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1. Summary of Conclusions

In this declaration, I explain why I believe it is desirable and appropriate for the Colombian Regulatory Commission (CRC) to set wholesale Mobile Termination Rates (MTR) and wholesale National Roaming (NR) rates at the efficient cost, and to avoid setting asymmetric rates for MTR and NR along the glide path toward efficient cost rates. Adopting this policy is in the public interest and is consistent with the goals of promoting economic growth and competition in wireless services and infrastructure. In the following paper, I will explain why it is the case that:

- (1) Promoting the deployment of an advanced 4G LTE national network in Colombia is necessary to keep on-track with the growing demand for mobile communication services that are increasingly viewed as essential socio-economic infrastructure. Enabling such deployment by a new entrant, Avantel, will help sustain competition, which offers the best way to ensure a healthy national telecommunications sector and continued investment and improvements in mobile infrastructure and services.
- (2) Ensuring Avantel's access to wholesale NR services for voice and SMS at efficient cost rates is essential for the viability of Avantel's business model. While the CRC has appropriately recognized the need to mandate access to wholesale NR services as an essential service, failure to ensure that such NR services are available at efficient cost rates effectively nullifies the benefits of this regulatory guarantee; is inconsistent with prior regulatory decisions; and is fundamentally anticompetitive in the present context. This failure is due to the recent CRC proposed decisions to apply to NR rates the same glide path set for MTR charges. If adopted, the effect would be

to substantially reduce Mobile Termination Rate (MTR) charges, while leaving NR rates inappropriately adjusted so as to be significantly higher.

- (3) The decision to reduce MTR charges is consistent with global trends and sound economic principals. There is no doubt that present NR and MTR charges are substantially above incremental costs. This inefficiently dampens demand and distorts market behavior by customers and service providers alike. Moving such charges to efficient cost levels is desirable. However, achieving this goal by lowering MTR without commensurate reductions in NR rates is neither necessary nor desirable.
- (4) The best way to remedy this problem and restore regulations to the pro-competitive trajectory previously established by Colombian policymakers is to maintain the criteria set before, in which NR is at the lowest value of the glide path. This would eliminate the additional and overwhelming cost disadvantage that would otherwise frustrate Avantel's efforts to offer a competitive retail service bundle to mobile subscribers in Colombia, and creates an unnecessary risk and opportunity for incumbent providers to execute a price squeeze or otherwise engage in anticompetitive strategies.
- (5) Setting asymmetric MTR and NR rates makes no economic sense since the two services are functionally the same from an end-user and cost-perspective. In both cases, a carrier is handing off a voice or text call to another operator (the MTR or NR provider) to terminate over the receiving operator's network. No additional resources are used in supporting wholesale NR than for wholesale mobile termination services. Setting the rates differently creates a regulatory-induced cost differential that may be exploited by incumbents to protect their market power and harm competition.

- (6) In the case of Avantel, the problem is especially acute because Avantel lacks viable alternatives to relying on incumbent provided NR services for its voice and text messaging retail offers. The need for such services is not limited to markets where Avantel has yet to build out coverage, but includes markets where Avantel has already deployed its LTE network. The reason Avantel lacks viable alternatives is because Voice-over-LTE (VoLTE) solutions are not yet commercially viable, and until such solutions become viable, Avantel will need to rely on NR services from 2G/3G service providers for its voice and text offers.
- (7) Moreover, concerns that setting MTR and NR rates at parity or setting NR to cost-based rates will deter network investment are not applicable in the present context. As a condition of its spectrum license, Avantel has to meet LTE network build-out requirements. Longer-term, Avantel will have a compelling incentive to migrate its text and voice services to its LTE network to reduce costs and fully realize the benefits of the all-IP platform that LTE enables. Ultimately, a full transition by all mobile operators to LTE is expected, but until such time as that occurs, NR for voice and text will be needed to address coverage and end-to-end interoperability issues.

2. Benefits of 4G LTE Mobile Networks Competition

Increasingly, mobile and broadband services are viewed as essential socio-economic infrastructure for our increasingly electronically interconnected national and global economies. Policymakers around the globe have been adopting ICT strategies committing

to the universal deployment of broadband Internet access services,[1] and increasingly, it is recognized that much if not most of such access will be provided over wireless mobile broadband networks (see Figure 1). In Colombia, the Ministry of Information Technologies and Communication's (MINTIC's) *Plan Vive Digital* and the 2010-2014 *Prosperidad para Todos* national plan for economic development set forth a bold agenda to promote competition and availability to advanced telecommunication services, including mobile broadband, for all Colombian citizens.

What was once a niche voice-only mobile telephony service has grown exponentially and morphed into *the* increasingly rich selection of data services (email, Web, streaming media, smartphone applications, etc.). In the United States, Europe and other mature mobile markets, penetration exceeds 100%, with a growing number of consumers having multiple and more capable devices (see Figure 2).[2] This transition has required continuous mass-market, personalized mobile multimedia platform for voice, text, and an investment in upgrading the quality, capabilities, and capacity of mobile network infrastructure and services, involving the transition through multiple generations of

[1] Both the United States and Europe have Digital Broadband Agendas (see FCC (2010), "Connecting America: The National Broadband Plan," Federal Communications Commission, Washington, DC, March 2010, available at: http://www.broadband.gov/; and EC (2010), "Digital Agenda for Europe," European Commission, COM(2010) 245 final/2, available at http://ec.europa.eu/digital-agenda/digital-agenda-europe). For a comparison of digital agendas from a number of countries, see OECD (2011), "National Broadband Plans", OECD Digital Economy Papers, No. 181, available at http://dx.doi.org/10.1787/5kg9sr5fmqwd-en. Most of those articulate a national commitment and goals to provide universal access

[2] A growing number of subscribers have eReaders, tablets, cameras and other mobile connected devices in addition to cell phones; and increasingly, the cell phones are more capable smartphones.

cellular technologies. Today, we are in the beginning stages of transitioning to the fourth generation of technology, 4G LTE.[3]

At the same time, policymakers around the world have recognized that the best way to promote healthy investment in improving mobile network infrastructure is to ensure the vibrancy of competition. Competitors are necessary for competition to succeed; but entry into mobile network services is difficult because of the large entry barriers. These include the high costs of constructing and operating a network that are largely fixed, sunk or shared; the existence of significant positive network externalities that make it more valuable to subscribe to a larger network; and the necessity of securing access to critical resources, which in the case of mobile services means access to radio frequency spectrum. With respect to each of these, incumbent operators have a potentially overwhelming competitive advantage in terms of lower costs and, absent regulatory protections, the means and opportunity to effectively foreclose competitive challenges. In telecommunication service markets without adequate competition, consumers pay higher prices, have fewer choices, and service quality is lower.

[3] In the 1980s, the first generation ("1G") of mobile telephones were based on analog technology. In the 1990s, the second generation ("2G") mobile telephones were digital, which offered important benefits in terms of lower costs, expanded capacity (including better spectral efficiency), and expanded capabilities. However, data capabilities were quite limited. The third generation ("3G") of mobile technology which began to emerge after 2000 provided support for data services, enabling the beginnings of the convergence of the Internet and mobile telephony. This coincided with the expansion of text messaging (SMS) as the first mass market mobile data communications service to takeoff. Although SMS was supported in 2G, it was not widely used until after 2000 when cell phone adoption grew sufficiently, interoperability issues were resolved, and new text-friendly handsets became available to enable SMS to grow rapidly. For a richer data experience, 3G services are necessary; and for this progress to continue and to meet the growth in data traffic needs, network operators need to upgrade to 4G LTE and beyond. (Efforts are already well underway to define the next generation of 5G mobile technologies.)

Policymakers in Colombia had addressed several of these key issues with sensible, forward-looking policies. These included passage of major communications regulatory reform with passage of the ICT Act in 2009;[4] recognizing that NR is an essential service for mobile operators;[5] in allocating spectrum for competitive entry by a new 4G LTE provider (i.e., Avantel);[6] and by recognizing the need to regulate MTRs to enable more efficient service pricing.[7] Unfortunately, recent CRC decisions that seek to extend the glide path in MTRs but fail to apply it to NR (i.e., dramatically lower MTRs for voice and SMS without concurrently extending those rates for NR) poses a serious, potentially fatal, threat to the business prospects of Avantel, the new 4G LTE provider. The proposed regulation would put Avantel at such a large cost disadvantage as to effectively destroy the viability of Avantel's 4G LTE business plans. Under the proposed plan, placing a call into Claro's network would cost Avantel 3 times as much as the cost the other two carriers would have to bear.

While it is sound policy to lower both NR and MTR rates toward cost-based levels, in the present context, there are no good reasons for failing to preserve the prior criteria of ensuring NR rates are equal to the lowest MTR at any point along the glide path. Since that lowest rate is the one for Claro, this implies NR is at parity with Claro MTR during

[4] Law 1341, the Information and Communications Technology Act of 2009 ("ICT Act of 2009") established the CRC with broad regulatory authority over telecommunications and television services.

[5] CRC 4112 (Feb 2013).

[6] MinTIC 449 (Mar 2013).

[7] CRC 4112 (Feb 2013).

the glide path. Furthermore, failure to preserve the parity with MTRs applicable to Claro poses a significant threat to competition and the public interest. One reason advanced for keeping NR rates high is to avoid deterring investment in facilities that might eventually render the need to mandate the provision of NR services unnecessary.[8] In the present circumstance that concern is ill-founded.

First, Avantel is committed to building out an LTE network to meet the requirements of its spectrum license. Even if Avantel wanted to free-ride on incumbent infrastructure, it could not do so without violating its build-out requirements and risking loss of the spectrum resources on which its business depends.

Second, even with parity rates between MTR and NR, Avantel would expect to be at a cost-disadvantage relative to incumbents initially as it endeavored to build out its service footprint and acquire a sufficient customer base to enable Avantel to realize scale and scope economies comparable to those already realized by incumbent operators.

A key feature of 4G LTE and Avantel's value proposition promise to consumers is its ability to offer a full range of multimedia services via a flexible and spectrally-efficient network. The multimedia service bundle that customers expect and demand includes mobile voice, text messaging, and data services. Unfortunately, while LTE promises to deliver all of these via a unified platform, it is not commercially feasible to offer Voice-

[8] Even if there were full and adequate facilities-based competition everywhere, network operators would likely still negotiate roaming agreements, but this could be left to market forces to dictate, and regulatory mandates would no longer be necessary.

over-LTE today, and when this will become widely viable remains uncertain. In the meantime, Avantel has a critical need for voice and text message NR services in order to be able to offer a service bundle to consumers that will have a chance of competing successfully with the bundles offered by competitors, even if Avantel's data services where it has built out its network are superior.

While Avantel is compelled to rely on NR for its offering of mobile telephony and text messaging in the near-term, a long-term strategy of relying on wholesale NR services would be inconsistent with the logic of deploying a 4G LTE network (even if this were not already rendered infeasible by spectrum licensing requirements). To realize the benefits of its 4G LTE network, Avantel will need to integrate its services onto its own network.

While the CRC continues to recognize the essentiality of ensuring availability of mandated NR services, allowing the proposed change in the regulation renders this useless (i.e., creating the price discrepancy between NR and MTR rates). Avantel needs to be able both to offer the right bundle of voice, text, and data services, and to be able to offer that bundle at a retail price that is reasonably competitive with the offers from incumbents to be viable in the marketplace. Under the current pricing rules that set NR rates significantly higher than efficient costs and MTR, it is impossible for Avantel to offer a competitive bundle of services to those offered by the incumbents.

Earlier, the CRC has adopted a glide-path to move the industry toward symmetric rates for MTR. As of CRC Resolution 3136, issued on September 26, 2011, the CRC proposed setting the MTR for the dominant provider, Claro, at 42.49[9] and for other providers (including Avantel) at 70.26 in 2013, and then adjusting those rates toward symmetry at 42.49 for the other providers by 2015 (see Table 1). The motivation behind adopting such asymmetric price setting was based on the expectation that smaller providers have higher costs for terminating traffic. Tapering toward symmetry over time was intended to capture the fact that the incumbent's cost advantage would naturally decrease as entrants grew in scale and market shares became more balanced. Under this earlier framework and of special relevance here, the CRC also established the NR rate for voice roaming at parity with the lowest value of the glide path, which is equal to the MTR for Claro at 42.49 in 2013. This was especially important for Avantel because of its need to rely on NR as its only option for offering voice and messaging services.

In its August 19, 2014 draft resolution, the CRC proposed to take another important step toward more efficient and precompetitive price regulations by reducing MTRs toward cost-based levels. Under that proposal, the CRC proposed reducing the MTR for Claro from the current level of 42.49 in 2014 to 8.66 by 2015, and for other providers to 56.38 in 2014 and then to 8.66 for Telefonica and Tigo by 2016, and for Avantel by 2017 (see

[9] All prices are in Colombian Pesos.

Table 1). Unfortunately, NR rates were left intact at 42.49, which meant that NR would be priced significantly above MTR after 2014.[10]

In its November 14, 2014 draft resolution, the CRC partially reversed itself, proposing a longer glide-path for adjusting Claro's MTR toward a new cost-based rate of 9.79 by 2018, and adjusting the MTR for other providers to symmetry with Claro at 20.81, and then to 9.79 the following year. For Telefonica and Tigo, symmetry with Claro occurs in 2017, and for Avantel in 2018. The voice NR rate was kept at the 42.49 rate through 2015 and then tapered to parity with the MTR Claro rate at 20.81 by 2017, and then 9.79 by 2018. After 2018, NR rates would be negotiated.

While the CRCs efforts to move MTR and NR toward cost-based rates is commendable and consistent with earlier efforts to promote competition and set efficient regulated rates, the path the CRC is recommending would severely and unfairly disadvantage Avantel by making it prohibitively expensive for Avantel to rely on NR for its voice and text messaging service offerings.

3. National Roaming at efficient cost is critical for viability of Avantel business

As noted above, facilities-based entry into mobile telecommunications markets confronts substantial barriers. A new entrant is at a significant disadvantage to incumbents in the early stages of its business model because the entrant lacks a national network and the

[10] According to an analysis prepared on behalf of Avantel (see Figure 3), the proposed rate revision would result in Avantel incurring mobile telephone costs that are higher than the costs experienced by its competitors.

scale of an established customer base from which to realize important scale and scope economies. As a consequence, CRC has recognized that NR is an essential service. NR makes it possible for a new entrant to offer a service that is comparable to the incumbents in terms of network coverage, which is an important dimension of service quality for mobile communication services. The option to rely on wholesale NR services to address coverage gaps can allow a new entrant to offer service sooner and therefore accelerate the competitive benefits of expanded competition in the marketplace. This can also allow an entrant to better manage (and thereby reduce) investment costs. These benefits were recognized in the OECD (2014) report reviewing telecommunications regulations in Colombia.[11]

In case of Avantel, the problem is aggravated by the fact that a viable mobile service bundle needs to include voice and text, and for a smaller subset of the market, data services. In its current stage of development, LTE can support data but lacks cost-competitive support for voice and text. While the LTE global community of operators, equipment vendors, and application providers are working hard to develop interoperable, cost-competitive Voice-over-LTE (VoLTE) solutions, these are still not ready for widespread deployment.[12] That means that Avantel must rely on NR for voice and text

[11] The OECD report noted that the need to mandate NR diminishes as competitors achieve critical mass, and is most important for early stage entrants such as Avantel. See OECD (2014), *OECD Review of Telecommunication Policy and Regulation in Colombia*, OECD Publishing, http://dx.doi.org/10.1787/9789264208131-en.

[12] The first time a VoLTE call was supported over a commercial network was in 2011, and this was on Verizon's leading edge network (see "Verizon Wireless makes World's first Voice over LTE call on a commercial LTE network," Cellular News, 10 February 2011, available at http://www.cellular-news.com/story/Operators/47827.php). While operators in mature markets are beginning to deploy VoLTE, this remains early stage and there are lots of questions about

services for *all* of its customers, not just those who travel to locations where Avantel does not yet have infrastructure.[13]

While current policies guarantee Avantel the right to purchase wholesale NR services, this right is worthless unless the price for such service is competitive. Under the current CRC proposal which results in MTRs that are several times higher than efficient cost levels during the glide path, yet are lower than the proposed NR rate, Avantel would confront an unacceptably large cost differential (3X) relative to incumbents that are not subject to these operations.[14]

4. No economic basis for setting asymmetric rates

The current problem arose because in the first proposal the CRC has proposed to significantly reduce MTRs to bring them closer in line with reasonable estimates of incremental costs, while leaving NR rates still regulated at the pre-MTR reduction levels. In the second proposal, the CRC sets MTRs much higher than incremental costs by

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interoperability (which is important for intercarrier roaming), handset availability, and competing options for alternative technical solutions (see "VoLTE and RCS: Next Step for Communication and Messaging," Press Release, 4G Americas, November 6, 2014, available at http://www.4gamericas.org/index.cfm?fuseaction=pressreleasedisplay&pressreleaseid=6113).

[13] Thus, evidence that subscribers in Colombia may roam nationally less frequently than subscribers in other markets like the U.S. or Europe does justify an argument that NR is not essential for Avantel. Furthermore, even if most subscribers do not roam nationally in Colombia frequently, those that do are also among the early-adopter users of advanced data services that are a key component of the value proposition for Avantel's 4G LTE network. Although these more advanced (and typically, higher ARPU) mobile subscribers may place a higher value on better support for data services, they are also likely to regard ubiquitous coverage for legacy voice and SMS as essential features for their mobile subscription service.

[14] See Note 10 *supra*. While the price discrepancy would be narrowed under the November proposal, the adjustment is insufficient to materially alter the harmful impact on the economic viability of Avantel's business plan.

creating a glide path, and abandons its previous policy of setting NR rates at parity with the lowest MTR of the glide path that is set to adjust rates to efficient cost levels.

It is generally recognized that current MTRs and NR rates are significantly above incremental cost levels any reasonable measure. Efficiency and policy call for moving rates closer to costs. Indeed, much of the effort in telecommunications tariff reform over the last several decades has been to rebalance rates to shift implicit subsidies toward explicit and less distortionary subsidy mechanisms. Multipart tariffs that reduce usage sensitive rate elements, which include MTRs and NR, toward incremental costs are more efficient since they avoid suppressing usage that could contribute more to the overall value of network services than such usage would add to costs. Excessive rates deter demand, hindering adoption and distorting behavior. National Regulatory Authorities in many countries have recognized the need to regulate MTRs and that setting rates closer to incremental costs levels is optimal.[15]

In its review of telecommunications regulation in Colombia, the OECD concluded that:

> "In addition, priority should be given to reducing mobile termination rates to efficient costs (i.e. a level close to zero), while phasing out asymmetries, as there

[15] There is a significant literature on precisely how such rates should be estimated. For surveys of international practices, see ITU (2010), "Mobile termination rates – should they be regulated?" ITU News, April 2010, available at http://www.itu.int/net/itunews/issues/2010/03/20.aspx; or PwC (2012), "The setting of mobile termination rates: Best practice in cost modeling," a report prepared on behalf of GSMA by PriceWaterhouseCoopers (PwC), 2012, available at: http://www.gsma.com/publicpolicy/wp-content/uploads/2012/03/settingofmobileterminationrates.pdf.

exists a danger of promoting inefficiencies in those markets if termination rates remain above costs."[16]

Moreover, NR and MTR costs are similar if not identical. In both cases, the originating carrier is handing off the call to the terminating carrier to terminate. The same network components and resources are used in both situations. There is no basis for setting different regulatory rates in these two situations, as proposed in the first draft. If one rate is reduced toward costs, then it makes sense to adjust the other rate to maintain parity. Setting different regulatory rates for otherwise equivalent services creates regulatory cost-based distortions. In the present context this will allow those carriers that can make use of MTR instead of NR to have a significant cost advantage that can help support a price squeeze.

With the magnitude of the cost differential, incumbent operators can price services sufficiently low that Avantel would have to price its services substantially below Avantel's incremental cost level to be competitive. Avantel would lose money on every minute of traffic it carried under that model. Alternatively, if incumbents are able to avoid passing on the cost savings of reduced MTRs in retail prices, incumbents would capture significant excess profits with which to subsidize their war chest that might be used in other ways in order to oppose Avantel's successful entry into the market.

[16] See page 10, OECD (2014), Note 11 *supra*.

5. Free-riding on Incumbent Infrastructure not a concern

A principal motivation for mandating NR at cost-based rates equivalent to the efficient level for MTRs, which implies that NR will be at parity with MTR at the lowest value of any glide path that may be adopted, is the concern that regulating wholesale NR rates at too low a level will discourage investment in competing infrastructure, and hence be detrimental to the competition in the long term. While this might be a valid concern in other contexts, it should not be concern in this case for several reasons.

First, Avantel is required to build out its national network by the terms of its spectrum license. Thus far, Avantel is on-track in meeting those build-out commitments. If Avantel violates the terms of its license, it risks losing its access to the spectrum resources on which Avantel's business depends. This regulatory control over Avantel's investment behavior is much more direct and effective than the indirect control afforded by manipulating rates for NR.

Second, even beyond any inducements to invest in network facilities arising from its spectrum license, Avantel has a powerful incentive to build out its 4G LTE network and migrate its services onto that platform. A key incentive for operators to upgrade to 4G LTE is to take advantage of the greater spectrum efficiency and lower network costs that the technology promises to delivery; and to take advantage of the expanded capabilities to offer higher quality and more capable services than are feasible with earlier generations of mobile technology. 4G LTE provides more granular control of radio spectrum resources in the radio access network (RAN), while offering an all-IP platform

for services in the data plane. This enables operators to take advantage of the global scale cost economies of IP networking technology and equipment. Although as already noted, VoLTE is not ready today, it is expected that VoLTE will be as much as 20 times cheaper for carrying voice calls than over 2G.[17]

The ability of Avantel to offer 4G LTE-powered services should also help Avantel favorably differentiate its service from providers of lower quality networks (e.g., the networks that Avantel would otherwise purchase wholesale NR services from). To exploit this value proposition, Avantel needs to continue to invest in 4G LTE services.

Finally, operating services over multiple technologies increases complexity, which adds to costs. Moving to a single network technology will facilitate the realization of cost-savings.[18]

6. Preserving viable NR option for Avantel is consistent with sound policy

As explained above, the current proposal for setting MTRs and NRs asymmetrically and significantly above incremental costs is inconsistent with sound economic policy and is

[17] See "Voice over LTE (VoLTE)," http://rcsvirtualexpo.gsma.com/documents/download/id/19/mavenir_volte_service_deployment_may_2011.pdf.

[18] See Chevalier, Franck (2013), "A Single RAN strategy can offer double-digit savings for LTE deployment: a real TCO Comparison," Analysys Mason, 28 October 2013, available at http://www.analysysmason.com/About-Us/News/Newsletter/Single-RAN-LTE-overlay-Oct2013-RDTW0/Article-PDF/.

fundamentally anticompetitive.[19] It is also inconsistent with recent and otherwise commendable history of policy reform in Colombia which recognize the essentiality of NR for entrants, and the need to ensure an economically viable NR option for Avantel to promote competition in Colombia. Colombia's mobile services market is highly concentrated (see OECD, 2014)[20] and facilities-based entry such as that being attempted by Avantel is needed to expand competitive options.

The present MTR/NR pricing proposal threatens all competitive facilities-based investment in Colombia, not just Avantel's. Avantel's plan was reasonably premised on the belief that policymakers would adhere to the their commitment to ensure economically viable access to essential facilities such as NR services since that was consistent with the national goal to promote competition in telecommunication services and was enshrined in law via the 2009 ICT Act. Reliance on that commitment helped justify Avantel's investments in executing its business plan to date, but failure to sustain that commitment threatens those investments and sends a poor signal to future potential investors in and outside Colombia.

7. About the Author

Dr. William Lehr is a telecommunications/Internet industry economist and policy analyst with over twenty years of experience in academic research and industry consulting.[21] He is currently a research scientist in the Computer Science and Artificial Intelligence

[19] For example, see OECD (2014), Note 11 *supra* and the other sources cited in Note 12 *supra*.

[20] See Chapter 2 in OECD (2014), Note 11 *supra*.

[21] For more information, please visit http://people.csail.mit.edu/wlehr.

Laboratory (CSAIL) at the Massachusetts Institute of Technology (MIT). Dr. Lehr's research focuses on the economic and policy implications of broadband Internet access, next generation Internet architecture, and the evolution of wireless technology.

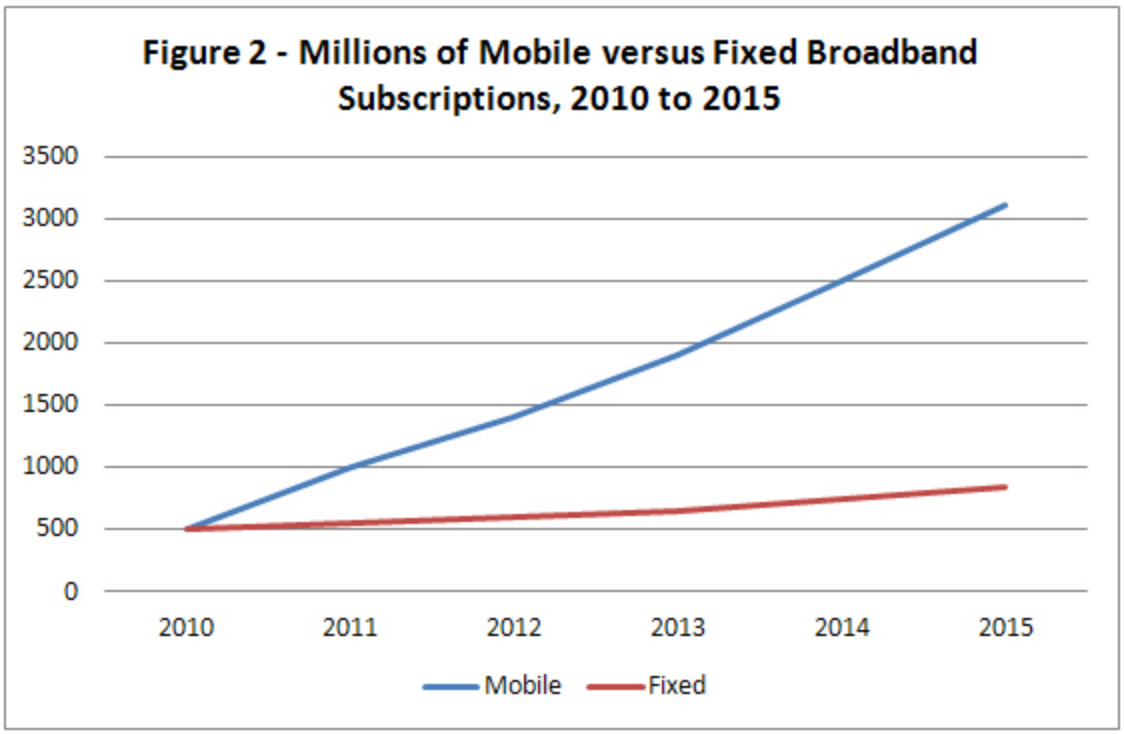
In addition to his academic research, Dr. Lehr regularly advises industry and regulatory authorities in the United States and abroad on matters associated with the evolution of broadband, spectrum policy, and regulatory reform.

Dr. Lehr holds a PhD in Economics from Stanford, an MBA in Finance from the Wharton School, and MSE, BA, and BS degrees from the University of Pennsylvania.

8. Figures and Exhibits

8.1. Figure 1: Global Mobile Broadband Subscriptions Exceed Fixed

Figure 1: Global Mobile Broadband Subscriptions Exceed Fixed

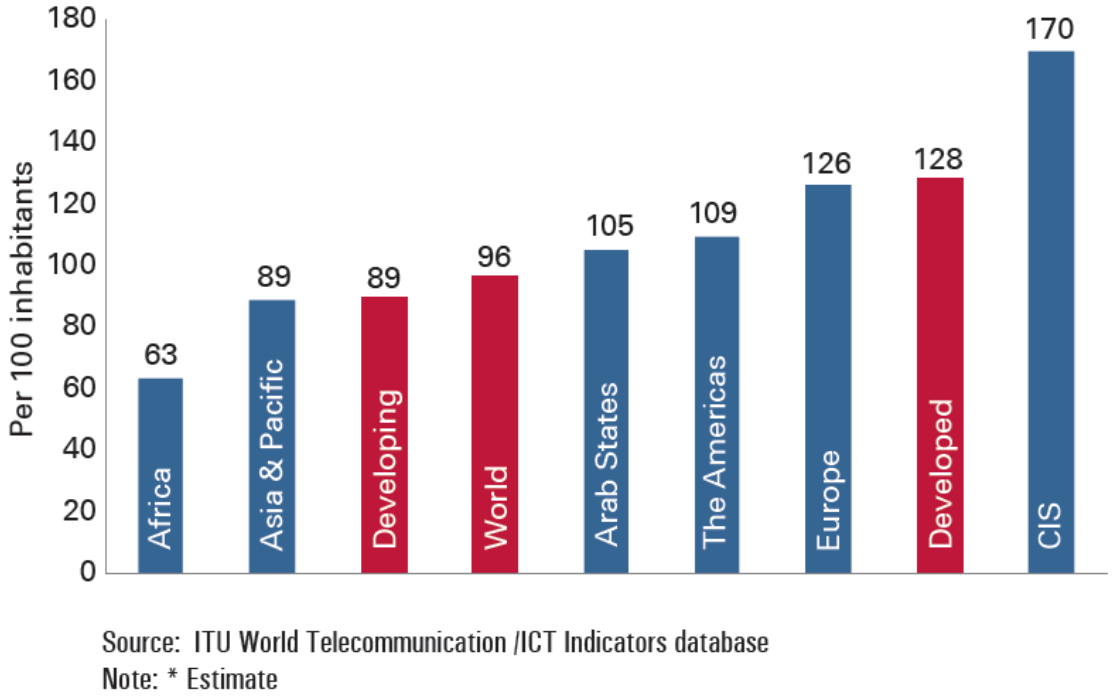


Sources: Wireless Intelligence, July 2011; Informa Telecoms & Media (WBIS), July 2011

Source: West, D. (2011), "Ten Facts about Mobile Broadband," Brookings Research Papers, December 2011, available at http://www.brookings.edu/research/papers/2011/12/08-mobile-broadband-west.

8.2. Figure 2: Mobile Penetration Exceeds 100% in Many Markets

Figure 2: Mobile Penetration Exceeds 100% in Many Markets



Source: ITU World Telecommunication /ICT Indicators database
Note: * Estimate

Source: ITU (2013), "ICT Facts and Figures," International Telecommunications Union, February 2013, available at http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2013-e.pdf.

8.3. Table 1: Mobile Termination Rates (MTRs) and National Roaming (NR)

Table 1: Mobile Termination Rates (MTRs) and National Roaming (NR)

CRC Resolution No. 3136, September 26, 2011				
Established Asymmetric Access Charge				
	MTRs - in Colombian Pesos			
	2013	**2014**	**2015**	**Thereafter**
American Movil	42.49	42.49	42.49	42.49
Telefonica	70.26	56.38	42.49	42.49
Tigo	70.26	56.38	42.49	42.49
Avantel	70.26	56.38	42.49	42.49
Voice Roaming Costs	42.49	42.49	42.49	42.49
Per CRC Resolution No. 4112 - MTRs = Roaming costs @ end of the glide path of MTRs				

DRAFT CRC Resolution, August 19, 2014				
	MTRs - in Colombian Pesos			
	2014	**2015**	**2016**	**Thereafter**
American Movil	42.49	8.66	8.66	8.66
Telefonica	56.38	42.49	8.66	8.66
Tigo	56.38	42.49	8.66	8.66
Avantel	56.38	42.49	41.61	8.66
Voice Roaming Costs	42.49	42.49	42.49	42.49
MTRS are reduced, yet roaming costs remain fixed at 42.49.				

DRAFT CRC Resolution, Noviembre 14, 2014

	MTRs - in Colombian Pesos					
	2014	**2015**	**2016**	**2017**	**2018**	**2019**
American Movil	42.49	20.81	20.81	20.81	9.79	9.79
Telefonica	56.38	42.49	31.83	20.81	9.79	9.79
Tigo	56.38	42.49	31.83	20.81	9.79	9.79
Avantel	56.38	56.38	42.49	31.83	20.81	9.79
Voice Roaming Costs (Avantel Only)	42.49	42.86	31.83	20.81	9.79	Direct Negotiation

8.4. Figure 3: Cost Impact of Proposed Disparate MTR and NR Rates

Figure 3: Cost Impact of Proposed Disparate MTR and NR Rates

	CLARO	MOVISTAR	TIGO	AVANTEL
Outgoing minutes	1	1	1	1
Incoming/Outgoing	1.03	0.91	1.05	0.65
%Incoming offnet	14%	22%	30%	19%
% Incoming onnet	86%	78%	70%	81%
%Outgoing offnet	11.00%	29.00%	27.00%	47.40%
%Outgoing offnet dominant	0%	75%	70%	70%
% Outgoing onnet	89.00%	71.00%	73.00%	52.60%
Originating cost	$ (9.79)	$ (9.79)	$ (9.79)	$ (42.86)
Terminating cost (opportunity cost)	$ (42.86)	$ (56.87)	$ (56.87)	$ (56.87)
Total originating costs	$ (9.79)	$ (9.79)	$ (9.79)	$ (42.86)
Outgoing terminating offnet costs	$ (6.26)	$ (13.45)	$ (12.71)	$ (22.31)
Incoming offnet costs	$ (1.41)	$ (1.92)	$ (3.13)	$ (5.31)
Incoming onnet costs	$ (38.15)	$ (40.38)	$ (41.52)	$ (29.91)
Incoming termination rates	$ 6.17	$ 11.17	$ 18.20	$ 7.05
Total Cost 2014	**$ (49.43)**	**$ (54.36)**	**$ (48.95)**	**$ (93.34)**
Originating cost	$ (9.79)	$ (9.79)	$ (9.79)	$ (42.86)
Terminating cost (opportunity cost)	$ (20.81)	$ (42.86)	$ (42.86)	$ (56.87)
Total originating costs	$ (9.79)	$ (9.79)	$ (9.79)	$ (42.86)
Outgoing terminating offnet costs	$ (4.71)	$ (7.63)	$ (7.40)	$ (13.00)
Incoming offnet costs	$ (1.41)	$ (1.92)	$ (3.13)	$ (5.31)
Incoming onnet costs	$ (18.52)	$ (30.43)	$ (31.29)	$ (29.91)
Incoming termination rates	$ 2.99	$ 8.42	$ 13.72	$ 7.05
Total Cost 2015	**$ (31.44)**	**$ (41.36)**	**$ (37.90)**	**$ (84.04)**
Originating cost	$ (9.79)	$ (9.79)	$ (9.79)	$ (31.83)
Terminating cost (opportunity cost)	$ (20.81)	$ (31.83)	$ (31.83)	$ (42.86)
Total originating costs	$ (9.79)	$ (9.79)	$ (9.79)	$ (31.83)
Outgoing terminating offnet costs	$ (3.50)	$ (6.83)	$ (6.51)	$ (11.43)
Incoming offnet costs	$ (1.41)	$ (1.92)	$ (3.13)	$ (3.95)
Incoming onnet costs	$ (18.52)	$ (22.60)	$ (23.24)	$ (22.54)
Incoming termination rates	$ 2.99	$ 6.25	$ 10.19	$ 5.31
Total Cost 2016	**$ (30.23)**	**$ (34.89)**	**$ (32.48)**	**$ (64.44)**
Originating cost	$ (9.79)	$ (9.79)	$ (9.79)	$ (20.81)
Terminating cost (opportunity cost)	$ (20.81)	$ (20.81)	$ (20.81)	$ (31.83)
Total originating costs	$ (9.79)	$ (9.79)	$ (9.79)	$ (20.81)
Outgoing terminating offnet costs	$ (2.29)	$ (6.03)	$ (5.62)	$ (9.86)
Incoming offnet costs	$ (1.41)	$ (1.92)	$ (3.13)	$ (2.58)
Incoming onnet costs	$ (18.52)	$ (14.78)	$ (15.19)	$ (16.74)
Incoming termination rates	$ 2.99	$ 4.09	$ 6.66	$ 3.95
Total Cost 2017	**$ (29.01)**	**$ (28.43)**	**$ (27.07)**	**$ (46.05)**
Originating cost	$ (9.79)	$ (9.79)	$ (9.79)	$ (9.79)
Terminating cost (opportunity cost)	$ (9.79)	$ (9.79)	$ (9.79)	$ (20.81)
Total originating costs	$ (9.79)	$ (9.79)	$ (9.79)	$ (9.79)
Outgoing terminating offnet costs	$ (1.08)	$ (2.84)	$ (2.64)	$ (4.64)
Incoming offnet costs	$ (1.41)	$ (1.92)	$ (3.13)	$ (1.21)
Incoming onnet costs	$ (8.71)	$ (6.95)	$ (7.15)	$ (10.95)
Incoming termination rates	$ 1.41	$ 1.92	$ 3.13	$ 2.58
Total Cost 2018	**$ (19.58)**	**$ (19.58)**	**$ (19.58)**	**$ (24.01)**