

## 2. Comparative analysis of costs of some selected infrastructure components across Africa: Results from the 2005 International Comparison Program for Africa (ICP-Africa)

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### **Abstract**

*The economic growth and development of a country depend on a solid infrastructure and the robustness of systems that have been put in place. Together, these constitute a nation's "engine of growth" and include housing, water, electricity, transportation, communication, and construction. It is postulated that the cost of doing business in Africa is much higher than in other regions, largely because of the poor quality of its infrastructure and to accessibility constraints. This paper analyzes the distribution of price levels of these economic drivers, which contribute to the cost of doing business in Africa. Price level indices (PLIs) have been calculated to provide a comparison of the cost of selected infrastructure components across African countries. The data were collected from the 2005 round of the International Comparison Program (ICP) in Africa, covering 48 out of a total of 52 countries and 22 major aggregates of the national accounts.*

**Key words:** GDP per capita, real levels of GDP, purchasing power parities, infrastructure

*Analyse comparative des coûts de certaines composantes choisies d'infrastructure à travers l'Afrique: résultats du Programme de comparaison internationale 2005 pour l'Afrique (PCI-Afrique)*

### **Résumé**

*La croissance économique et le développement d'un pays dépendent d'une infrastructure solide et la robustesse des systèmes mis en place. Ensemble, ils constituent le "moteur de croissance" d'une nation et comprennent le logement, l'eau, l'électricité, le transport, la communication, et la construction. Il est admis que le coût de faire des affaires en Afrique est beaucoup plus élevé que dans d'autres régions, principalement en raison de la mauvaise qualité de son infrastructure et à des contraintes d'accessibilité. Cet article analyse la distribution des niveaux*

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*de prix de ces facteurs économiques, qui contribuent au coût de faire des affaires en Afrique.*

*Des indices de niveau de prix (INP) ont été calculés pour faire une comparaison du coût des composantes d'infrastructure choisies à travers les pays africains. Les données ont été recueillies à partir du cycle 2005 du Programme de comparaison internationale pour l'Afrique (PCI-Afrique), qui a couvert 48 sur un total de 52 pays et 22 grands agrégats des comptes nationaux.*

**Mots clés:** PIB par habitant, niveaux réels du PIB, parités de pouvoir d'achat (PPA)

## 1. INTRODUCTION

The incentive to invest in an economic activity is affected by factors such as the cost of labor, the available infrastructure (e.g., transportation and ICT), and the regulatory and fiscal environment. A potential investor will be drawn to regions or countries that promise to deliver the greatest economic gains. A measure for making such comparisons is the price level index (PLI),<sup>4</sup> which is derived by dividing the purchasing power parity (PPP) index by the corresponding exchange rate. A PLI represents the average percentage by which the prices of goods and services in country X, when converted into country Z's currency at the current exchange rate, exceed or fall below the prices of the same goods and services in country Z. Because the PLI is usually measured in percentages, a PLI of 100 denotes that the price levels in both countries are the same. A higher or lower PLI indicates higher or lower costs, respectively. When currencies are converted using market exchange rates, they provide a comparison at a single point in time of relative purchasing power of one currency over another. However, this is a somewhat distorted picture, since exchange rates are volatile and the comparison does not take the price levels into account. Price level indices are better determinants. They can be used to make investment decisions, for example, whether to transfer capital from one country to another, or whether to alter the composition of an investment portfolio by switching

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4 PPPs and PLIs can also be used by international organizations and companies as equalizing factors for wages and salaries in order to compensate for purchasing power losses or gains experienced by employees working abroad ("correction coefficients"). The IMF, for instance, has used purchasing power parity (PPP) adjusted Gross Domestic Product (GDP) measures in their *World Economic Outlook* (WEO) since 1993, and, more recently, in the formula used to guide decisions on the distribution of members' quotas. PLIs are not intended to rank countries in a strict hierarchy. Rather, they indicate the order of magnitude of the price level in one country in relation to others.

economic activities, depending on the comparative advantage and economies of scale in one country over another.

According to the paper, “Overhauling the Engine of Growth: Infrastructure in Africa” (Foster, 2008), African countries devote 6% to 8% of their GDP to infrastructure. Calderón and Servén (2008) argue that across Africa, infrastructure contributed 99 basis points to per capita economic growth over the 1990-to-2005 period, whereas the contribution of structural policies represented 68 basis points. This infrastructural contribution is almost entirely attributable to advances in the telecommunications sector. Foster notes that deterioration in the energy infrastructure over the same period has had a significant lagging effect on economic growth in a number of African countries.

The paper by Olu Ajakaiye and Mthuli Ncube, “Infrastructure and Economic Development in Africa: An overview,” argues that the cost of doing business in Sub-Saharan Africa is higher than in any other global region, with infrastructure services making up a disproportionately large part of production and trade costs. This viewpoint is supported by the World Economic Forum’s *Global Competitiveness Report 2010-2011*, which points out that although some African countries such as South Africa and Mauritius have made great strides, Sub-Saharan Africa as a whole lags behind the rest of the world in terms of competitiveness. This is largely attributable to a severe deficit in the quality, quantity, and ease of access to infrastructure services. Although some schools of thought suggest that the relationship between infrastructure development and economic development is far from clear-cut, evidence from other studies indicates that good infrastructure is making a major contribution to reducing inequality and improving growth in all regions of the world except Africa. The poor quality and low level of accessibility of Africa’s infrastructure negatively impacts the continent’s productivity and growth, and acts as a major disincentive to FDI and domestic investment, as well as curtailing international trade.

A working paper by the African Development Bank, “Infrastructure Deficit and Opportunities in Africa” (AfDB, 2010), highlights the role of infrastructure in improving a nation’s competitiveness and in facilitating domestic and international trade. Poor infrastructure means higher delivery costs, which, in turn, increase the price of goods in domestic and export markets. Moreover, this must be set against the background of the recent fuel and food crises, which led to hikes and volatility in commodity prices, rendering Africa more vulnerable to exogenous shocks and further weakening its competitiveness.

## **2. METHODOLOGY**

This paper provides a cost comparison for selected infrastructure components across countries using PLIs. It defines the PLI as the ratio of PPP to a corresponding market exchange rate. The PPPs were calculated using the African average as the base, i.e., they were normalized with the average for Africa = 1.0. The PLI is not designed to measure inflation from one year to the next; rather, it is used to compare the cost of six selected infrastructure components—housing, water, electricity, transportation, communication, and construction—among 48 African countries, using price data collected from the International Comparison Program (ICP) round of 2005. The infrastructure components selected represent major drivers of an economy's development.

A descriptive analysis of each of the six infrastructure components is provided. A Principal Component Analysis (PCA) is performed to explain the variation of a few uncorrelated linear combinations of the original variables. This was undertaken to shed light on the multivariate nature of the infrastructure components and to identify similarities among countries. However, because PCA is an exploratory method, the question of whether these objectives can be achieved through the use of principal components cannot be ascertained in advance of the analysis of the numerical results. The paper concludes with a summary of results.

## **3. PRICE LEVEL INDICES (PLI) RESULTS**

The price level indices for the six selected infrastructure components are presented in Table 1.

**Table 1. Price level indices for infrastructure components by country, Africa region (Average = 1.00)**

COUNTRY	Housing	Water	Electricity	Gas	Other Fuels	Transport	Communication	Construction
Angola	0.66	4.44	1.20	0.82	2.43	1.47	1.72	1.24
Benin	0.76	0.97	0.59	0.78	0.61	0.87	1.62	0.70
Botswana	1.17	1.51	1.27	1.67	1.34	1.07	0.82	0.94
Burkina Faso	0.70	0.82	0.62	0.69	0.76	1.12	1.25	0.89
Burundi	0.74	0.38	1.05	2.49	0.61	0.89	0.38	0.60
Cameroon	1.02	0.89	0.82	0.90	1.03	0.87	1.54	1.13
Cape Verde	4.47	4.19	1.13	1.24	1.42	1.12	1.02	1.30
Central African Republic	0.35	0.86	1.01	2.17	0.65	1.35	1.30	1.19
Chad	0.34	1.24	1.00	1.51	0.91	1.10	1.60	1.30
Comoros	1.73	1.22	1.73	2.22	...	1.37	1.20	0.82
Congo	1.31	1.61	0.83	0.88	1.08	1.24	1.63	1.98
Congo, Democratic Rep	1.08	1.08	2.03	3.64	1.56	1.34	1.70	0.74
Côte d'Ivoire	1.08	1.17	0.70	0.65	1.04	1.17	1.50	3.03
Djibouti	1.13	0.83	1.51	1.69	1.85	1.16	0.94	0.91
Egypt	0.92	0.66	2.44	3.19	2.57	0.40	0.65	0.54
Equatorial Guinea	1.69	...	1.42	1.22	2.30	1.29	2.06	2.24
Ethiopia	0.65	0.36	0.93	1.11	1.08	0.49	0.50	0.57
Gabon	2.02	1.99	1.21	1.10	1.84	1.27	1.62	1.04
Gambia	0.19	0.68	1.03	1.77	0.83	0.82	0.57	0.83
Ghana	0.15	1.19	0.66	0.59	1.01	0.86	0.99	0.83
Guinea	0.47	0.77	0.87	2.56	0.41	0.81	0.79	0.78
Guinea-Bissau	0.58	1.26	1.17	1.78	1.06	1.06	2.34	0.78
Kenya	0.45	1.39	0.98	1.63	0.81	0.94	1.34	0.93
Lesotho	0.78	1.47	0.95	1.44	0.87	1.01	1.34	1.53
Liberia	1.53	3.68	1.20	2.52	0.79	1.24	1.24	1.22
Madagascar	1.02	0.36	0.69	1.43	0.46	0.83	0.71	0.67
Malawi	0.53	2.05	1.03	2.57	0.57	1.10	1.30	0.35

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<b>COUNTRY</b>	<b>Housing</b>	<b>Water</b>	<b>Electricity</b>	<b>Gas</b>	<b>Other Fuels</b>	<b>Transport</b>	<b>Communication</b>	<b>Construction</b>
Mali	1.08	0.81	0.82	1.24	0.76	0.95	1.17	1.09
Mauritania	0.32	1.68	0.95	0.78	1.59	0.88	1.15	0.84
Mauritius	2.06	0.67	0.54	0.70	0.57	1.19	0.49	1.09
Morocco	1.63	2.35	0.73	0.41	1.78	1.00	0.97	1.32
Mozambique	0.49	0.92	0.67	1.03	0.61	1.16	1.28	1.54
Namibia	1.95	2.27	1.99	2.27	2.40	1.13	1.21	1.51
Niger	0.66	1.08	0.91	1.26	0.90	1.02	1.20	0.84
Nigeria	0.52	1.15	1.26	1.78	1.23	0.79	1.14	1.10
Rwanda	1.31	0.59	0.72	0.94	0.76	0.88	0.95	0.80
Sao Tome and Principe	0.87	1.74	1.51	2.26	1.40	0.96	1.22	1.18
Senegal	0.73	1.52	1.20	1.42	1.40	0.99	0.74	0.92
Sierra Leone	0.34	1.97	0.86	1.97	0.52	0.89	1.47	0.61
South Africa	1.78	1.21	1.57	2.06	1.66	1.08	0.99	1.56
Sudan	0.78	2.45	0.90	0.54	2.04	0.79	1.03	1.33
Swaziland	1.74	1.80	1.95	1.58	3.32	1.00	1.13	1.34
Tanzania	0.76	1.75	1.10	2.05	0.81	0.82	1.21	0.76
Togo	0.45	1.19	0.52	0.55	0.68	0.99	1.62	1.26
Tunisia	1.57	0.40	0.82	0.37	2.52	0.98	0.69	0.90
Uganda	0.90	1.36	0.84	1.95	0.50	0.93	1.37	0.88
Zambia	2.65	0.42	1.13	1.93	0.91	1.30	2.28	1.09
Zimbabwe	4.85	...	5.54	...	5.83	3.56	2.28	1.28
Average	1,00	1,00	1,00	1,00	1,00	1,00	1,00	1,00
Standard deviation	0,93	0,91	0,77	0,75	0,95	0,42	0,46	0,46
Coefficient of Variation (%)	93	91	77	75	95	42	46	46

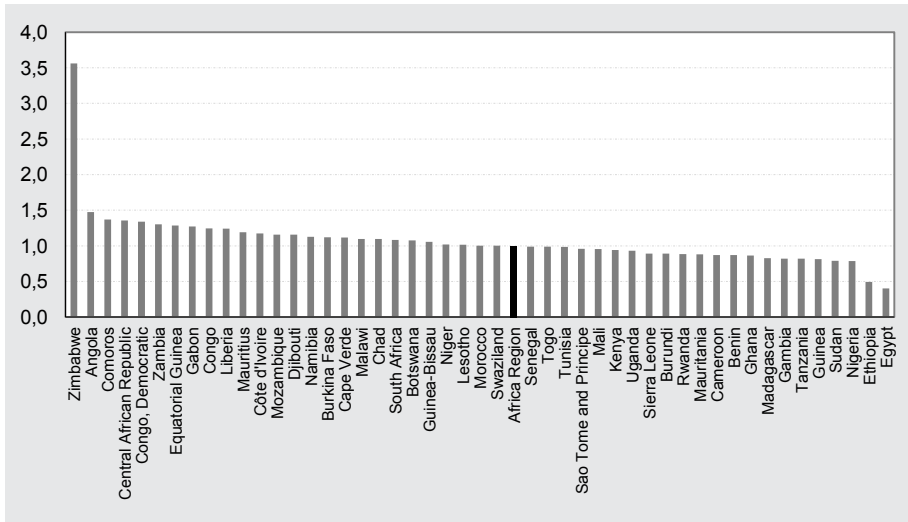
Note: Ellipsis (...) indicates that the data were not submitted.

### 3.1 Infrastructure components

#### *Transportation*

This component includes passenger transportation by railroad, road, air, sea and inland waterways, and other purchased transport services. Figure 1 shows a ranking of countries from the most to the least expensive transportation price levels. The distribution of PLI varies widely, resulting in a relative variation (coefficient of variation)<sup>5</sup> of 39.4%. This could be attributed to the high cost of air travel on the continent. Poor road and rail networks in many parts of Africa, and between ports and the hinterland, also contribute to high transport costs, and therefore, high PLIs. In 22 of 48 countries (nearly half), the transport PLIs are less than 1.0, ranging from 0.4 (Egypt) to 0.99 (Senegal).

**Figure 1: Transport, most and least expensive countries (2005, Africa = 1.0)**



Source: Results of the International Comparison Program-Africa, 2005

Costs were highest in Zimbabwe, followed by Angola, Comoros, and the Central African Republic. The countries with the lowest costs were Egypt, Ethiopia, and Nigeria. The transport PLI for Zimbabwe—more than 250% above the African average—is an outlier, and, in part, reflects the massive inflation the country was experiencing as a result of its economic crisis. As

<sup>5</sup> The coefficient of variation is the standard deviation of the PLIs of countries as a percentage of their average PLI. The higher the coefficient, the higher the price dispersion across countries.

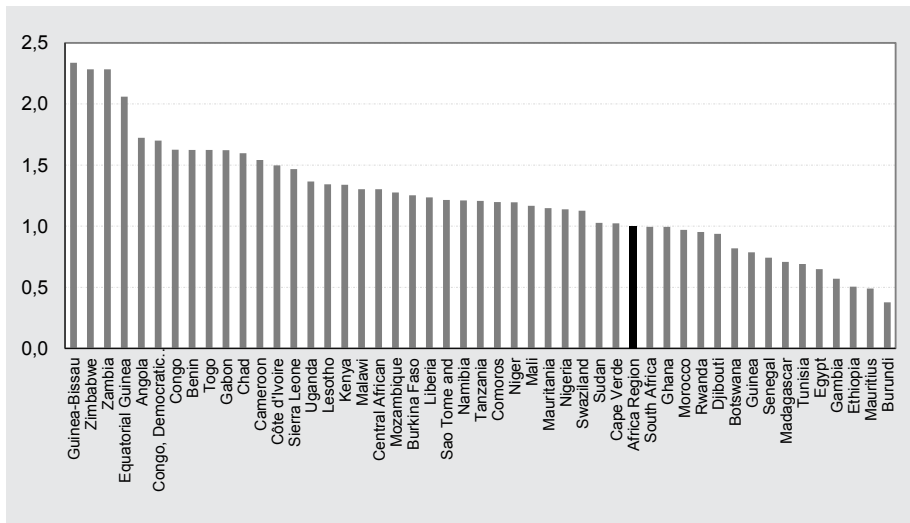
well, the economic embargo imposed on the country would likely have contributed to deterioration in its infrastructure.

As indicated earlier, PLIs are not intended to rank countries in a strict hierarchy, but rather, to indicate the magnitude of price levels in one country relative to others. A counter-intuitive finding is that price levels of neighboring countries are not always of the same order of magnitude.

**Communication**

Communication includes postal services, telephone (cell phones and land-lines), internet, etc. These services facilitate communication for public and private enterprises within and between countries. Figure 2 shows that Guinea-Bissau, Zimbabwe, and Zambia have the highest communication PLIs, and Burundi, Mauritius, Ethiopia, The Gambia and Egypt, the lowest. Guinea-Bissau, the most expensive, has a communication PLI of 2.34, while Burundi is the cheapest at 0.38. The coefficient of variation is about 37%, indicating relatively high price variation among countries.

**Figure 2: Communication, most and least expensive countries (2005, Africa = 1.0)**



Source: Results of the International Comparison Program-Africa, 2005

Thirty-four countries (71%) record PLIs for communication above the African average, ranging from 1.02 in Cape Verde to 2.34 in Guinea-Bissau.

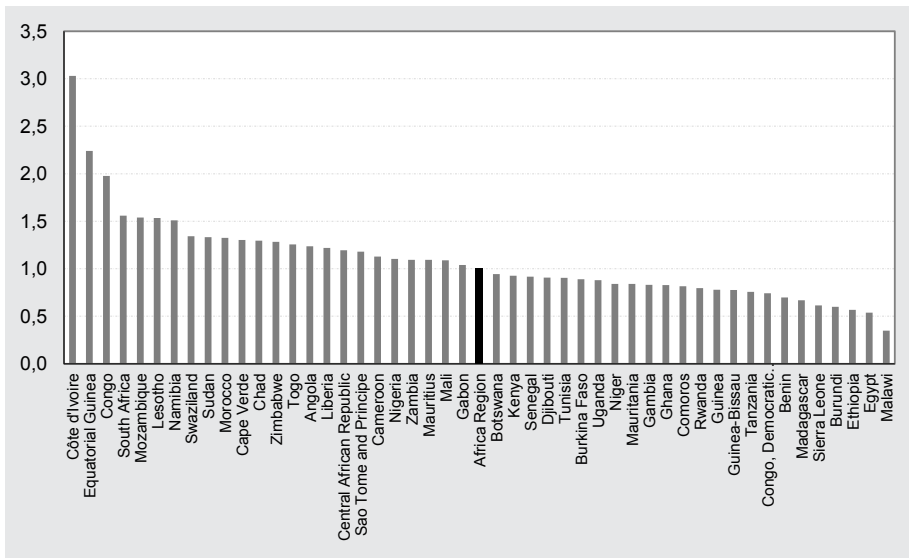


Intuitively, the cost of telecommunication services between neighboring countries or those located in regional economic communities (RECs) might be expected to be roughly equivalent. However, based on the price data collected from the ICP 2005 round, this is not the case. Provision of communication services, particularly for telephones, seems to be differentiated and fragmented across countries. And even when countries share the same service provider, the cost of the service often varies widely, for instance, for mobile telephony.

**Construction**

This includes construction of residential buildings, non-residential buildings, and civil engineering works. PLIs vary widely among countries, with a coefficient of variation of 42.5%. PLIs for construction were lowest in Malawi, Egypt, Ethiopia, and Burundi—Malawi was the cheapest at 0.35. The highest PLIs were in Côte d’Ivoire, Equatorial Guinea, Congo Republic, South Africa, and Lesotho. Côte d’Ivoire recorded the highest costs, at 50% above the African average.

**Figure 3: Construction, most and least expensive countries (2005, Africa = 1.0)**

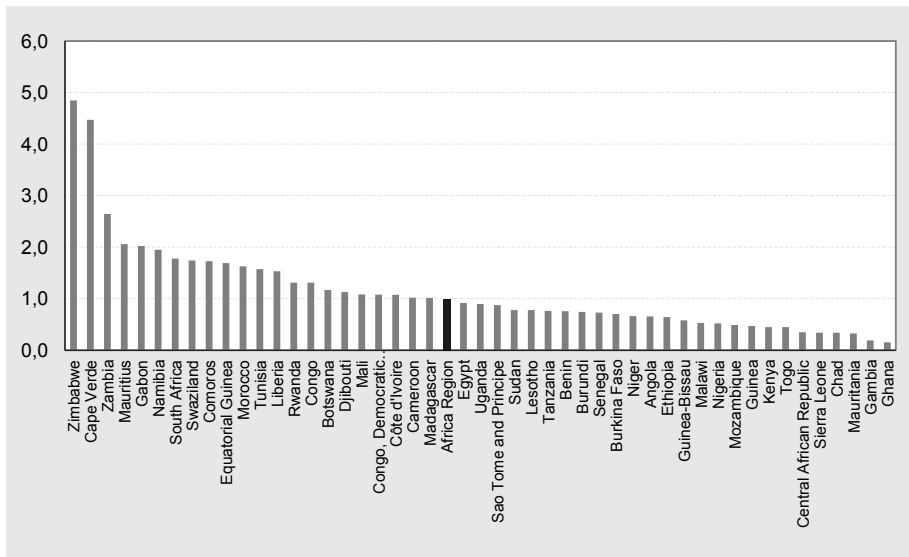


Source: Results of the International Comparison Program-Africa, 2005

### *Housing*

This component includes actual and imputed rentals for housing and maintenance, plus the cost of repair for dwellings. The distribution of the PLIs for housing in Figure 4 shows that Zimbabwe is, by far, the most expensive country, followed by Cape Verde, Zambia, and Mauritius. At the other end of the scale, Ghana enjoys the lowest housing costs, followed by The Gambia and Mauritania. The coefficient of variation for the housing PLI is 81.4%, revealing significantly high variation among countries.

**Figure 4: Housing, most and least expensive countries (2005, Africa = 1.0)**

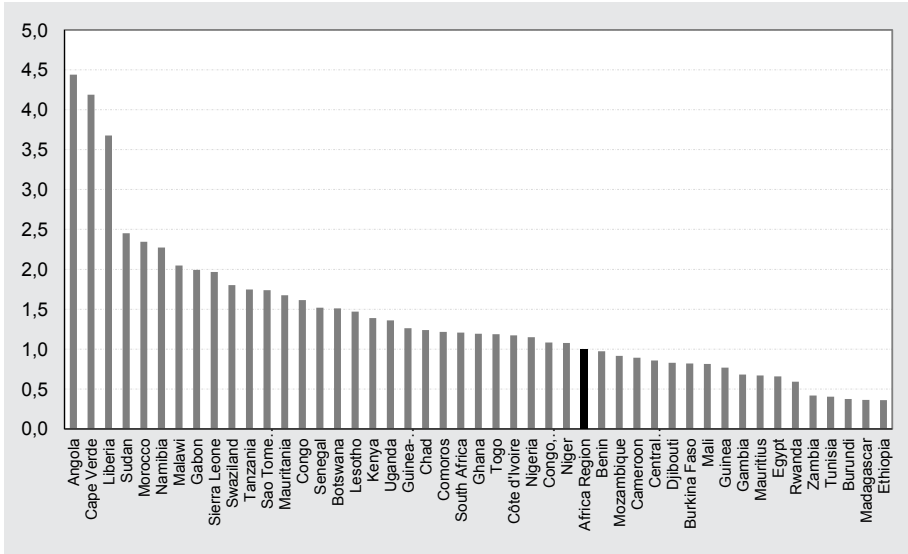


Source: Results of the International Comparison Program-Africa, 2005

### *Water*

This includes water supply and miscellaneous services, such as sanitation and sewage. Also included are associated costs such as the hire of meters, the reading of meters, and standing charges. The cost excludes drinking water sold in bottles or containers, and hot water or steam supplied by distinct heating plants. The distribution of water PLIs in Figure 5 shows high price dispersion across countries, indicated by a coefficient of variation of 64.7%. Water is most expensive in Angola, followed by Cape Verde and Liberia, while it is cheapest in Ethiopia, Madagascar, Burundi, Tunisia, and Zambia.

**Figure 5: Water, most and least expensive countries (2005, Africa = 1.0)**

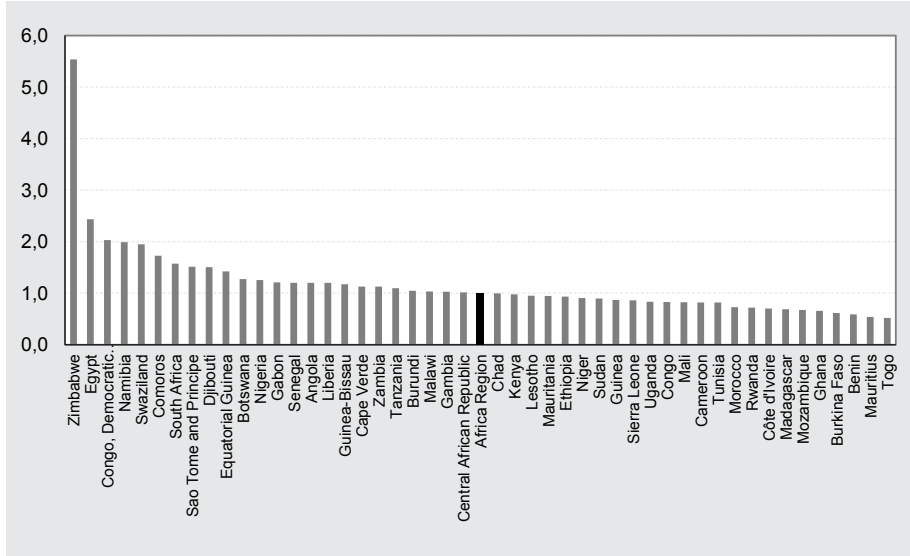


Source: Results of the International Comparison Program-Africa, 2005

**Electricity**

The PLI for electricity includes associated costs, such as the hire and reading of meters and standing charges. Figure 6 shows substantial price variation across countries, indicated by a coefficient variation of 64.9%. The cost of electricity in Zimbabwe is, by far the highest, with prices 454% above the African average. The two countries with the next highest costs (though far below Zimbabwe) are Egypt and the Democratic Republic of Congo. Prices in the latter might be expected to be lower, given the country’s production potential, but the 2005 ICP data refute this. The lowest electricity costs are in Togo, Mauritius, and Benin.

**Figure 6: Electricity, most and least expensive countries (2005, Africa = 1.0)**



Source: Results of the International Comparison Program-Africa, 2005

**Principal Component Analysis and scatter plot**

A Principal Component Analysis (PCA) for all the infrastructure components under study (housing, water, electricity, transportation, communication, and construction) was performed to explain the total variation with a few uncorrelated linear combinations of the original variables, called **principal components**. The number of principal components in the analysis is less than or equal to the number of original variables. This transformation is defined so that the first principal component has the highest possible variance among all linear combinations of the original variables, while each succeeding component has the next highest variance possible under the constraint that it be uncorrelated with the preceding components.

The PCA in Table 2 shows that most of the total variation is explained by the first four principal components (83%), with the first two accounting for 57%. The correlation coefficients of these components with variables used in the analysis are presented in Table 3. The first number is the correlation coefficient and the second number in parentheses is the observed significance level (OSL) of the null hypothesis of a zero correlation coefficient.

**Table 2: Proportion of variation explained by first four components**

Component	Eigen value	Difference	Proportion	Cumulative
Component 1	2.182	0.942	36%	36%
Component 2	1.240	0.351	21%	57%
Component 3	0.889	0.208	15%	72%
Component 4	0.684	---	11%	83%

Source: Results of the International Comparison Program-Africa, 2005

**Table 3: Correlation coefficients of the three principal components with variables**

Infra-structure components	Component 1	Component 2	Component 3	Component 4
Housing	0.57 (<0.0001)	0.52 (0.0002)	-0.39 (0.006)	0.09 (0.527)
Water	0.66 (<0.0001)	0.24 (0.097)	-0.005 (0.973)	-0.66 (<0.0001)
Electricity	0.17 (0.247)	0.76 (<0.0001)	0.45 (0.002)	0.33 (0.023)
Transportation	0.81 (<0.0001)	-0.17 (0.254)	0.13 (0.380)	0.11 (0.468)
Communication	0.59 (<0.0001)	-0.45 (0.001)	0.55 (<0.0001)	0.045 (0.767)
Construction	0.61 (<0.0001)	-0.302 (0.041)	-0.46 (0.0013)	0.34 (0.022)

Source: Results of the International Comparison Program-Africa, 2005

The first component, which accounts for about 36% of the total variation, is correlated with housing (0.57), water (0.66), transportation (0.81), communication (0.59), and construction (0.61). It may be interpreted as a measure of price levels on all infrastructure components except electricity. Countries with relatively high costs for housing, water, transport, communication, and construction will have large values for this component.

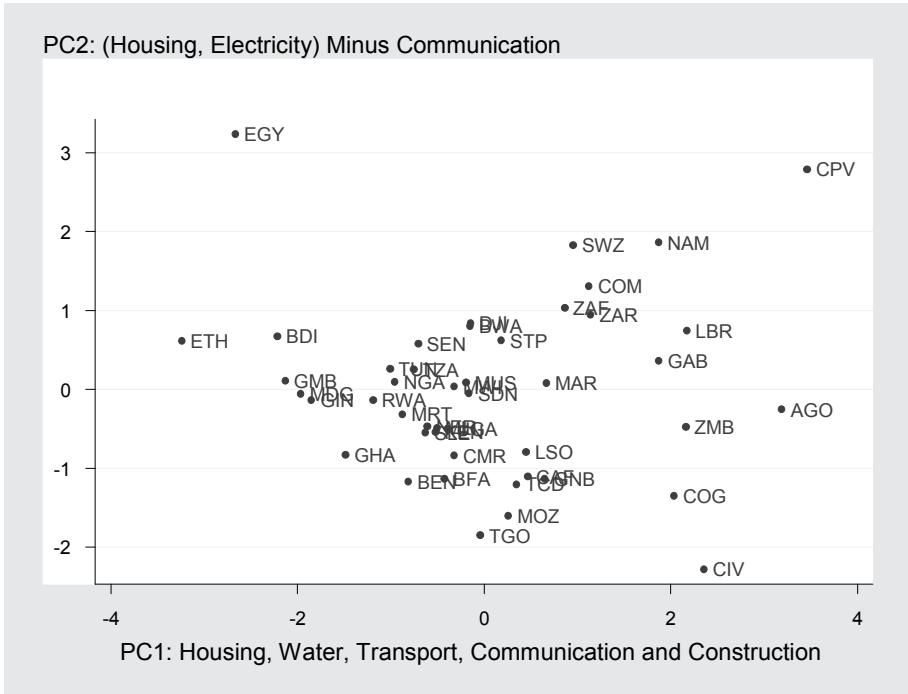
The second component is positively correlated with housing (0.52) and electricity (0.76), and negatively correlated with communication (-0.45) and construction (-0.30). Countries that have a high value for this component are characterized by high costs for electricity and housing and low costs for communication and construction.

The third component is positively correlated with electricity (0.45) and communication (0.55), and negatively correlated with housing (-0.39) and construction (-0.46). Countries with high values for these components will have high PLIs for electricity and communication, and low PLIs for construction and housing.

The fourth component is positively correlated with electricity (0.33) and construction (0.34), and negatively correlated with water (-0.66). Countries with high values for these components will have relatively high PLIs for electricity and construction and low PLIs for water.

A scatter plot of countries in the plane of the first two principal components is presented in Figure 7. From left to right, the plot shows the least expensive to the most expensive countries in terms of all infrastructure components except electricity. From the top down, it presents the most expensive countries for electricity and the cheapest for communication to the cheapest for electricity and the most expensive for communication. When the two dimensions are cross-tabulated, a possible grouping of countries into 15 clusters emerges. Some countries like Egypt, Cape Verde, Angola, and Zambia stand out and constitute single-element clusters. Within clusters, countries might be expected to exhibit similarities with respect to all components, but in some clusters, countries differ for one or two components. Country codes are presented in Annex 1.

**Figure 7: Countries Projections in the plan of principal components 1 and 2**



Source: Results of the International Comparison Program-Africa, 2005

The 15 possible clusters are:

*Cluster 1:* Egypt has the lowest costs for communication, construction and transportation; the third lowest cost for water; a low cost for housing; and the highest cost for electricity.

*Cluster 2:* Cape Verde is the most expensive for housing; the second most expensive for water; 30% above the African average for construction; 13% above the average for electricity; 12% above the average for transportation; and an average cost for communication.

*Cluster 3:* Angola has the highest costs for water and transportation; 20% above the average cost for electricity; 23% above the average for construction; 72% above the average for communication; and a low cost of housing (35% below the average).

*Cluster 4:* Zambia has the highest cost for communication; the second highest costs for transportation and housing; an above-average cost for electricity, the lowest cost for water; and an average cost for construction.

*Cluster 5:* Namibia and Swaziland have 84%, 103%, 96% and 42.5% above-average costs for housing, water, electricity and construction, respectively; an above-average cost for communication; and an average cost for transportation.

*Cluster 6:* Côte d'Ivoire and Congo Republic have the highest cost for construction (150% above average); the second lowest cost for electricity; and above-average costs for housing (19%), water (39%), transportation (21%), and communication (56%).

*Cluster 7:* Gabon and Liberia have above-average costs for all components, varying from 13% above average for construction to 183% above average for water. This cluster has 20%, 25%, 43% and 78% above-average costs for electricity, transportation, communication, and housing, respectively. The costs of water are higher in Liberia.

*Cluster 8:* Comoros, the Democratic Republic of Congo, and South Africa have average costs for construction, above-average costs for water (16%), and high to very high costs for transportation (26%), communication (29%), housing (52%), and electricity (77%).

*Cluster 9:* The cluster made up of Botswana, Djibouti, and São Tomé and Príncipe is characterized by average costs for housing, transportation, communication, and construction, but above-average costs for water (35%) and electricity (43%). Djibouti differs from the other cluster members in the cost of water.

*Cluster 10:* Burundi, Ethiopia, The Gambia, Guinea, and Madagascar make up this cluster, which has the lowest cost of communication, the second-lowest costs for housing, water, transportation, and construction, and a cost of electricity about 10% below average. The cost of housing in The Gambia is far below the cluster average, while the costs of water in The Gambia and Guinea are above the average.

*Cluster 11:* The cluster consisting of Central African Republic, Chad, Guinea-Bissau, Lesotho, Mozambique, and Togo has the lowest cost of housing; a below-average cost of electricity; and above-average costs of transportation (11%), water (15%), construction (26%), and communication (58%).



*Cluster 12:* The cluster made up of Kenya, Mali, Mauritania, Niger, Rwanda, Sierra Leone, and Uganda has below-average costs of housing (28%), electricity (14%) construction (15%), and transport (8%). It has above-average costs of water (26%) and communication (23%). In Rwanda, the cost of housing is far above the cluster average, and in Mauritania and Sierra Leone, the cost of water is also above the cluster average.

*Cluster 13:* Benin, Burkina Faso, Cameroon, and Ghana constitute this cluster, which has the lowest cost of electricity, below the regional -average costs for housing (35%) and construction (12%); average regional costs for water and transportation; and an above-average cost for communication (35%). Within the cluster, the price of housing in Cameroon is 37% above the cluster average, and in Ghana, it is 50% below the average.

*Cluster 14:* Nigeria, Senegal, Tanzania, and Tunisia make up this cluster which has below the regional average costs for housing and transportation (11%), communication (6%) and construction (8%). It has above the regional average costs for electricity (9%) and water (20%). Tunisia's cost of housing is far above (68%) the cluster average, while the cost of water is far below (80%) the cluster average.

*Cluster 15:* The cluster consisting of Malawi, Morocco, Mauritius, and Sudan is characterized by below-the regional average costs for electricity (21%) and communication (6%); average costs for transportation and construction, and above-the regional average costs of housing (24%) and water (87%). The cost of housing in Mauritius and Morocco is above the cluster average, while the cost of water in Mauritius is 120% below the cluster average.

#### 4. CONCLUSIONS

The costs of the infrastructure components examined in this study (housing, water, electricity, transport, communication, and construction) vary substantially among countries. And while it might be expected that the price levels of these infrastructure components in neighboring countries, or countries within the same regional economic communities, would be roughly similar, the price data collected from the ICP 2005 round show that this is not the case.

The variation in price levels suggests that policy frameworks in different countries, even those within the same regional economic communities, are not fully integrated, and so seem to be out of alignment with the prevailing

climate of support for integration at subregional and regional levels. Policy frameworks should aim to channel investment toward economic drivers that will accelerate economic transformation, and thus, productivity. According to the World Economic Forum,<sup>6</sup> the level of productivity determines the rates of return to investments in an economy. By extension, an improvement in productivity should increase trade and foster subregional and regional integration. Some studies have shown that infrastructure is key to creating an environment that attracts foreign direct investment (FDI), which should translate into sustainable economic development. This is more likely to occur in countries with policies support infrastructure development.

Country projections of the costs of infrastructure components indicate possible clustering on the basis of similarities. The results suggest that the costs of some components are unexpectedly cheaper in some clusters than in others. Further research is needed to better understand the dynamics that could improve the restructuring and to formulate evidenced-based policy and economic decisions.

The variation in the price levels of items such energy, communication, and transportation—essential to a country's competitiveness—should prompt African governments to direct more investment toward infrastructure. International and multilateral development agencies such as the African Development Bank should continue to prioritize and increase development funding for subregional and regional infrastructure projects.

There is also a need to define strategies and mechanisms for mobilizing resources and financing infrastructure. Various instruments for financing infrastructure within the framework of public–private partnerships (PPPs) have been considered by Mthuli Ncube in his paper on financing and managing infrastructure in Africa (Ncube, 2010). He analyzes various options, which include build-operate-transfer (BOT), build-own-operate-transfer (BOOT), design-bid-build (DBB), design-build-operate-maintain (DBOM), and design-build-finance-operate (DBFO). These proposals should be reviewed and implemented at national, subregional, and regional levels.

The present study reveals differences in price levels among countries, which, in part, may reflect current policies. The paper also argues for a better clustering or grouping approach for countries with similar attributes, to allow comparison on the basis of economic similarities within and outside the regional economic communities. It is recommended that this study be repeated by calculating price level indices for the 2006-to-2011 period, and

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6 World Economic Forum, *Global Competitiveness Report 2010–2011*, p. 4.

be expanded to include other economic variables. The objective is to gain a clearer understanding of the relationships between the variations in price levels of infrastructure services. Such an analysis would shed light not only on the relationship between the costs of infrastructure services in different countries, but also on the distortion in prices. Further, it would be an indication of the pace and direction of regional integration efforts aimed at enhancing investment and expanding trade.

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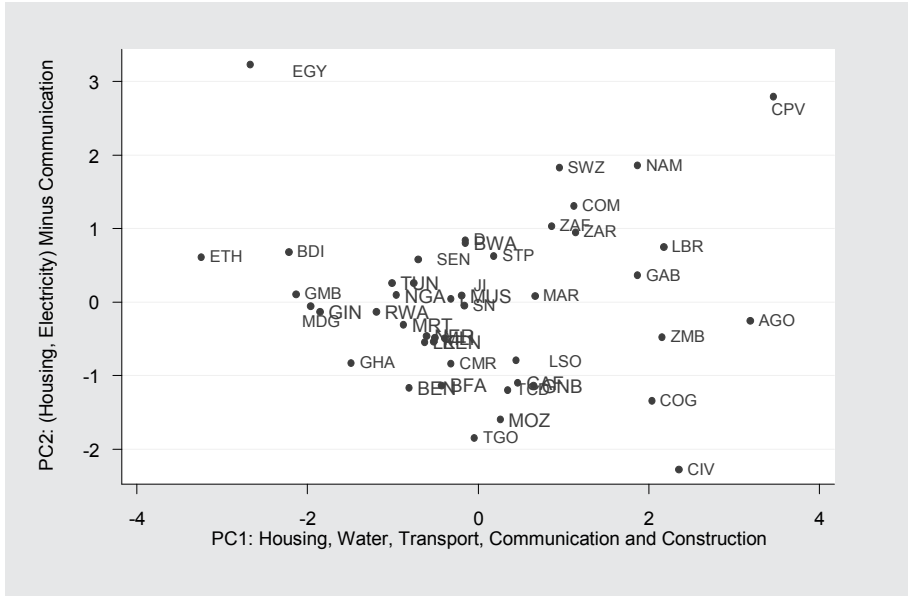
World Economic Forum (2010), *Global Competitiveness Report 2010–2011*. Geneva: World Economic Forum.

## ANNEX 1: COUNTRY CODES

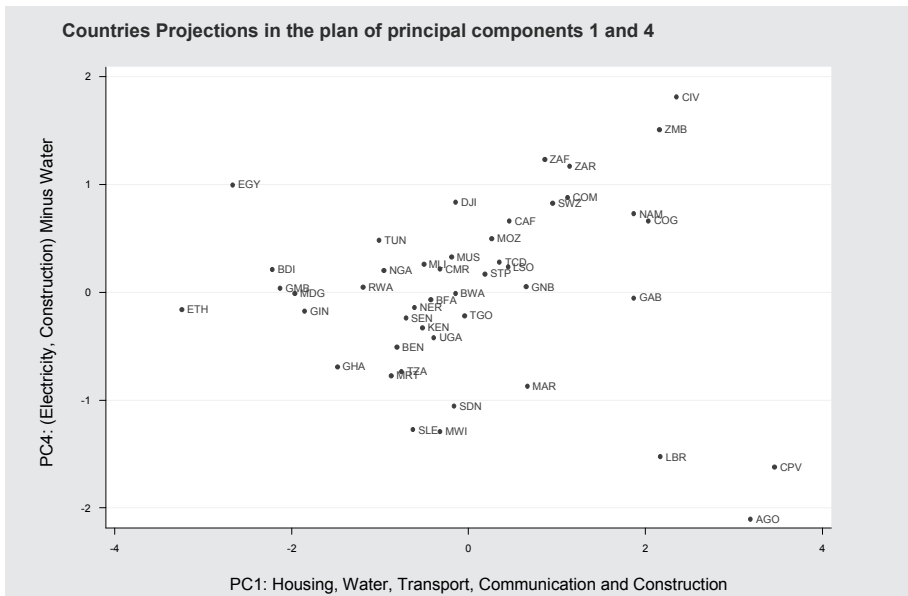
Country	Code	Country	Code
Algeria	DZA	Libya	LYB
Angola	AGO	Madagascar	MDG
Benin	BEN	Malawi	MWI
Botswana	BWA	Mali	MLI
Burkina Faso	BFA	Mauritania	MRT
Burundi	BDI	Mauritius	MUS
Cameroon	CMR	Morocco	MAR
Cape Verde	CPV	Mozambique	MOZ
Central African Republic	CAF	Namibia	NAM
Chad	TCD	Niger	NER
Comoros	COM	Nigeria	NGA
Congo	COG	Rwanda	RWA
Congo, Democratic Republic	ZAR	São Tomé and Príncipe	STP
Côte d'Ivoire	CIV	Senegal	SEN
Djibouti	DJI	Seychelles	SYC
Egypt	EGY	Sierra Leone	SLE
Equatorial Guinea	GNQ	Somalia	SOM
Eritrea	ERI	South Africa	ZAF
Ethiopia	ETH	Sudan	SDN
Gabon	GAB	Swaziland	SWZ
Gambia	GMB	Tanzania	TZA
Ghana	GHA	Togo	TGO
Guinea	GIN	Tunisia	TUN
Guinea-Bissau	GNB	Uganda	UGA
Kenya	KEN	Zambia	ZMB
Lesotho	LSO	Zimbabwe	ZWE
Liberia	LBR		

Source: Results of the International Comparison Program-Africa, 2005

**ANNEX 2: COUNTRIES PROJECTIONS IN THE PLAN OF FIRST FOUR PRINCIPAL COMPONENTS, WHICH EXPLAIN 83% OF TOTAL VARIATION**

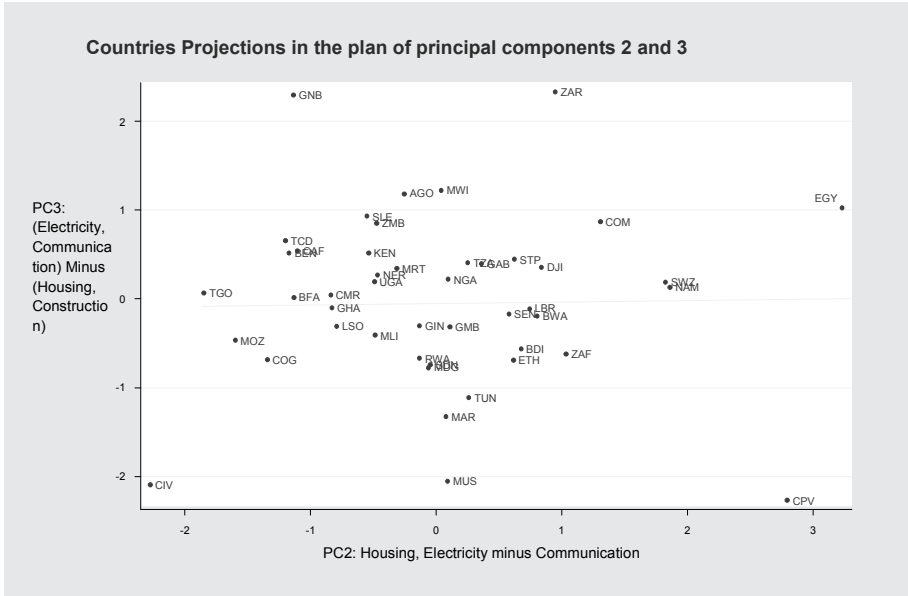


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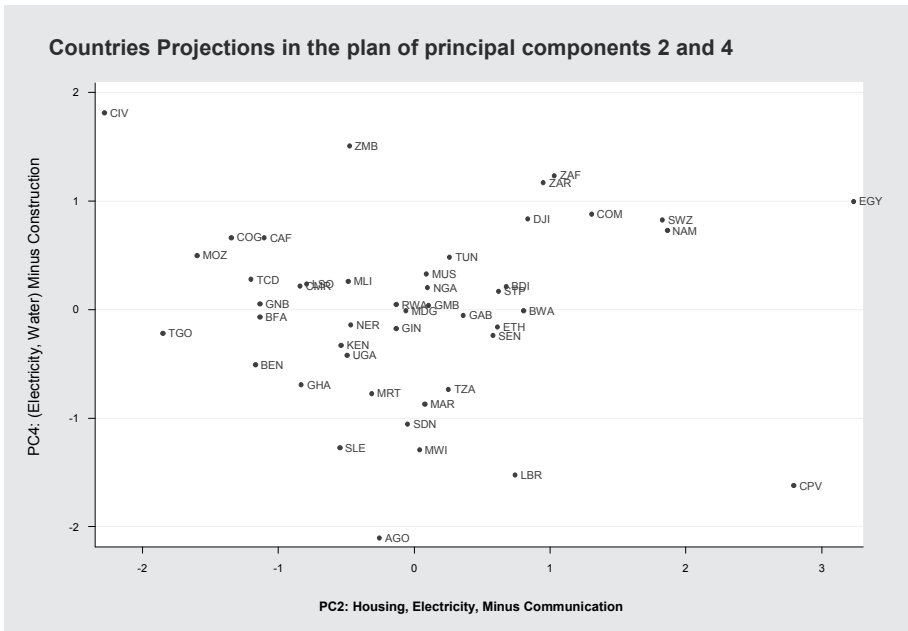


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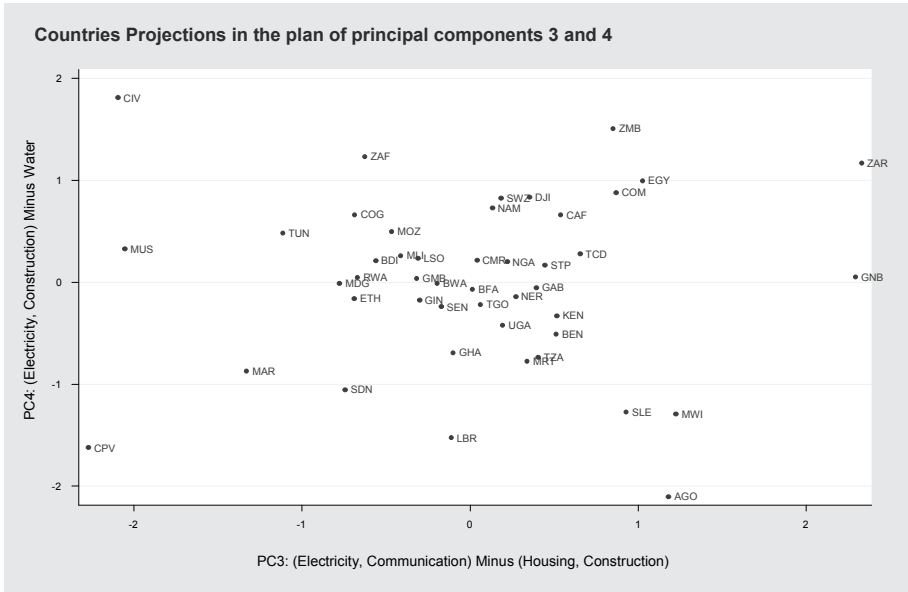
2. Comparative analysis of costs of some selected infrastructure components across Africa: Results from the 2005 International Comparison Program for Africa (ICP-Africa)



Source: Results of the International Comparison Program-Africa, 2005



Source: Results of the International Comparison Program-Africa, 2005



Source: Results of the International Comparison Program-Africa, 2005