



Disruptive Technologies in South Africa and Sub-Saharan Africa: The Case of Mobile Telecommunications Services

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August 2022 / No.DT-005

Introduction

The last decade around the world has been marked by digital transformation of the economies and societies. In most developed countries, almost every household is now connected to fast broadband Internet via fixed networks. Mobile operators have been covering the globe with LTE networks, which offer high-speed Internet connections on mobile devices. These investments in telecommunications infrastructure and increasing number of people with fast Internet connections on fixed or mobile networks resulted in an explosion of innovative Internet services. They have impacted the functioning of almost

every major industry including media, retail and transportation among others. The impact of digital markets on individuals, households and small business is gaining a momentum with the emergence and rapid growth of social media platforms, peer-to-peer lending, crowd-funding services and many other online platforms.

These recent changes take place at different pace in developed and developing countries, which is largely due to differences in the availability of infrastructure, affordability of Internet access, education and technological literacy as well as social and economic development. But even though developing countries are lagging behind, the rapid deployment of mobile Internet services in the last years allows them to overcome poor or non-existent fixed-line infrastructure for Internet access. Affordability of Internet services, digital literacy and digital divide between poor and richer areas and between segments of the societies remain the key challenges to overcome.

Access to mobile Internet can dramatically improve standard of living in developing countries by saving wasted trips, providing information about prices or serving as a conduit to banking, health care and other services. There are different ways through which mobile services can benefit people and economies in developing countries. First, mobile services can improve the functioning of markets by improving access to information and thus increasing transparency. Second, better communication can improve management of supplies and improve the efficiency of firms. Third, mobile phones may facilitate services which are in general not available to low-income households, such as mobile phonebased financial, agricultural, health, and educational services. Fourth, communications apps used on mobile phones, such as Messenger, WhatsApp, Skype, Viber and others not only cut the expenses on telecommunications services of low-income households, but they may also facilitate the co-ordination and cooperation of communities without access to other means of communications.

To date, there is only scarce research on how people in developing countries use mobile phones and Internet to access different mobile services and consequently how this impacts their well-being and the functioning of different markets. This is largely due to the shortage of individual-level data on the use of mobile services in these countries. In this report we contribute to filling this research gap by conducting a detailed study on the availability and access to mobile Internet services, use of different mobile services and their impact on economic outcomes such as adoption of financial services and labour market participation.

Content analysis

We address the following questions using different individual-level datasets for South Africa. The main research questions and findings are discussed in three sections below. First, we analyze how the price of smartphones impacts the adoption decision in different income groups. This is important because as mentioned above, smartphone is the only mean of accessing internet by poor people in South Africa and other developing countries. Second, we study the role of investment in mobile infrastructure for broadening access to mobile Internet and financial services. Third, we study whether change in employment status over time can be attributed to some extent to ownership of mobile phones.

Adoption of smartphones and digital divide

Mobile communications offer a major opportunity to advance economic growth in developing countries, where fixed-line infrastructure is non-existent or of limited coverage. Even when fixed networks exist, they are typically available in urban areas and to better-off households who are the minority. Therefore, the majority of population has to rely on mobile networks to access internet.

Yet, mobile phones and especially smartphones are still expensive and not affordable to the majority of population in low-income countries. Many poor people in these countries do not have stable jobs or work in informal sector. Thus, they are not eligible for tariff plans which would enable them to pay off the cost of a smartphone over one or two years. Because of limited budgets they also cannot afford purchasing bigger bundles of data and minutes at one time and instead make frequent purchases of small bundles. This increases the average price they pay for mobile services. Overall, poor households spend a relatively high share of their income on telecommunications services. Another problem is that mobile networks which enable high-speed internet access are first rolled out in densely populated urban areas which tend to be richer on average. This further contributes to widening the digital divide between rich and poor and between urban and rural areas.

We use biannual panel data of subscribers of mobile telecommunications services in South Africa to analyze how the price of smartphones impacts the adoption decision in different income groups. This is important because as mentioned above, a smartphone is the only mean of accessing internet by poor people, which has economic and societal consequences. The governments and international organizations such as World Bank have been trying to design policies to increase smartphone penetration and internet access among poor people in Africa and in

other low-income countries. The potential policies are lower taxes on the imports and sale of smartphones, or smartphone subsidy schemes, which could lower the prices paid by poor consumers. But, the effectiveness of these policies cannot be evaluated without knowing how price responsiveness vary across different income groups. We are especially interested how demand responds to price among poorest people who should be targeted by these policies. But the price of smartphones is not the only factor which impacts adoption. There is little value in having a smartphone in areas without coverage with 3G or 4G/LTE technologies, i.e., without mobile internet access. Also, the cost of mobile data may determine the adoption decision.

We estimate a number of discrete choice models, where we take into consideration the fact that smartphones are durable goods and consumers are forward-looking. We find that there is digital divide in the population because poor people live in areas without network coverage, while the cost of smartphones does not have significant impact on adoption. In particular, if poor and richer areas were fully covered by LTE networks in the period of our data, the adoption of smartphones would increase from 57.1% to 76.0% among people below poverty line, while it would only change from 81.5% to 82.2% in the richest group of consumers as of 1st quarter of 2018. This is precisely because richer areas have almost full LTE coverage, while poorer regions are only partially covered. At the same time, removing 15% VAT on smartphones would increase adoption only to 57.7% among people below poverty line, and to 81.7% among richest consumers as of 1st quarter of 2018. The price effect has only marginal impact on adoption in all income groups. We conclude that to reduce digital divide it is critical to develop LTE infrastructure in poorer areas and people will respond by adopting smartphones irrespective of their income. Our static and dynamic models yield comparable results suggesting that consumers do not take future price and quality into account when purchasing smartphones.

Usage of mobile money and financial services

In our second research project we study the role of investment in mobile infrastructure for broadening access to Internet and financial services in nine Sub-Saharan African countries: Ghana, Kenya, Mozambique, Nigeria, Rwanda, Senegal, South Africa, Tanzania and Uganda. The banking sector in Sub-Saharan Africa remains underdeveloped. Based on the mentioned survey by Research ICT Africa, which we use in this paper, as of 2017 only 29% of people in nine Sub-Saharan African countries had bank account. This number is much below the average for developing countries worldwide. The main reasons for lack of access to financial services are deficit infrastructure, inaccessibility and financial illiteracy. Mobile phones can change this situation by enabling people who are excluded from access to financial services to use them in the form of mobile wallet through which they can transfer, receive and

save money. In this way, they can overcome the problem of poor infrastructure and expensive traditional banking model, which relies a network of branches at physical locations. Mobile phones can also contribute to reduction in inequality when there is a transfer of money from richer to less developed areas.

We analyze how the following two decisions of individuals are impacted by the proximity of towers for different mobile networks and by distance to ATMs and banking facilities. First, we study what makes people decide to adopt a mobile phone, where we distinguish between a feature phone which cannot access Internet and a smartphone. Next, we analyze how they decide whether to use mobile money services. We use our model to simulate how investments in coverage of mobile networks impact the adoption of feature phones and smartphones, and use of mobile money services. We also estimate how the proximity of physical infrastructure and banking facilities impact the decision to send or receive money.

We find that network coverage has a significant impact on the decisions to adopt a mobile phone. In particular, individuals who live within 2km radius from GSM, UMTS and LTE towers are more likely to adopt both a feature phone and a smartphone, where there is a greater impact on the adoption of smartphones. The coverage by these different networks is highly correlated, where approximately 66% of individuals in our sample live within 2km from GSM tower, 64% from UMTS tower and 21% from LTE tower. We estimate different model specifications including coverage by one or more networks with comparable results. In counterfactual simulations, we consider that the whole population lives within 2km from any of these networks. We find that in such scenario the adoption of smartphones would increase by 12-32% depending on a country. The adoption of feature phones would decline for most countries when network coverage expands. The share of population without cell phones would decline by 8-18% depending on a country. Our results emphasize the role of investments in network coverage for increasing penetration of smartphones in African countries and for reduction of digital divide.

Overall, individuals who live in less developed economically areas, i.e., without night-time light at all, are less likely to use mobile services. Next, we find that smartphone users who live within 10km from a bank branch are less likely to use mobile money services, but this is not the case for users of feature phones. Furthermore, users of any type of handset who live within 25km from an ATM are also less likely to use mobile money services. Thus, while overall there is less mobile money usage in areas which are less developed economically, a greater distance to financial facilities increases the incentives to use mobile money services. We also find that individuals who live in less developed areas are less likely to send money, but this is not the case with respect to receiving money. Thus, mobile money services enable transfers from richer to poorer areas and contribute to reduction in income inequality.

Mobile phones and labor market in South Africa

The deployment and adoption of mobile phones and Internet services have broad implications for the economies of developing countries. This includes improved market efficiency, increased employment and reduced household poverty levels. In this research project, we provide further evidence on the impact of mobile phones on employment in the case of South Africa, where unemployment rates have been persistently high and even increased in the last decade from 22.4% in 2008 to 29.2% in 2020.

One of the key problems of the labour market in South Africa is the spatial distribution of supply and demand for labour. Due to spatial laws developed during Apartheid, many people live in rural areas which are far away from towns and cities where jobs are located. Moreover, search costs and limited access to information make it difficult for people living in rural areas to find jobs. As suggested by former research based on Quarterly Labour Force Survey conducted in South Africa in 2015, seeking assistance from family or friends and enquiring at workplaces were the most popular channels for unemployed individuals to search for work. Mobile phones and Internet access can help people to find jobs by improving access to information and reducing search costs. They can search for jobs online and call potential employers instead of personal inquiries, and be called back when opportunities arise.

In this project, we study whether change in employment status over time can be attributed to some extent to ownership of mobile phones. We use five waves of panel data from the National Income Dynamic Survey (NIDS), which was conducted in South Africa from 2008 to 2017. In the estimation, we control for a set of individual characteristics such as race, age, gender, physical health, educational attainment, place of living and others. The panel data structure allows us to account for unobserved heterogeneity amongst individuals. During the period covered by our data, Internet usage among South Africans increased from 8.4% in 2008 to 68.2% of the population in 2019. Mobile devices are the most popular means of accessing the Internet with 64.1% of South African households using mobile broadband, as compared to 8.3% that access the Internet using fixed broadband at home. Our estimation results suggest that mobile phone ownership has a positive impact on the change in employment status from unemployed to employed. On the other hand, ownership of a computer by a household and computer literacy do not have a significant impact on the change in employment status. We also find that having a mobile phone and ownership of a computer by a household reduce the likelihood of becoming unemployed.

Our paper contributes to the growing body of research on the impact of mobile phones and Internet on the labour market. This is particularly important in developing countries where search costs for jobs are high due to the lack of physical infrastructure among others. We show that mobile phones have the potential to reduce this inefficiency to some extent. It is therefore critically important to develop policies which stimulate their adoption. The key factors for this are expanding network coverage, affordable prices of smartphones and mobile devices, and low prices of mobile data services.

Conclusions and policy recommendations

Our main conclusions and policy recommendations on the basis of empirical studies discussed above are as follows.

- In our first analysis of adoption of smartphones, individuals with higher income tend to choose more expensive high-quality handsets than poorer individuals. There are therefore differences in Internet access among income groups as well as in the volume of downloaded data. The difference in affordability and use of smartphones is indicative of digital divide among individuals belonging to different income groups.

We find that there is digital divide in the population because poor people live in areas without network coverage, while the cost of smartphones does not have significant impact on adoption. In particular, if poor and richer areas were fully covered by LTE networks in the period of our data, the adoption of smartphones would increase from 57.1% to 76.0% among people below poverty line, while it would only change from 81.5% to 82.2% in the richest group of consumers as of 1st quarter of 2018. This is precisely because richer areas have almost full LTE coverage, while poorer regions are only partially covered.

At the same time, removing 15% VAT on smartphones would increase adoption only to 57.7% among people below poverty line, and to 81.7% among richest consumers as of 1st quarter of 2018. The price effect has only marginal impact on adoption in all income groups. We conclude that to reduce digital divide it is critical to develop LTE infrastructure in poorer areas and people will respond by adopting smartphones irrespective of their income.

- In our second analysis we analyse how the proximity of mobile networks infrastructure and banking facilities impact the decision to adopt a mobile phone and to use mobile money services. Our analysis again emphasizes critical role of investment in network coverage to increase adoption of smartphones and use

of Internet, and thus reduction of digital divide in geographic areas. We also find that individuals who live in areas which are less developed economically are less likely to use mobile money services.

Furthermore, we find that smartphone users who live in the proximity of a bank branch are less likely to use mobile money services, but this is not the case for users of feature phones. Furthermore, users of any type of mobile phone who live within 25km from an ATM are also less likely to use mobile money services. This indicates that mobile money is critical mean for financial inclusion of people who do not have access to physical banking infrastructure. Thus, while there is overall less mobile money usage in areas which are less developed economically, a greater distance to financial facilities increases the incentives to use mobile money.

We also find that individuals who live in less developed areas are less likely to send money using mobile money services, but this is not the case with respect to receiving money. We conclude that mobile money services enable transfers from richer to poorer areas, from richer to poorer people and from younger to older, which contributes to reduction in income inequality.

- In our third analysis, we study the impact of mobile phone ownership on change in employment status using data conducted among individuals and households in South Africa. Our estimation results suggest that mobile phone ownership has positive impact on employment status. On the other hand, ownership of a computer by a household and computer literacy do not have a significant impact on the change in employment status.

We also find that having a mobile phone and ownership of a computer by a household reduce the likelihood of becoming unemployed. Our findings emphasize that policies which stimulate adoption of mobile phones have also impact on the labour market. The policies include smartphone subsidies and development of network coverage in areas where poor people live.



Mission

To strengthen local capacity for conducting independent, rigorous inquiry into the problems facing the management of economies in sub-Saharan Africa.

The mission rests on two basic premises: that development is more likely to occur where there is sustained sound management of the economy, and that such management is more likely to happen where there is an active, well-informed group of locally based professional economists to conduct policy-relevant research.

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