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Economics

FIT IN Initiative

Policy papers

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Mobile money

How can phones improve financial inclusion?

Tower up

Shared infrastructure can bridge the digital divide

Economics for the Common Good

FIT IN Initiative

In the world's poorest countries, mobile and Internet networks have become a gateway to economic advancement, inclusion and technological opportunities. Among these, mobile money has arisen as a beacon of hope, with proven value in streamlining transactions and facilitating access to financial services. In Africa and other developing regions, its meteoric growth has allowed many underprivileged people in remote areas to overcome the problem of poor infrastructure and expensive traditional banks, which rely on a network of branches at physical locations. Mobile networks can also reduce inequality when money is transferred to less developed areas.

Public policy, once concentrated on building the foundations of digital financial services, now grapples with a more nuanced set of concerns. While mobile money networks were in their infancy, the primary focus was to establish robust infrastructures and to attract and engage new users. However, as these payment ecosystems mature, a new set of challenges and opportunities has emerged, requiring decision-makers to pay attention to complex market dynamics.

Interoperability – or the ability of mobile money users to interact – has become a crucial policy focus. Scientific investigation can offer valuable insights into its complex interaction with competition, investment incentives and consumer welfare, informing decisions on whether interoperability should be mandated centrally, and evaluating its influence on data usage and access to services. Interoperability may help to build a more efficient and inclusive financial landscape, but it does not guarantee intense competition, as shown by telecom providers who use differentiated services and strategic pricing to leverage network connections.

Launched by TSE in November 2020, the [FIT IN Initiative](#) (Financial Inclusion Through Interoperability) aims to assist policymakers with these new challenges, optimizing the design and regulation of digital financial services in low- and middle-income countries. Supported by the [Bill & Melinda Gates Foundation's Financial Services for the Poor program](#), this four-year research project seeks to understand the implications of alternative competition and regulatory policies and improve the scope, quality, and affordability of digital payment systems for the disadvantaged.

Building an inclusive financial system

As part of our quest to improve digital financial services, this document presents some of the project's latest research contributions. In two related studies, '[Mobile phones and financial inclusion in Sub-Saharan Africa](#)' and '[Interoperability between mobile money agents and choice of network operators: the case of Tanzania](#)', Lukasz Grzybowski, Valentin Lindlacher and Onkokame Mthobi combine detailed survey and satellite data to study how mobile networks impact financial inclusion. In '[The Impact of Shared Telecom Infrastructure on Digital Connectivity and Inclusion](#)', Georges Vivien Hounbouon, Marc Ivaldi, Emil Palikot and Davide Strusani show how shared ownership of telecoms infrastructure can have important benefits for firms and consumers in developing countries.

Together, the FIT IN Initiative research featured in this document provides compelling evidence that investments in mobile infrastructure can improve the availability, affordability and uptake of digital financial services. In particular, their findings emphasize the value of mobile networks and mobile money in reducing inequality and promoting connectivity and financial inclusion for marginalized citizens, including women and rural households.

55%
of people in Sub-Saharan Africa owned a financial account in 2021. This compares to 96% in high-income countries. The gender gap in account ownership across developing economies has fallen to 6 percentage points from 9 percentage points, where it hovered for many years

Source: World Bank

The contrasting empirical approaches in this document highlight the paramount importance of understanding how competition and interoperability can drive such benefits, with implications for service quality, pricing structures, innovation, investment in infrastructure, and the overall risks involved. For instance, Georges Hounbouon et al suggest a welcome boost in digital connectivity may be due to the increased intensity of service-based competition when telecom firms share infrastructure. Lukasz Grzybowski's team, meanwhile, assess how compatibility between mobile money agents impacts competition among service providers.

In a context of diverse providers vying for market share, ensuring a level playing field in which telecoms systems seamlessly communicate with one another may be pivotal to consumer welfare. However, there is much work still to be done to understand the drivers, interactions and tradeoffs involved, as well as the potential role of access regulation. We welcome the researchers' efforts to shed new light on this changing landscape.

The contributions featured in this document add to a series of FIT IN Initiative research papers demonstrating that digital technologies can be a tool for empowerment, inclusion, efficiency, and economic progress. Without competition and interoperability, mobile

money risks losing these flagship attributes. However, effectively unlocking its transformative power raises many critical questions: How should regulators strike a balance between incentives for competition and cooperation? Or between the benefits of compatibility and variety? How should key infrastructure assets be managed? What is the impact of interoperable systems on market participants?

By exploring effective strategies for promoting digital and financial inclusion, our researchers aim to ensure that developing countries are included in the fast-paced, interconnected world of the 21st century. Providing universal access to high-quality financial services is more than just a technical challenge. It is a moral imperative and an investment in a more equitable and connected future for all.



How can phones improve financial inclusion?

How can the power of digital technologies be harnessed for the benefit of the world's poorest? With the support of TSE's FIT IN Initiative, two new studies by Lukasz Grzybowski, Valentin Lindlacher, and Onkokame Mothobi combine the results of an extensive survey in Sub-Saharan Africa with detailed geographic data on the coverage of mobile networks and financial services. Their research explores the impact of imposing interoperability on mobile money agents and shows that investment in mobile infrastructure can have far-reaching effects in reducing inequality.



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Why are mobile networks so crucial to development in Africa?

Investment in mobile infrastructure is vital to broadening access to the Internet and financial services. This is particularly important in Sub-Saharan Africa where the banking sector remains underdeveloped. In 2017, only 29% of the population in the nine Sub-Saharan African countries covered by our research had a bank account, which is significantly lower than the 94% reported in high-income countries. However, when including people who also have a mobile money wallet, the proportion of the population with access to financial services in these developing economies increases significantly to 51%.

More specifically, mobile money services can enhance financial resilience and security for rural households by providing a secure way to store, transfer, and access funds. Offering safer and more affordable financial transactions, mobile money can help these households smooth consumption and protect themselves against financial shocks and other risks, such as floods and famine. Existing research has also indicated that mobile phones can improve market efficiency, thereby increasing both consumer and producer welfare. The widespread adoption of mobile phones has contributed not only to increased financial inclusion in these countries but has also significantly boosted access to and usage of Internet services. Given that only about 4% of households own a computer, 95% of internet connections in these countries are made using smartphones. As smartphones are generally more affordable than computers and their quality is continuously improving, they have the potential to narrow the digital divide in the developing world.

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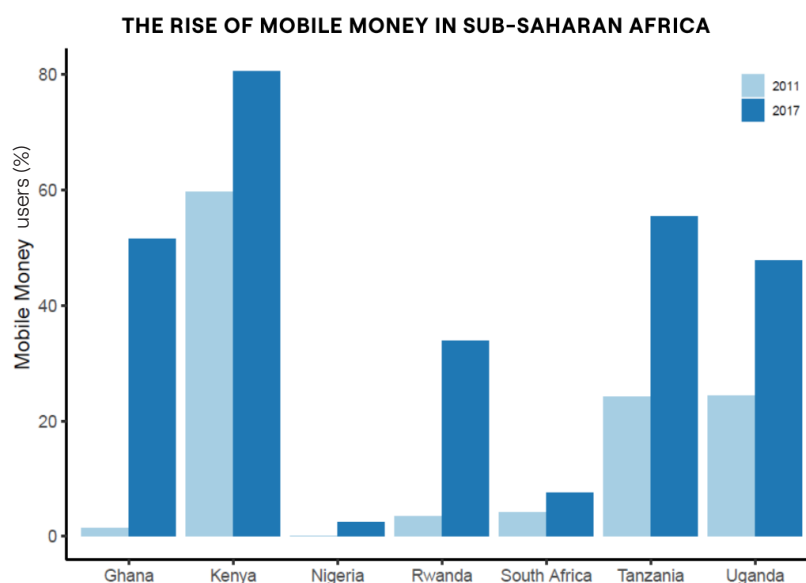
What is mobile money and how can it be improved?

This service enables users of inexpensive mobile phones to transact through a mobile account linked to a unique number. Mobile money accounts can be used for various financial services, including transfers, savings, loans, and insurance. Mobile money is distinct from mobile banking, which requires users to manage their bank accounts using internet-enabled mobile devices.

Boosted by interoperable payment systems that allow users to transfer money between accounts held with different mobile operators and other financial institutions, mobile money is now widely used in Sub-Saharan Africa. However, digital payments are not yet commonly accepted for everyday purchases at local stores and markets. Thus, mobile money users need to deposit and withdraw cash at cash-in and cash-out points, which may be a bank agent, mobile money agent, or an automated teller machine (ATM). A large network and proximity of agents may be a key determinant when choosing a mobile money provider, where first movers and large network operators have a competitive advantage.

As network effects are central to success in this market, there is consensus among economists that all providers should interconnect to maximize welfare. However, dominant firms may opt not to interconnect to protect their customer base. Imposing interoperability between mobile money providers may therefore be a way of

mitigating market domination. By reducing the cost of transactions and expanding each network's reach, interoperability should increase the volume of money transfers and the use of mobile money. Firms can also share large costs, such as providing liquidity and building a network of agents.



Source: Calculations based on Research ICT Africa surveys

How do you examine the impact of mobile networks on financial inclusion?

Existing studies on mobile money and financial inclusion focus mainly on Kenya, where M-Pesa became very successful early on. We contribute to this literature in '[Mobile Money and Financial Inclusion in Sub-Saharan Africa](#)' by analyzing how network coverage and banking facilities impact the use of mobile phones and mobile money in Ghana, Kenya, Mozambique, Nigeria, Rwanda, Senegal, South Africa, Tanzania and Uganda.

In a related study, '[Interoperability between Mobile Money Agents and Choice of Network Operators: The Case of Tanzania](#)', we examine the impact of interoperability between mobile money agents. We focus on Tanzania because geo-location information for mobile money agents, disaggregated by the service provider, is unavailable for most of the above countries. Kenya is an exception, but its mobile money services are dominated by Safaricom, which makes it difficult to study interoperability.

Both our studies exploit rich data from a 2017 survey conducted by Research ICT Africa. Using respondents' geo-location, we combine this survey data with detailed information on the proximity of physical infrastructure and mobile money agents. We use variables such as the proximity of the nearest bank branch, ATM, main road, and town. To approximate the level of economic development, we use nighttime light intensity satellite data while mobile coverage is approximated using distance to mobile towers from OpenCelliD.

What do your results suggest about the benefits of expanding mobile coverage?

Our results emphasize the role of investments in network coverage in reducing the digital divide. We find that individuals who live within a 2km radius of mobile towers are more likely to adopt mobile phones, especially smartphones. In counterfactual simulations, we find that the uptake of smartphones would increase by between 12% and 32%, depending on the country, if everyone lived no more than 2km from a tower. Expanding network coverage would reduce the use of feature phones in most countries, while the population without mobile phones would decline by between 8% and 18%.

“ Our research shows that mobile money services can contribute to a reduction in income inequality, by enabling transfers from richer to poorer areas, and from richer to poorer people

Overall, individuals who live in less economically developed areas – that is, with no nighttime lights – are less likely to use mobile services. However, we also find that large distances to financial facilities increase the incentives to use mobile money. Most importantly, our research shows that mobile money services can contribute to a reduction in income inequality by enabling transfers from richer to poorer areas and from richer to poorer people.

Individual characteristics can play a significant role. For instance, sending mobile money is more likely among the young, married, and higher-income groups, as well as those with a computer and a bank account. Older people and women are more likely to be recipients.

Financial inclusion is not guaranteed by network access. Policymakers should pay particular attention to our finding that people without education are less likely to send, receive, or save mobile money, which suggests that investment in infrastructure to bridge the digital divide should be accompanied by measures to improve education and financial literacy.

What about the impact of interoperability between mobile money agents?

We find that the distance to a mobile money agent influences people’s decisions to adopt a phone and to subscribe to the agent’s network. Mobile networks with a smaller network of agents who are further away are less likely to be chosen by consumers. However, this distance has no significant impact on mobile money use for people who already have a mobile phone.

In counterfactual simulations, we examine the impact of imposing interoperability by estimating the impact of allowing consumers to use the closest agent from any mobile money provider. Here, we find that interoperability has only a small impact on the market shares of mobile network operators: smaller operators marginally gain because their consumers can now use agents of larger providers which tend to be closer.

We conclude that agent-level interoperability does not have a large impact on competition between mobile money operators in Tanzania. However, we caution that our results hold in a country where the national bank introduced regulation of interoperability and mandated non-exclusivity in 2016, allowing agents to work for many mobile network operators. The distance to mobile money agents may be less important in this market where consumers can transfer money between different operators.



In general, Tanzania’s approach to interoperability has had a positive impact on financial inclusion. The percentage of adults with access to formal financial services, including mobile money, increased from 16% in 2009 to 56% in 2017. The percentage of people living within 5km of a financial service provider, including mobile money agents, increased from 45% to 86%.

KEY TAKEAWAYS

- Individuals who live close to mobile towers and mobile money agents are more likely to adopt mobile phones. Uptake of smartphones would increase by up to 32% if everyone else lived less than 2km from a tower.
- People living in less developed areas are less likely to use mobile services. However, greater distance to financial facilities increases use of mobile money.
- Mobile money enables transfers from richer to poorer areas and people, which reduces income inequality.
- Imposing interoperability between agents would not have a large impact on competition in Tanzania, where interconnection has already had a positive impact on financial inclusion.

FURTHER READING

The empirical literature on the adoption of mobile phones in developing countries is already mature. For instance, analysis by [Grzybowski \(2015\)](#) uses panel data on South African households. [Aker & Mbiti \(2010\)](#) investigate the increase in mobile coverage and usage across Africa.

About the authors

Lukasz Grzybowski

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His research focuses on economics and public policy issues in the network industries. It includes the analysis of market power, switching costs, network effects, and demand side complementarities in telecommunications markets. He is currently Managing Editor of the *Review of Network Economics*.

Valentin Lindlacher

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His main fields are economics of digitization, development economics, and political economy. He focuses on the effects of digital infrastructure, such as fixed-line and mobile internet and mobile telephony.

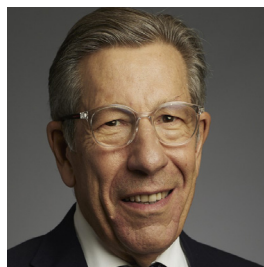
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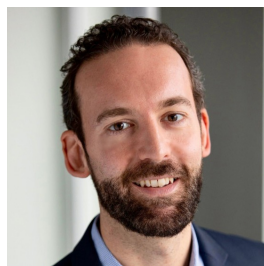
He is an expert in industrial economics, competition, and regulatory policies. He has been involved with Research ICT Africa in several business and management consultancies in private and public organizations. Currently, he is a postdoctoral fellow at Tayarisha Digital Governance Centre in Johannesburg.

Shared infrastructure can bridge the digital divide

Huge infrastructure costs have often kept the opportunities of digital technology beyond the reach of many citizens in developing countries. As part of the FIT IN Initiative, a new working paper by Georges Hounbouon, Marc Ivaldi, Emil Palikot and Davide Strusani investigates the impact on digital connectivity and inclusion when mobile network operators transfer towers to neutral owners. This research suggests that both firms and consumers – especially women and rural households – can benefit from a growing trend for multilateral telecom infrastructure sharing.



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Why should we be concerned about who owns telecom infrastructure?

Infrastructure-based competition, whereby mobile operators deploy their own network infrastructure and compete for end-users, has been considered by regulators to improve service affordability and boost investment. However, maintaining or upgrading network infrastructure can be very costly in the long run as it requires frequent investment to keep pace with technological progress. When network operators do not have sufficient funds to invest in infrastructure development, this can lead to deteriorating quality of service and eventually weaken competition. In developing countries, the challenge of hefty maintenance costs is compounded by end-users' low ability to pay for connectivity services. These supply and demand-side challenges have contributed to the development of shared infrastructure business models.

In practice, various forms of network ownership and governance coexist. Under full ownership, a telecom service provider can share its network infrastructure through bilateral agreements that might cover, for example, roaming access or the use of mobile masts and towers. However, this may lead to owners discriminating against competitors by raising the access cost or limiting the quality of services. Access regulation aims to avoid such discrimination by fixing access prices or service quality or setting up dispute resolution mechanisms.

“ In developing countries, the challenge of hefty maintenance costs is compounded by end-users' low ability to pay for connectivity services. These supply and demand-side challenges have contributed to the development of shared infrastructure business models

Under partial ownership, telecom service providers typically establish joint ventures among themselves or with a third party specialized in the operations of network infrastructure. This also carries risks, such as coordination failure among operators with competing interests that results in delays in network deployment. Under a no-ownership scenario, infrastructure ownership is transferred from service providers to neutral operator, who then rents access back to the service providers.

Multilateral infrastructure sharing is gaining momentum across developing countries. Under such agreements, neutral tower companies – or ‘towercos’ – take over the ownership and operation of towers from mobile network operators. As of 2020, three in four mobile towers in emerging markets were managed by towercos. The Southeast Asia region had the highest share of towers managed by towercos (91%), primarily driven by the 100% rate in China. This was followed by South Asia (76%), primarily driven by India (84%); and Latin America (59%), primarily driven by Brazil (70%) and Mexico (90%).

By reducing the cost of deployment and operations, shared infrastructure can generate savings for mobile network operators that have been estimated at 20% to 30%

What explains the appeal of shared telecom infrastructure?

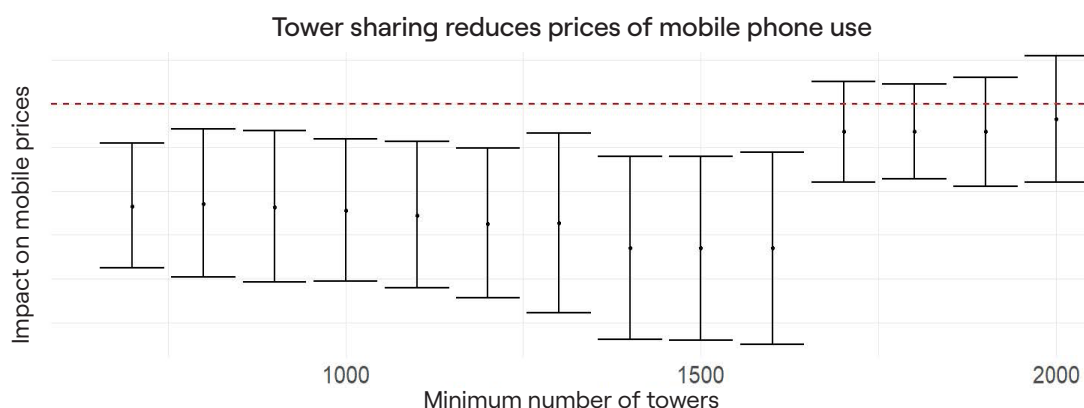
By reducing the cost of deployment and operations, shared infrastructure can generate savings for mobile network operators that have been estimated at 20% to 30%. Shared towers, for instance, dramatically lower the cost of entry into mobile markets. This helps to level the playing field between large and smaller mobile network operators, enabling faster network coverage and increased service-based competition.

Depending on the intensity of competition, cost savings can also be passed on to consumers, especially when infrastructure is shared on an open-access and non-discriminatory basis. Consumers can also benefit when infrastructure sharing increases investment in mobile and high-speed broadband networks, increasing the availability and quality of digital connectivity.

How do you investigate the impact of shared infrastructure on digital connectivity and inclusion?

Our paper evaluates the effects of multilateral infrastructure sharing in 137 developing countries. More specifically, we study what happens when towers are transferred from mobile operators to neutral operators. Specifically, we focus on how cost savings due to infrastructure sharing can affect competition in the downstream market for retail mobile connectivity, and ultimately the welfare of end-users.

We use a novel dataset on about 150 tower transactions between 2008 and 2020 in addition to data on the price of mobile telephones and Internet, as well as data on the uptake of mobile Internet in rural areas and by women. We rely on five main data sources: TowerXchange (TXC), a leading industry research firm in the tower sector; GSMA, the global association of mobile operators; International Telecommunications Union (ITU); Gallup Survey; and the World Bank’s World Development Indicators.



Infrastructure deals lower the price of mobile subscriptions (without broadband). However, the effect is statistically insignificant for the largest deals

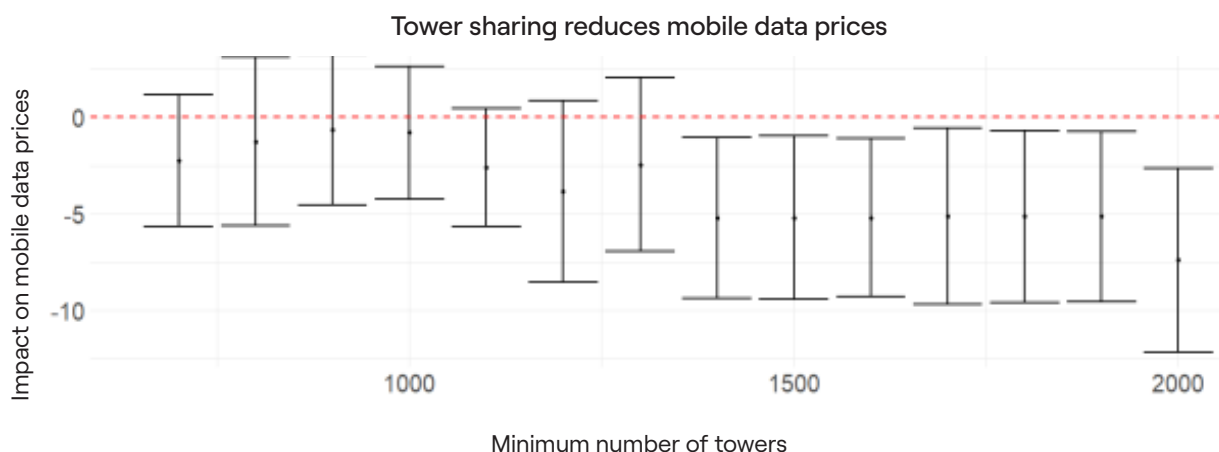
Focusing on large transactions, in which at least 1,000 towers are included, we estimate the average effects of a tower-sharing agreement on the availability of mobile Internet, uptake of mobile Internet, and access to mobile Internet by women and people living in rural areas. As such effects can take time to materialize, we consider outcomes in the year the deal has taken place and the year after. To do that, we carry out a difference-in-differences analysis, in which the comparison group consists of countries in which we did not observe tower-sharing agreements.

What are your key findings?

We find that tower transactions result in significant improvements in mobile connectivity, especially for rural households and women. First, tower-sharing deals improve the availability of mobile internet: after two years, 3G coverage increases by 8.5 percentage points (13%), and 4G coverage rises by 7.8 percentage points (13.1%). There is no statistically significant impact on 4G coverage, probably due to the nascent stage of this technology in developing countries at the time of the majority of transactions.

Second, the price of mobile phone connections decreases by 20% in the year of the tower deal, and by 18% two years later. However, the impact on the price of mobile data is insignificant (although, we cannot rule out medium-size positive effects either). Third, we find a statistically significant increase in the uptake of both mobile telephones and mobile Internet.

These improvements in affordability, availability and uptake may be due to cost reductions or increased competition. As we do not observe companies' costs, we cannot directly test whether the improvements are driven by cost savings from tower sharing. However, we do observe that tower transfers reduce market concentration, and this effect increases over time. This suggests that the above outcomes are driven by increased competition intensity in the wake of agreements to share infrastructure.



When deals involve more than 1,300 towers, infrastructure sharing lowers the price of mobile Internet. For smaller deals, this effect is statistically insignificant.

KEY TAKEAWAYS

- **Sharing telecom infrastructure can improve the availability, affordability, and uptake of mobile telephones and the Internet.**
- **By divesting towers to neutral operators, mobile network operators can advance digital inclusion for women and rural households.**
- **The main driver of these benefits appears to be increased service-based competition following the sharing of telecom towers.**

FURTHER READING

For more on the welfare effects of market structure in the mobile industry, see [Genakos et al. \(2018\)](#), [Jeanjean & Hounghonon \(2017\)](#) and [Elliott et al. \(2021\)](#) who investigate the impact of infrastructure-based competition on price and investment. [Koutroumpis et al. \(2021\)](#) evaluate the effects of bilateral sharing of telecom infrastructure.

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His work combines theories of industrial organization and development economics with data analytics and impact evaluation methodologies to improve the functioning of inclusive and sustainable digital markets and maximize their benefits for societies; while mitigating their risks through recommendations on public policies, regulations, and corporate strategies. He received his PhD from Paris School of Economics (France).

Marc Ivaldi

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He is an expert in the use of empirical and quantitative methods for competition and regulation policy and has advised firms as well as competition and regulatory authorities on a wide range of issues in competition economics. Much of his work has been devoted to the analysis of networks and transport service industries including rail, air, urban transport, energy, telecommunications, banking, and information technologies.

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He is a recognized expert on the role of communications and technology in delivering economic and social growth, having led numerous in-country campaigns with governments and private sector to boost ICT usage, and numerous thought leadership pieces on the role of technology and digital services in fostering development. At the IFC, Davide leads the economics team that focuses on telecoms, technology, digital services, venture and equity fund investing.

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