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Is aid the capital component making countries efficient?

A Data Envelopment Analysis approach

by

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Abstract

Cross country regressions on aid effectiveness have failed to provide substantial evidence on the effects of foreign aid. This study focuses on country performance in a production theory context. By means of the non-parametric DEA method, we study 60 individual low and middle income countries between 1995 and 2000. Is there a systematic correlation between resource intensity and country efficiency? We find indications of a positive relation between capital intensity and country efficiency. We then investigate whether aid is the conclusive part of capital providing this correlation, but when linking country efficiency development to aid, there is no clear pattern to be found.

1 Introduction

This study attempts to add a piece to the aid effectiveness puzzle by presenting an alternative to the common growth regression approach. Most studies of country performance simply rely on regression analysis and exploit the GDP per capita measure when capturing economic growth. Not only have these cross country regressions failed to provide substantial and conclusive evidence on the effects of aid, they are also characterized by well known methodological drawbacks. Furthermore, the GDP per capita measure is similar in nature to the labour productivity measure and consequently subjected to the drawbacks of such partial measures.

To remedy these shortcomings, we suggest evaluating aid effectiveness in a production theory context, applying the Data Envelopment Analysis (DEA) method. This approach considers all factors of production, and hence also includes the capital and energy components of production, implying that we will evaluate the economic performance considering achieved production in relation to *all* resources used in the production process.

DEA has several attractive characteristics. Since the technology is non-parametric, there is no need to assume a specific functional form, nor do we need to place any restrictions on the scale properties of the underlying production technology. Furthermore, no assumptions regarding economic behaviour in terms of profit maximization or cost minimization need to be made and we do not need information on input prices. The flexible DEA approach is thus particularly suitable in a context like the present, where price information is weak and where little is known about production technologies and economic behaviour.

The report is organized as follows. We begin with a brief summary of some of the recent work in the field of aid effectiveness and point to the value of trying a different approach to the issue. This is followed by Section 3, a discussion of the efficiency concept. Section 4 is a presentation of data and model specification, while empirical results are found in Section 5. Section 6 concludes.

2 Aid Effectiveness

Aid issues have received renewed political interest during the first years of the 21st century. At the Millennium Summit of 2000, the international community agreed on the Millennium Development Goals (MDG) to be reached by 2015. World leaders have acknowledged that objective attainment depends on increased resource transfers as well as improved aid effectiveness through donor co-ordination. Aid increase has been suggested in the Monterrey Consensus (UN 2004) and (UN 2005). Furthermore, the multilateral debt relief initiative (MDRI) has been introduced to reduce the debt burden of developing countries.

The political interest together with increased resource transfers have resulted in numerous studies on the impact of aid on growth. There is, however, little evidence of a significant positive effect of aid on the long-term growth of poor countries. The classic view is that aid increases savings, investments and thus the capital stock. There should be no doubt that aid sometimes finances investment. Dalgaard, Hansen and Tarp (2004) have shown that aid transfers improve steady state productivity in partner countries through raising the capital stock per person.

A key study is Burnside and Dollar (2000), where the authors find support for the basic idea that an increase in aid flows strengthens economic growth in poor countries when the policy environment is conducive. In the presence of poor policies, aid was not found to have any positive effect on growth. The Burnside and Dollar result was supported by a number of follow-up studies. Collier and Dollar (2002), using a different data set and another specification, validated the significance of the policy environment. Collier and Dehn (2001) find that well-timed aid alleviates effects of negative export shocks, while Collier and Hoeffler (2004) find that aid works particularly well in good policy environments a few years after a conflict has ended.

Subsequent studies have, however, suggested that the Burnside and Dollar results were not robust. Dalgaard and Hansen (2001) argue that the Burnside and Dollar results are sensitive to the treatment of outliers and when removing outliers they found that aid had no effect on growth. Easterly, Levine and Roodman (2004) discovered that the results were sensitive to data expansion, both in years and countries. Hansen and Tarp (2001) show that aid is effective on average, but with diminishing returns. This finding holds regardless of partner country policy. The hypothesis of Guillaumont and Chauvet (2001) is that economic vulnerability influences aid effectiveness. Aid stabilizes countries with terms of trade difficulties. The authors introduce a "vulnerability variable" resulting in the Burnside and Dollar (2000) policy variable becoming insignificant. Dalgaard, Hansen and Tarp (2004) introduce a geographical variable into the aid-growth perspective to find that, on average, aid seems to work for areas outside the tropics.

Roodman (2004) has indicated that non-robustness is a common feature of the cross-country aid effectiveness literature. Most sensitive were the results of Burnside and Dollar (2000), Collier and Dollar (2002) and Collier and Dehn (2001), while Dalgaard, Hansen and Tarp (2004) and Hansen and Tarp (2001) proved more stable.

Aid heterogeneity is an inherent problem when studying the aid-growth relationship. Growth and poverty reduction have not always been the main motives for providing aid. Berthélemy (2006) shows that strategic motives and self-interest by donors to a large extent explain aid allocation. Clemens, Radelet and Bhavnani (2004) divide aid into three categories to discover that the effects on growth differ considerably. Emergency and humanitarian aid has no effect on growth. The same is true for aid aiming at a long term growth effect, such as aid in support of democracy, the environment, education and health[1]. Aid with possible short term growth effects, such as aid as budget support and support to productive sectors, is found to have a strong effect on growth.

Rajan and Subramanian (2005) discuss another possible outcome of aid flows. They claim that aid flows reduce partner country competitiveness through exchange rate appreciations. This could prove particularly harmful if results by Hausmann, Pritchett and Rodrik (2005) are proven to be correct. The authors studied turning points in growth to discover that growth acceleration tends to correlate with increases in investment and exports, and with real exchange depreciation.

Our study takes a different approach to the issue. By exploiting properties of the traditional micro economic theory of production, we study how the efficiency with which individual countries produce GDP may be linked to the relative size of aid received by the country.

3 Measuring Efficiency

The efficiency of a production unit is defined as the ratio between the output(s) produced by the unit and the amount of resources used in the production process. To be meaningful, the individual efficiency measure must be compared to equivalent efficiency measures of other production units, over time or at the same point of time. Consequently, efficiency is a *relative* measure.

Efficiency may, however, be calculated in different ways. A common method is to calculate partial efficiency measures, often called key performance indicators or productivity measures. A partial measure is often regarded as easier to interpret.

All resources and achievements are interdependent in the production process. This means that several partial efficiency measures need to be calculated – one measure for each combination of

[1] The authors emphasise though that the standard growth regression analysis based on a four year panel data set is an inappropriate tool for examining the effects of these two types of aid.

products and production resources. The fact that the different partial efficiency measures of an individual production unit generally yield different results, imply serious interpretation problems. Consequently, there is a substantial risk of partial measures being misleading.

In view of this fact, the approach taken in this study makes use of a performance indicator that allows for a multiple input – multiple output structure common in most production processes. The indicator considers *all* factors of production since the study is based on a well established method in the field of production theory, the so called Data Envelopment Analysis (DEA) method.

DEA is a non-parametric representation of the production process. In the same way as the production function, DEA has its origin in micro economics and in the same way as the production function traditionally has been (see e.g. Solow (1957)), and still is, used in macro modelling it is natural to employ the DEA concept in a similar manner which, for instance, is demonstrated by Färe et. al. (1994).

A central feature of this method is that no assumption regarding the functional form of the underlying production needs to be made. DEA is a linear programming technique for the construction of a non-parametric, piecewise linear convex hull to the observed set of output and input data; see e.g. Charnes and Cooper (1985) for a detailed discussion of the methodology. The DEA approach defines a non-parametric frontier (hull) which may serve as a benchmark for efficiency measures. The most efficient units constitute the efficiency (best practice or production) frontier, i.e. define the production possibility set, which is solely based on the actual observations of the different production units.

Farrell (1957) presented a method by which technical efficiency could be measured against an efficiency frontier, assuming constant returns to scale. The DEA method is closely related to Farrell's original approach and should be regarded as an extension of that approach initiated by Charnes et. al. (1978) and related work by Färe et. al. (1983 and 1985) and Banker et. al. (1984).

This study applies Farrell-type ray measures as generalized into input saving and output increasing efficiency measures by Førsund and Hjalmarsson (1974, 1979 and 1987)[2].

The production unit in this study is a country and the output of the country is GDP while inputs (resources used to produce GDP) are labour, capital and energy. Increased GDP growth is considered to be the objective of the 60 countries included in the study. Consequently, we focus on the output oriented (output increasing) efficiency measure. The output oriented efficiency measure here indicates potential output, i.e. GDP growth, of each country relative to observed GDP growth, given that the country's resources had been used efficiently.

To calculate the output increasing efficiency measure for Country A operating in a variable returns to scale production technology, the following linear programming problem is solved:

$$\min \mu = \sum_{i=1}^{m} v_i x_i^A + v_0 \qquad 1\ (a)$$

$$-\sum_{r=1}^{s} u_r y_r^j + \sum_{i=1}^{m} v_i x_i^j + v_0 \geq 0, \qquad j = 1,\ldots,N \qquad 1\ (c)$$

$$\sum_{r=1}^{s} u_r y_r^A = 1 \qquad 1\ (b)$$

$$v_i \geq 0, \quad u_r \geq 0, \quad v_0 \overset{<}{\underset{>}{=}} 0 \qquad 1\ (d)$$

The output efficiency measure is calculated as μ^{-1}. For Country A, we obtain the solution by minimizing the weighted sum of inputs for this unit (1 (a)), given that the weighted sum of outputs for the unit in question equals one (1 (b)). Furthermore, the weighted sum of inputs minus the weighted sum of outputs for all units included is greater than or equal to zero (1 (c)). To calculate

[2] For a more detailed presentation of different Farrell-type efficiency measures and their application to Data Envelopment Analysis, see, for example, Hjalmarsson and Veiderpass (1992).

the corresponding measure under the assumption of constant returns to scale, the weight v_0 is excluded from the LP-problems.

4 Data and model specification

The data used in this study comprise information on 60 different countries for which we were able to collect consistent data for the period between 1995 and 2000. The countries belong to five different geographical categories: Sub-Saharan Africa (SSA), East Africa and the Pacific (EAP), Latin America and the Caribbean (LAC), Middle East and North Africa (MNA) and South Asia (SAS).

An intertemporal frontier approach[3] is used, enabling comparison between all countries and all years of study. Assuming the reference production set to be invariant over time, we are thus able to follow and compare the efficiency development of each country each year between 1995 and 2000 without further calculations of productivity measures or concern about changing production sets.

The study employs a multiple input – single output production model with energy use, labour force and capital as inputs and GDP as output.

Energy use refers to use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport.
Unit of measurement: Kt of oil equivalent.
Source: International Energy Agency.

[3] The concept of intertemporal efficiency estimation was first defined and labelled by Tulkens and Vanden Eeckaut 1991. For non-parametric applications of intertemporal frontiers in a developing economy context, see e.g. Cabezas Vega and Veiderapss (1994), Veiderpass (1997) or Isgut, Tello and Veiderpass (1999).

Labour force comprises people who meet the International Labour Organization definition of economically active population: All people who supply labour for the production of goods and services during a specified period.

Unit of measurement: Number of people.

Source: International Labour Organization, using World Bank population estimates.

Capital is the capital stock based on Nehru and Dhareshwar (1993), mid-year value (two-period average). The Capital Stock is based on a geometric depreciation rate of 0.05.

Unit of measurement: Billions of USD and the prices of 1995.

Output**,** *GDP* is measured by real gross domestic product based on World Bank data.

Unit of measurement: Billions of USD and the prices of 1995.

Table 1 presents the full data set which includes 359 observations. Data are divided into five different geographical categories.

INSERT TABLE 1

It is apparent from Table 1 that the sizes of all four variables included in the study vary considerably within all geographical categories. The lowest energy and labour input values are found in 1995, in (LAC) Haiti and Guyana respectively, while the lowest capital input value as well as the lowest output value are found in Ghana in 2000. Mainly due to extensive exchange rate adjustments, capital inputs, as well as GDP, are declining in Ghana every year during the period of study. The corresponding maximum energy and labour input values are found in China (in the year 2000), while Brazil presents the highest capital input and GDP.

5 Empirical Results

This section reports the efficiency development, as measured by the output increasing efficiency measure, of the different countries. It also illustrates the results of the efficiency analysis together with the relative aid proportions of the different countries. All individual efficiency values are listed in Appendix 1.

In this study we do not place any restrictions on the scale properties of the underlying production technology. If, in a DEA context, the underlying production technology is specified in a way flexible enough to allow variable returns to scale, the resulting efficiency measures would nevertheless display constant returns to scale characteristics if the actual technology is characterized by constant returns to scale. Furthermore, as outlined above, the efficiency measure used in this study measures the relationship between actual production volume (output i.e. GDP) and the production volume that could have been obtained if the resources were employed in the most efficient way possible. Given the amount and combination of inputs used, the estimated efficiency values thus indicate how much GDP a country "produces" as a portion of the GDP that would have been possible to produce had the country in question been on the best practice frontier, i.e. had it been efficient.

For an efficient production unit (country), the estimated efficiency equals 1. An efficiency value of, for example, 0.73 means that this country is only producing 73% of the GDP that would have been possible to produce with the observed amount of resources (inputs) used.

China, followed by Nigeria, displays the highest relative efficiency values over the period of study. The lowest efficiency, between 14 and 15 per cent each year between 1995 and 2000, is found in India, Indonesia and Pakistan.

Substantial and steady efficiency decline is found in Colombia (from an efficiency score of 0.965 in 1995 to an efficiency score of 0.774 in 2000; i.e. from 96.5 % to 77.4 %), Turkey (from an efficiency score of 0.85 in 1995 to an efficiency score of 0.341 in 2000), Zimbabwe (from an efficiency score of 0.533 in 1995 to an efficiency score of 0.251 in 2000) and Venezuela (from an efficiency score of 0.384 in 1995 to an efficiency score of 0.149 in 2000).

Since it has not been possible to obtain data on energy use for 8 of the 60 countries, an auxiliary model has been used to test the importance of these missing values and to ensure the reliability of our results. The auxiliary model consists of the same output measure while labour and capital are the only inputs. This model covers all 60 countries. With the exception of Ecuador, Guatemala and Haiti, the result of the auxiliary model provides a virtually identical ranking of the performance of the observed countries. The same countries are found to be the most/least efficient and the sharp efficiency decline of Colombia, Turkey, Zimbabwe and Venezuela is confirmed. In addition, Malawi, one of the 8 countries not included in our main model is found to be highly inefficient displaying falling efficiency scores between 0.179 and 0.088. Consequently, this result may be regarded as an indication of the robustness of our main model findings.

INSERT FIGURE 1

By means of Figure 1, the efficiency analysis is taken a step further, as we examine whether there are any systematic correlations between input size and efficiency. Figure 1 shows the efficiency distribution in three different efficiency diagrams, often called Salter-Diagrams[4]. The efficiency of each country is shown by the height of the corresponding bar, while the width of the bar shows the size of the (input) variable in question. Consequently, the distance from the top of each bar to the

[4] This type of diagram, based on the input coefficient in Salter (1960), was first introduced in Førsund and Hjalmarsson (1979).

1.0 mark is a measure of the country's inefficiency. Countries are sorted from left to right by increasing efficiency scores.

For example, the height of the first bar indicates that that country has an efficiency value of approximately 0.12 and, consequently, the inefficiency is the difference between 1.00 and 0.12 (i.e. approximately 88 per cent). The width of the bar shows that the country's share of total labour input is approximately 0.03, i.e. 3 per cent.

It is obvious from the figure that countries with substantial labour input are found among the most, as well as among the least, efficient ones. The same circumstance seems to apply when studying efficiency distribution and energy use. These findings are also confirmed for resource intensity and country efficiency, see Appendix 3.

When studying efficiency and capital utilisation, we find a somewhat different picture as indicated by the third diagram in Figure 1. Large units, where large is defined in terms of capital utilization, are now found to dominate the higher and "medium" efficiency intervals. Very few small units are found among the fully efficient ones, and only small units are found at the lowest efficiency values.

These findings are also confirmed for resource intensity and country efficiency, see Appendix 3. When focusing on the energy labour ratio, the least efficient units are clearly among the least energy intensive, while high as well as low energy labour ratios are found among the most efficient countries. Capital intensive countries, on the other hand, generally seem to have had a more positive efficiency development.

The finding that capital intensive countries have had a more positive efficiency development compared to less capital intensive countries may come as no surprise. Does this then mean that we can conclude that aid, as a component adding to the size of the capital stock of a country, contributes to an increased efficiency development of that country? Is there in fact a positive correlation between aid and GDP growth?

We conclude this analysis by presenting Figure 2, showing the efficiency distribution and the extent of aid in the countries of study in an efficiency diagram of the same type as was presented in Figure 1. Due to data considerations, i.e. to be able to include as many countries as possible in the analysis, the figure is based on the auxiliary two input model specification. Aid is measured in per cent of government expenditures[5] and includes both official development assistance and official aid.

INSERT FIGURE 2

Figure 2 provides no definite answer to our questions. When linking country efficiency development to aid, we get a somewhat ambiguous picture. Although some of the more efficient countries seem to have a relatively low percentage of government expenditures being financed by aid, we also see that units with a relatively small aid share are found among the more as well as among the less efficient units. Generally, we find the large units in the centre of the diagram.

6 Concluding Comments

Farrell type efficiency measurement, based on non-parametric frontier estimates, has by now become the standard procedure in the field of production theory. The reasons for this are the important advantages related to a non-parametric representation of the production technology; no assumptions regarding functional form or scale properties of the production function need be made, no assumptions regarding economic behaviour (e.g. cost minimizing or revenue

[5] Source: Development Assistance Committee of the Organisation for Economic co-operation and Development, and IMF government expenditures estimates.

maximizing) and ability to handle multiple inputs and multiple outputs. Furthermore, this approach also avoids the methodological drawbacks related to partial measures that do not reflect the fact that the efficiency of *all* factors of production are relevant and must be considered.

Apart from being theoretically sound, the efficiency measures of the Data Envelopment Analysis approach also display another attractive characteristic – the measures are concepts that have proven to be intuitively easy to comprehend for non-economists (policy makers, company boards of directors etc).

We study the relationships between three different factors of production, capital, energy, labour, and country efficiency. As might have been expected, we find that labour and energy intensive countries display lower efficiency scores in relation to less labour and energy intensive countries. Furthermore, we find a positive relationship between capital intensity and country efficiency. Although foreign aid has a number of different objectives, growth has traditionally been the main yardstick by which aid effectiveness has been measured. The classic view of aid is that it increases savings, investments and thus the capital stock, but when investigating whether aid is the conclusive part of the positive relationship, our finding is inconclusive. Neither the most, nor the least, efficient countries are generally heavily aid dependent. We conclude that for the most efficient countries aid does not seem to be the crucial factor when achieving efficiency.

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Table 1: Summary statistics on inputs and outputs

	Energy	Labour	Capital	GDP
SSA				
Max	109478	42545604	375731	151113
Min	2371	482351	3	2
Median	8859	5799325	4427	2245
Mean	23454	9759570	19468	9089
EAP				
Max	1140446	738929024	1426804	588063
Min	21468	1764813	25	12
Median	71718	29335333	224573	73601
Mean	227103	129436669	426248	166217
LAC				
Max	185061	83444192	1907893	704304
Min	1717	287658	19	9
Median	6329	3128259	10633	5124
Mean	27577	9832295	152659	57845
MNA				
Max	118646	24409360	216534	90548
Min	2007	349718	10494	3359
Median	17619	9254000	30229	12619
Mean	31367	9791016	58754	24743
SAS				
Max	516891	396216480	81153	39935
Min	5950	7220793	234	123
Median	36513	48932936	3186	1527
Mean	140491	120880133	21611	10702
TOTAL DATA				
Max	1140446	738929024	1907893	704304
Min	1717	287658	3	2
Median	11793	6226845	8591	3935
Mean	62826	31160106	119486	46910

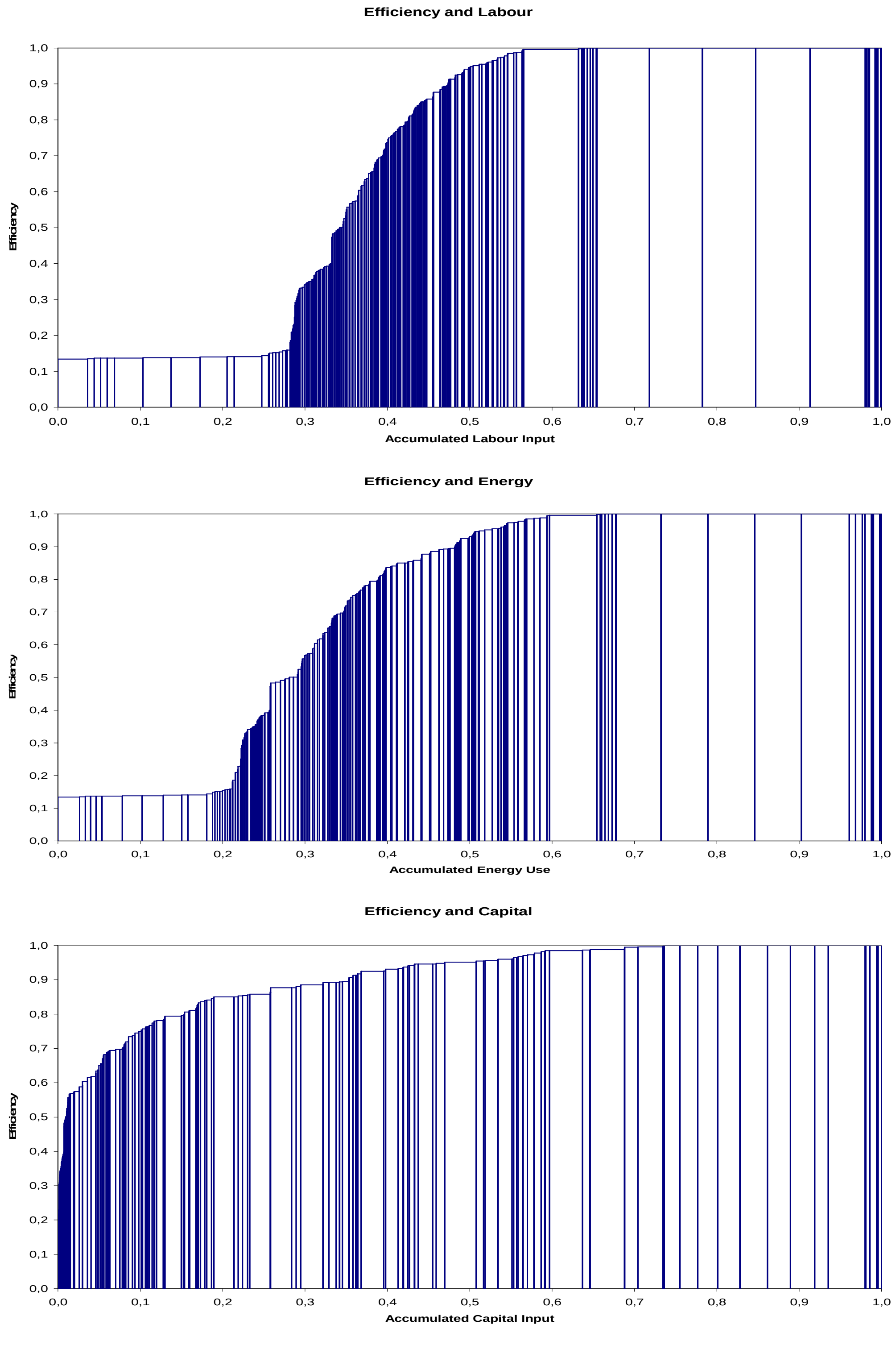

Figure 1: Efficiency distribution 1995 – 2000

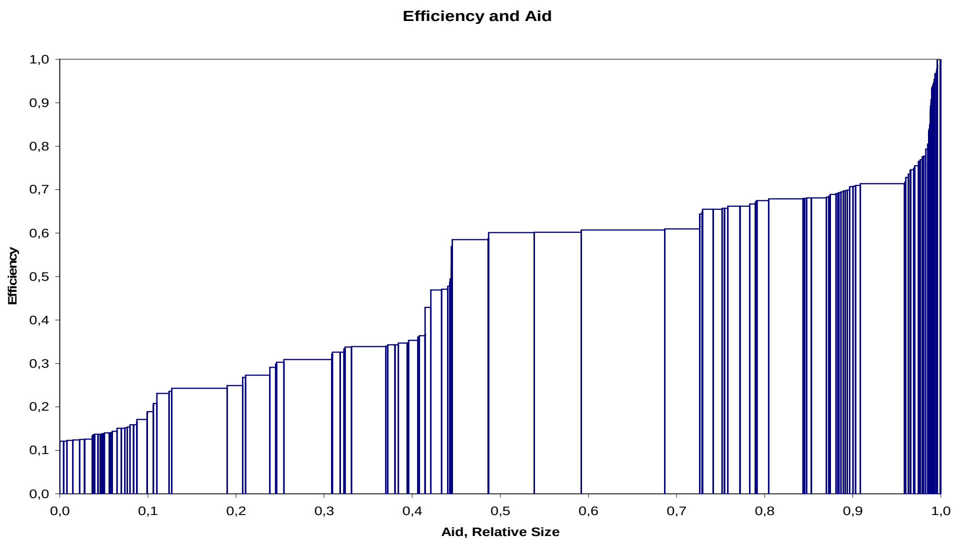

Figure 2: Efficiency and Aid

Appendix 1 Efficiency development 1995 – 2000

Table A1a: Output increasing efficiency (E) development, Sub-Saharan Africa, 1995-2000

	Year	E		Year	E		Year	E
Cote d'Ivoire	1995	0.894	Kenya	1995	0.393	Tanzania	1995	0.389
	1996	0.925		1996	0.381		1996	0.4
	1997	0.936		1997	0.367		1997	0.398
	1998	0.975		1998	0.351		1998	0.382
	1999	0.929		1999	0.316		1999	0.356
	2000	0.876		2000	0.292		2000	0.347
Cameroon	1995	0.628	Mozambique	1995	0.5	South Africa	1995	0.893
	1996	0.653		1996	0.481		1996	0.895
	1997	0.653		1997	0.517		1997	0.892
	1998	0.676		1998	0.558		1998	0.854
	1999	0.688		1999	0.55		1999	0.841
	2000	0.666		2000	0.495		2000	0.836
Ethiopia	1995	0.378	Nigeria	1995	1	Zambia	1995	0.376
	1996	0.393		1996	1		1996	0.379
	1997	0.384		1997	0.998		1997	0.385
	1998	0.35		1998	1		1998	0.346
	1999	0.334		1999	0.974		1999	0.325
	2000	0.332		2000	1		2000	0.304
Ghana	1995	1	Senegal	1995	1	Zimbabwe	1995	0.533
	1996	1		1996	1		1996	0.543
	1997	1		1997	0.994		1997	0.509
	1998	0.655		1998	1		1998	0.368
	1999	0.473		1999	0.999		1999	0.283
	2000	1		2000	0.996		2000	0.251

Table A1b: Output increasing efficiency (E) development, East Asia and the Pacific, 1995-2000

	Year	E		Year	E		Year	E
China	1995	1	Malaysia	1995	0.745	Thailand	1995	0.811
	1996	1		1996	0.734		1996	0.781
	1997	1		1997	0.697		1997	0.694
	1998	1		1998	0.569		1998	0.574
	1999	0.996		1999	0.588		1999	0.604
	2000	1		2000	0.615		2000	0.618
Indonesia	1995	0.137	Philippines	1995	0.651			
	1996	0.137		1996	0.656			
	1997	0.135		1997	0.634			
	1998	0.144		1998	0.567			
	1999	0.141		1999	0.573			
	2000	0.137		2000	0.557			
Korea, Rep.	1995	1	Singapore	1995	0.946			
	1996	1		1996	0.971			
	1997	0.925		1997	0.985			
	1998	0.794		1998	0.853			
	1999	0.85		1999	0.88			
	2000	0.885		2000	0.933			

Table A1c: Output increasing efficiency (E) development, Latin America and the Caribbean, 1995-2000

	Year	E		Year	E		Year	E
Argentina	1995	0.931	Ecuador	1995	1	Ecuador	1995	1
	1996	0.956		1996	0.945		1996	0.945
	1997	0.995		1997	1		1997	0.792
	1998	1		1998	0.591		1998	0.806
	1999	0.96		1999	1		1999	0.807
	2000	0.946		2000	1		2000	0.775
Bolivia	1995	0.917	Guatemala	1995	0.925	Panama	1995	1
	1996	0.908		1996	0.9		1996	0.94
	1997	0.888		1997	0.848		1997	0.911
	1998	0.865		1998	0.817		1998	0.848
	1999	0.814		1999	0.819		1999	0.82
	2000	0.786		2000	0.767		2000	0.78
Brazil	1995	1	Honduras	1995	1	Peru	1995	0.856
	1996	0.988		1996	1		1996	0.833
	1997	0.985		1997	0.974		1997	0.846
	1998	0.951		1998	0.83		1998	0.796
	1999	0.858		1999	0.763		1999	0.763
	2000	0.877		2000	0.715		2000	0.764
Chile	1995	0.825	Haiti	1995	1	Paraguay	1995	1
	1996	0.81		1996	0.913		1996	0.913
	1997	0.798		1997	0.884		1997	0.863
	1998	0.754		1998	0.814		1998	0.971
	1999	0.69		1999	0.794		1999	1
	2000	0.689		2000	1		2000	1
Colombia	1995	0.965	Jamaica	1995	1	El Salvador	1995	0.997
	1996	0.913		1996	0.937		1996	0.968
	1997	0.894		1997	0.967		1997	0.959
	1998	0.84		1998	0.942		1998	0.944
	1999	0.78		1999	0.877		1999	0.931
	2000	0.774		2000	0.806		2000	0.907
Costa Rica	1995	1	Mexico	1995	0.948	Trinidad and Tobago	1995	1
	1996	0.974		1996	0.955		1996	0.983
	1997	0.979		1997	0.987		1997	0.936
	1998	0.991		1998	0.978		1998	0.903
	1999	1		1999	0.973		1999	0.899
	2000	0.963		2000	1		2000	0.905
Dominican Republic	1995	0.721	Nicaragua			Venezuela	1995	0.384
	1996	0.747		1996	0.778		1996	0.228
	1997	0.775		1997	•		1997	0.21
	1998	0.786		1998	•		1998	0.186
	1999	0.795		1999	•		1999	0.158
	2000	0.805		2000	•		2000	0.149

- Data not available

Table A1d: Output increasing efficiency (E) development, Middle East and North Africa, 1995-2000

	Year	E		Year	E		Year	E
Cyprus	1995	1	Iran	1995	0.496	Morocco	1995	0.76
	1996	0.983		1996	0.501		1996	0.828
	1997	1		1997	0.501		1997	0.782
	1998	0.987		1998	0.491		1998	0.816
	1999	0.997		1999	0.483		1999	0.785
	2000	1		2000	0.486		2000	0.754
Algeria	1995	0.371	Israel	1995	1	Tunisia	1995	0.67
	1996	0.357		1996	0.982		1996	0.693
	1997	0.344		1997	0.946		1997	0.701
	1998	0.349		1998	0.917		1998	0.704
	1999	0.33		1999	0.893		1999	0.716
	2000	0.309		2000	0.907		2000	0.711
Egypt	1995	0.682	Jordan	1995	0.713	Turkey	1995	0.85
	1996	0.697		1996	0.691		1996	0.75
	1997	0.719		1997	0.682		1997	0.637
	1998	0.737		1998	0.681		1998	0.525
	1999	0.757		1999	0.688		1999	0.392
	2000	0.767		2000	0.701		2000	0.341

Table A1e: Output increasing efficiency (E) development, South Asia, 1995-2000

	Year	E		Year	E
Bangladesh	1995	0.965	Sri Lanka	1995	0.298
	1996	0.961		1996	0.231
	1997	0.955		1997	0.218
	1998	0.941		1998	0.209
	1999	0.926		1999	0.181
	2000	0.913		2000	0.159
India	1995	0.14	Pakistan	1995	0.159
	1996	0.141		1996	0.157
	1997	0.138		1997	0.152
	1998	0.137		1998	0.151
	1999	0.138		1999	0.152
	2000	0.134		2000	0,154

Appendix 2 Geographical Categories, in accordance with World Development Indicators (World Bank *2006*).

Category Sub-Saharan Africa (SSA)

IVORY COAST, CAMEROON, ETHIOPIA, GHANA, KENYA, MADAGASCAR, MALI, MOZAMBIQUE, MAURITIUS, MALAWI, NIGERIA, RWANDA, SENEGAL, SIERRA LEONE, TANZANIA, UGANDA, SOUTH AFRICA, ZAMBIA, ZIMBABWE

Category East Asia and Pacific (EAP)

CHINA, INDONESIA, KOREA REP., MALAYSIA, PHILIPPINES, SINGAPORE, THAILAND

Category Latin America and Caribbean (LAC)

ARGENTINA, BOLIVIA, BRAZIL, CHILE, COLOMBIA, COSTA RICA, DOMINICAN REP. ECUADOR, GUATEMALA, GUYANA, HONDURAS, HAITI, JAMAICA, MEXICO, NICARAGUA, PANAMA, PERU, PARAGUAY, EL SALVADOR, TRINIDAD and TOBAGO, VENEZUELA

Category Middle East and North Africa (MNA)

CYPRUS, ALGERIA, EGYPT, IRAN, ISRAEL, JORDAN, MOROCCO, TUNISIA, TURKEY

Category South Asia (SAS)

BANGLADESH, INDIA, SRI LANKA, PAKISTAN

Appendix 3 Efficiency and Factor Intensity, 1995-2000