

Access to Communications Services in Sub-Saharan Africa

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Over the last decades, the global economy has embarked on a dramatic transformation characterized by shifts in the location of economic activities, increased fragmentation of production processes, and the emergence of some new types of trade, most notably in services.

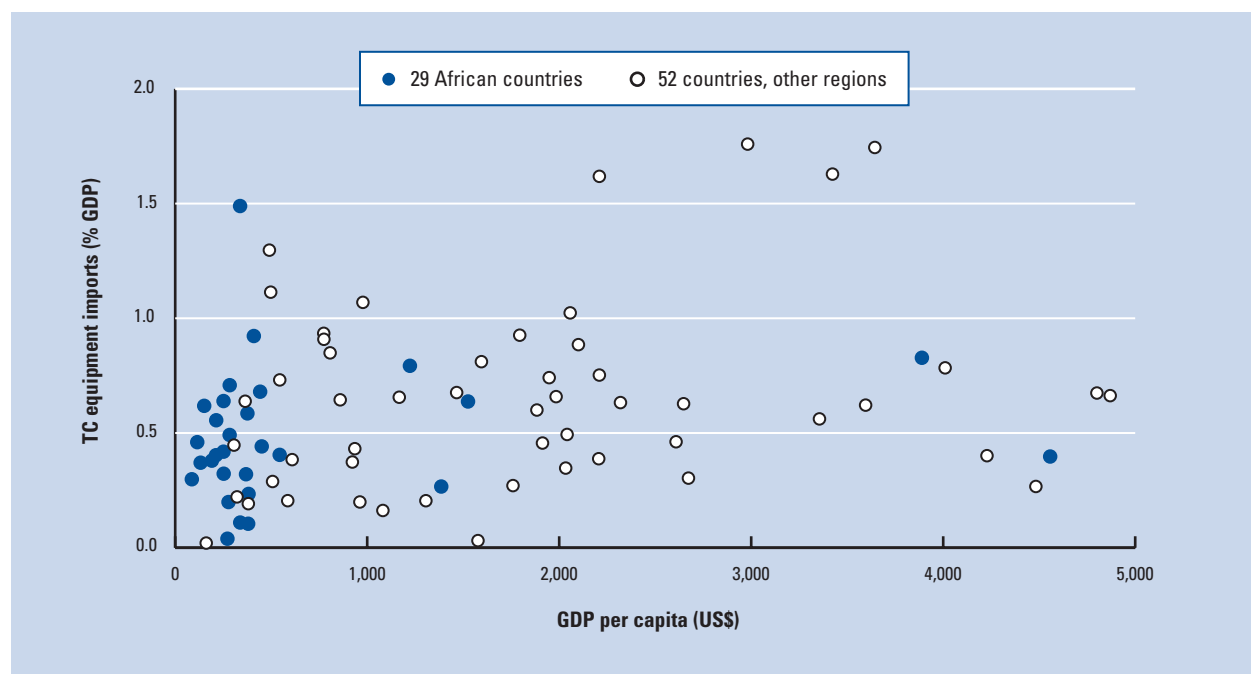
From a company's perspective, the decision of where to locate production is primarily driven by the costs of production. Much of the ongoing re-location of economic activities on the global scale is driven by differences in labor costs across countries (reinforced by the opening of the economies of the former Soviet bloc, China, and India, which—as Freeman (2005) puts it—have doubled the size of the global labor force). To the extent that agglomeration economies matter for an industry, countries may be able to sustain or reinforce a competitive advantage that initially is driven mainly by labor costs.

At the same time, the ongoing transformations are enabled by technological progress, in particular the rapid advances in information and communication technologies (ICT). These have resulted in the emergence of new categories of trade in services (for example, call centers, programming, and back-office operations). Regarding commodity trade, the role of ICT as an engine of the ongoing global transformations is at least threefold:

1. Improved communications facilitate trade in traditional commodities (such as textiles) and improve the availability of market information.
2. By making possible an increased fragmentation of production processes, ICT has also increased the potential for trade in components.
3. Much of the value of ICT equipment is embodied in electronic components, which travel lightly.

However, the benefits of globalization have not accrued to all developing economies in a similar fashion. Specifically, most of the “success stories” have been written in Asia, and few in Africa. Therefore, Asia's share in global GDP has more than doubled between 1950 and 2001 (from 18 percent to 38 percent), whereas the share of Africa in world GDP has declined from 3.8 percent to 3.2 percent (Maddison 2003).¹

As a consequence, some observers conclude that Africa has—at least so far—“missed the boat,” and that Asia now has the double advantage of a vast pool of cheap labor coupled with an increasingly sophisticated know-how of production processes and other agglomeration economies.²

Figure 1: Imports of telecommunications equipment

Source: Author's calculations, based on United Nations, 2006; IMF, 2006.

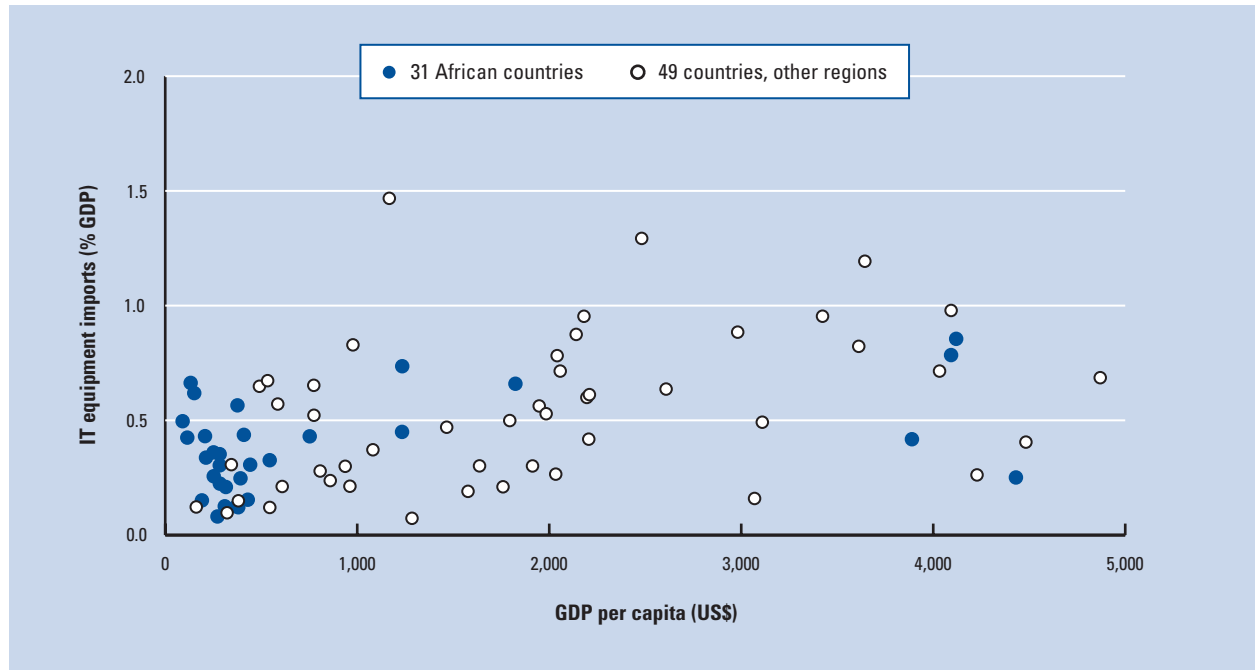
On the other hand, progress in communication technologies means that sub-Saharan Africa's access to the global economy—in terms of the ease of doing business between Africa and other regions—has immensely improved. Indeed, some of our findings suggest that advances in communication technologies are having a disproportionately positive impact in sub-Saharan Africa.

Although our focus is on a specific aspect of globalization, we arrive at a differentiated assessment of the forces underlying ongoing transformations in the global economy. Clearly, most economies in Africa have not been as successful as several “star” performers in Asia in taking advantage of structural shifts in the global economy. At the same time, we observe that advances in communication technologies are leveling the field to the advantage of African economies. While “agglomeration forces” may give the most successful developing economies to date an edge and some long-lasting advantages, we find that there are powerful trends that are working in the opposite direction, improving access to the global economy for some of those developing economies that were not among the first movers in terms of taking advantage of the opportunities of an increasingly globalized world economy.

Trends in equipment spending

Some important insights can also be gleaned from an analysis of the pattern of spending on ICT-related equipment. As these data are not available for many low-income countries, we instead use data on ICT-related imports (a good measure of spending on IT equipment, because most low-income countries do not produce such equipment).³ Figure 1 shows telecommunications import data for 29 African countries as well as 52 countries from other regions with similar income levels.

We find that for most countries, imports of communications equipment lies within a band between 0.2 and 1.0 percent of GDP. Most African countries are located toward the left of Figure 1, with income levels up to US\$1,000. Although imports of communications equipment in low-income countries are lower on a per-capita basis than in higher-income countries, there is essentially no difference in the *teledensity* of economic activities across countries with different income levels (as measured by ICT imports or spending as a percentage of GDP). This result is reinforced if one considers that the five countries with the highest level of imports relative to GDP are small island economies, a factor that likely drives up their costs of communication. Also, we see that the *teledensity* of economic activity in African economies is similar to that of other economies at similar or somewhat higher income levels. This finding suggests that African

Figure 2: Imports of IT equipment

Source: Author's calculations, based on United Nations, 2006; IMF, 2006.

economies benefit from advances in communication technologies in a fashion similar to that of low- or middle-income countries from other regions.

Because—for many applications—IT equipment complements the use of communications equipment and services, we also report the corresponding data for IT equipment. We find that the IT density of economic activity increases with income level. However, as before, we do not find a difference in IT density between African economies and those from other regions.

Thus, our spending data suggest that African economies benefit from advances in ICT in a fashion similar to low- and middle-income countries, as far as the tele- and IT-density of economic activities is concerned.

To complement our analysis of spending patterns across countries, we have conducted an empirical analysis, including some structural and policy variables. We find that the composition of GDP is relevant for the teledensity of economic activities. ICT-related spending, as a percentage of GDP, is significantly lower in oil-exporting countries than elsewhere. We also find that policy matters. ICT-related imports are negatively related to overall tariff rates. The latter also means that some of the positive association between the IT-density and income per capita (Figure 2) may reflect the fact that tariff rates tend to be lower in countries with higher income per capita.

Networked readiness in sub-Saharan Africa

A different approach to measuring access to communication services is the Networked Readiness Index (NRI) developed by the World Economic Forum and INSEAD (described in Chapter 1.1). The Index includes ratings for 23 African countries out of a total of 122 countries (see Table 1). Overall, African countries appear between rank 47 (South Africa) and 122 (Chad), with an average rank of 99.5. Beyond this, some useful lessons can be learned from analyzing the pillars of the Index. First, the 23 African countries tend to rank much lower in the infrastructure environment pillar than they do for the political and regulatory environment (and, to a lesser extent, the market environment). Second, the individual usage pillar tends to have lower ranks than the business and government usage pillars. Our interpretation of these differences is that actual usage of communication services is lagging behind indicators for, among other things, the market environment (availability of trained people, ease of doing business) the regulatory environment (property rights, legal framework), and technology absorption. Both the infrastructure environment pillar (including the number of telephone lines or Internet hosts) and the individual usage pillar, on which the scores for sub-Saharan Africa are relatively low, are the most intensive in terms of measures of actual usage of communication equipment and services (see Appendix A, Chapter 1.1).

Table 1: Networked readiness: 23 African countries

Country	Market environment	Political and regulatory environment	Infrastructure environment	Individual readiness	Business readiness	Government readiness	Individual usage	Business usage	Government usage
Angola	120	116	122	120	108	118	108	116	109
Benin	90	99	111	113	114	98	106	112	71
Botswana	66	45	93	56	61	83	64	94	81
Burkina Faso	93	75	104	117	99	96	116	90	52
Burundi	117	117	116	115	116	122	117	121	107
Cameroon	115	119	112	102	92	115	98	109	105
Chad	122	122	117	122	121	121	120	122	115
Ethiopia	98	112	119	118	122	111	122	118	92
Kenya	100	66	90	108	79	97	105	81	91
Lesotho	96	109	107	111	120	110	100	115	114
Madagascar	94	86	99	104	106	90	118	102	78
Malawi	105	71	114	112	96	108	119	111	106
Mali	101	70	98	119	112	87	114	87	45
Mauritius	51	46	61	49	54	41	49	67	70
Mauritania	83	94	118	109	103	51	95	57	21
Mozambique	118	113	121	116	107	89	110	101	112
Namibia	64	38	115	91	72	106	87	78	102
Nigeria	59	62	95	103	87	75	101	82	67
South Africa	34	25	70	70	31	40	60	43	59
Tanzania	85	49	100	107	98	77	112	85	75
Uganda	107	63	88	121	113	82	113	76	56
Zambia	113	85	113	101	115	116	109	86	120
Zimbabwe	119	111	103	110	81	119	94	119	121
Average	93	82	104	104	96	94	102	94	86

Source: NRI 2006–07.

Access to communication services in sub-Saharan Africa: Some indicators

Communication services are unique in terms of data availability because utilizing them usually requires some form of subscription, which can be easily collected. Thus, for both main telephone lines and mobile telephone services, data on the number of subscribers are available for essentially all low-income countries. Another variable we will look at is the number of Internet users (this variable includes not only subscribers but also an allowance for Internet access through Internet cafés and the like). Figure 3 provides the latest available data (2004) on the usage of these key communication technologies by region.

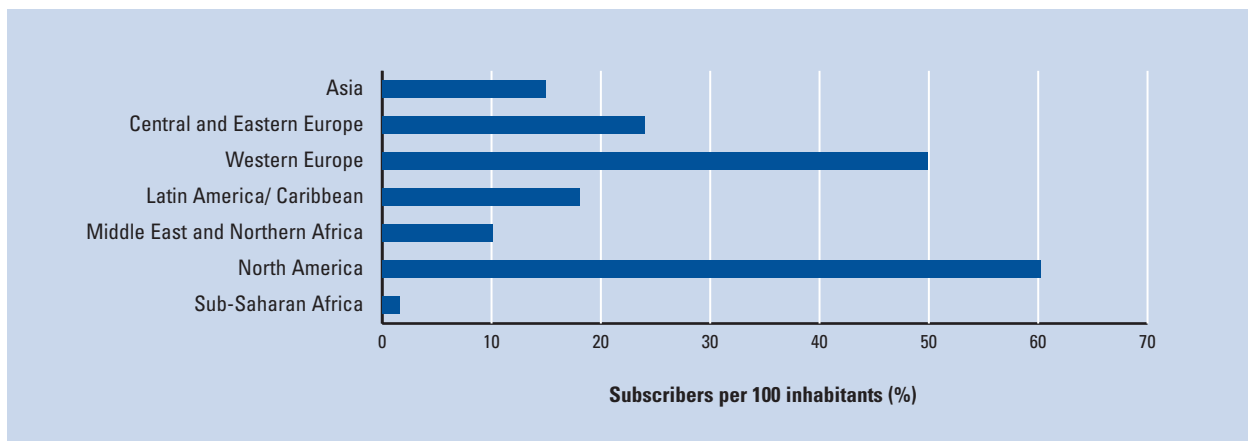
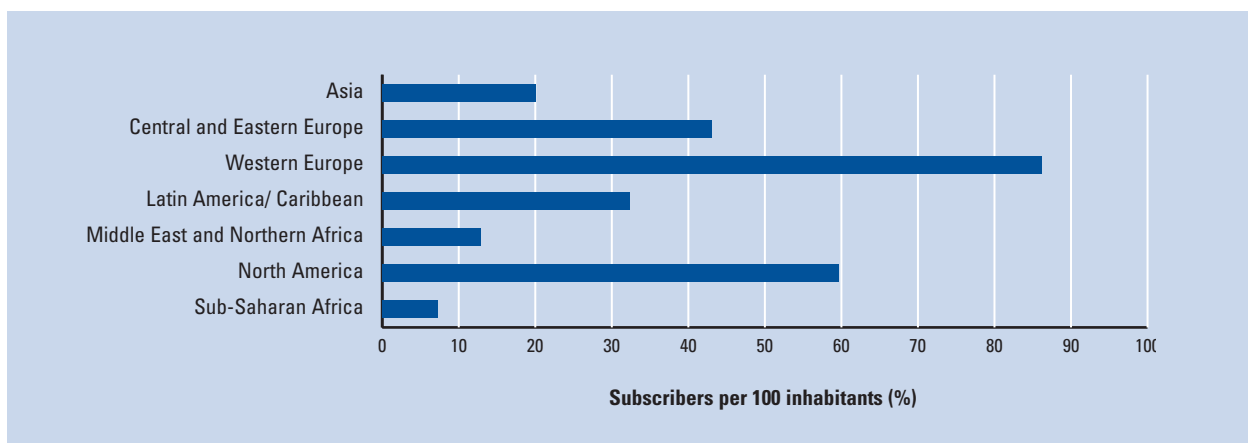
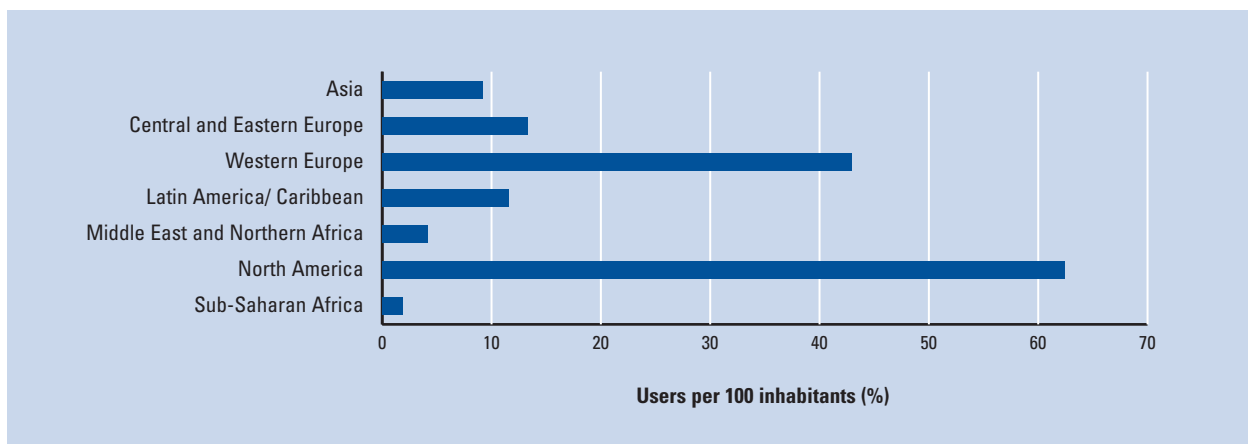
We see—as expected—that access to communication services in sub-Saharan Africa is very limited compared with other world regions. Access to main telephone line services (1.8 per 100 inhabitants) is only about 9 percent of the global average. For mobile telephone services, the level of access in sub-Saharan Africa is much higher (7.2 per 100 inhabitants, or 25 percent of the global average), and there are 1.9 Internet users per 100 inhabitants (14 percent of the global average).

The role of mobile communication services warrants further attention. From Figure 3, it is very clear that mobile telephone services in sub-Saharan Africa have helped to increase access to communication services unlike in any

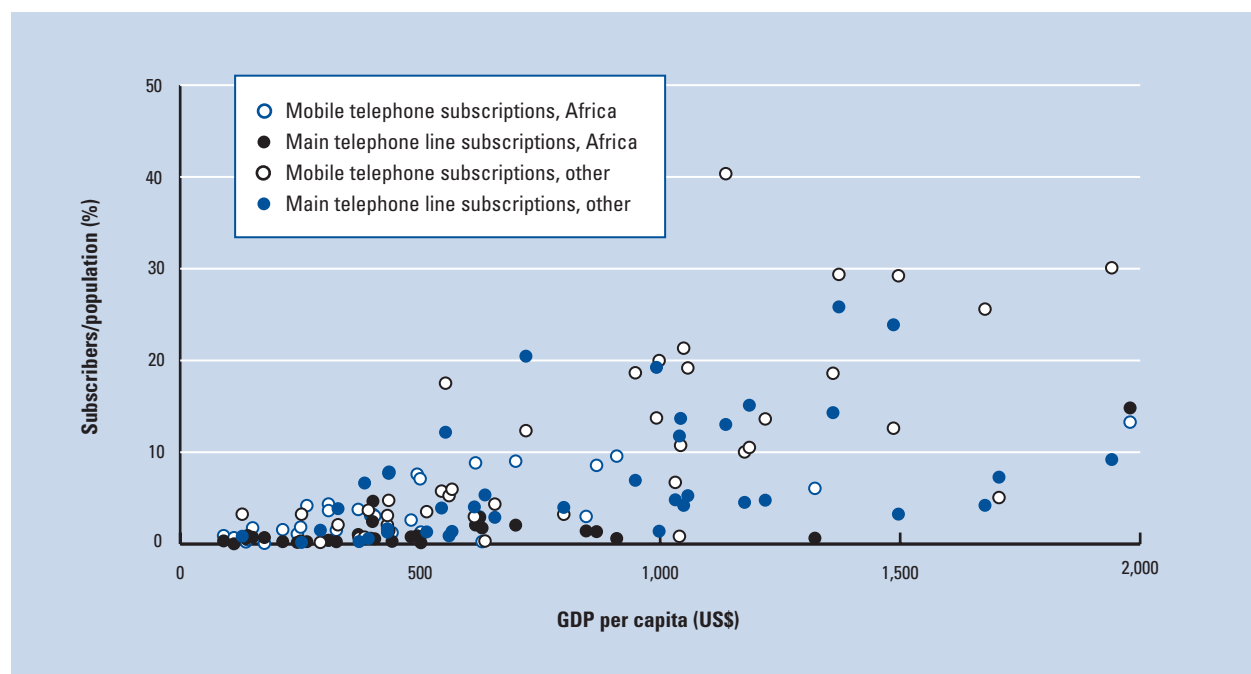
other world region. Since 1991, when mobile telephone services were available in Mauritius and South Africa only, the number of mobile subscribers in the region has grown at an average annual rate of 91 percent; it has grown at a rate of 50 percent between 1999 and 2004. Over the same period, main telephone line subscriptions in sub-Saharan Africa grew at an annual rate of 6 percent and 4 percent only. However, growth of mobile telephone services was so strong that total telephone subscription grew at an annual rate of 21 percent (1991–2004) or 31 percent (1999–2004), making sub-Saharan Africa the fastest-growing market for communication services over these periods.

Relative to the global average, sub-Saharan Africa has therefore been able to very substantially narrow the gap in access to communication services, as total subscriptions (per 100 inhabitants) almost doubled—from 10 percent of the global average in 1991 to 19 percent of the global average in 2004.

These impressive gains, however, certainly understate the progress made in sub-Saharan Africa relative to the rest of the world. In the technologically most advanced countries (which can be proxied by Western Europe and North America in Figure 3), mobile telephone services have primarily increased the depth of access to communication services (because a mobile telephone most commonly complements or replaces a main telephone line subscription).

Figure 3: Access to communication services by region, 2004**3a: Subscriptions to main telephone lines****3b: Subscriptions to mobile telephone services****3c: Internet users**

Source: Author's calculations, based on ITU, 2006.

Figure 4. Main telephone line and mobile telephone services

Source: Author's calculations, based on IMF, 2006; ITU, 2006.

In sub-Saharan Africa, however, the majority of mobile telephone subscriptions were purchased by individuals or businesses who previously did not subscribe to main telephone line services.

A closer look at access to telephone services

Figure 4 shows the number of subscribers to telephone services for countries with a GDP per capita of US\$2,000 or less, including 33 countries from Africa and 39 from other regions.⁴ The most important lesson from this kind of analysis is that access to telephone services is clearly correlated with GDP per capita.

In order to—literally—get a better picture of the role of mobile telephone technologies, Figure 5 illustrates the share of mobile telephone subscribers among total telephone subscriptions. Regarding the average share of mobile subscribers, our findings are consistent with our overview of access to communication services (which shows that mobile telephone technologies have substantially increased access to telephone services): mobile telephone services account for about two-thirds of total subscribers for the countries shown. Although low-income countries tend to have a higher share of mobile telephone subscribers, the other notable feature of the data is the high dispersion of this share, ranging from about 10 percent to close to 100 percent. We discuss possible determinants of the share of mobile telephone services below.

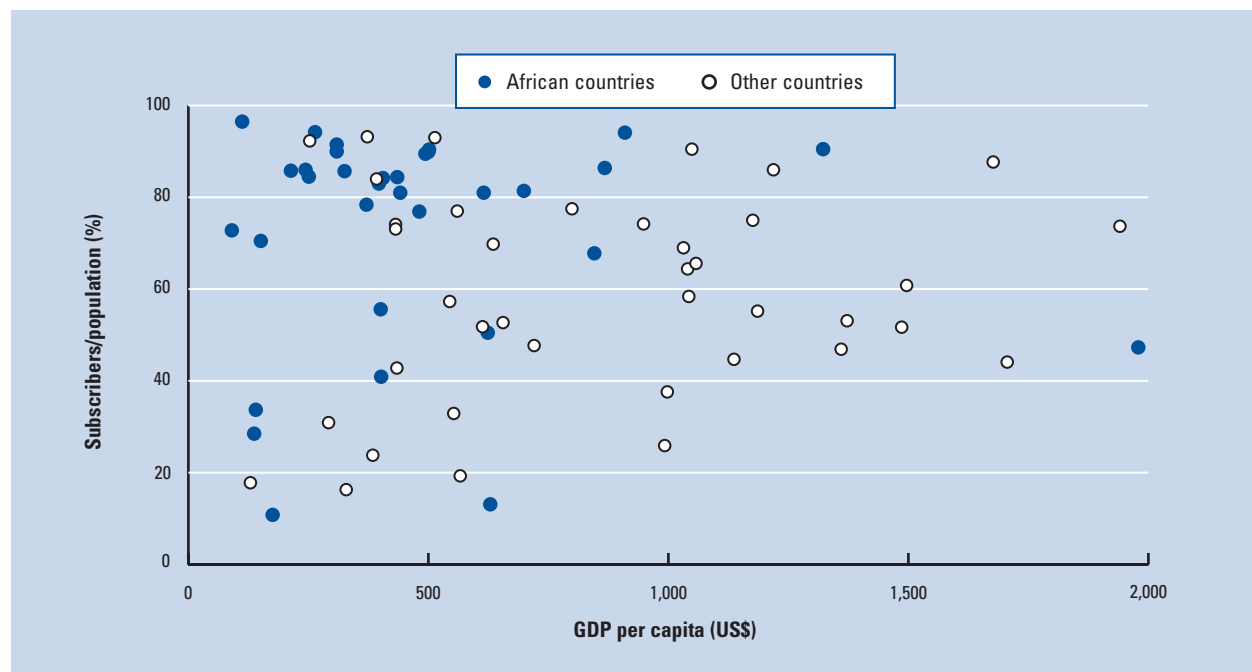
Teledensity in sub-Saharan Africa

A different way of addressing the role of communication services in economic activity is by looking directly at the teledensity of economic activity. We use this term to relate indicators measuring access to communication services to indicators of the scale of economic activity. Through this device, we hope to gain a better understanding of the importance of communication services for a country's economy. Specifically, we look at the number of subscriptions or users relative to GDP (measured as units of services per US\$ million of GDP).

We find that the teledensity of economic activity in sub-Saharan Africa holds up well relative to other regions. Overall, for each US\$ million of value-added created in sub-Saharan Africa, there are 118 phones—a number that holds up to teledensity in Asia (120), is similar in magnitude to teledensity in Latin America and the Caribbean or in the Middle East and North Africa, and is over 60 percent higher than the global average of 72.

Remarkably, we find that the teledensity of economic activity in the United States or Western Europe is much lower than in these four regions, while it is much higher in Eastern Europe, possibly reflecting the ongoing adjustment and transformation there.

In line with our previous discussion of main telephone lines versus mobile telephone services, we also find that the high density in sub-Saharan Africa is predominantly

Figure 5: Mobile telephone subscriptions (percent of total)

Source: Author's calculations, based on IMF, 2006; ITU, 2006.

the result of mobile telephone services, accounting for about 80 percent of total telephone subscriptions, a ratio higher than in any other region. Figure 6 also shows the density of Internet users, with similar results—for sub-Saharan Africa, each US\$ million in value-added is associated with 25 Internet users, a level that is higher than the global average.

A note is in order here on our measure of usage of communication services, which is based on telephone subscription or the number of Internet users. Our measures reflect the width of usage, but, owing to data limitations, we cannot address the intensity of usage (for example, hours or data transfer per user). Thus, in terms of the absolute level of usage, our measures likely overstate the level of usage in low-income countries.

To understand the consequences of applying the concept of teledensity to the intensity of usage rather than to its width, consider the following example. Recall that the density of access to communication services in sub-Saharan Africa, measured as subscribers per US\$ million of value added, is 64 percent higher than the global average. If the intensity of usage in sub-Saharan Africa was only one-half or one-quarter of the global average, then the number of hours of telephone communications per US\$ million of value added would be 20 percent or 60 percent lower in sub-Saharan Africa, relative to the global average.

Which measure of teledensity is most appropriate depends on the context. If the most important aspect of communication is accessibility and the exchange of essential market or order information, then our measures—based on the number of subscriptions or users—is the appropriate one, and we find that sub-Saharan Africa has disproportionately benefited from advances in communication technologies. For activities that require continuous and high-density data flows, the measures based on the intensity of usage are appropriate. While our reasoning here is somewhat speculative, in light of data limitations, we believe that sub-Saharan Africa may be lagging behind the global average in intensity of usage, which could explain why certain communication-intensive economic activities (for example, call centers) are usually not located in Africa. Our preliminary conclusion therefore is that sub-Saharan Africa is among the primary beneficiaries of advances in communication technologies as far as width of access is concerned (measured by the number of users), but it is less clear that the region is a primary beneficiary in terms of the intensity of utilization of communication services.

What drives investment in mobile communication services in sub-Saharan Africa?

Primarily, the decision of a provider to enter a market is driven by expectations of profitability. Conversely, the number of providers a market can sustain is determined by

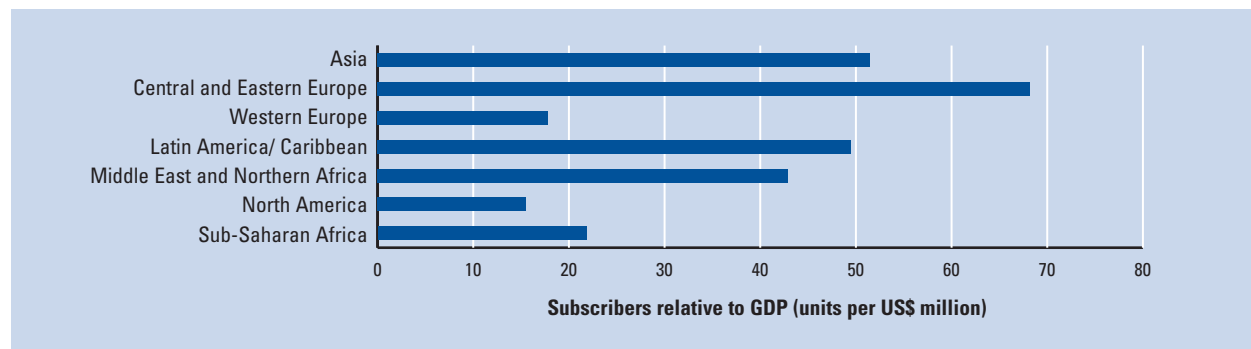
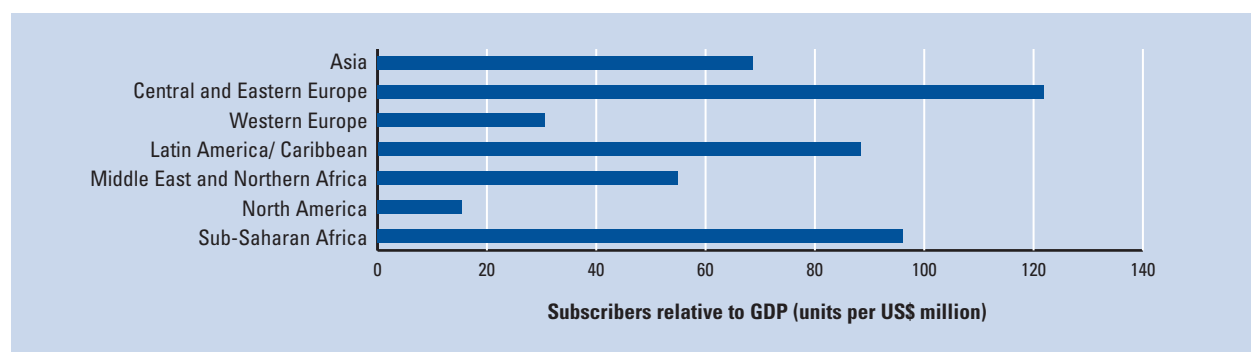
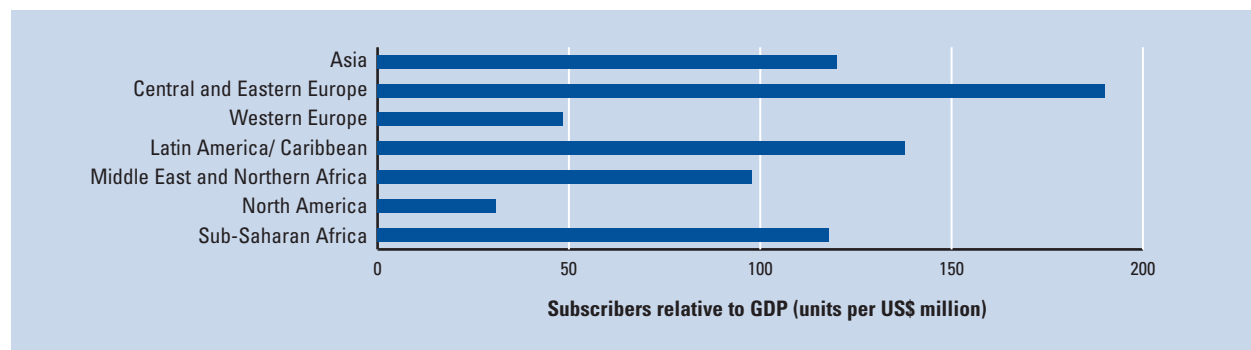
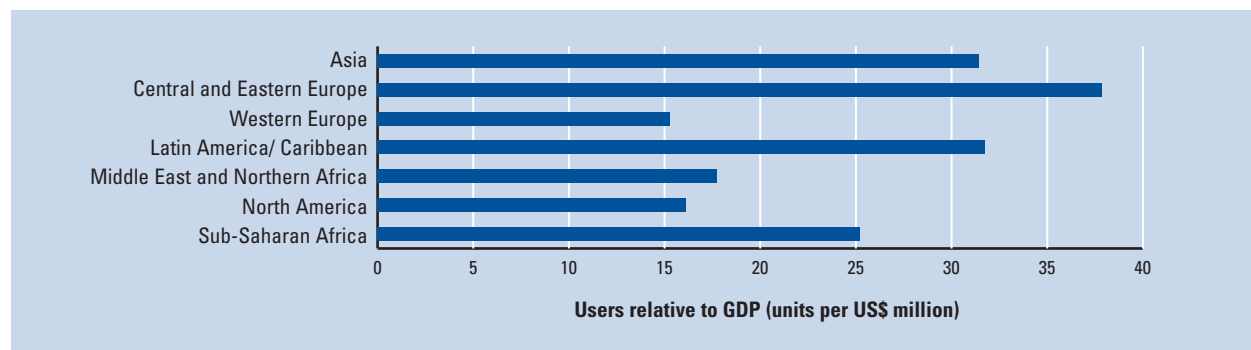
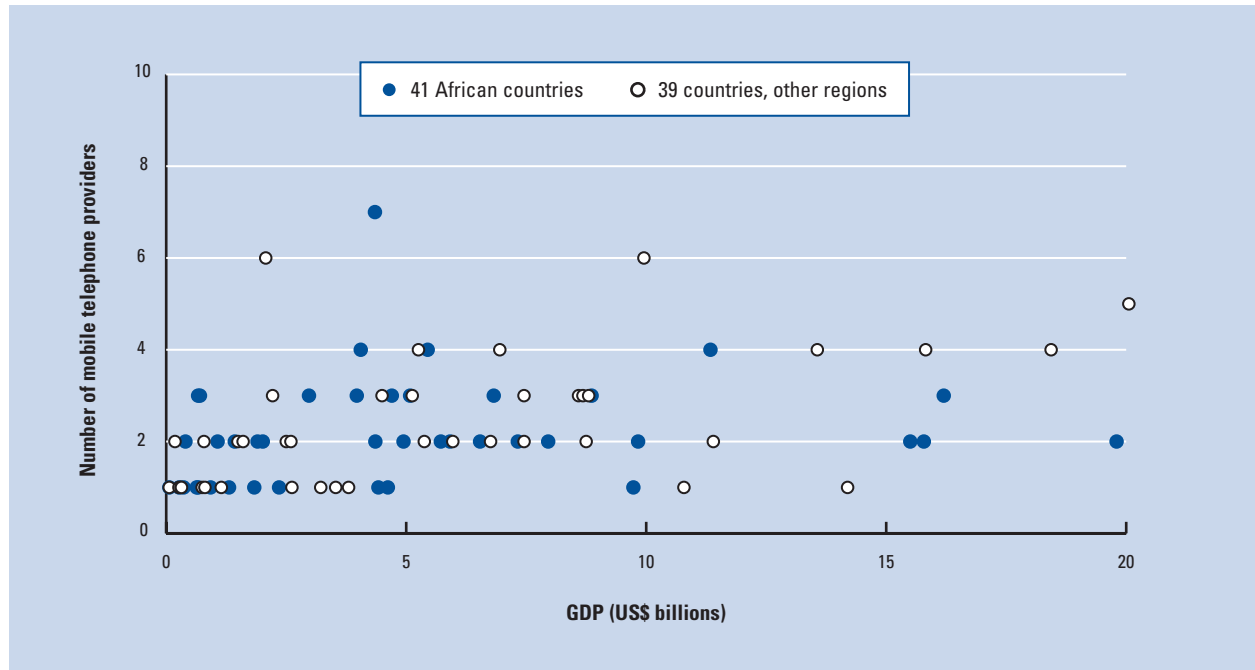
Figure 6: Teledensity of economic activity by region, 2004**6a: Density of main telephone line subscriptions****6b: Density of mobile telephone subscriptions****6c: Density of total telephone subscriptions****6d: Density of Internet users**

Figure 7: Mobile telephone providers and GDP

Source: Author's calculations, based on IMF, 2006; ITU, 2006.

the size of the market. One aspect that is relevant for many low-income countries is that a large proportion of the population may not be able to afford a subscription to telephone services.

This line of reasoning was succinctly summarized by Andrew Mhembe, the Deputy CEO of Vodacom, when his company won a license to operate a GSM network in Mozambique in 2002:

As is the case with most African countries, the vast majority of the population is very poor. However, there is a wealthy segment of the population prepared to pay for cellular services in US dollars and large enough in size for our investment to be very worthwhile.⁵

While these considerations apply to any kind of investment, the market for mobile telephone services is peculiar because market entry requires a license, which gives a direct role to government. At the same time, as the number of competitors is limited, the market structure and market regulation also affect profitability and outcomes in terms of access to communication services.

How much do these considerations matter? To address this question, we have created a database covering providers of mobile telephone services.⁶ Figure 7 relates the number of providers to GDP. We see what appears to be a positive (though not very clear) correlation between the level of GDP and the number of providers. This is

confirmed by an empirical analysis, which suggests that a difference in GDP of US\$50 billion is associated with one additional provider. At the same time, GDP per capita (and some other proxies for market size) do not explain the variations in the number of providers.

This finding, however, does not explain much of the variation between countries with low levels of GDP. We therefore also look at whether there is a monopoly or “competition” (crudely defined as two or more providers) in the market. Although GDP matters, it turns out that the most important predictor of competition is the World Bank’s index of regulatory quality.

Thus, we find that many countries in sub-Saharan Africa are at a disadvantage in terms of attracting providers of mobile telephone services, because the size of the respective market (measured by the level of GDP) is relatively small. However, there is a role for policy—countries that rank highly on the World Bank index for regulatory quality are more likely to feature more than one provider.

More on market structure

The markets for main telephone line and mobile telephone services do not differ only in terms of the number of providers. Haacker (2005) investigates the main shareholders of providers of main telephone line and mobile telephone services in 21 African countries.⁷ In 20 of these countries, there was only one national provider for main

telephone line services; in 15 of these countries, the dominant operator was controlled and frequently wholly owned by the government. The number of providers of main telephone line services averaged 2.3 in these countries; of a total of 48 national providers, 32 were controlled by multinational companies, and only 12 (including 4 monopolies) were controlled by the respective governments. This finding suggests that mobile telephone technologies are not only associated with an increase in competition in the telecommunications market, they also act as vehicles of technology transfer, with multinational providers bringing in their expertise and technological know-how.

The pricing of telephone services

A key indicator (and determinant) of access to mobile telephone services is the price of these services in relation to income (which we proxy by gross national income [GNI] per capita). As an indicator for the costs of access to communication, we use the price baskets for residential fixed lines and mobile telephone services from the World Bank (2006).

Figure 8 shows the respective price baskets in US dollar terms and as a percentage of GNI. Regarding the price baskets in US dollar terms, two features stand out. First, for low-income countries, mobile telephone services appear to be more expensive than residential fixed lines. Second, the variations across countries by income in the price of telephone services are less pronounced for mobile telephone services than for fixed lines. When the prices for telephone services are related to GNI, the message that emerges is very similar for each type of telephone service. Although the costs of each basket is generally lower than 1 percent of GNI per capita for high-income countries, the costs range from 1 percent to of GNI to 10 percent of GNI for middle-income countries, and from 5 percent of GNI to around 100 percent of GNI for low-income countries. This means that access to telephone services of either form is essentially universal for high-income countries, but unaffordable for a wide range of the population in low-income countries.

Prepaid mobile telephone accounts

One constraint to expanding access to communication services in low-income countries is the low level of development of the financial sector in these countries (which increases the costs of monetary transfers) and their weak contract enforcement (which makes it difficult to collect unpaid bills). Mobile telephone technologies facilitate the use of prepaid service arrangements along several lines. First, they are practicable in settings where contract enforcement is weak, as providers are not at risk for having

to collect arrears. Second (this point primarily applies to prepaid cards), the transactions between the provider and the user are facilitated by the use of mobile telephone technology, involving a wireless financial transfer when the user credits his or her mobile telephone account with the value of the purchased card. Thus, there is no financial intermediation required other than the distribution of the coded cards through retailers, small merchants, and—frequently—street vendors.

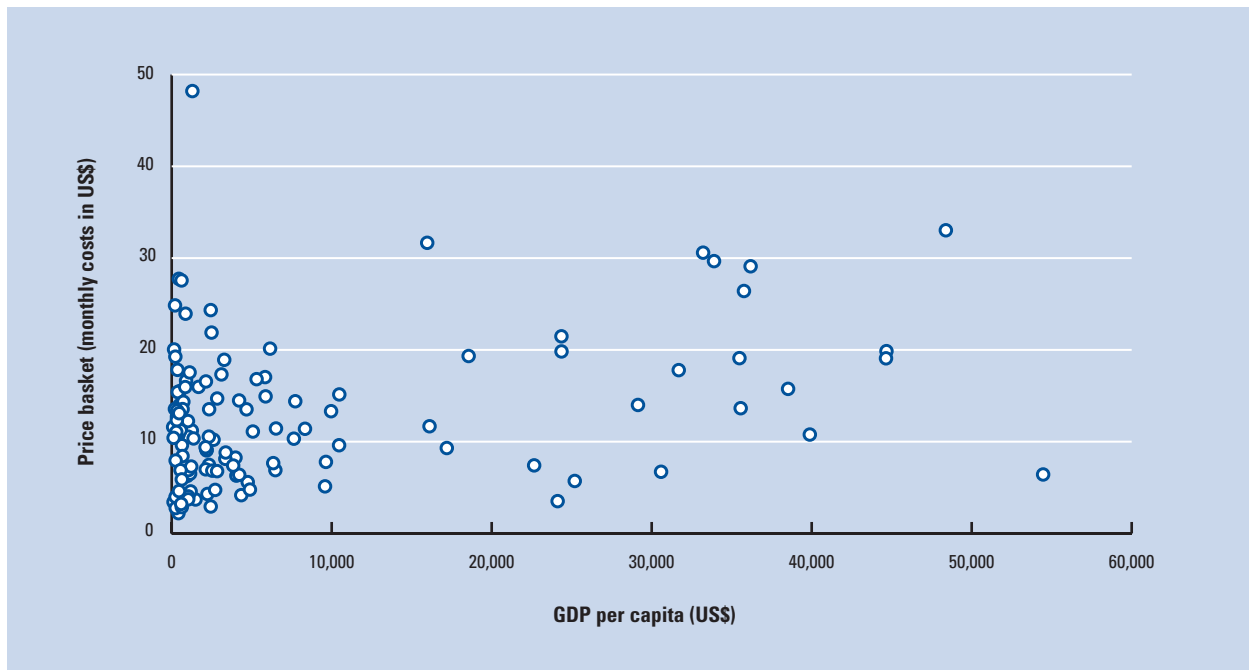
Figure 9 suggests that prepaid subscriptions may indeed be a factor behind the disproportionate spread of mobile telephone services in low-income countries. Prepaid services are the dominant mode of access to mobile telephone services in low- and low-middle-income countries, accounting for a share of almost 90 percent in low-income countries and about three-quarters in middle-income countries, but only about half in high-income countries.

Market density and geographical access

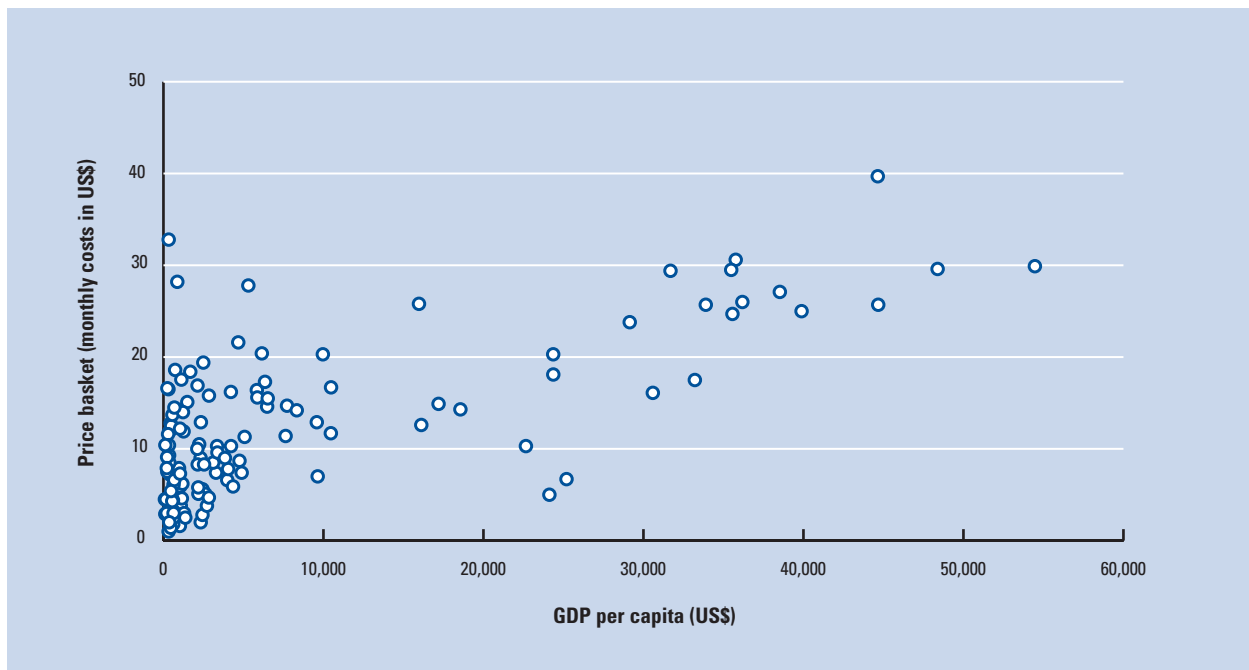
Above, we discussed the prices of main telephone line and mobile telephone services, and concluded that they are unaffordable for a large share of the population. To some extent, sharing a telephone (and its costs), or using public telephones, provides a way around this, although these arrangements do not offer the same degree of accessibility.

A second form of exclusion from communication services works through *aggregate* demand for such services on the regional or local level. Telephone providers may not extend service to areas where the market is too thin to recover the costs of installing or operating the network. This could be the case because the income level (total, not average) of the population of an area is too low, either because average incomes are low or because the population density is low.

The geographical coverage of mobile (and fixed-line) telephone services is limited in low- and low-middle-income countries. A survey of 184 companies operating in these countries shows that individual companies cover, on average, 27.2 percent of the area of the respective country (the median is 10.0). The overall rate of geographical coverage, however, is higher, because there is more than one provider in most low- and low-middle-income countries (although the areas covered by the respective networks tend to overlap strongly).⁸ Another important distinction is between geographical coverage and access measured as a percentage of the population. As the areas covered appear to include the areas with the highest population density, the share of the population of a country within reach of a mobile telephone network is higher than the geographical coverage rate.

Figure 8: Costs of access to telephone services**8a: Price basket for mobile telephone services**

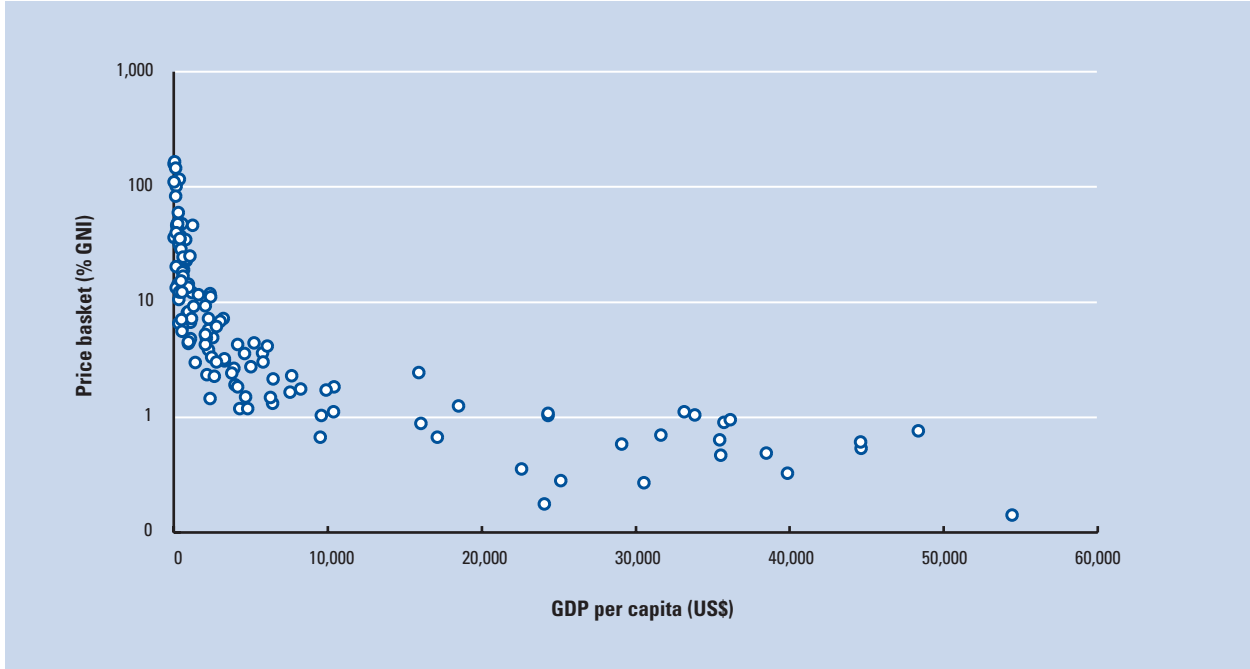
Source: Author's calculations, based on IMF, 2006; ITU, 2006; and World Bank, 2006.

8b: Price basket for residential fixed telephone lines

Source: Author's calculations, based on IMF, 2006; ITU, 2006; and World Bank, 2006.

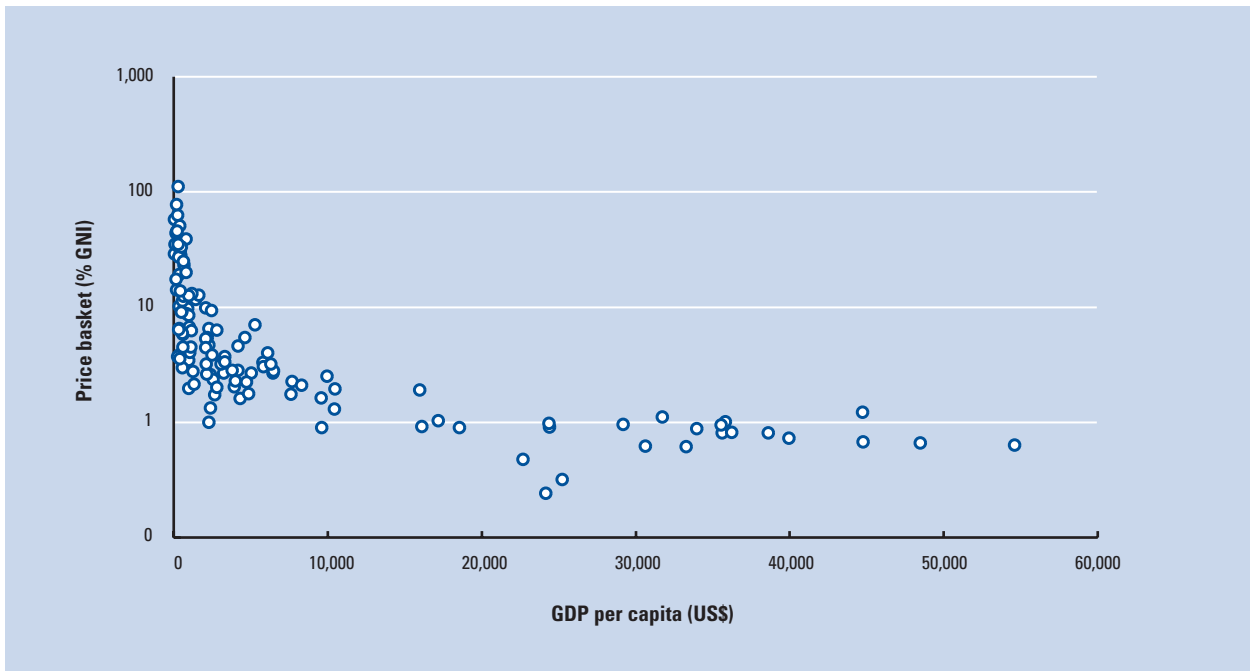
Figure 8: Costs of access to telephone services (cont'd.)

8c: Price basket for mobile telephone services (annualized, % GNI, log scale)

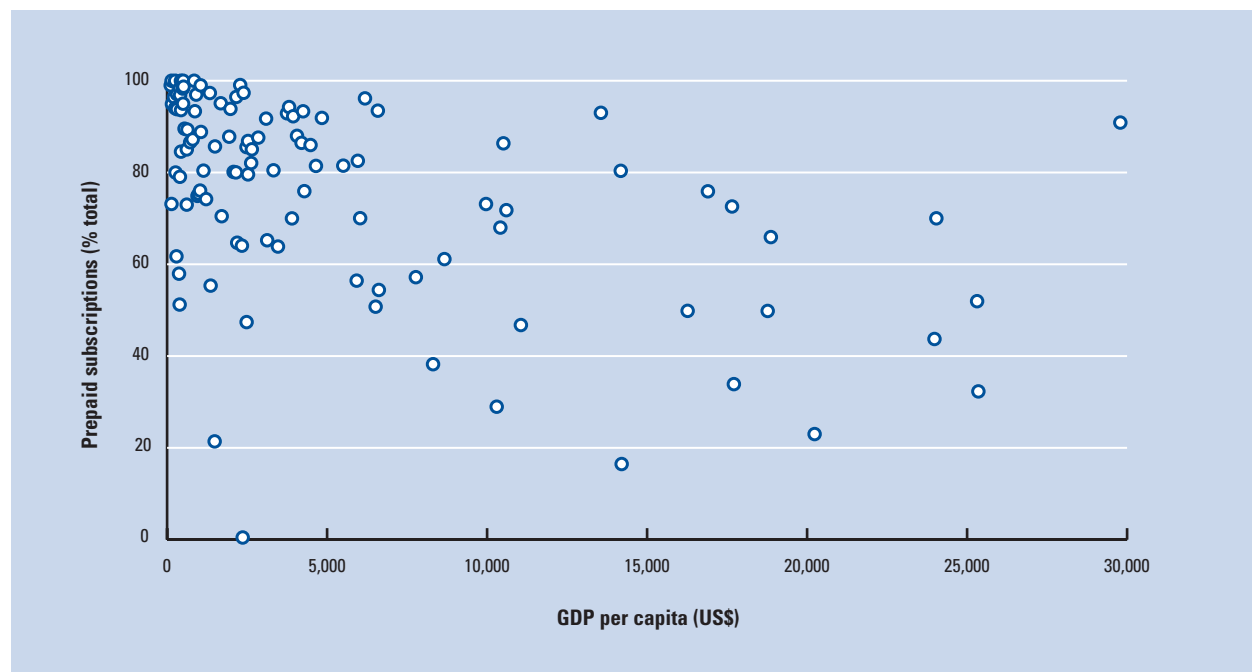


Source: Author's calculations, based on IMF, 2006; ITU, 2006; and World Bank, 2006.

8d: Price basket for residential fixed telephone lines (annualized, % GNI, log scale)



Source: Author's calculations, based on IMF, 2006; ITU, 2006; and World Bank, 2006.

Figure 9: The role of prepaid subscriptions

Source: Author's calculations, based on IMF, 2006; ITU, 2006.

What determines the costs of access?

We already observed, based on Figure 8, that the costs of access to communication services on average differ little across countries from different income categories, even though the difference between individual countries can be substantial. We are now going to take a closer look at the determinants of prices of telephone services, using the prices for bundles of mobile and main telephone line services compiled by the World Bank (introduced above), examining in particular the role of the market structure and various measures of economic activity.

For mobile telephone services, the most important determinant of the price of services is the number of providers (and its square), suggesting that there are substantial savings to customers as the market for mobile telephone services becomes more competitive. The estimated coefficients imply that the 2nd, 3rd, and 4th entrants to the market mean incremental annual savings to the subscribers of about US\$25, US\$20, and US\$15, respectively (or accumulated savings of US\$25, US\$45, and US\$60), which are substantial compared with a median annual cost of US\$133 for the sample. The potential savings from increased competition then taper off with about six competitors in the market (at an annual savings of US\$ 80 compared with a monopoly). Whereas the coefficient of GDP per capita is small and insignificant across various specifications, we also find that some proxies for the

overall scale of economic activity (GDP, population size) return negative coefficients, which could imply that there are some economies of scale at work.⁹

Regarding the prices of fixed-line services, the picture is somewhat less clear. GDP per capita explains little; there is some negative association between the level of GDP and the price of telephone services. However, the price of fixed-line services appears to depend negatively on the number of providers of mobile telephone services—moving from a monopoly to a highly competitive environment in mobile telephone services is associated with a fall in the bill for main telephone line services of US\$40. This may imply that a more competitive market from mobile telephone services puts pressure on the price for main telephone line services too, but it could also be the result of some common factors that have a bearing on both markets (for example, regulation).

Determinants of access

We have touched on various aspects of access to communication services in sub-Saharan Africa above. Now, we will pull together these different strands to provide a more comprehensive empirical analysis of determinants of access. Using the respective coverage rates of mobile and main telephone line services as dependent variables, we start out with a broad specification that includes scale variables such as GDP, GDP per capita, population size,

the prices for the respective services, and the number of providers (for mobile services). As indicators for the market and institutional environment, we use the World Bank's governance indexes; to capture some effects related to the geographical density of economic activity, we add the rate of urbanization and interact it with each of the scale variables.

We find that the level of economic development is the most important determinant of access, but that the structure of the market for communication services also plays an important role in explaining cross-country differences. Unsurprisingly, the coverage rate of mobile telephone services increases with GDP per capita. However, through different specifications, we find that it is not the levels of GDP or GDP per capita that matter most, but these variables multiplied with the rate of urbanization. This probably indicates that in low- and low-middle-income countries, it is generally not cost effective for providers to cover rural areas; the interaction terms may represent the effect of "effective demand" for mobile telephone services, depending on the level of economic activity and the share of the population that can be reached at low cost.

The other determinant of access to mobile telephone services we can identify is the extent of competition and the regulatory environment. We find that each additional competitor is associated with a 1.8 percentage point increase in access to mobile telephone services, and countries ranked by the World Bank as featuring an effective regulatory environment also tend to have higher coverage rates. The own-price has a negative effect on coverage of mobile telephone services, while the coefficient of the price of main telephone line services is positive. However, these price effects are not significant at the 10 percent level.

In a similar fashion, we analyze the determinants of the coverage rates of main telephone line services. Successively eliminating insignificant variables yields a simple representation—the product of GDP per capita and urbanization explains 60 percent of the variation in the coverage rate of main telephone line services. Adding the prices of the different types of services to the regression, the coefficients show the expected sign (the own-price is negative and the price of mobile telephone services negative, although only the own-price is significant).

Some conclusions

What did we learn about the role of modern communication technologies in sub-Saharan Africa? What are the consequences for the ease of doing business in, with, and from Africa? And what are the implications for Africa's role in the world economy?

First, we find that Africa has benefited from recent advances in communication technologies, allowing many countries and the region as a whole to diminish the gap

in access to communication services between Africa and other world regions. Indeed, if one considers the teledensity of economic activity, no such gap is apparent, largely owing to the impact of mobile telephone technologies in Africa.

Second, we find that the number of providers primarily depends on the size of the market, which puts countries with small populations or low GDP per capita at a disadvantage. However, policy can play a role in creating a competitive environment.

Third, the number of providers does have an impact on the costs of services. Our results suggest that moving from a monopolistic setting to a highly competitive environment can save about US\$80 per year to a fairly regular user. The number of mobile telephone providers also appears to affect the prices of main telephone line services; however, it is not clear whether this reflects competitive or regulatory effects.

Fourth, we find—unsurprisingly—that higher levels of GDP per capita are associated with higher coverage rates of both mobile and main telephone line services. The structure of the market for communication services also plays an important role in explaining cross-country differences—the World Bank index for regulatory quality and the number of mobile telephone providers always have a positive and highly significant effect on the coverage of mobile telephone services.

Fifth, we find evidence of interactions between the markets for mobile and main telephone line services. A more competitive market for mobile telephone services also drives down prices for main telephone line services, and—through price effects—also affects the coverage rates of main telephone line services.

Sixth, our findings regarding the role of urbanization point toward some structural impediments to expanding access to communication services in sub-Saharan Africa. Where the level of GDP per capita is low, as in rural areas, the density of potential demand may not be sufficient to profitably expand access to telephone services. As a consequence, lower-income and/or isolated segments of the population may not benefit from the innovations in communication services.

Although it is beyond the scope of this chapter, it is important to note that the benefits of improved access to communication services occur both in the formal and in the informal sectors of the economy. For the formal sector, benefits include the ability to improve the management of production and procurement processes and to expand marketing and trading activities. For the informal sector, mobile telephone services extend some of the benefits of a stationary office to independent contractors, helping them to attract additional business.¹⁰

Africa's role in the global economy

We come back to the broader issues we discussed at the outset—the implications of advances in communication technologies for the role of sub-Saharan Africa in the global economy. Modern communication technologies, especially mobile telephone services and the Internet, have enormously improved the ease of doing business in and with Africa.

Thus, expanding on the line of reasoning offered by Collier (2006), sub-Saharan Africa may be lagging behind Asian competitors in terms of agglomeration economies, and may have no significant advantage in terms of labor costs. Nevertheless, we find that Africa has caught up impressively over the last two decades in terms of access to communication services, which—in turn—improves the capabilities of African businesses to participate in global production processes. We also note that many African countries are much closer to the European market than their Asian competitors, and that “all of the specific misfortunes that impeded coastal Africa from entering global markets are now over” (Collier 2006).

Although Collier fears that Africa may have to wait several decades to initiate an economic transformation similar to the one Asia is experiencing, we arrive at a more differentiated conclusion. First, it is worth pointing out that the argument that Asia has gained a permanent advantage in terms of agglomeration economies is too broad—many agglomeration economies occur on the industrial or regional level,¹¹ and achieving such economies in sub-Saharan Africa is conceivable. At the same time, our findings suggest that the playing field in one important area has shifted to the benefit of Africa, as sub-Saharan Africa has made major strides in utilizing modern communication technologies, considerably improving the ease of doing business in Africa. Thus there are opportunities now for benefiting from the ongoing transformations in the global economy, and Collier's “several decades” may turn out shorter than expected.

At the same time, there are roles for policy to create conditions for businesses to take advantage of these opportunities. First, we find that access to communication technologies depends on the quality of policies, by creating a competitive environment in the telecommunications sector. Second, important elements of the costs of trading and exporting are the ease and the costs of transportation—not only in terms of distance and the physical infrastructure but also in terms of the effectiveness of transportation services. This is an area where many coastal African countries are at a disadvantage vis-à-vis their Asian competitors, and government policies can help addressing these bottlenecks, helping to fulfill the new economic opportunities that have developed in recent years.

Notes

- 1 It is important to bear in mind that these averages mask very substantial differences across countries within the respective regions. For example, sub-Saharan Africa includes fast-growing economies such as Botswana and Mauritius, while Asia includes economies like Bangladesh or Nepal that grew very little over this period.
- 2 See Collier (2006) and Venables (2006).
- 3 To ensure that our import data adequately reflect spending for the countries under consideration, we eliminate all countries that do export significant quantities of ICT-related equipment from the sample. For the remainder, we net out exports of such equipment. For more details, see Haacker (2006).
- 4 The figure excludes five African countries with higher GDP levels for which data are available, but “zooming in” on countries with lower levels of GDP per capita allows us to get a clearer picture of trends among the vast majority of African countries.
- 5 Quoted from CellularOnline, <http://www.cellular.co.za>, in a story dated June 10, 2002 (accessed on November 11, 2006).
- 6 The primary data sources on providers were the websites of the GSM Association (www.gsmworld.com) and of the CDMA Development Group (www.cdg.org), cross-checked for comprehensiveness against various informal data sources.
- 7 Data were kindly provided by BMI-TechKnowledge Group (South Africa), based on their *Communication Technologies Handbook*.
- 8 Based on the sample of 361 providers operating in the 112 countries classified as low- and low-middle-income countries, we find that there is more than one provider in 88 of the 112 countries.
- 9 These empirical findings are documented in more detail in Haacker (2006).
- 10 This is a point made to the author by Keith Jefferis of Botswana, personal communication, August, 2006.
- 11 See, for example, Porter (1990).

References

- CellularOnline. 2002. “Vodacom Gets Mozambique Contract,” June 10. Available at <http://www.cellular.co.za>.
- Collier, P. 2006. “Africa: Geography and Growth.” Paper presented at the New Economic Geography: Effects and Policy Implications, a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August 24–26.
- Freeman, R. B. 2005. “What Really Ails Europe (and America): The Doubling of the Global Workforce.” *The Globalist*, June 3.
- Haacker, M. 2005. “The ICT Sector and the Global Economy: Counting the Gains.” *The Global Information Technology Report 2004–2005*. New York: Palgrave Macmillan.
- . 2006. “Information and Communication Technologies in Low- and Low-Middle-Income Countries: An Economic Assessment.” Unpublished manuscript. Forthcoming as IMF Working Paper, Washington, DC: IMF.
- IMF (International Monetary Fund). 2006. *World Economic Outlook Database*, April 2006. Washington, DC: IMF.
- Maddison, A. 2003. *The World Economy: Historical Statistics*. Paris: OECD.
- Porter, M. 1990. *The Competitive Advantage of Nations*. New York: Free Press.
- United Nations Statistical Division. 2006. Commodity Trade Data Base, a.k.a. COMTRADE, (data downloaded in July/August 2006).
- Venables, A. J. 2006. “Shifts in Economic Geography and their Causes.” Paper presented at the New Economic Geography: Effects and Policy Implications, a symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August 24–26.
- World Bank. 2006. *World Development Indicators 2006*. Washington, DC: World Bank.