The data in this table has been centered around their means. Some of the years, however, were omitted afterwards and the data was not centered again.

VARIABLE NAME, SHARE AND EDUCATION OF 35-49 YEAR OLDS INTERACTING								
YEAR	North America	Western Europe	Japan/ Oceania	China Region	South Asia	Other Pacific Asia	Latin America and the Caribbean	Sub-Saharan Africa
1971	0.2657	0.1934	0.7211	0.3970	0.6908	0.6372	0.6351	1.5563
1972	0.1629	0.2108	0.7869	0.4049	0.6940	0.5796	0.6154	1.5653
1973	0.0616	0.2227	0.8473	0.4104	0.6982	0.5265	0.5950	1.5735
1974	-0.0268	0.2309	0.9053	0.4112	0.7061	0.4801	0.5747	1.5805
1975	-0.0928	0.2374	0.9638	0.4060	0.7191	0.4411	0.5543	1.5858
1976	-0.1324	0.2449	1.0239	0.3886	0.7274	0.4049	0.5312	1.5803
1977	-0.1444	0.2506	1.0834	0.3652	0.7378	0.3732	0.5069	1.5723
1978	-0.1246	0.2569	1.1484	0.3366	0.7494	0.3437	0.4798	1.5632
1979	-0.0688	0.2672	1.2277	0.3039	0.7615	0.3140	0.4484	1.5544
1980	0.0255	0.2842	1.3277	0.2676	0.7728	0.2830	0.4126	1.5466
1981	0.1604	0.3185	1.4738	0.2324	0.7812	0.2487	0.3687	1.5363
1982	0.3351	0.3642	1.6464	0.1958	0.7872	0.2134	0.3227	1.5255
1983	0.5443	0.4197	1.8362	0.1568	0.7861	0.1774	0.2756	1.5117
1984	0.7804	0.4801	2.0263	0.1153	0.7723	0.1411	0.2288	1.4923
1985	1.0364	0.5412	2.2015	0.0740	0.7435	0.1052	0.1833	1.4658
1986	1.3002	0.5890	2.3652	0.0378	0.6972	0.0732	0.1401	1.4256
1987	1.5745	0.6353	2.5073	0.0098	0.6402	0.0430	0.1005	1.3801
1988	1.8562	0.6835	2.6263	-0.0058	0.5772	0.0156	0.0656	1.3301
1989	2.1425	0.7397	2.7231	-0.0074	0.5136	-0.0073	0.0363	1.2767
1990	2.4302	0.8086	2.7982	0.0034	0.4524	-0.0239	0.0131	1.2211
1991	2.6927	0.8882	2.8558	0.0212	0.3999	-0.0306	-0.0023	1.1651
1992	2.9446	0.9806	2.8892	0.0454	0.3495	-0.0283	-0.0119	1.1081
1993	3.1791	1.0831	2.8953	0.0757	0.3005	-0.0157	-0.0157	1.0513
1994	3.3880	1.1914	2.8699	0.1135	0.2520	0.0078	-0.0135	0.9957
1995	3.5655	1.3019	2.8102	0.1610	0.2037	0.0425	-0.0051	0.9423
1996	3.6968	1.4079	2.6887	0.2181	0.1567	0.0882	0.0096	0.8917
1997	3.7928	1.5141	2.5360	0.2868	0.1106	0.1449	0.0300	0.8428
1998	3.8516	1.6216	2.3687	0.3676	0.0677	0.2108	0.0555	0.7964
1999	3.8724	1.7322	2.2121	0.4607	0.0308	0.2834	0.0850	0.7528
2000	3.8553	1.8468	2.0879	0.5657	0.0012	0.3599	0.1174	0.7119
2001	3.8082	1.9647	2.0010	0.6431	-0.0210	0.4323	0.1481	0.6837
MEAN	1.64	0.76	1.95	0.24	0.51	0.22	0.24	1.28
(std.)	(1.579)	(0.557)	(0.759)	(0.181)	(0.281)	(0.198)	(0.23)	(0.313)

Note: The data in this table has been centered around their means. Some of the years, however, were omitted afterwards and the data was not centered again.