



**TOGETHER**  
*for a sustainable future*

## OCCASION

This publication has been made available to the public on the occasion of the 50<sup>th</sup> anniversary of the United Nations Industrial Development Organisation.



**TOGETHER**  
*for a sustainable future*

## DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

## FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

## CONTACT

Please contact [publications@unido.org](mailto:publications@unido.org) for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at [www.unido.org](http://www.unido.org)



## Downloading Data from the World Productivity Database: User Guide



RESEARCH AND STATISTICS BRANCH  
STAFF WORKING PAPER 11/2007

# **Downloading Data from the World Productivity Database: User Guide**

Anders Isaksson

United Nations Industrial Development Organization (UNIDO) PCF/RST

December 2007



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION  
Vienna, 2008

## **Abstract**

This paper functions as a tutorial as how to retrieve data from the World Productivity Database. More specifically, it informs on the available data and, briefly, how these were constructed and estimated, how to operate the screens and how the output can be organized.

*Keywords:* Total factor productivity; labour productivity; technical efficiency; scale efficiency; technical change; production function; measurement methods; capital; labour; schooling; health; and forecasting.

## **Acknowledgements**

I should like to thank, especially, Omer Aksoyca for his hard and diligent work on producing the World Productivity Database website. Thanks also to Harvir Kalirai and Thiam Hee Ng for their advice on layout and accessibility of the website.

## **Disclaimer**

This document represents work in progress and is intended to generate comment and discussion. It is not a fully polished publication. The views expressed herein are those of the author(s) and do not necessarily reflect the views of the United Nations Industrial Development Organization.

This publication has not been formally edited.

## 1. Introduction

The purpose of this manual is to assist the user in downloading data from the World Productivity Database (WPD). The premise is that there are two broad groups of users, where the first includes relatively “inexperienced” users, while the second comprises users with very good knowledge of the concept of total factor productivity (TFP).<sup>1</sup> Users in the first group, while undoubtedly aware of what TFP is, are not overly concerned, for example, with measurement methods and functional form of the production function, but are more interested in quantitative information for direct or subsequent (e.g. to correlate TFP with environmental regulation) use. The “experienced” users, however, are more concerned about how the input data used to produce TFP have been computed and have preferences as to, for example, the specification of the production function and assumptions about returns to scale. The aim here is to cater to the most common needs of both groups.

It is proposed that the inexperienced user starts with *Basic Selection*, while the more experienced may wish to go directly to *Advanced Selection*. The former selection can be seen as a subset of the latter, in that under *Basic Selection* the user is provided pre-selected TFP measures where only countries and time period need to be selected. As will be seen, the number of choices under *Advanced Selection* is quite large and hence necessitates in-depth knowledge of what different assumptions imply.

WPD, at its maximum, contains data on 112 countries for 41 years (1960-2000). Depending on users’ choices both these parameters change. For example, some countries do not have data on schooling, or, if a certain capital stock is selected, only data from 1969-2000 might be available. The manual discusses these issues in more detail as they become applicable. Isaksson (2007a) provides all the necessary information in detail.

The manual starts with a description of how to operate *Basic Selection* screen and is followed by a description of the much lengthier *Advanced Selection*. Some final remarks conclude the manual.

## 2. Basic Selection screen

The menu is very simple. The user merely needs to decide what output is of particular interest. There are two columns: the first allows for the selection of four different levels measures (income per worker; capital per worker; income per worker relative to the US; and

---

<sup>1</sup> Isaksson (2007b) discusses the concept of TFP and present some different ways of understanding it.

TFP relative to the US), while the second presents the user with various growth indicators (growth of income and capital per worker and, of course, TFP growth). Income and capital per worker, in levels or growth rates, are primarily descriptive indicators and can be downloaded separately from indicators of TFP. Indicators that can be selected by simply ticking the relevant box are illustrated by Figure 1.

WPD, in its current version, ends with year 2000. The two boxes to the far right allow for the selection of forecasts of TFP level and growth, respectively, up to 2010. TFP series can be obtained with or without forecasts. For example, if the user marks TFP growth *and* TFP growth forecasts, TFP growth with forecasts appended are obtained. If the user wishes to obtain forecasts alone, only TFP growth forecasts should be ticked. It is worth emphasizing that data from 2001 to 2010 are forecasts and nothing more.<sup>2</sup> As can be seen, TFP level, income growth, TFP growth, as well as forecasts have been selected.

Certain features, which are choices under advanced selection, are hidden and pre-selected here. For example, capital stock is calculated based on the perpetual inventory method (PIM) assuming a six per cent depreciation rate per year, while labour is measured as labour force. These choices of measurement are intended to present the user with the maximum number of countries over the longest possible time span.

While there exist many different ways of calculating TFP growth, the chosen or preferred measurement method is the Malmquist TFP index based on Long-Memory Data Envelopment Analysis (LMDEA) under the assumption of constant returns to scale. LMDEA presents TFP growth in index form. In this case, it means that 1.00 implies no TFP growth, 1.01 one per cent TFP growth and 0.99 a negative growth of one per cent. While the forecasts have been converted into percentage form (for *Advanced Selection* purposes), such conversion has not occurred for LMDEA TFP data pertaining to 1960-2000. To convert these into percentage form, subtract 1 and multiply by 100, e.g.,  $(1.01-1)*100$ .

In case the user is dissatisfied with the pre-selections of measurement method and labour and capital inputs, the *Advanced Selection* screen is a recommended option, since results obtained from there can be better “tailored” to users’ needs.

Once the choice of variables is made, the user next selects the countries of interest by either double-clicking on each of the relevant countries or marking countries using ctrl + left mouse-click and then pressing “>>” to move those countries to the selection box (“All >>” selects and moves all countries at the same time; “<<” deselects countries). The same

---

<sup>2</sup> Isaksson (2007a) describes how TFP levels and growth have been forecasted.

principle applies to the selection of years, where the time period is 1960-2000. In Figure 2, four Asian countries from 1990 to 2000 have been selected.

The third and final step is to click on *Show Data*, which takes the user to the results window (Figure 3). Here, the results can be viewed and/or downloaded as an Excel, XML or text file. Data are sorted by country, type of labour input and year, but other sorting is possible. For example, by clicking on “Year”, the data will be sorted by year, country and labour input instead. The column order can be changed by simply clicking on the column header and drag it to the preferred location.

Accompanying the data is an information field, which provides some technical details of the selection, for example, measurement method and production factors included (for example, labour and capital). There is also a Glossary to the right in the window, which explains the variable abbreviations used. If the user wishes to carry out another query (for example, have a different selection of countries), on returning to the selection screen the last query will be found.

### **3. Advanced Selection screen**

Figure 4 shows the *Advanced Selection* screen. Compared with *Basic Selection* there are many more options available to the user regarding, for example, measurement method, specification, functional form and how capital and labour should be measured.

The first choice is *how* the user wishes to measure TFP growth, in other words a measurement method needs to be selected. In principle, the different measurement methods can be divided into three main groups: Growth accounting, regression analysis, and frontier estimation. Within these groups there are several methods to select from. Figure 5 shows the entire range of methods available. The user may wish to consult Isaksson (2007c) for a discussion of measurement methods and their implications and assumptions.

Four growth accounting measurement methods are allowed for:

- Growth Accounting with Hicks-Neutral Technical Change
- Growth Accounting with Harrod-Neutral Technical Change
- Dynamic Growth Accounting with Hicks-Neutral Technical Change
- Dynamic Growth Accounting with Harrod-Neutral Technical Change,

where in all cases income shares are the conventional 2/3 and 1/3 for labour and capital input, respectively, and irrespective of country and possible changes over time.<sup>3</sup> As is customary, TFP growth is calculated as the residual, in other words, as the output growth not explained by input growth.

Actual income shares may in reality differ from the aforementioned standard assumption, and regression analysis by way of estimation provides a possible resolution to the dilemma of unknown income shares.

Standard regression analysis broadly includes:

- Pooled regression analysis
- Fixed-effects regression analysis,

where the regression residual provides for the measure of TFP growth. Although income shares are estimated, only one value for the entire sample can be obtained in this manner. Ideally, income shares should be country-specific. While this has not yet been accomplished (individual country regressions produced results with little confidence) steps have been taken to let those shares vary with what may be termed development stage (e.g., industrialized countries) and geographical location (e.g., Latin America).

To this end, TFP growth has been computed based on the residual obtained from pooled and fixed-effects estimations on industrialized, developing and least developed countries, on the one hand, and industrialized<sup>4</sup>, Latin America, Asia and the Pacific, North Africa and Middle East and sub-Saharan Africa, on the other. For example, income shares in the OECD are likely to differ from those in least developed countries, with return to capital being higher in relatively poor countries. However, it must be noted that the geographic distinction is possible for labour force (but all capital versions) only; for other labour measures the samples are too small to obtain reasonable estimation results. In the case of the “development stage” distinction, TFP growth based on employment and derived employment (see below) is possible, but with a slight adjustment in that the distinction is now between industrialized countries and developing countries; very few least developed countries have employment or unemployment data.

Finally, the frontier method group permits the user to choose between deterministic (non-parametric) and random-effects stochastic (parametric) frontiers, and within the former

---

<sup>3</sup> Hulten and Isaksson (2007) devote considerable time exploring the implications of this not so innocuous assumption and show that results are sensitive to it and discuss different possibilities on how more accurate income shares can be acquired.

<sup>4</sup> It did not seem plausible to group, for example, Australia with Fiji and Bangladesh.



between TFP growth either allowing or not allowing for technical regress (DEA and LMDEA).<sup>5</sup> One attractive feature of frontier methods is that they allow for a decomposition of TFP growth into change in technical efficiency and technical change. As discussed in *Basic Selection*, DEA and LMDEA presents TFP growth in index form.

Note that the choice of method will alter the subsequent selections that can be made. For instance, if growth accounting is selected, no choice of functional form of the production function will be expected, as it is redundant (this is marked NA, not applicable).

Assuming that pooled regression is the selected measurement method, the next step is to decide on the desired functional form (this is only applicable to regression analysis and stochastic frontiers). Note that the technical change, technical efficiency change and scale component boxes are still grey and, hence, cannot yet be selected. At the moment, only two functional forms are provided, Cobb-Douglas and Translog (see Figure 6), where the former is a restricted version of the latter.<sup>6</sup>

TFP growth has been measured based on production functions with and without time trend (or time dummy variables).<sup>7</sup> The main reason for offering this option is that some users might be particularly interested in isolating technical change from overall TFP growth. If trend is selected (Figure 7), the box for technical change is no longer grey, but has become an option that can be selected in addition to TFP growth; in the illustration this was done.

With respect to returns to scale (Figure 8), two options are available: constant (restricted) and variable (unrestricted). The default assumption is that of constant returns to scale, but the user may have good reasons to believe in non-constant returns to scale. In addition, a comparison of the two will reveal which of the two prevails. If the constant returns to scale option is chosen, TFP growth is still captured by the residual, whereas under variable returns to scale, TFP growth is calculated as the residual plus the scale effect. However, one can also see this as a distinction between scale effects and technology. In other words the residual is purged of items unrelated to technical change. But if seen this way, one may no longer perceive the residual as representing TFP growth.

---

<sup>5</sup> Forstner and Isaksson (2002) argue that technical regress at the country level is unlikely to occur, as that would imply a “loss of memory”. A method to address that problem is developed, resulting in what is called LMDEA.

<sup>6</sup> Statistical tests invariably show a preference for the Translog functional form. However, because there are many observations statistical tests may have a tendency over-reject the null hypothesis of Cobb-Douglas.

<sup>7</sup> The advantage of using time dummy variables is that technical change can be allowed to change over time, whereas when using a time trend only the annual average technical change over the entire period is obtained. However, both ways of estimating technical change are average across countries. This was relaxed in the case of random-effects stochastic frontier estimation, where country and year-specific technical change were obtained by including interaction terms between country and time dummy variables.

The default and minimum production function specification contains one output and two inputs, capital and labour. However, one may envisage a production function with additional inputs. WPD allows for the inclusion of schooling (proxied with attainment level of education for the population aged 15 and above) and health (proxied with life expectancy), which together form a measure of human capital<sup>8</sup>, in addition to capital and labour (see Figure 9). It should be noted that it is possible to add schooling without health, or both variables together, but not add health without schooling.

It is also important to know that under the Cobb-Douglas assumption, these additional production factors are added in the form of actual values (in other words, years of schooling and life expectancy) and not in a logarithmic fashion. The rationale for this is the fact that schooling is measured in full years, and not half or quarter years. Students add entire years to the stock of education (see Jones (1996) for a good discussion on this). Health, on the other hand, could have been added in log form, but because of the intention to lump the two factors together for growth accounting purposes also that factor enters in actual years (Isaksson, 2007c, elaborates further on this). This is done when the chosen functional form is Cobb-Douglas. But when the functional form is Translog, schooling and life expectancy have to enter in logarithmic form. It is clear that users can expect to detect discrepancies in these functional forms and specifications.<sup>9</sup>

In the special case of growth accounting, schooling and health have already been discussed. It should be noted that when only schooling is added to capital and labour, the income share of education used in Mankiw, Romer and Weil (1992), namely 1/3, is adopted. The alternative to including health as well is restricted to a broader concept of human capital, namely, education plus health. Again, the income share is assumed to be 1/3.

Assuming the user wishes to include both schooling and health in addition to labour and capital in the production function, Figure 10 shows two different ways of doing this. While the default option is to enter human capital variables as additional factors, following the work of Hall and Jones (1999), the possibility to select capital and labour, with the latter adjusted for schooling or for schooling and health (in this particular case health is proxied with the adult mortality rate, AMR) is offered. In this case, labour can be seen to be measured in terms of efficiency units. An educated and healthy worker is expected to produce more

---

<sup>8</sup> Hence, a broader concept of human capital than that often found in literature is applied here. The standard connotation seems to be that education equals human capital and the user should be aware of this deviation.

<sup>9</sup> A technical point is worth mentioning. Researchers have had major problems with education not being statistically significant in the production function when it is included in log form. In the estimations undertaken here, the same problem was encountered, but was resolved by using education in years instead.

than pure raw labour would. AMR is strongly correlated to life expectancy (the other health proxy used), but is chosen on the grounds that Weil (2001) has provided a clever way, similar to that of Hall and Jones (1999) with respect to schooling, to account for it. To select labour in efficiency units, change “Labour adjustment” from the default option “without” to for example “L adjusted by HC + AMR” (see Figure 9). Finally, the user should note that one cannot simultaneously select adjusted labour and human capital variables as additional production factors.

The first row or set of selections has been completed. However, the experienced user’s preferences may extend to how capital and labour are measured as well. The default capital and labour are the same as for *Basic Selection*, and the aim is to cover as many countries for as long a time period as possible. Some users may, however, disagree with the default choice and therefore four different capital stocks and five versions of labour are offered.

The default capital stock (K06) is based on the perpetual inventory method (PIM) with an annual depreciation rate of six per cent and the initial capital stock includes ten years of investment. The curve describing the economic value of an investment in capital over time is convex (geometric decline), meaning that the value of capital services declines rapidly in the beginning and then diminishes over time. Although it is possible to decide on a scrapping rule when an investment has reached a specific (low) value, this is not done here. In other words, an investment to K06 has eternal life but, of course, adds next to nothing to it after a while.

The second capital stock, K13, is due to Leamer (1988). Here the depreciation rate is considerably higher at 13 per cent per year and applies better to economies where capital consists of a large share of machines rather than long-life items, such as roads and buildings. As for K06, the initial capital stock is built up from ten years of investment. Contrary to K06, and following Leamer, after 15 years the investment is scrapped and the contribution to capital stock immediately drops to zero.

Some users may not agree with how initial capital stock has been computed. Another common way of calculating initial capital stock (Ks) is to assume that the economy is in steady state the first year of the sample period (say 1960). If so, initial capital can be arrived at by dividing the average investment rate by the sum of average economic growth and the depreciation rate (here equal to six per cent, as in the case of K06).<sup>10</sup>

---

<sup>10</sup> It is arbitrary on how many years one bases average investment rate and growth. In WPD, those averages are based on ten years of data (1960 to 1969).

Finally, not all users agree with geometric curvature assumed for K06, K13 and Ks. As an alternative, a concave capital stock (Keff) is offered.<sup>11</sup> The way of calculating this capital stock is different from previous ones in that no depreciation rate is assumed (it actually varies over time). Instead, the starting point is to assume a lifetime (in this case 20 years) and then decide on a slope of the curve. In the first few years, the economic contribution of capital to production declines slowly, but after a while it declines at a more rapid pace until the investment is scrapped. This contrasts other capital stocks, where the value depreciates at a constant rate. Because lifetime is assumed to be 20 years, compared with other capital stocks twice the amount of years are used for the initial capital stock calculation (20 instead of 10). This implies a greater loss of data for Keff and therefore this series is available only from 1969 onwards.

Two final remarks on capital are warranted. First, it is assumed that the flow of capital services is proportional to the stock of capital. This is obviously not necessarily the case, but given the aim to include countries with rather poor statistical information it is the best that can be achieved. Secondly, as seen below, labour has been adjusted for two dimensions of utilization. For capital, due to the lack of information such adjustment is not possible across a broad set of countries.

For labour input, the default is based on labour force (LF), which is standard in the literature. This choice also ensures that all 112 countries in the sample are covered. The data are derived from Penn World Tables 6.1, but because of oddities in some countries' labour series slight adjustments have been made (for a complete description of these adjustments, see Isaksson, 2007a).

As mentioned earlier, utilization rates have been accounted for. There are two dimensions that should be considered. First, unemployment in terms of the difference between labour demand and supply in terms of numbers of workers and, secondly, adjustment to demand shifts revealed as changes in hours worked rather than in the number of workers.

The first two alternatives to labour force consider unemployment. While data on labour force provide a TFP measure more in line with potential TFP, employment data appear to be closer to what may be termed "achieved" TFP. In this sense, labour force data are likely to

---

<sup>11</sup> The philosophy behind Keff is to capture when an investment is efficient and how that efficiency declines over time—hence the abbreviation.

understate actual TFP levels, whereas the effect on TFP growth can go in either direction depending on which factor, employment or labour force, grows more rapidly.

The first of these alternatives is a direct measure of employment (EMP), obtained from Groningen Growth and Development Center (GGDC). Although this measure is superior to labour force, the number of countries with such data is drastically reduced (about 55 countries depending on previous choices made). The second alternative accounting for unemployment takes unemployment rate data from the International Labour Organization (ILO), which are then applied to the labour force data to derive employment data (hence, it is called derived employment, DEMP). Data coverage is about the same as for the ‘direct’ employment measure.

The next two alternatives also account for utilization in terms of hours worked. Average hours worked (from GGDC) are multiplied by employment and derived employment to arrive at “Hours worked, employment, HEMP” and “Hours worked, derived employment, HDEMP”. Although, the price of this feat is quite high in terms of country coverage (down to some 35 countries), in terms of actual labour input these two alternatives are superior to previous ones. Figure 11 shows the default choice K06 and labour force, but it is possible to select any combination of capital and labour, including multiple choices.

The remaining selections—levels and growth indicators, forecasts, countries and years—are nearly identical to those under *Basic Selection*. The only difference occurs in the case of frontier methods, where, in addition to the decomposition of TFP growth into change in technical efficiency and technical change, it is also possible to decompose change in technical efficiency into change in pure technical efficiency, and change in scale efficiency if the user selected variable returns to scale. Note that this choice will be disabled unless the user has chosen either Stochastic Frontier or Data Envelopment Analysis.

By simply ticking basic indicators, such as income and capital per worker, these can be acquired with or without any TFP measure (the user might, for example, desire basic indicators as a preliminary step in growth analysis). The difference compared to *Basic Selection*—where the user was confined to labour force and K06—is that, now, there are many possible combinations. For example, hours worked can be combined with K13 and KS, and so on. Likewise, TFP indicators based on many different combinations can be downloaded and compared.

Figure 12 shows that TFP level and growth for 1974-1980 and Argentina, Brazil and Chile, as well as forecasts, have been selected. Compared to *Basic Selection*, it is now also possible to download forecasts in cases where the production function, in addition to K06 and

labour force, includes schooling, or schooling and health. As above, the latter two can enter the production function either as separate inputs or with labour force adjusted for schooling or both. In other words, TFP growth forecasts vary according to production factors (“Sets of regressors”) as well as how they (schooling and health) enter the production function (“Labour adjustment”).<sup>12</sup>

Another feature of *Advanced Selection* is that the forecasts can be appended to TFP measures based on, for example, other measurement methods (e.g., pooled regression) and measures of labour (e.g., employment) and capital (e.g., K13). Although this is good, two warnings need to be issued. First, although TFP forecasts can be downloaded and appended, it must be re-emphasized that those forecasts were generated based on labour force, including variations accounting for schooling and health, and K06. Secondly, as the forecasts were calibrated to fit LMDEA, caution must be exercised when these forecasts are applied to other measurement methods. In the end, it is up to the user to decide the extent to which the forecasts seem reasonable given the other selections made with respect to measurement method, labour input and so on.

The final step is to proceed to the results screen. Again, to view the data, click the button labelled *Show Data* and as before, the data can be saved either as an Excel, XML or delimited text file. Figure 13 shows the result of the exercise. As for *Basic Selection*, another query can be carried out, either by continuing on the last selection or afresh by pressing the *Refresh* button.

#### **4. Concluding remarks**

The goal of this manual has been to explain how to download data from the World Productivity Database (WPD). Two alternatives, *Basic* and *Advanced Selection*, are offered depending on the level of experience of the user. Understandably, the second alternative demands more in terms of knowledge of production theory, productivity and even empirical growth economics.

The work with developing WPD continues. For example, the next step is to update it based on the most recent version of Penn World Tables (Heston, Summers and Aten, 2006), which include data up to 2005 and for more countries. Another step is to include results from work on measuring manufacturing productivity performance. Furthermore, extensive

---

<sup>12</sup> Based on forecasts for TFP growth, TFP level forecasts based on all four capital stocks have been computed as well.

information pertaining to the econometric work is not yet presented. For example, in the course of measuring TFP using regression methods, tests for constant returns to scale and functional forms have been carried out. These results are not shown because the main purpose of this website is to provide information on TFP and not the production function estimates *per se*. These results will be available shortly for downloading.


WPD includes an extensive amount of data and a high degree of work and effort have gone into its production. Although attempts are made to check the output for errors, it is nevertheless possible that some results are in one way or another flawed. In fact, with work of this scale it is almost impossible to avoid mistakes. The user is kindly requested to contact UNIDO in case a bug, problem or error is encountered. Needless to say, ideas or suggestions on how to improve WPD as well as the World Productivity website are very welcome.

## References

- Forstner, H. and A. Isaksson (2002), "Productivity, Technology, and Efficiency: an Analysis of the World Technology Frontier When Memory is Infinite", *SIN Working Paper No. 7*, Vienna: UNIDO.
- Hulten, C.R. and A. Isaksson (2007), "Why Development Levels Differ: The Sources of Differential Economic Growth in a Panel of High and Low Income Countries", *NBER Working Paper no. 13469*, Cambridge, MA: NBER.
- Heston, A., R. Summers and B. Aten (2006), *Penn World Table Version 6.2*, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.
- Isaksson, A. (2007a), "World Productivity Database: A Technical Description", *Research and Statistics Staff Working Paper 10/2007, forthcoming*, Vienna: UNIDO.
- Isaksson, A. (2007b), "Understanding Productivity", *mimeograph*, Vienna: UNIDO.
- Isaksson, A. (2007c), "Measuring Productivity Performance", *mimeograph*, Vienna: UNIDO.
- Jones, C.I. (1996), "Human Capital, Ideas, and Economic Growth", *paper presented at the VIII Villa Mondragone International Economic Seminar on Finance, Research, Education, and Growth in Rome, June 25-27, 1996*.
- Leamer, E.E. (1988), "The Sensitivity of International Comparisons of Capital Stock Measures to Different "Real" Exchange Rates", *American Economic Review*, Vol. 78(2), pp. 479-84.
- Weil, D.N. (2001), "Accounting for the Effect of Health on Economic Growth", *mimeograph*, Brown University.



Figure 1. Basic Selection page



# United Nations Industrial Development Organization

World Productivity Database

Country Studies

Working Papers

Ongoing Projects

News

Links

About the Project

Introduction
Basic Selection
Advanced Selection
Result

**Measurement method:** Long Memory Data Envelopment Analysis, inputs: labour force and capital (K06)

**Select results**

Levels:

Income per worker (Y/L)

Capital per worker (K/L)

Income per worker (rel. to the US)

Total factor productivity (relative to the US)

Growth rates:

Income per worker ( $\Delta$  (Y/L))

Capital per worker ( $\Delta$  (K/L))

$\Delta$ TFP

Forecast: 2001-2010

TFP level

TFP growth

**Country/Region**

- Algeria
- ANDEAN
- Angola
- Argentina
- ASEAN
- Australia
- Austria
- Bangladesh
- Barbados
- Belgium

**Your selection**

> All >

**Year**

- 1980
- 1981
- 1982
- 1983
- 1984
- 1985
- 1986
- 1987
- 1988
- 1989

**Your selection**

> All >

**Region only includes countries which have WPD data.**

[Show Data](#)

Figure 2. Countries and years

Introduction   Basic Selection   Advanced Selection   Result

**Measurement method:** Long Memory Data Envelopment Analysis, inputs: labour force and capital (K,06)

---

**Select results**

Levels:

Income per worker (Y/L)

Capital per worker (K/L)

Income per worker (rel. to the US)

Total factor productivity (relative to the US)

Forecast: 2001-2010

TFP level

TFP growth

Growth rates:

Income per worker ( $\Delta$  (Y/L))

Capital per worker ( $\Delta$  (K/L))

$\Delta$ TFP

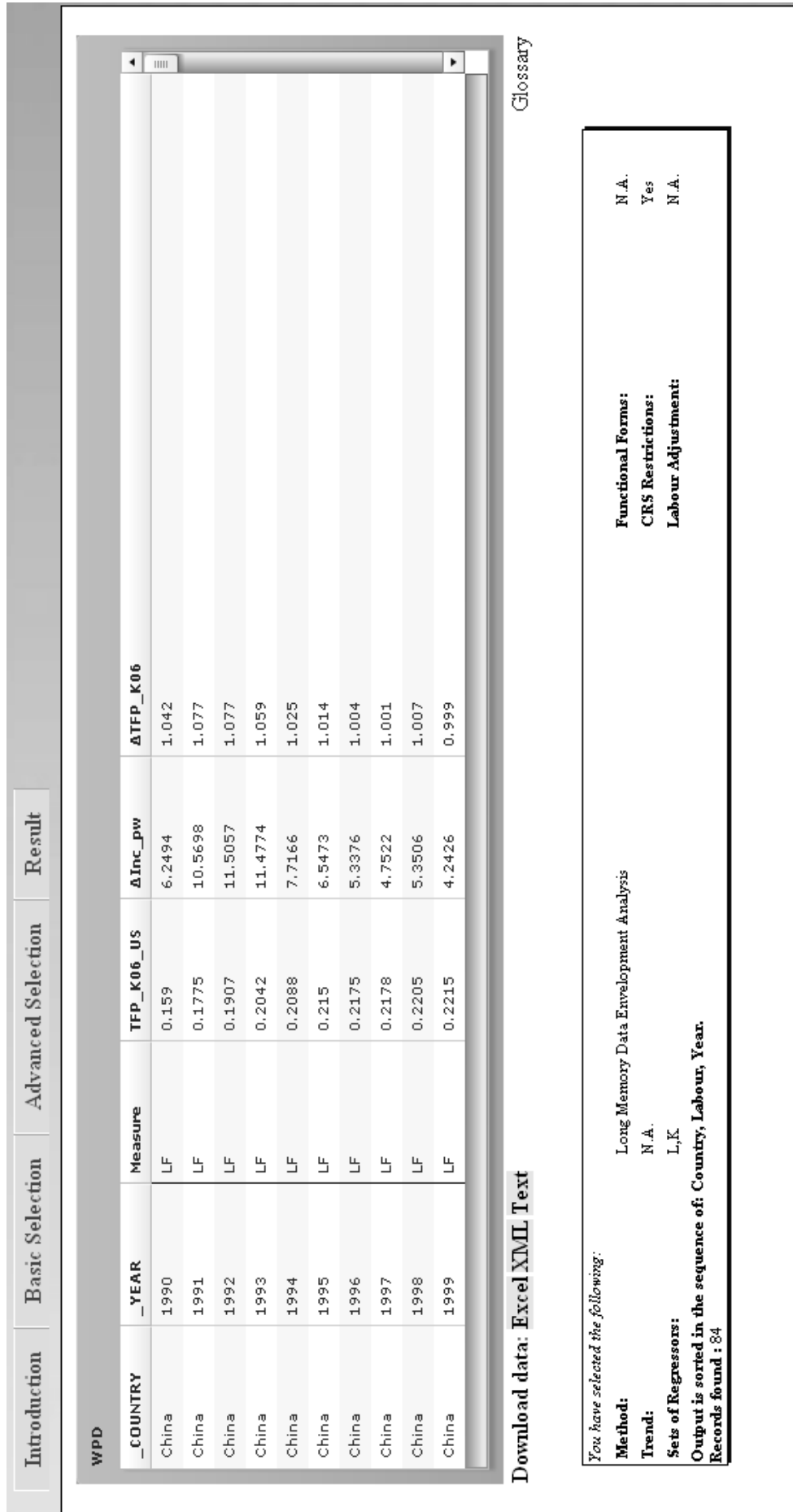
---

Country/Region	Year	Your selection	Your selection
<input type="checkbox"/> ANDEAN <input type="checkbox"/> ASEAN <input type="checkbox"/> Algeria <input type="checkbox"/> Angola <input type="checkbox"/> Argentina <input type="checkbox"/> Australia <input type="checkbox"/> Austria <input type="checkbox"/> Bangladesh <input type="checkbox"/> Barbados <input type="checkbox"/> Belgium	<input type="checkbox"/> 1960 <input type="checkbox"/> 1961 <input type="checkbox"/> 1962 <input type="checkbox"/> 1963 <input type="checkbox"/> 1964 <input type="checkbox"/> 1965 <input type="checkbox"/> 1966 <input type="checkbox"/> 1967 <input type="checkbox"/> 1968 <input type="checkbox"/> 1969	<input type="checkbox"/> China <input type="checkbox"/> India <input type="checkbox"/> Republic of Korea <input type="checkbox"/> Singapore	<input type="checkbox"/> 1990 <input type="checkbox"/> 1991 <input type="checkbox"/> 1992 <input type="checkbox"/> 1993 <input type="checkbox"/> 1994 <input type="checkbox"/> 1995 <input type="checkbox"/> 1996 <input type="checkbox"/> 1997 <input type="checkbox"/> 1998 <input type="checkbox"/> 1999

Region only includes countries which have WPD data.

[Show Data](#)

Figure 3. Results





- World Productivity Database
- Country Studies
- Working Papers
- Ongoing Projects
- News
- Links
- About the Project

# United Nations Industrial Development Organization

[Introduction](#)   
 [Basic Selection](#)   
 [Advanced Selection](#)   
 [Result](#)

**Measurement method**    
 **Functional form**    
 **Trend**    
 **Returns to scale**    
 **Sets of inputs**    
 **Labour adjustment**

**Select primary inputs**

**Capital (K)**  
 K\_eff  
 K\_06  
 K\_13  
 K\_s

**Labour (L)**  
 LF  
 EMP  
 DEMP  
 HEMP  
 HDEMP

(De)Select all   
  (De)Select all

**Select results**

**Levels**  
 Income per worker (Y/L)  
 Capital per worker (K/L)  
 Income per worker (rel. to the US)  
 Total factor productivity (relative to the US)

**Growth rates**  
  $\Delta$  (Y/L)  
  $\Delta$  (K/L)  
  $\Delta$ TFP  
 Technical change  
 Technical Efficiency Change  
 Scale component

(De)Select all   
  (De)Select all

Forecast 2001-2010  
 TFP level  
 TFP growth

**Country/Region**

  
 >   
 All >   
 <   
 All <

Algeria  
 ANDEAN  
 Angola  
 Argentina  
 ASEAN  
 Australia  
 Austria  
 Bangladesh  
 Barbados  
 Belgium

**Year**

  
 >   
 All >   
 <   
 All <

1960  
 1961  
 1962  
 1963  
 1964  
 1965  
 1966  
 1967  
 1968  
 1969

**Your selection**

  
 >   
 All >   
 <   
 All <

Region only includes countries which have WPD data.

[Show Data](#)

Figure 4. Advanced Selection screen

Figure 5. Selection of measurement method

Introduction
Basic Selection
Advanced Selection
Result

**Measurement method**

- Pooled Regression
- Growth Accounting-Hicks neutral
- Growth Accounting-Harrod neutral
- Dynamic Growth Accounting-Hicks neutral
- Dynamic Growth Accounting-Harrod neutral
- Pooled Regression**
- Regions Pooled Regression-RPoR\_dev
- Regions Pooled Regression-RPoR\_geo
- Panel Regression
- Fixed-effects Panel Regression-by development stage
- Fixed-effects Panel Regression-by geographic regions
- Stochastic frontier random effects
- Data Envelopment Analysis
- Long Memory Data Envelopment Analysis

**Functional form**

Cobb-Douglas

**Returns to scale**

Constant

**Labour adjustment**

N.A.

**Trend**

No

**Sets of inputs**

L,K

**Select results**

**Levels**

- Income per worker (Y/L)
- Capital per worker (K/L)
- Income per worker (rel. to the US)
- Total factor productivity (relative to the US)

**Growth rates**

- $\Delta$  (Y/L)
- $\Delta$  (K/L)
- $\Delta$  TFP
- Technical change
- Technical Efficiency Change
- Scale component

(De)Select all

**Country/Region**

- Algeria
- ANDEAN
- Angola
- Argentina
- ASEAN
- Australia
- Austria
- Bangladesh
- Barbados
- Belgium

**Year**

- 1960
- 1961
- 1962
- 1963
- 1964
- 1965
- 1966
- 1967
- 1968
- 1969

**Your selection**

**Your selection**

Region only includes countries which have WPD data.

Show Data

Figure 6. Selection of functional form of production function

Introduction
Basic Selection
Advanced Selection
Result

**Measurement method**

Pooled Regression

**Functional form**

Cobb-Douglas

Cobb-Douglas

Translog

**Returns to scale**

Constant

**Sets of inputs**

L,K

**Labour adjustment**

N.A.

**Trend**

No

**Select primary inputs**

Capital (K)

K\_eff

K\_06

K\_13

K\_s

**Labour (L)**

LF

EMP

DEMP

HEMP

HDEMP

**Select results**

Levels

Income per worker (Y/L)

Capital per worker (K/L)

Income per worker (rel. to the US)

Total factor productivity (relative to the US)

(De)Select all

**Growth rates**

$\Delta$  (Y/L)

$\Delta$  (K/L)

$\Delta$  TFP

Technical change

Technical Efficiency Change

Scale component

**Forecast 2001-2010**

TFP level

TFP growth

**Country/Region**

Algeria

ANDEAN

Angola

Argentina

ASEAN

Australia

Austria

Bangladesh

Barbados

Belgium

**Your selection**

**Year**

1960

1961

1962

1963

1964

1965

1966

1967

1968

1969

**Your selection**

**Region only includes countries which have WPD data.**

Show Data

Figure 7. With or without trend

Introduction
Basic Selection
Advanced Selection
Result

**Measurement method**

Pooled Regression

**Returns to scale**

Constant

**Sets of inputs**

L,K

**Labour adjustment**

N.A.

**Trend**

No

**Functional form**

Cobb-Douglas

**Forecast 2001-2010**

TFP level

TFP growth

**Select primary inputs**

Capital (K)

K\_eff

K\_06

K\_13

K\_s

Labour (L)

LF

EMP

DEMP

HEMP

HDEMP

(De)Select all

**Select results**

Levels

Income per worker (Y/L)

Capital per worker (K/L)

Income per worker (rel. to the US)

Total factor productivity (relative to the US)

Growth rates

$\Delta(Y/L)$

$\Delta(K/L)$

$\Delta TFP$

Technical change

Technical Efficiency Change

Scale component

(De)Select all

**Country/Region**

Algeria

ANDEAN

Angola

Argentina

ASEAN

Australia

Austria

Bangladesh

Barbados

Belgium

Region only includes countries which have WPD data.

Show Data

**Year**

1980

1981

1982

1983

1984

1985

1986

1987

1988

1989

**Your selection**

**Your selection**

Figure 8. Constant or variable returns to scale

Introduction
Basic Selection
Advanced Selection
Result

**Measurement method**

Pooled Regression

**Returns to scale**

Constant  Variable

**Sets of inputs**

L,K

**Labour adjustment**

N.A.

**Functional form**

Cobb-Douglas

**Trend**

Yes

**Select primary inputs**

Capital (K)

K\_eff

K\_06

K\_13

K\_s

(De)Select all

Labour (L)

LF

EMP

DEMP

HEMP

HDEMP

(De)Select all

**Select results**

Levels

Income per worker (Y/L)

Capital per worker (K/L)

Income per worker (rel. to the US)

Total factor productivity (relative to the US)

**Growth rates**

$\Delta$  (Y/L)

$\Delta$  (K/L)

$\Delta$ TFP

Technical change

Technical Efficiency Change

Scale component

(De)Select all

**Forecast 2001-2010**

TFP level

TFP growth

**Country/Region**

Algeria

ANDEAN

Angola

Argentina

ASEAN

Australia

Austria

Bangladesh

Barbados

Belgium

>

All >

<

All <

**Year**

1960

1961

1962

1963

1964

1965

1966

1967

1968

1969

>

All >

<

All <

**Your selection**

**Region only includes countries which have WPD data.**

Show Data



Figure 9. Selection of production factors

Introduction
Basic Selection
Advanced Selection
Result

**Measurement method**

Pooled Regression

**Returns to scale**

Constant

**Functional form**

Cobb-Douglas

**Trend**

Yes

**Labour adjustment**

N.A.

**Sets of inputs**

LK  
LK,S  
LK,SH

**Select primary inputs**

Capital (K)

K\_eff

K\_06

K\_13

K\_s

Labour (L)

LF

EMP

DEMP

HEMP

HDEMP

(De)Select all

**Select results**

Levels

Income per worker (Y/L)

Capital per worker (K/L)

Income per worker (rel. to the US)

Total factor productivity (relative to the US)

(De)Select all

**Country/Region**

Algeria

ANDEAN

Angola

Argentina

ASEAN

Australia

Austria

Bangladesh

Barbados

Belgium

**Year**

1960

1961

1962

1963

1964

1965

1966

1967

1968

1969

**Your selection**

**Your selection**

Forecast 2001-2010

TFP level

TFP growth

Growth rates

$\Delta(Y/L)$

$\Delta(K/L)$

$\Delta TFP$

Technical change

Technical Efficiency Change

Scale component

(De)Select all

Region only includes countries which have WPD data.

Show Data

Figure 10. Labour adjusted for education and health

Introduction
Basic Selection
Advanced Selection
Result

**Measurement method**

**Functional form**

**Returns to scale**

**Trend**

**Sets of inputs**

**Labour adjustment**

**Select primary inputs**

Capital (K)

 K\_eff  
 K\_06  
 K\_13  
 K\_s

Labour (L)

 LF  
 EMP  
 DEMP  
 HEMP  
 HDEMP

(De)Select all

**Select results**

Levels

 Income per worker (Y/L)  
 Capital per worker (K/L)  
 Income per worker (rel. to the US)  
 Total factor productivity (relative to the US)

Growth rates

 Δ (Y/L)  
 Δ (K/L)  
 Δ TFP  
 Technical change  
 Technical Efficiency Change  
 Scale component

(De)Select all

Forecast 2001-2010

 TFP level  
 TFP growth

**Country/Region**

**Year**

**Your selection**

Region only includes countries which have WPD data.

Show Data

Figure 11. Capital and Labour variations

Introduction
Basic Selection
Advanced Selection
Result

**Measurement method**

**Returns to scale**

**Sets of inputs**

**Labour adjustment**

**Functional form**

**Trend**

**Select primary inputs**

Capital (K)

K\_eff

K\_06

K\_13

K\_s

Labour (L)

LF

EMP

DEMP

HEMP

HDEMP

(De)Select all

**Select results**

Levels

Income per worker (Y/L)

Capital per worker (K/L)

Income per worker (rel. to the US)

Total factor productivity (relative to the US)

(De)Select all

**Country/Region**

**Year**

**Growth rates**

$\Delta(Y/L)$

$\Delta(K/L)$

$\Delta TFP$

Technical change

Technical Efficiency Change

Scale component

(De)Select all

**Forecast 2001-2010**

TFP level

TFP growth

Region only includes countries which have WPD data.

[Show Data](#)

Figure 12. Selection of results to display

Introduction
Basic Selection
Advanced Selection
Result

**Measurement method**

**Returns to scale**

**Sets of inputs**

**Labour adjustment**

**Functional form**

**Trend**

**Select primary inputs**

Capital (K)

 K\_eff  
 K\_06  
 K\_13  
 K\_s

Labour (L)

 LF  
 EMP  
 DEMP  
 HEMP  
 HDEMP

(De)Select all

**Select results**

Levels

 Income per worker (Y/L)  
 Capital per worker (K/L)  
 Income per worker (rel. to the US)  
 Total factor productivity (relative to the US)

Growth rates

  $\Delta$  (Y/L)  
  $\Delta$  (K/L)  
  $\Delta$ TFP  
 Technical change  
 Technical Efficiency Change  
 Scale component

(De)Select all

**Forecast 2001-2010**

 TFP level  
 TFP growth

**Country/Region**

- ASEAN
- Algeria
- Angola
- Australia
- Austria
- Bangladesh
- Barbados
- Belgium
- Benin

**Year**

- 1961
- 1962
- 1963
- 1964
- 1965
- 1966
- 1967
- 1968
- 1969

**Your selection**

- Brazil
- Chile

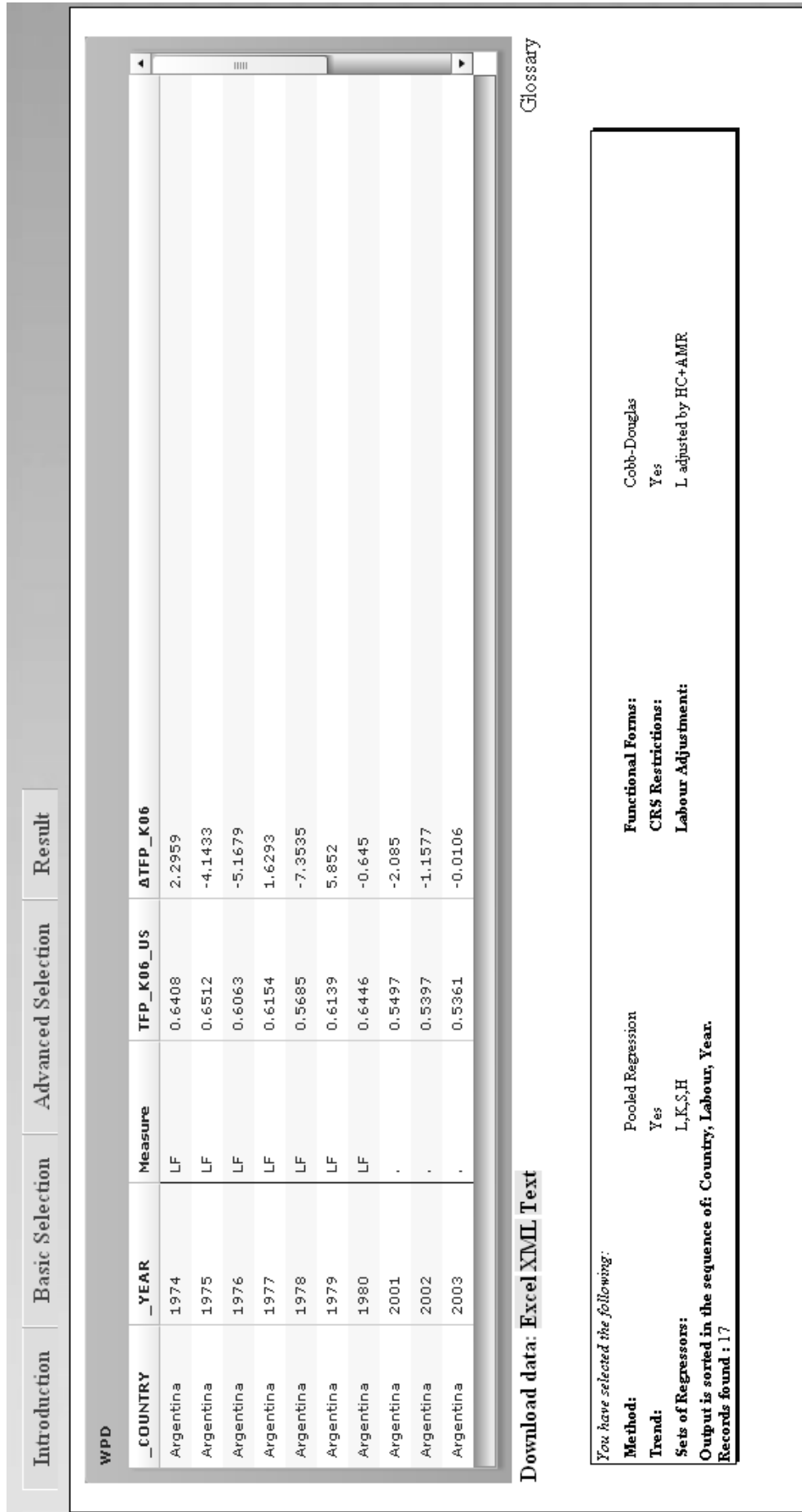
**Your selection**

- 1975
- 1976
- 1977
- 1978
- 1979
- 1980

Region only includes countries which have WFPD data.

Show Data

Figure 13. Results





**UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION**  
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria  
Telephone: (+43-1) 26026-0, Fax: (+43-1) 26926-69  
E-mail: [unido@unido.org](mailto:unido@unido.org), Internet: <http://www.unido.org>