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Mobile Communication Price Parity and index: Making money off the poor

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ABSTRACT

The price for mobile services is the most important determinant in the way low-income households use mobile phones. Based on existing data on mobile communication prices, a global index for measuring the price of mobile communication with 2G handsets has been developed. This index allows the comparison of price levels in different countries. The first step involves defining a mobile communication basket, containing a specific amount of speech and short messaging per month. The definition of this basket is based on the OECD definition of a standard basket of monthly mobile communication consumption (OECD, 2010) and targets the consumption habits of low income users. Two different indices are proposed. A first calculation from the years 2009 to 2012 involving the indices of 149 countries provides a useful overview of the global mobile price landscape.

1. Introduction

The world seems to be saturated with mobile communication access. The annual statistics report of the International Telecommunication Union (ITU) states that 6.8 billion mobile-cellular subscriptions globally were reached by the end of 2013 (ITU, 2013a). This figure equals almost the number of people living on our planet. Although the coverage of the earth with mobile phone signals is impressive, a closer look at the distribution of mobile phone subscriptions shows that we are still far from an equal access to mobile communication. Estimations assume that only 3.2 billion subscribers own the 6.8 billion subscriptions reported (Page et al., 2013). The density of subscriptions per 100 inhabitants varies from region to region, with 63.5% in Africa, 126.5% in Europe and even 169.8% in the Commonwealth of Independent States (ITU, 2013a). Within the continents the variation can be very striking, for example in Africa, where the range varies from 179.47% in Gabon to 4.98% in Eritrea (ITU, 2013).

The importance of mobile technology for developing countries and the relevance of mobile phones for poor people is widely recognized and has already led to an increasing number of research studies. In 2008, a literature review of about two hundred research articles about the impact of mobile phones in developing countries categorized the different research approaches to the mobile usage in developing countries (Donner, 2008). Donner mainly distinguished between studies about the determinants of mobile adoption and those about the impact of mobile phones on their users and finally identified a third category, which examined the interrelationships between mobile technology and the users (Donner 2008, p. 143). We do not go as far as Banks (Banks, 2013), who doubts that research and debate over ICT4D has progressed in the last ten years. Today, mobile for development (m4d) stands for different topics and leads to diverging research communities with

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different approaches, such as m-health, m-payments, m-learning, etc. Since the World Summit on the Information Society (WSIS) 2005, a tremendous number of indicators and data have been and are being highlighted and published (ITU, 2010).

With this diversity in mind we explored what could be a common denominator for a global approach to measuring the accessibility of mobile communication, especially for those people who are at the bottom of the income pyramid. We were looking for a simple and reliable parameter which would allow us to measure globally the accessibility of mobile communication in daily life. The parameter we chose was the price which has to be paid when using a mobile phone for a simple call or to send a text message.

We believe that this price is the most important determinant in the way low-income households use mobile phones. Discussions on the social, technological or cultural aspects of mobile phone usage are biased if they do not include reference to the price. Comparisons of different studies on the usage of mobile phones in different markets or along a time series are questionable if they do not normalize the data regarding the costs of mobile communication.

The price of mobile communication is part of the ICT Development Index (IDI), which is published yearly by the International Telecommunication Union (ITU, 2012). However, in this form, the data about mobile communication is not suitable as an independent variable because the index combines eleven indicators into one benchmark measure. The Mobile Communication Price Index (MCPI 2G), which is introduced and discussed in this paper, overcomes this limitation and offers a global benchmark for mobile development research.

2. Methods

2.1. Research questions

The global availability of mobile communication opens the unique possibility of research on the usage and the impact of mobile communication. We assume that, in contrast to the almost complete global coverage with mobile technology, the real accessibility of mobile communication is very diverse. One reason for this diversity is the relative price difference for the usage of mobile communication services. In this study we are developing methods for a global comparison of mobile communication prices. The research questions which had to be answered are as follows:

RQ1: Are globally comparable data about mobile communication available?
RQ3: How can the price of mobile communication be compared between different countries?
RQ4: How can the affordability of mobile communication be compared globally?

2.2. Measuring the price of mobile communication

Twice a year, the International Telecommunication Union (ITU) collects and publishes the World Telecommunication/ICT Indicators Database, which relies on a standardized handbook for the collection of administrative data on telecommunications (ITU, 2011; ITU, 2013c). The strength of this data collection lies in particular in the continuity and homogeneity of the data collection.

Using the price of mobile communication does not at first glance appear to be a good idea for a global survey, as there are so many different price plans combined with temporary price discounts or volume discounts etc. In fact, it is even hard to compare the price plans of different mobile operators in one country. This is due to the fact that, for marketing reasons, mobile network operators are very inventive in disguising the real cost of a call or a text message. With flat rates it would not even be possible to calculate the price of these units. All this is related to post-paid tariffs where customers are billed on a monthly basis after using the services.

Prepaid tariffs for mobile communications are therefore much more transparent, because the customers pay for a certain number of calls and minutes or a certain number of text messages (SMS).

2.3. Prepaid tariffs

Globally, 77% of all mobile phone subscriptions are on a prepaid basis. This figure varies from North America with 25% to Africa with 96% (Page et al., 2013, p. 21). The reason for these differences are partly historical, but are mainly for prevailing economic reasons. With prepaid tariffs, the mobile network operators bear no risk of unpaid monthly bills whereas the customers have the advantage of buying credits for mobile services in very small amounts. Finally, for the billions of citizens with no bank account, only prepaid contracts, are accessible. For these reasons it is not surprising that all around the world, it is mostly people on low incomes who use prepaid tariffs (ITU, 2012).

2.4. Mobile basket

The OECD describes how a standard basket of monthly mobile communication consumption is composed and how the costs for this basket can be measured consistently and globally (OECD, 2010). The OECD makes an effort to maintain the representativeness of the baskets by regular revisions and routinely updating it to reflect changing consumption patterns

(OECD, 2013). The OECD basket methodology is applied in different regional studies on the affordability of mobile communication (Barrantes and Galperin, 2007; Galperin, 2010).

The OECD provides a solution by building standard baskets of monthly consumption. Different types of users are applied to these patterns representing different standard levels of consumption (OECD, 2010, p. 3). The standard baskets were built on data provided by member countries and telecommunication providers. The organization calculates how much it costs for each OECD country to purchase the baskets.

For our purpose, only the 40 calls prepaid basket is suitable but needs further adaptation. Fig. 2 shows the composition of this basket in detail.

Another mobile basket has been developed and published by the ITU, where it is part of the ICT Price Basket (IPB), which is itself an element of the ICT Development Index (IDI). Besides the prices for mobile communication, the IPB basket also includes those for fixed telephone and the fixed broadband usage (ITU, 2012). The ITU mobile sub-basket is based on the OECD basket but unfortunately differs in the number of calls per month from the former. The IPB mobile sub-basket contains 30 calls and 100 text messages (SMS).

3. Mobile Communication Price Index 2G

For the purpose of measuring the cost of mobile communication for the poor we relied on the OECD 2009 methodology (OECD, 2010) with the 40 prepaid calls (see Figs. 1 and 2). 2G refers to the fact that our index only covers the use of speech and text messages which are transmitted over 2G networks. In regard to the increase of 3G and 4G networks it will be important to distinguish between the 2G and broadband as completely different price plans apply for the latter. The following adaptations have been made in order to obtain a robust and relevant index:

- The use of MMS is not included in the index.

  Although the OECD still mentions MMS in the definition of the mobile basket, those are not specified in the "Revision of the methodology for constructing telecommunication price baskets" (OECD, 2010). Besides, it is assumed that MMS are

Volume	Calls	SMS	MMS	Total minutes*
30 calls basket	30	100	100	50
100 calls basket	100	140	140	188
300 calls basket	300	225	225	569
900 calls basket	900	350	350	1 787
40 calls prepaid basket	40	60	60	75
400 messages basket		400		

* Assumes calls are billed by the second. Operators rounding up to the nearest minute will require more minutes to fulfil the baskets.

Fig. 1. OECD mobile baskets (OECD, 2013).

	Mobile to fixed	On-net	Off-net	Voicemail	Total	Call distribution by time of day (%)
Call distribution (%)	14.0	64.0	18.0	4.0	100.0	100.0
Calls (number)	5.6	25.6	7.2	1.6	40.0	
Day (Peak)	2.6	11.8	3.3	0.7	18.4	46.0
Evening (Off-peak)	1.6	7.4	2.1	0.5	11.6	29.0
Weekend	1.4	6.4	1.8	0.4	10.0	25.0
Duration (minutes / call)	1.9	1.9	2.0	0.9		
Duration (total minutes of calls)	10.6	48.6	14.4	1.4	75.1	N/A
Day (Peak)	4.9	22.4	6.6	0.7	34.6	46.0
Evening (Off-peak)	3.1	14.1	4.2	0.4	21.8	29.0
Weekend	2.7	12.2	3.6	0.4	18.8	25.0
SMS distribution (%)	N/A	53.0	47.0	N/A	100.0	100.0
SMS distribution (number)	N/A	31.8	28.2	N/A	60.0	
Peak	N/A	21.0	18.6	N/A	39.6	66.0
Off-peak	N/A	10.8	9.6	N/A	20.4	34.0

Fig. 2. OECD 40 calls prepaid basket (own illustration based on data from OECD, 2010).

	Mobile to fixed	On-net	Off-net	Voicemail	Total	Call distribution by time of day (%)
Call distribution (%)	14.6	66.7	18.8	-	100.0	100.0
Calls (number)	5.8	26.7	7.5	-	40.0	
Day (Peak)	2.7	12.3	3.5	-	18.4	46.0
Evening (Off-peak)	1.7	7.7	2.2	-	11.6	29.0
Weekend	1.5	6.7	1.9	-	10.0	25.0
Duration (minutes / call)	1.86	1.86	1.96	-		
Duration (total minutes of calls)	10.8	49.6	14.7	-	75.1	N/A
Day (Peak)	5.0	22.8	6.8	-	34.6	46.0
Evening (Off-peak)	3.1	14.4	4.3	-	21.8	29.0
Weekend	2.7	12.4	3.7	-	18.8	25.0
SMS distribution (%)	N/A	53.0	47.0	-	100.0	100.0
SMS distribution (number)	N/A	31.8	28.2	-	60.0	
Peak	-	-	-	-	-	-
Off-peak	-	-	-	-	-	-

Fig. 3. Mobile Communication Price Index (MCPI 2G) for low income users.

not widely used because the service is generally too expensive for low income users. The inclusion of MMS contradicts the low-usage basket concept.

- The amount of voicemail calls (4%) and average duration (0.9 min/call) is distributed to the other types of calls in the basket.
  It is assumed that the voicemail service bears little relevance as the fees for normal calls apply. The OECD basket methodology is unnecessarily complex and does not provide additional information by calculating the amount of voicemail calls made. To comply with the 2009 OECD basket methodology, the rates of voicemail calls are allocated to the remaining types of calls.
- No distinction is made between peak and off-peak SMS.
  Again, we aim for a reduction in complexity. If there are different prices for peak and off-peak SMS, an average price is calculated.

With these adjustments, the calculation of the Mobile Communication Price Index (MCPI 2G) looks as follows (Fig. 3).

3.1. Data sources

3.1.1. World Telecommunication ICT Indicators database 2013

The World Telecommunication ICT Indicators database 2013 includes statistics "covering fixed-telephone network, mobile-cellular and internet services, quality of service, traffic, persons employed, ICT prices, revenue, investment and data on ICT access and use by households and individuals". There are 151 telecommunication and ICT indicators available for the years 1960, 1965, 1970 and annually from 1975 to 2012. The data is collected for 214 economies (ITU, 2013c).

For their data collection the ITU uses primary official country contacts (the regulatory ministry or the ministry in charge of telecommunication and ICT) to fill in an annual questionnaire. "Additional data are obtained from reports provided by

	Mobile to fixed	On-net	Off-net	Voicemail	Total	Call distribution by time of day (%)
Call distribution (%)	14.6	66.7	18.8	-	100.0	100.0
Calls (number)	5.8	26.7	7.5	-	40.0	
Day (Peak)	2.7	12.3	3.5	-	18.4	46.0
Evening (Off-peak)	1.7	7.7	2.2	-	11.6	29.0
Weekend	1.5	6.7	1.9	-	10.0	25.0
Duration (minutes / call)	1.86	1.86	1.96	-		
Duration (total minutes of calls)	10.8	49.6	14.7	-	75.1	N/A
Day (Peak)	6	5	4	-	34.6	46.0
Evening (Off-peak)	3	2	1	-	21.8	29.0
Weekend	9	8	7	-	18.8	25.0
SMS distribution (%)	N/A	53.0	47.0	-	100.0	100.0
SMS distribution (number)	N/A	11	10	-	60.0	
Peak	-	-	-	-	-	-
Off-peak	-	-	-	-	-	-

Fig. 4. How ITU data are used for the calculation of the MCPI 2G.

telecommunication ministries, regulators and providers and from ITU staff reports," as the ITU states on its website (ITU, 2013c).

The methodological description of the data collection for mobile-cellular indicators is provided in the Handbook for the Collection of Administrative Data on Telecommunication/ICT 2011. As mentioned previously, there is a wide variety of mobile tariffs available through telecommunication providers. Therefore the ITU defined twelve rules and premises related to gathering comparable and transparent data (ITU, 2011: p. 77). The points are summarized below:

(1) The tariffs refer to prepaid services.
(2) The tariffs of the provider with the largest market should be used.
(3) Special offers and plans with limited availability shall not be used.
(4) If subscribers can choose 'favorite' numbers with a special tariff, this special tariff shall not be taken into consideration.
(5) The tariffs refer to outgoing national calls. If different rates apply for local and national calls, then the local rate should be used.

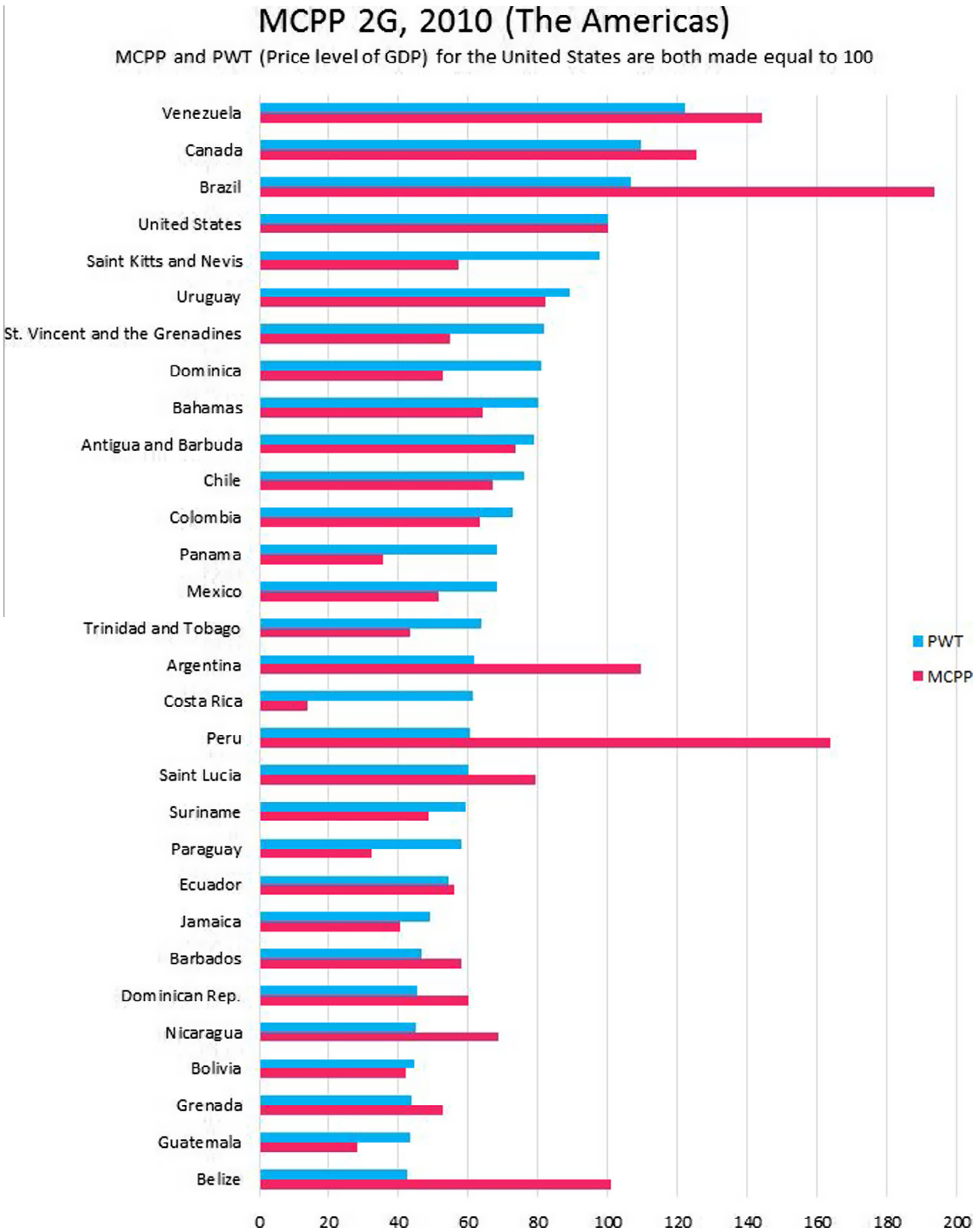

Fig. 5. MCPP 2G, 2010, region The Americas (own calculations based on OECD, 2010; ITU, 2013b Penn World Table Version 7.1, 2012).

(6) Calls are often priced differently depending on the destination network. A distinction is made between on-net (same mobile network), off-net (another mobile network), and fixed network.
(7) Any connection costs per call are included in a separate sub-indicator.
(8) If free minutes/calls/text messages are included in the connection fee, details should be provided in a note.
(9) Mobile providers often charge different rates depending on when the call is made. The exact times and days vary from country to country, but in general they distinguish between peak, off-peak, and weekend. If calls are charged by call (and not by minute), then the price of the call should be used.
(10) Relevant taxes should be included. If taxes are not included, this information, and the applicable tax rate, should be provided in a note.
(11) Tariffs should be reported in national currency. If this is not the case, it should be indicated, and the currency used should be specified in a note.
(12) Some countries use the receiving party pays (RPP) system, whereby subscribers are charged to receive calls. If this is the case, it should be specified in a note.

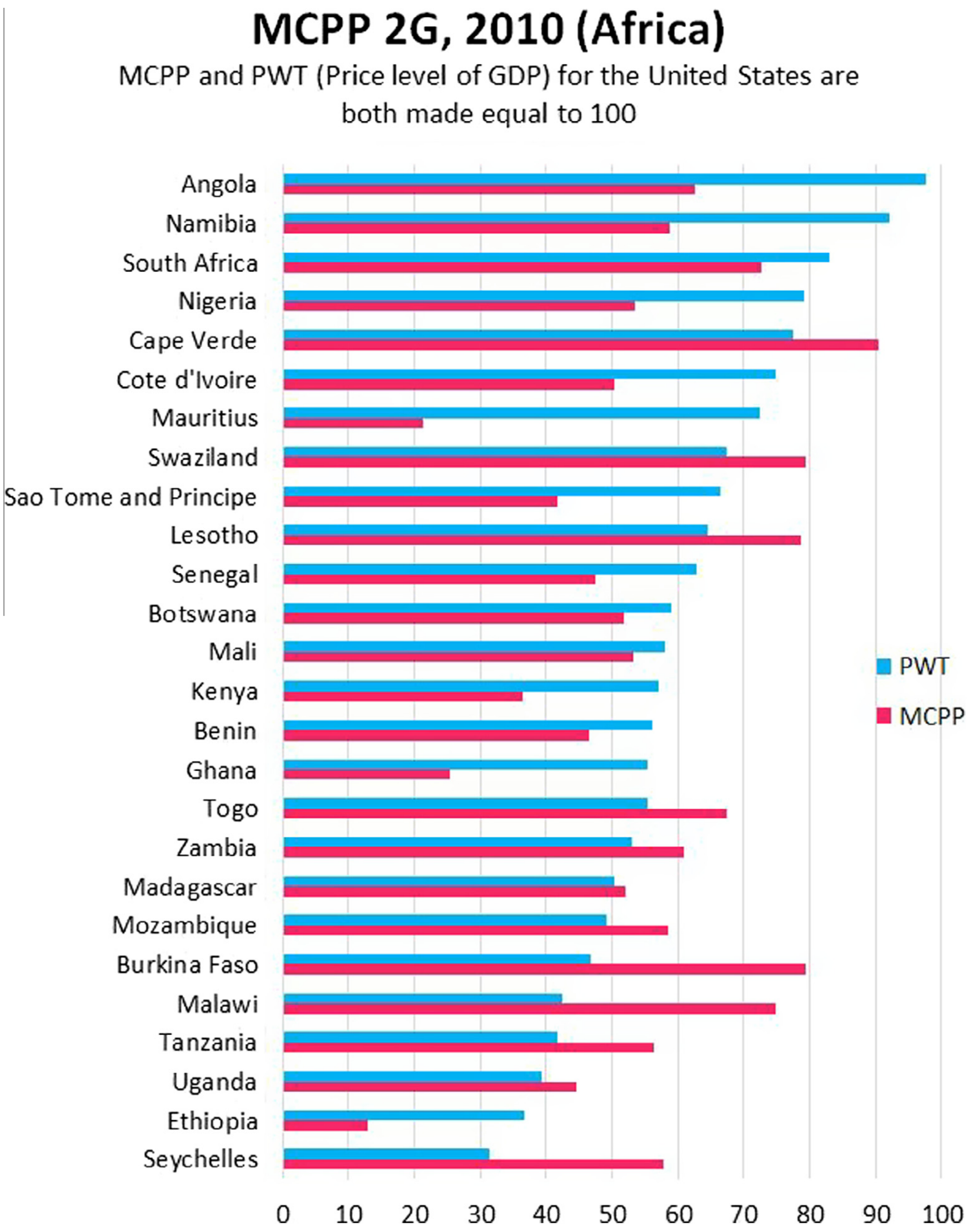

Fig. 6. MCPP 2G, 2010, region Africa (own calculations based on OECD, 2010; ITU, 2013b; Penn World Table Version 7.1, 2012).

3.1.2. Mobile series

There are eleven mobile-cellular prepaid series in the ITU database which are used to calculate the MCPI 2G basket. The following mobile-cellular prepaid indicators provide the data to cover the MCPI 2G basket as shown in Fig. 4.

(1) Mobile-cellular prepaid | price of a one-minute local call (off-peak, off-net).
(2) Mobile-cellular prepaid | price of a one-minute local call (off-peak, on-net).
(3) Mobile-cellular prepaid | price of one-minute local call (off-peak, to fixed).
(4) Mobile-cellular prepaid | price of a one-minute local call (peak, off-net).
(5) Mobile-cellular prepaid | price of a one-minute local call (peak, on-net).
(6) Mobile-cellular prepaid | price of a one-minute local call (peak, to fixed).
(7) Mobile-cellular prepaid | price of a one-minute local call (weekend, off-net).
(8) Mobile-cellular prepaid | price of a one-minute local call (weekend, on-net).
(9) Mobile-cellular prepaid | price of a one-minute local call (weekend, to fixed).
(10) Mobile-cellular prepaid | price of SMS (off-net).
(11) Mobile-cellular prepaid | price of SMS (on-net).

4. Comparing prices for mobile communication

The Mobile Communication Price Parity (MCPP) can now be calculated by using the above MCPI basket which is comprehensive and comparable. The ITU database relies on the prices in the local currencies in each country. To obtain comparable

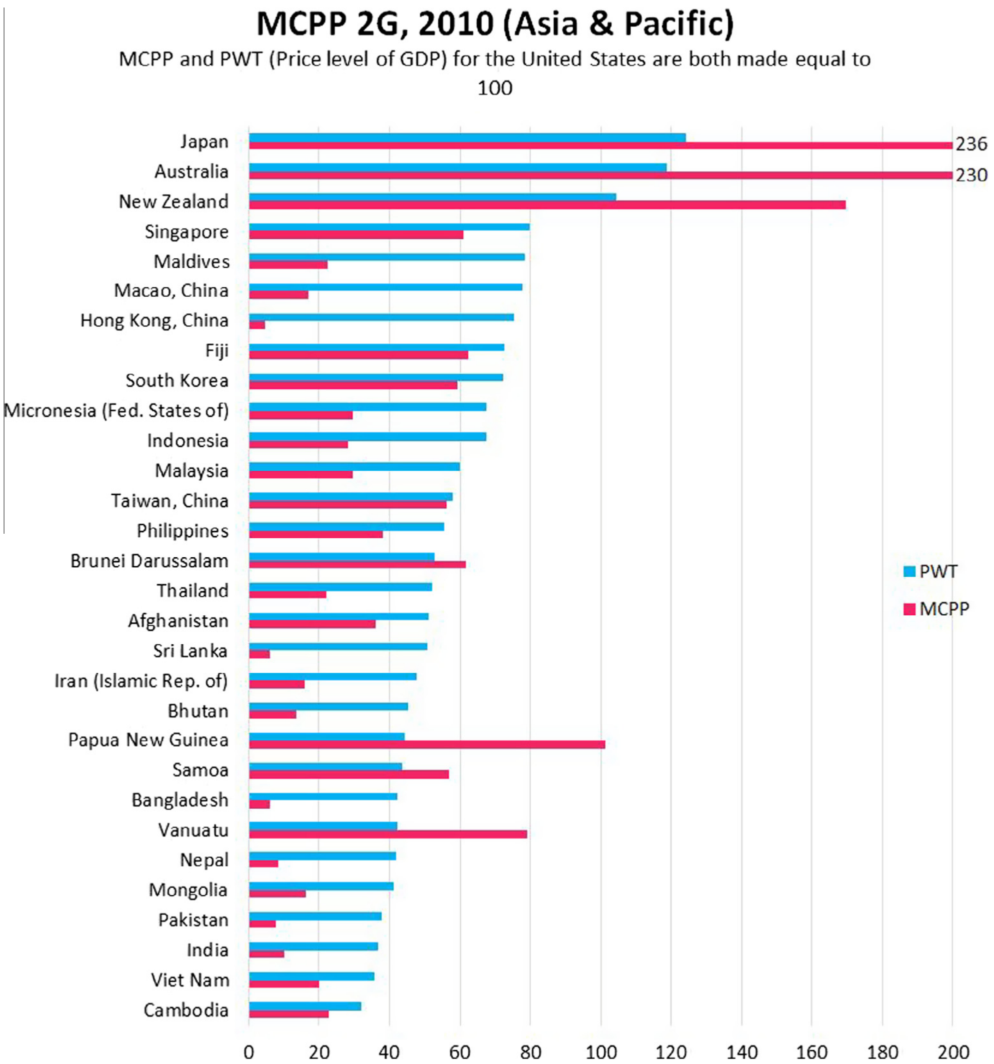

Fig. 7. MCPP 2G, 2010, region Asia & Pacific (own calculations based on OECD, 2010; ITU, 2013b; Penn World Table Version 7.1, 2012).

data we choose two different approaches from the standard PPP theory. As data source for exchange rates, the GDP and PPP we used the Pen World Table (PWT) 7.1 (Heston et al., 2012). The PWT 7.1 provides economic data (exchange rates, PPP results) up to the year 2010. Before 2008 only limited data about mobile communication prices were available from the ITU database. It was not until 2008 that comprehensive data collection was carried out. However, there is still a lack of data concerning the price of one off-net text messages in particular. Calculations for the MCPP are made from the year 2009 onwards. Any earlier dates would have reduced the number of applicable countries to around 40. As a first version, the calculations were made for the years 2009 and 2010. Due to limited space, we present the results for 2010 only.

4.1. Mobile Communication Price Parity (MCPP 2G)

The first method relies on the conversion of the currencies. The price of the basket in local currency is divided by the price of the basket in the reference currency (US$) to obtain the implied PPP. For example, in 2010 the MCPI basket cost 114.07 real

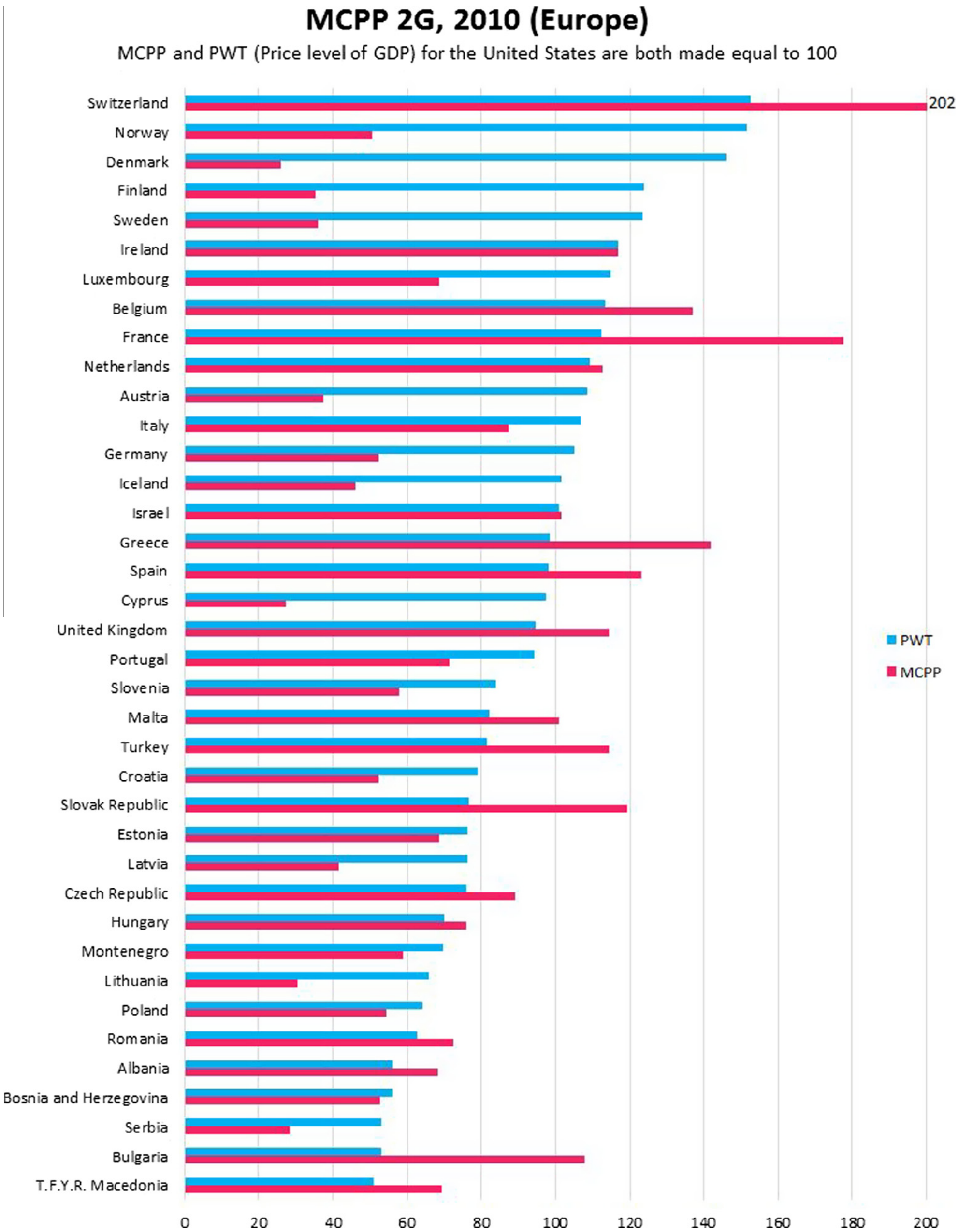

Fig. 8. MCPP 2G, 2010, region Europe (own calculations based on OECD, 2010; ITU, 2013b; Penn World Table Version 7.1, 2012).

in Brazil and 33.48 US dollars in the United States, which leads to the implied PPP 3.41. This means that the PPP theory implies an exchange rate of 3.41 real to 1 US dollar. In full awareness of the PPP debate we neither attempt nor suggest interpreting this implied PPP value further (Taylor and Taylor, 2004). In the second step the exchange rates are included in the calculation to obtain the Mobile Communication Price Parity (MCPP). We divide the implied PPP by the annual exchange rate into US dollars for each currency and multiply it by 100. Following this approach, the MCPP 2G shows how the price of mobile communication with 2G in each currency differs from the price in the United States where the reference value is 100. Continuing the example of Brazil, the division of 3.41 with the annual currency rate of the real to US dollars (1.76) times 100 leads to an MCPP 2G of 194. By assuming that the currency rate reflects the overall Purchasing Power Parity correctly, Brazilians paid almost twice as much for the same basic mobile communication basket. In the following Figs. 5–10 we added the price level of GDP from the Pen World Table 7.1 (Heston et al., 2012). The price level of GDP is the PPP over GDP divided by the exchange rate times 100 (PWT). Again, this value is 100 for the United States. For Brazil this value in 2010 was 106. So we can say that the price of mobile communication in Brazil compared to the price level of GDP was 182 percent in 2010 (Fig. 5).

Fig. 5 shows that in those countries of the Americas where the price level of GDP according to the Pen World Table (PWT) is higher than in the US, the price level for mobile communication is also higher than in the USA (Venezuela, Canada, Brazil). There are three countries which in contrast to their low PWT value have higher or equal communication prices compared to the USA (Argentina, Peru and Belize). The cheapest country in the Americas is Costa Rica with a MCPP 2G of 14.

A different picture is shown in Fig. 6 with the data from the African states.

In none of the twenty-six African countries where data were available does the MCPP 2G attain the reference value 100 (US). However, in almost half of the countries (12) this value is higher than the PWT. Like in the Americas, the differences from country to country can be very high and the range starts in Ethiopia with a MCPP 2G of 13 up to a value of 91 in Cape Verde.

Of the thirty countries considered within the Asia & Pacific regions in 2010 (Fig. 7), only four (Japan, Australia, New Zealand and Papa New Guinea) exceed the reference value 100. Like in the Americas, a price level of GDP higher than in the USA always goes together with a higher price level for mobile communication. In more than two thirds (23) of these countries, mobile communication prices are below the PWT level.

The data for Europe shows a high disparity (Fig. 8). Nine of the 38 states have an MCPP value higher than 100 and for fifteen the MCPP value is higher than the PWT. But only four (Switzerland, Belgium, France and Netherlands) of the fifteen states with a PWT over 100 also have a high MCPP value. Denmark, with the third highest PWT in Europe (146), has the lowest MCPP with 26.

To complete the data series for the whole world, Figs. 9 and 10 show the Arab States and the Commonwealth of Independent States (CIS).

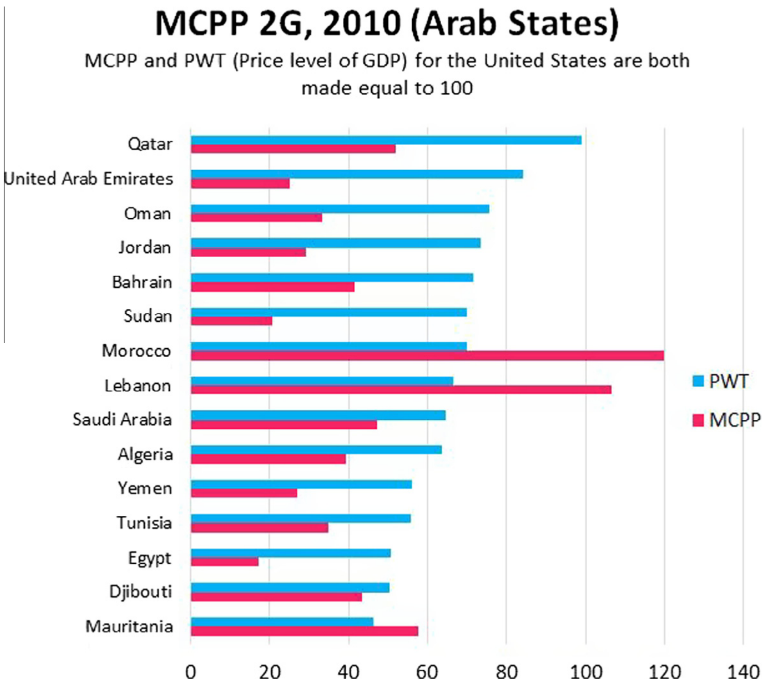

Fig. 9. MCPP 2G, 2010, region Arab States (own calculations based on OECD, 2010; ITU, 2013c; Penn World Table Version 7.1, 2012).

4.2. Mobile Communication Price Index (MCPI 2G)

Besides various shortcomings in the MCPP 2G related to the complexity of using PPP data, the comparison of the countries is only possible with reference to a great deal of additional information about the economies, monetary policies and also the national telecommunication regulation framework. The MCPI 2G equals the price of the MCPI basket multiplied by twelve (yearly MCPI basket) divided by the gross domestic product (GDP) per capita times 100. In order to avoid the inclusion of exchange rates, the market data should be in local currency.

The indicators GDP per capita (current LCU) provided by the World Bank are used to calculate the MCPI 2G (The World Bank, 2013, 2014, 2010).

This approach enables us to gain an overview of the development and to compare the affordability of prepaid mobile communication within each country. This method was also used by Barrantes and Galperin (Galperin, 2010; Barrantes and Galperin, 2007) in a study about the affordability of mobile phone services in Latin America. Barrantes states that a percentage share of the GDP per capita below 4% corresponds to an acceptable affordability level. Values above 10% indicate a low level of affordability (Barrantes and Galperin, 2007, p. 23).

We present the results for 2012 by means of a world map. Six colours represent the percentage of the MCPI basket purchased in one year on the GDP per capita. The map gives an overview of affordability among prepaid mobile communication services during the year 2012 (Fig. 11). For countries shaded in gray no data was available.

The results are split by ITU regions: Africa, Arab States, Asia & Pacific, CIS, Europe and the Americas. Each region and its countries are presented using a chart. The results are presented for the year 2009 and beyond, and any developments in the share of percentages between the years 2009 and 2012 are indicated for each country. What becomes immediately apparent

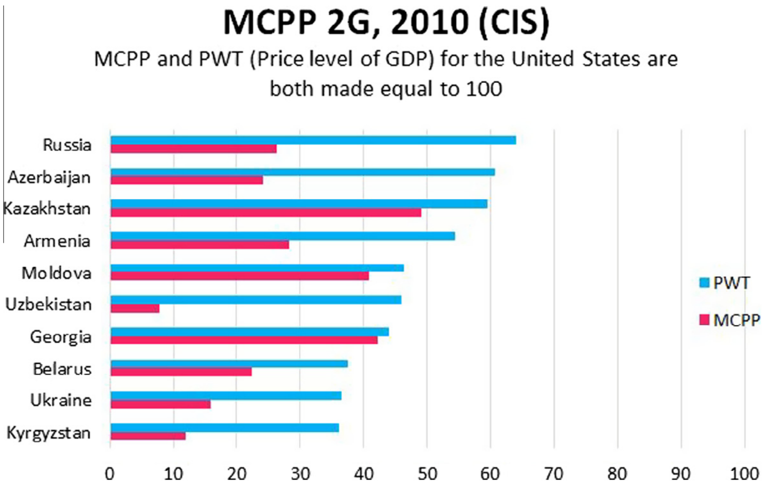

Fig. 10. MCPP 2G, 2010, region CIS (own calculations based on OECD, 2010; ITU, 2013c; Penn World Table Version 7.1, 2012).

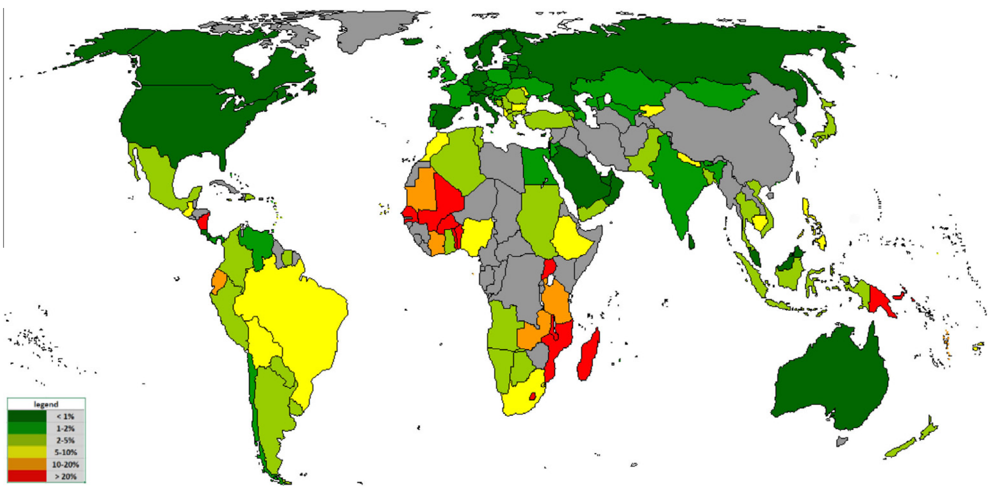

Fig. 11. MCPI 2G, 2012 (own calculations based on data from OECD, 2010; ITU, 2013c and The World Bank, 2013).

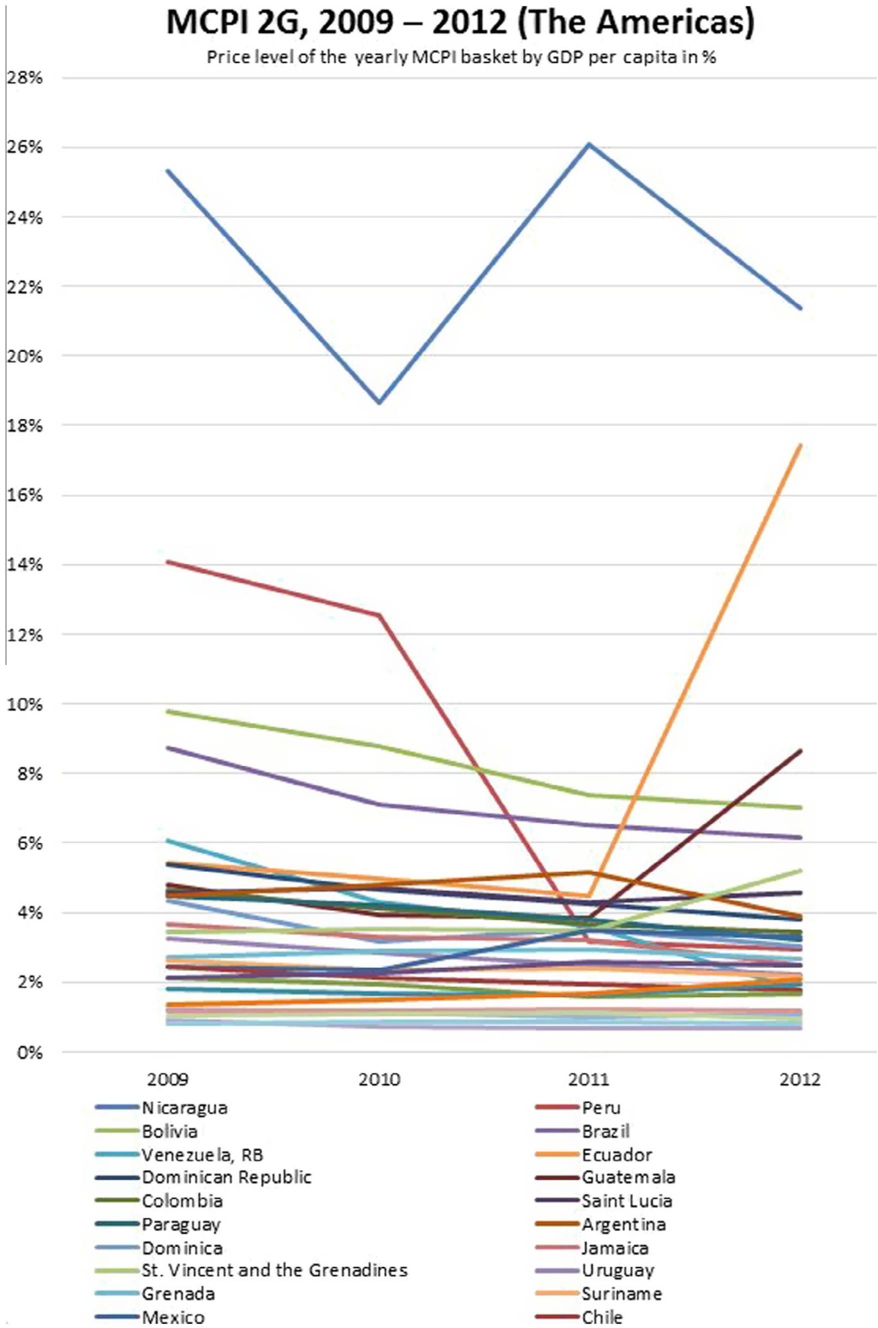

Fig. 12. MCPI 2G covering the Americas, 2009–2012 (own calculations based on data from OECD, 2010; ITU, 2013b and The World Bank, 2013).

is the global trend toward more affordable prepaid mobile communication costs. In the vast majority of examined countries the percentage share of the MCPI basket on the GDP per capita has become smaller in the observed time frame. In addition, countries which were at the top of the list with their MCPP 2G value are often among those with the most affordable MCPI. For example, Switzerland, at the top of the European list with an MCPP of 202 in 2010, had an MCPI of 1.15 in 2010, which went down to 0.88 in 2012. It is in the eleventh position of the most affordable mobile baskets in Europe (Fig. 14).

For the Americas, we wish to point out that the trend toward lowering price levels has some extraordinary exceptions (Fig. 12). Besides Nicaragua, where no trend toward lowering the highest price level over all American countries can be observed, despite big changes, Ecuador and Guatemala demonstrated the opposite trend, namely toward higher price levels. Overall the price levels in the Americas were below 4% in 2012 in most countries. At the bottom of the list we find Canada, the United States and Costa Rica, all with values below 1%.

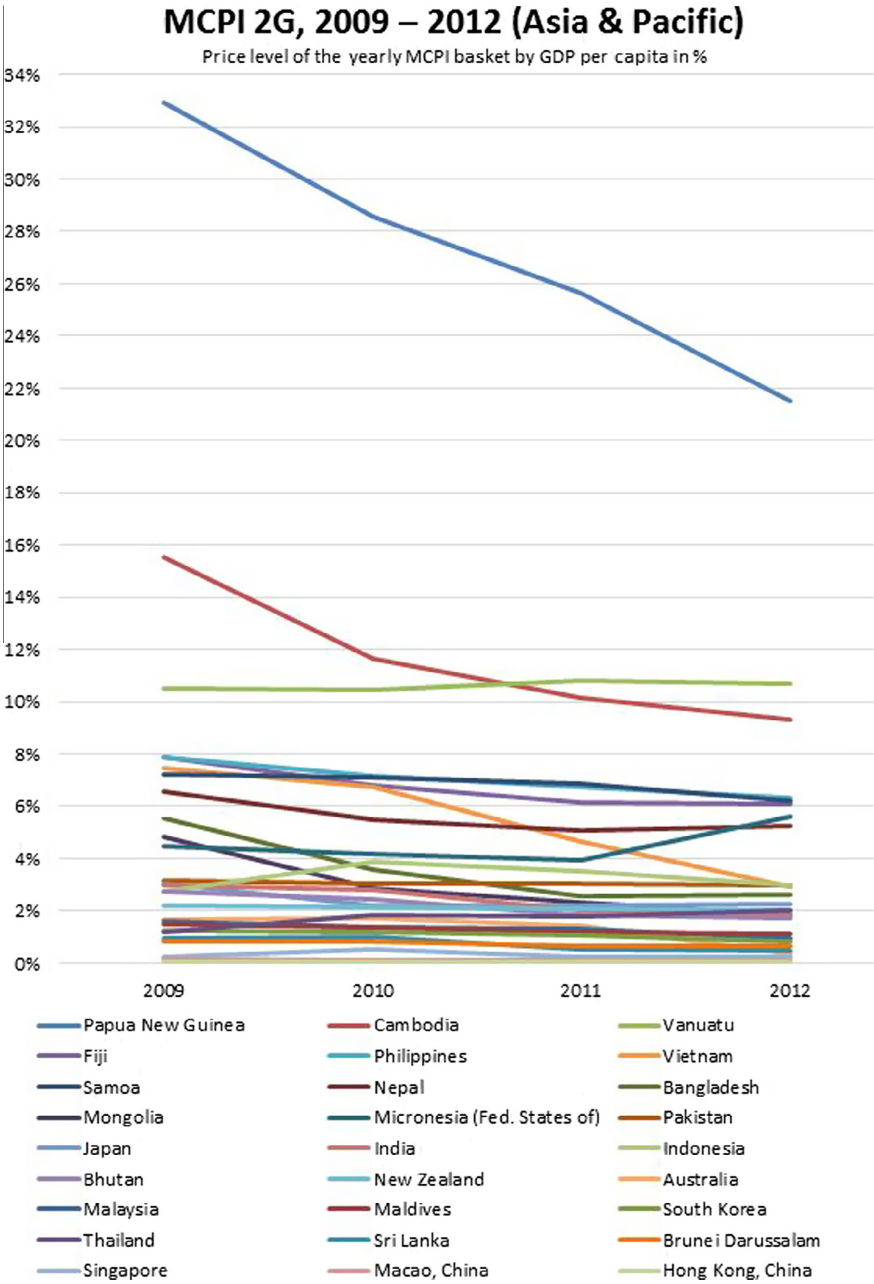

Fig. 13. MCPI 2G covering the Asian & Pacific region, 2009–2012 (own calculations based on data from OECD, 2010; ITU, 2013b and The World Bank, 2013).

In the Asia & Pacific region, the trends are, with few exceptions, mostly lateral (Fig. 13). Papua New Guinea, Cambodia and Vietnam show clear trends toward reduced price levels. The MCPI grew in a few states (e.g. Taiwan, Japan) albeit only a little. Overall the price levels in the Asia & Pacific region were below 4% in 2012 in most countries. At the bottom of the list we find Macao and Hong Kong with values below 0.1%!

The most homogeneous region is Europe, where in 2012 all price levels were below 7% (Fig. 14). The general trend also goes in the direction of lowering prices even though few countries in the upper region (e.g. Greece, Turkey) had an upwards trend from 2011 to 2012. At the bottom of the price level in Europe are Luxembourg, Norway and Denmark with values between 0.25 to 0.18%.

Africa is the region with the highest disparity in MCPI, with values starting at 0.87% in Mauritius and going up to 75.94% in Malawi (Fig. 15). Although a downward trend is also noticeable in Africa, ten countries still had values over 20% and four between 11% and 18%.

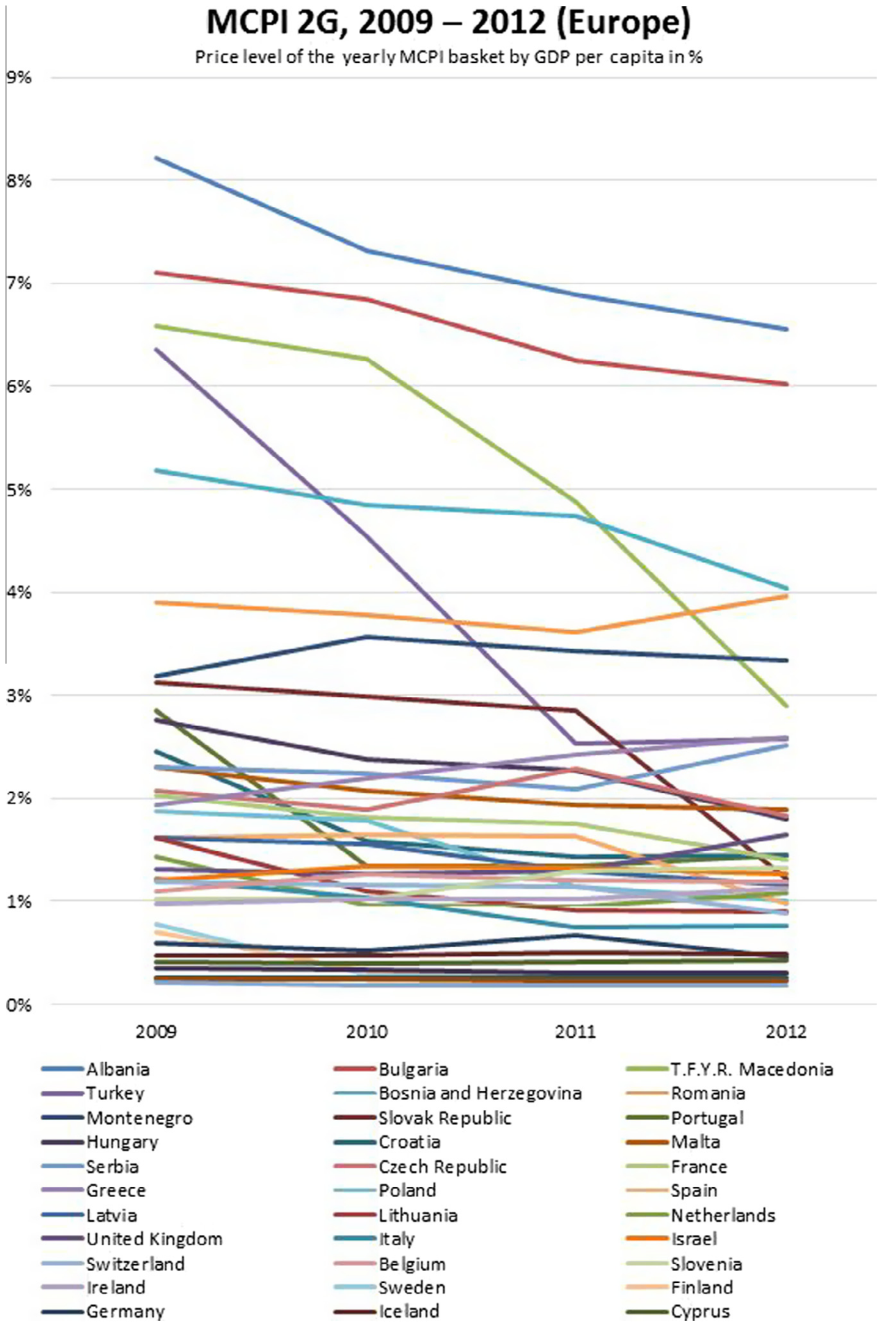

Fig. 14. MCPI 2G covering Europe, 2009–2012 (own calculations based on data from OECD, 2010; ITU, 2013b and The World Bank, 2013).

Again, to complete the data series for the whole world, Figs. 16 and 17 show the Arab States and the Commonwealth of Independent States (CIS).

5. Results

When answering research question one, we examined the globally available and comparable data for mobile communication prices. With the usage of prepaid 2G price schemes we were able to define a global mobile price basket with data of 149 countries. Literature research on existing methods and data showed that different, though quite similar, approaches already exist. In a first step we defined a mobile communication price basket. This basket is mainly based on the method

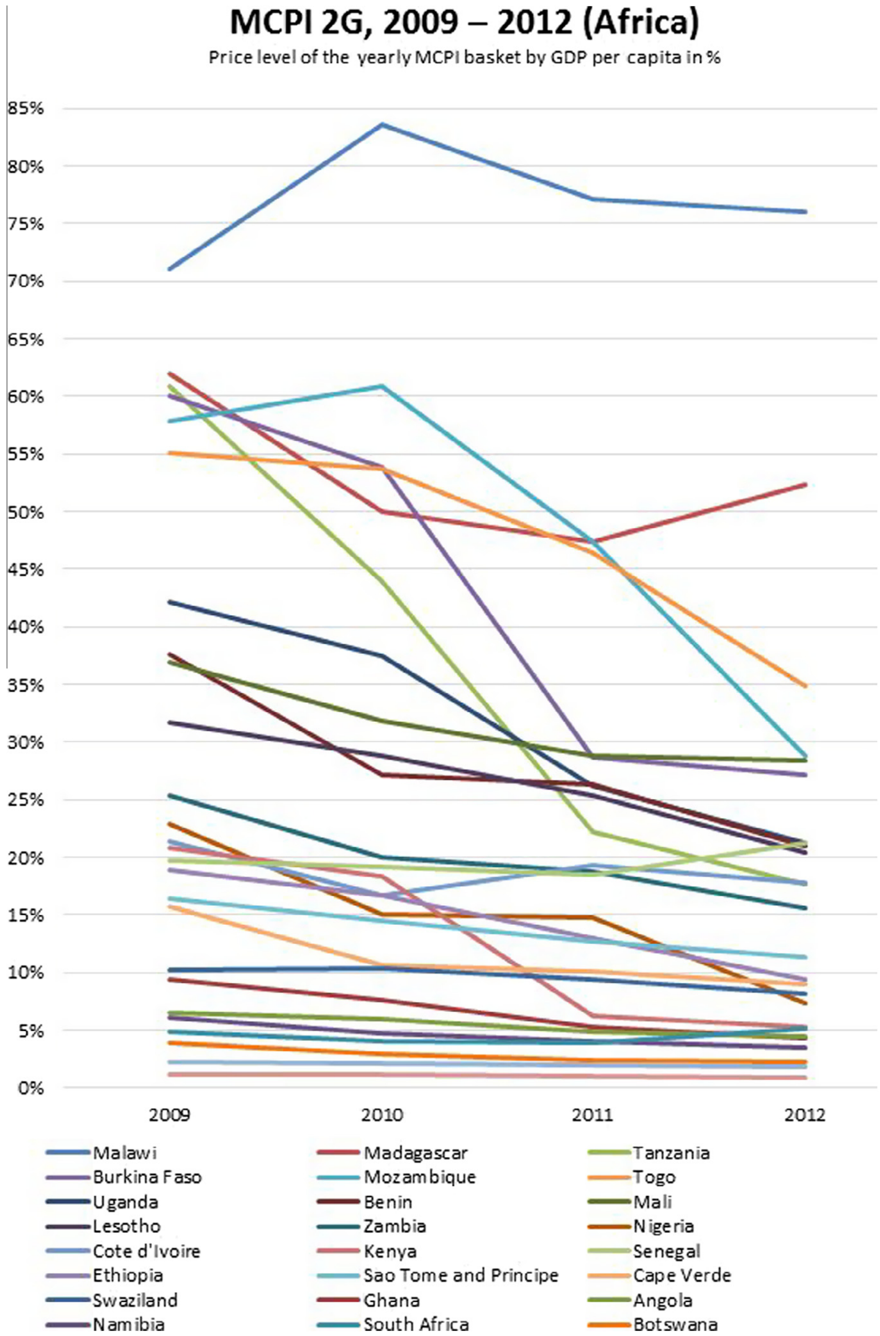

Fig. 15. MCPI 2G covering Africa, 2009–2012 (own calculations based on data from OECD, 2010; ITU, 2013b and The World Bank, 2013).

of the OECD whereas the data base for calculating the real values stems from the ITU which collects this data twice a year from its members globally.

The Mobile Communication Price Parity (MCPP 2G) is a method to calculate a global price level of mobile communication and answers research question two. This index relies on the PPP theory and provides interesting results. In 2010 only 25 states in the world had a price level which exceeded the reference value 100 of the United States of America (USA). Most of these states are located in Europe (13 states), followed by the Americas (6 states), Asia & Pacific (4 states) and the Arab States (2 states). The three states with the global highest prices are Japan (236), Australia (230) and Switzerland (202). In the commonwealth of independent states (CIS) and in Africa no state reaches the price level 100.

A further comparison was made by adding the figures of the Pen World Table (PWT) which is also called the price level of THE GDP. The comparison of the MCPP 2G with the PWT index shows whether the price for mobile communication is higher

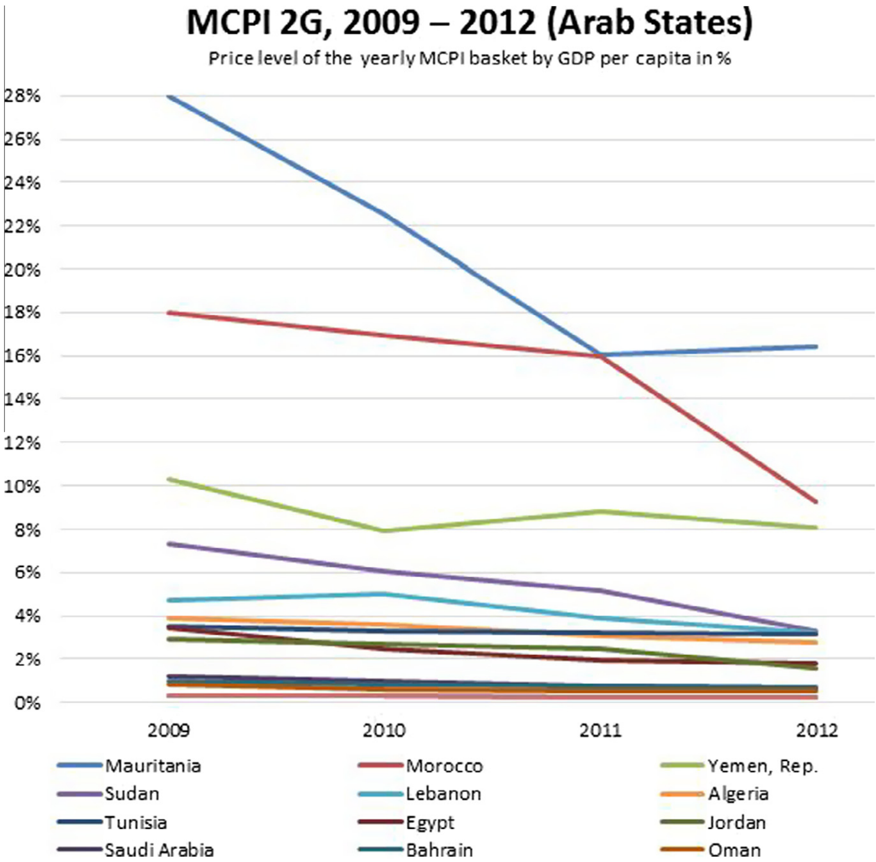

Fig. 16. MCPI 2G covering the Arab States, 2009–2012 (own calculations based on data from OECD, 2010; ITU, 2013c and The World Bank, 2013).

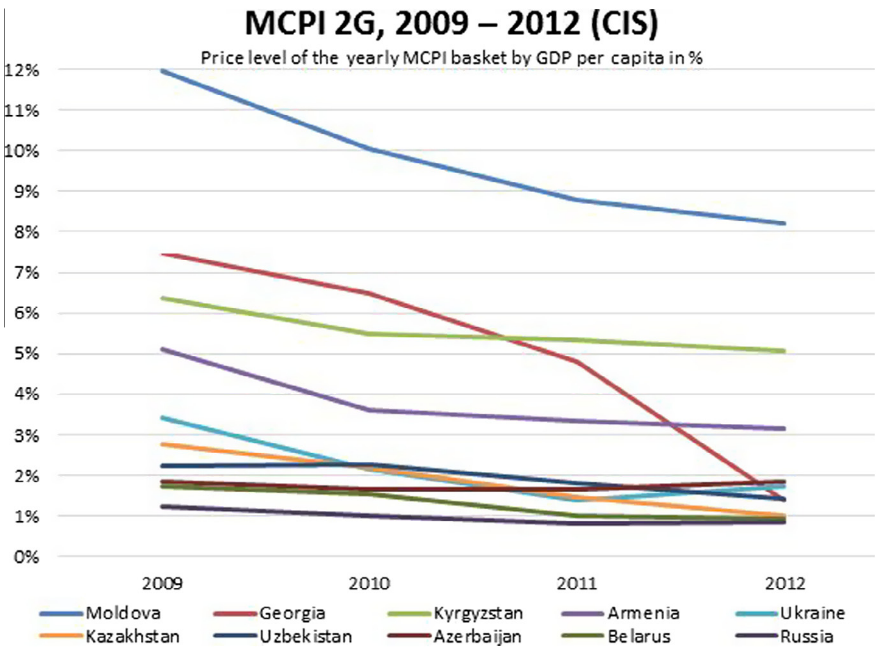

Fig. 17. MCPI 2G covering the CIS, 2009–2012 (own calculations based on data from OECD, 2010; ITU, 2013c and The World Bank, 2013).

or lower than the total price level of this country. This comparison is more relevant for an estimation of the affordability of mobile communication. So it is not surprising that in Africa twelve states out of the twenty-six where data were available have a higher MCPPP 2G than their respective price level of THE GDP.

As stated in the introduction and formulated in research question three, our focus lies not in an overall economic and political approach but on the impact of prices for the consumer, especially for those with a low income. For this reason we decided to compare the price of mobile communication with the GDP of each country. The MCPI 2G equals the price of the MCPI basket multiplied by twelve (yearly MCPI basket) divided by the gross domestic product (GDP) per capita times 100. Globally, nineteen countries have a MCPI value over 10%, of which fourteen, or about 75%, are African. In 2012 each examined country within the regions of Europe and the CIS had an MCPI basket purchased annually at less than 10% of the GDP per capita. In the Americas, Asia and the Pacific as well as in the Arab States the basket was also more affordable compared with the prices in 2009. However there are still countries where the basket corresponds to more than 10% of the GDP per capita. The African region differs from all other regions. In many African countries the yearly MCPI basket is equivalent to 10% or more of the GDP per capita. In Malawi it corresponds to nearly 76% of the GDP per capita in 2012. This suggests that an average citizen is not able to afford the low-usage prepaid mobile communication basket.

With the focus on a global comparison of affordability of mobile communication for the people at the bottom of the pyramid we discarded the usage of regional salaries. It would have added complexity and fuzziness to the Index. It is also questionable if a relative comparison to local salaries would deliver a different qualitative result regarding the group of people who could profit the most from the affordability of mobile communication: Those at the bottom of the pyramid with less than $ 2 income per day.

6. Conclusion

This article describes a method for making global comparison of mobile communication prices with a first set of recent data which provides a fair assessment of its significance. We can summarize the result holistically with a glance at the MCPI 2G map in Fig. 11. We can therefore state that with mobile communication not only is a very important technology for development within the reach of almost everybody on earth but the low investment needed for mobile technology and the concept of prepayment also allows the delivery of this service even to the poorest people at the bottom of the pyramid. Mobile communication services use a business model which enables companies to even make money from the poor. This statement could be understood in a moralising way, but we suggest seeing it as a big opportunity for sustainable development. When poor people become eligible for paid services which are affordable for them and must only be paid when the service is needed, other basic services could be delivered which today are not available for these people. For instance it could become interesting for private investors or for states to invest in power or water supply in regions where basic infrastructure is lacking or where it is very unreliable. A recent case study provided by GSMA about the water supply in India gives an example of this new way of doing business with the poor (Wills et al., 2015).

The MCPP 2G and MCPI 2G indices have some specific characteristics which are relevant for the purpose of any interpretation. Telecommunication services for the end user are a highly standardized commodity which is globally comparable. Like most services, they are not tradable because of their restriction to territorial availability. But in contrast to most services, which are highly dependent on the local workforce, mobile telecommunication services are not labor intensive. National or regional salaries are therefore not the most important determining factor for the price level. Mobile communication services are an industrial product requiring moderate investment, with a high level dependency on national regulations. Politics and its ugly companion, corruption, therefore have a high impact on the availability and the cost of mobile communication services. However, the example of India shows that it is not advisable to simply draw conclusions between price levels and weak governance. In 2008 the Indian government sold 2G licenses in an irregular manner following a first-come, first-served principle. Some licences were sold to ineligible participants who enriched themselves reselling the licenses for a much higher price than they had initially paid when purchasing them from the Indian government (Doron, 2013). In this case the corruption led to a highly deregulated market with high competition and modest prices, as the MCPP 2G and MCPI time series 2009 to 2012 show.

In 2012 the Indian top court decided to cancel 122 licenses awarded during the irregular sale. These licenses were mainly owned by newer and smaller providers who entered the Indian market late. The disappearance of these providers may lead to a consolidation in the market and a subsequent price rise (The Guardian, 2012). In this case the Indian government failed to govern and tax the first move toward 2G mobile communication, which at least led to modest prices for the consumers. The case of India shows that even moderate price levels are no proof of good national governance of the telecommunication industry (see Fig. 18).

Year	2009	2010	2011	2012
Mobile basket in Rupee	135.12	152.28	125.36	125.36
MCPP 2G (US=100)	9.07	9.95	8.02	7.00
MCPI 2G	2.98	2.83	2.05	1.86

Fig. 18. India Mobile Basket in Rupee and MCPP 2G and MCPI 2G time series 2009 to 2012.

We advise against the use of the MCPP 2G and MCPI 2G time series to explain any economic development. The reason why prices in some countries are higher or lower than in other countries with comparable economies can be manifold. Besides regulation, the level of competition in national markets is also very important. The entrance of new telecommunication providers in an existing market usually leads to higher competition and lower prices (ITU, 2012; Galperin, 2010). Furthermore, the mobile communication market segment is a growing and fast-changing industry with many global players.

7. Further research

The MCPP 2G and MCPI 2G can contribute to normalizing existing data about price levels and indicate in which countries an improvement of the availability of mobile communication is still needed, especially for the low income population. Which of the two proposed forms of the Mobile Communication Price Index should be considered as more significant depends on its application. We consider the MCPI 2G accurate for any national survey on the development of price levels in a given time period. It avoids the influence of change in currency exchange rates. On the other hand, for comparisons between one or more countries it might be more significant to use the MCPP 2G, which, besides the currency rates, also considers the different price levels in these countries.

Our calculations relied on data from the International Telecommunication Union (ITU), the World Bank, OECD and the Pen World Table 7.1. The last underwent significant change by moving from the University of Pennsylvania to the University of California, Davis and the University of Groningen. When continuing the calculation of the MCPP 2G with current price data, it will be necessary to assess all data referring to the price level of the GDP and overlapping between 2010 and 2011 (Feenstra et al., 2013; Heston et al., 2012).

In line with the global increase in 3G and 4G coverage, the next step would be the development of price indexes for mobile broadband services. When assessing the last four years, development appears to be continual. The ITU estimates a growth within the mobile broadband market segment of around 40% per year between the years 2010 and 2013. In contrast, fixed broadband penetration is expected to experience a slight growth of 10%. That said, mobile broadband subscriptions have overhauled fixed broadband subscriptions within the developed world with a penetration of 75%, making them commonplace. In the developing world, the ITU estimates that mobile broadband penetration will represent 20% of the market by the end of 2013 (ITU, 2013b). The ITU describes the relevance of this trend with "In view of the steep growth of mobile broadband and the widespread deployment of mobile infrastructure, expectations are high that mobile-broadband services will become equally as available as mobile-cellular telephony in the near future" (ITU, 2013a).

These figures indicate that the discrepancy in the availability of mobile communication will increase. The competition between international investors as well as the players in the global technology industry will take place in national markets which are regulated and taxed by their governments and administration. An important aspect is whether states recognize the importance of mobile communication as a means to improve infrastructure and hence economic development in their country (GSMA, 2014), not to mention whether mobile services are exploited as another source of income for treasury. The outcome of this development will determine quality and price for the next generation of mobile communication. It will be highly significant for the people at the bottom of the pyramid.

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