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Global patterns of broadband pricing

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COMMUNICATIONS CHAMBERS

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1. Introduction

For a number of years, Google has funded the development of a international database of fixed and mobile broadband prices, prepared by Communications Chambers. Google publishes this database and it is freely available for commercial and academic use.

The database covers virtually all countries with a population of 5m or more. The latest edition (Q4 2014) contains details on over 5,000 tariffs.

This paper sets out a basic analysis of these tariffs, starting with mobile and then turning to fixed.

2. Mobile broadband pricing

Pre- and post-paid tariffs

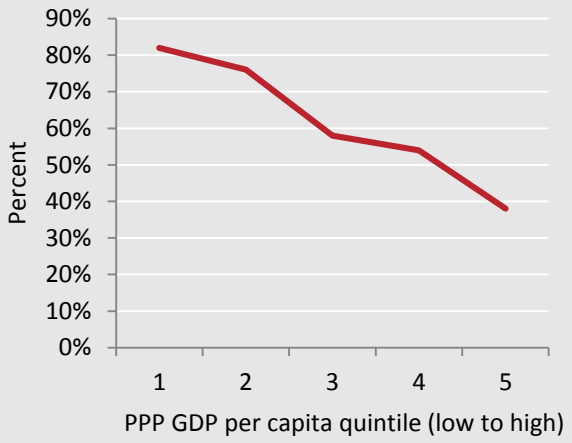
The mobile broadband price database contains 331 mobile operators and 3,306 tariffs. This covers both pre-paid and post-paid tariffs.

Figure 1 : Mobile tariffs by GDP per Capita Quintile and pre/post

PPP GDP per capita Quintile[1]	Number of tariffs			Pre-paid
	Pre	Post	Total	Percent
1 -Low	405	86	491	82%
2	594	186	780	76%
3 - Medium	399	289	688	58%
4	358	308	666	54%
5 - High	233	385	618	38%
N/A	33	30	63	52%
Total	2,022	1,284	3,306	61%

Post-paid tariffs are on a subscription basis, with the cost of usage paid in arrears. Pre-paid (also known as pay-as-you-go or stored value) provides a fixed amount of usage in exchange for payment in advance. Pre-paid can be attractive to those without the credit history necessary for subscription service, for those on tight budgets, or for those with highly variable income. Conversely, post-paid generally requires a credit card or bank account, which may simply be unavailable for poorer consumers living in a cash economy.

Figure 2: Pre-paid tariffs as portion of total



Consequently pre-paid tariffs are more common in lower income markets. For those operators in bottom-quintile GDP markets, 82% of tariffs are pre-paid. By contrast, in the wealthiest quintile just 38% of tariffs are pre-paid.

Data allowance

The data allowances of the tariffs included in the database range from 0.1MB to 2,000GB. Roughly 5% of tariffs are 'unlimited', though in practice many of these are likely to have a fair usage policy capping data consumption.[2] Less than 1% of tariffs were denominated by time

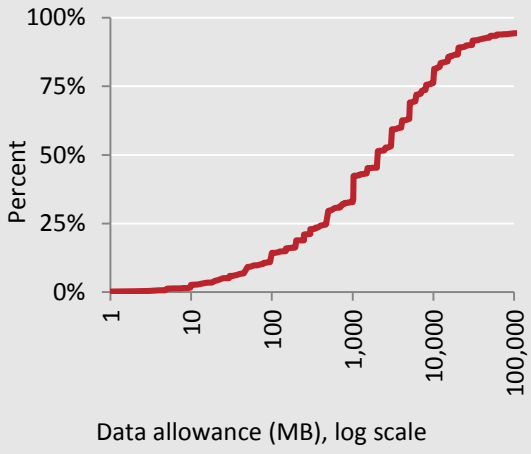
[1] Note that PPP exchange rates are not available for all countries

[2] Note that where we could identify a FUP cap, we have recorded that in the database

rather than by a data allowance - for example, Syriatel offers a pre-paid tariff of 6 hours of internet usage within a 30 day period.[3]

Overall the median data allowance of the tariffs in the database is 2GB (Figure 3), though the single most popular allowance is 1GB, representing 9% of the total number of tariffs.[4] The 25th and 75th percentile allowances are 500MB and 8GB respectively.

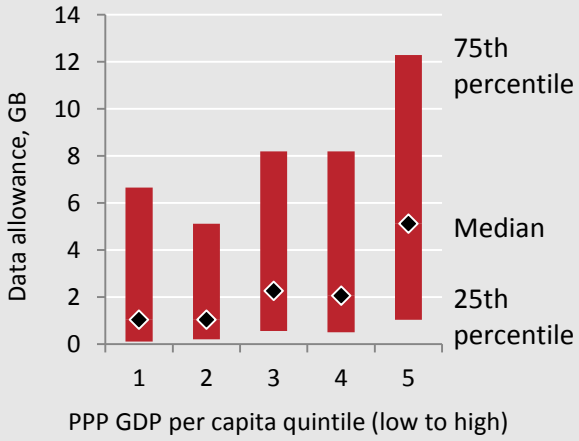
Figure 3: Cumulative distr'n of data allowances



Note however that these are offered tariffs, and the offered mix may differ materially from the mix of tariffs taken by consumers. This is both because consumers may still be subscribing to tariffs which are no longer on offer to new subscribers, and because even consumers taking a current tariff may (for example) skew to the lower end of the range of tariffs on offer.

There is some variation in data allowances by national PPP GDP per capita, likely driven by greater ability to afford larger allowances in wealthier countries., and greater availability of post-paid plans, which generally have large allowances (see below). For Quintiles 1 and 2, the median tariff has an allowance of 1GB, for Quintiles 3 and 4 it is 2GB and for Quintile 5 it is 5GB (Figure 4).[5]

Figure 4: Allowance distr'n by GDP quintile



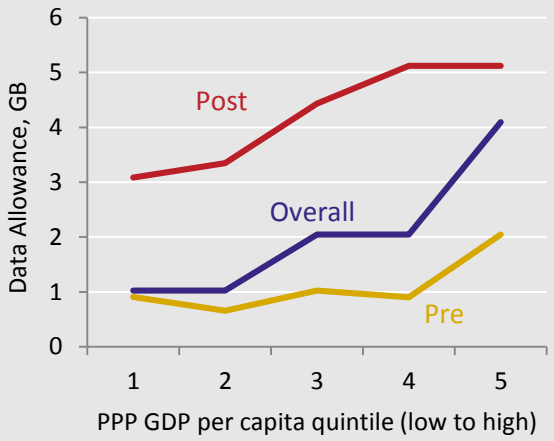
However this variation in allowance across the first four quintiles it is perhaps less than might be expected. A key factor which may increase mobile network data usage in poorer countries (countervailing the wealth effect) is the lower availability of PCs and fixed broadband. This both means that internet usage is more likely to be via a mobile device in such markets, and that that usage is more likely to be via cellular networks, given lower availability of wifi, both in- and out-of-home.

[3] Syriatel, *Electronic Easy One Prepaid Internet Vouchers* [Accessed 5th January 2015]
[4] Excluding those denominated in hours rather than in MB or GB
[5] Note that the database is primarily focused on mobile broadband tariffs, as distinct from data tariffs for smartphones. This distinction is frequently less clear in developing markets, and this may act to pull down the median allowance in these markets, since lower-allowance smartphone tariffs are more likely to be included

Data allowances are also different for pre- and post-paid plans, with the latter generally having substantially higher caps across all GDP quintiles (Figure 5).

Since part of the proposition of pre-paid plans is to serve those on tight budgets, it is natural that they tend to include smaller, cheaper data allowances. Moreover, pre-paid plans frequently cover both mobile broadband and smartphones, whereas post-paid plans are more likely to be focused on mobile broadband, which has heavier usage.

Figure 5: Median data allowance by GDP Quintile



Price levels

Pricing for mobile data is driven by a wide range of factors, including: local labour costs, spectrum costs, market maturity, competitive intensity, the contractual commitment accepted by the customer, the level of data bought, levels of sales tax and many others. In this section we set out a limited analysis of price levels, but certainly do not claim to have identified all the key drivers of variation.

Tax issues

One particularly challenging issue in making cross border comparisons is sales tax and VAT. In many countries (for instance, most of Europe) VAT is included by default in listed prices, and is effectively invisible to the consumer. In some countries (notably the US), sales taxes are routinely excluded from published prices. To address this the database includes a flag for whether sales taxes and VAT are included in the published tariff, and a figure for the relevant level of tax.

However, in practice this data is not always available. It may not be clear from a mobile operator's website whether sales taxes are included in the listed prices, and in some markets it is not practical to list a single figure for the tax rate. In the US for example, sales taxes (and other taxes applicable to telecoms services) vary by state, meaning that a single national figure is not meaningful.

Overall, 48% of the tariffs include tax, 13% exclude it and in 38% of cases it was unclear. It is likely, though not certain, that the majority of the 38% do in fact include tax. We believe this since this seems to be the more general practice internationally (the 48% vs the 13%), and because it is more likely that a site will omit comment on tax if it is already included in a list price than if it needs to be added on top.

Given these constraints, in the following analysis prices are, as far as possible, inclusive of taxes. Where listed prices excluded tax, we have grossed them up to reflect relevant tax rates, *where these were known*. However, for countries such as the US this means rates are effectively shown excluding tax. Clearly this is not entirely consistent. However, we believe it is less inconsistent than simply using list prices.

Using prices inclusive of tax (as far as possible) also gives a better sense of the affordability of broadband to citizens.

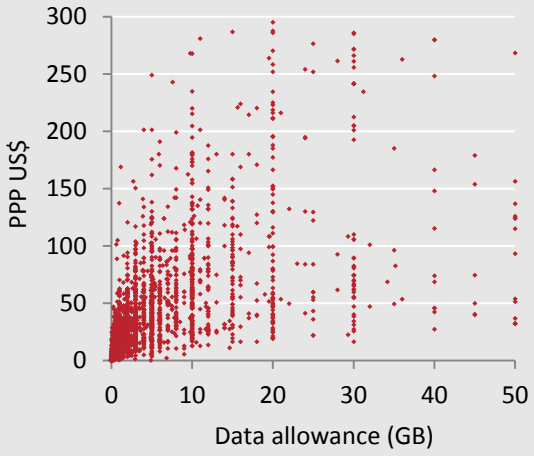
Exchange rates

Choice of exchange rates is also an important factor in making international comparisons. In our analysis we have used PPP (purchasing power parity) rates rather than market rates, since these are likely to give a better sense of the affordability of mobile data services in different countries.[6]

Price vs data allowance

Figure 6 shows the price of the database tariffs against the relevant data allowance. Note that a small number of tariffs are outside the bounds of this chart, and those with an unlimited data allowance are necessarily excluded.

Figure 6: Price vs data allowance



Clearly there is enormous variation in pricing, even for tariffs with identical data allowances. To take just one example, the price of a 1GB data allowance ranges from $0.66 (from Viettel in Vietnam) to $62.75 (Airtel in Sierra Leone).[7]

One reason for such variation is that the data allowance may be very different from the actual data consumed. In general consumers significantly under-use their data allowance. For example UK regulator Ofcom has found that the average usage of those with 2-5GB data allowances is just 0.7GB.[8] Returning to the 1GB tariffs, the Viettel tariff was valid for just 1 day. By contrast, the Airtel tariff had a 30 day validity. Thus *actual* data usage is likely to be much higher for the Airtel tariff than for Viettel's, despite the allowance being identical.

[6] We note that for other purposes using ex-tax rates and/or standard exchange rates could be more appropriate, for instance in assessing the efficiency of national operators - a mobile operator cannot be accused of inefficiency if the reason for its higher prices is a higher national VAT rate

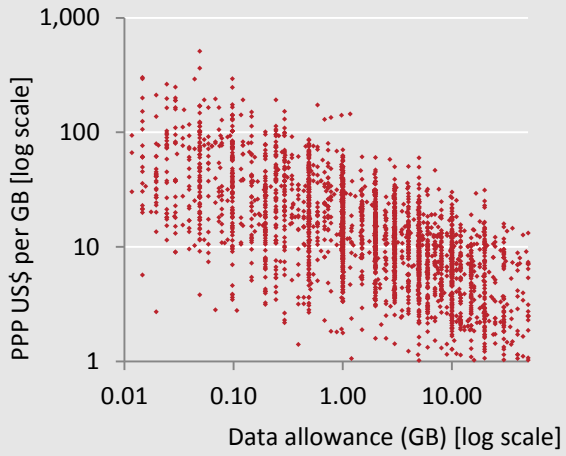
[7] Note that the Airtel tariff is denominated in US dollars, with a list price of $25. However, this has been adjusted for PPP

[8] Ofcom, *Infrastructure Report 2013 Update*, 24 October 2013

Price per GB vs data allowance

Figure 7 shows how the price per GB varies across data allowances. The variation for a given data allowance is again evident, with a range of more than 10x between the highest and lowest prices for a given allowance. However, it is also clear that larger data allowances bring a lower unit cost.

Figure 7: Price per GB vs data allowance

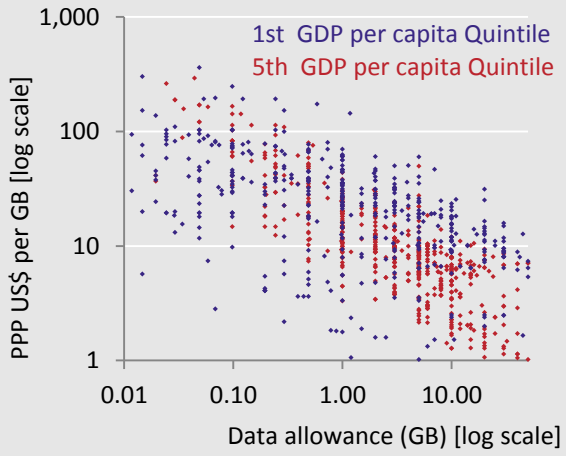


This is to be expected, given that:

- Larger allowances are less likely to be fully used (so that that price per GB of allowance understates the price per GB carried on the network)
- Larger allowances represent a 'bulk purchase' of data
- Larger allowances are (as we have seen) associated with post-paid plans. Since these often come with a multi-month commitment, they represent a bulk purchase of data across time as well as within a month.

Figure 8 shows the same data, but focusing in on plans from the bottom (first) GDP per capita quintile and the top quintile. For plans of a similar data allowance, there is not an obvious pattern of one or the other having lower prices. However, the richest quintile plans skew towards higher data allowances, which have lower unit costs than plans with lower data allowances. As a result, the median cost per GB for plans in the richest quintile of countries is $8.28, compared to $23.57 for the poorest quintile.

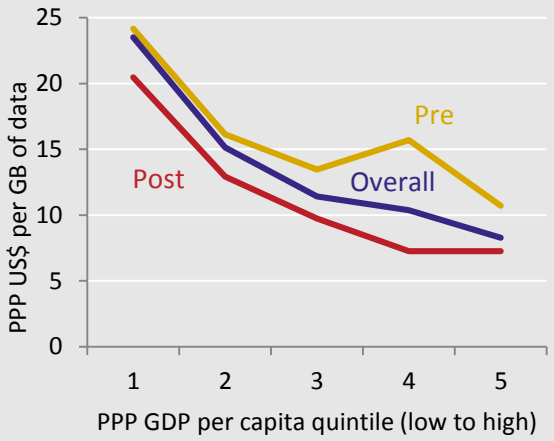
Figure 8: Price per GB vs data allowance



Thus it seems likely that consumers in poorer countries are paying a higher unit cost for their data, not necessarily because like-for-like tariffs are higher, but rather because they are not able to make 'bulk purchases' to the same degree. (That said, consumers in richer countries may be paying for more data than they need).

Figure 9 shows median unit prices across all five quintiles and pre- and post-paid plans. There is a clear pattern of unit price falling with increased GDP per capita.[9]

Figure 9: Median price per GB by GDP Quintile



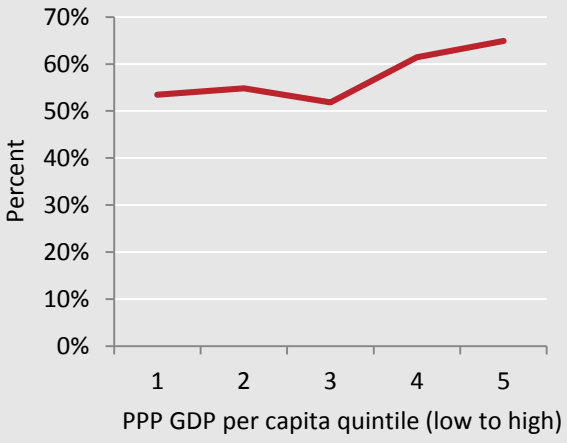
Market dynamism

All else being equal, it might be expected that in highly dynamic or competitive markets, prices would change more rapidly. In general, there is an expectation that mobile tariffs will fall over time, thanks to improved technology and greater spectrum allocations, both of which allow more capacity to be provided for the same operating cost (though spectrum may come at a significant acquisition cost in many markets).

One proxy for market dynamism is the portion of tariffs in the Q4 2014 database which are new since the Q4 2013 iteration. For ISPs which appear in both datasets, 57% of their Q4 2014 tariffs have no match from a year earlier. (This matching based on price, validity or contract length and cost).

The figures suggest that markets in wealthier countries may be *slightly* more dynamic - operators in top PPP GDP per capita countries have 65% new tariffs, compared to 53% for bottom quintile.

Figure 10: New tariffs as portion of total



[9] The 'bump' in prepaid unit costs in quintile 4 appears to be driven by a large number of relatively high unit-cost tariffs in Mexico. Setting aside Mexico, the median unit cost for pre-paid plans from this quintile is $12.58

3. Fixed Broadband Pricing

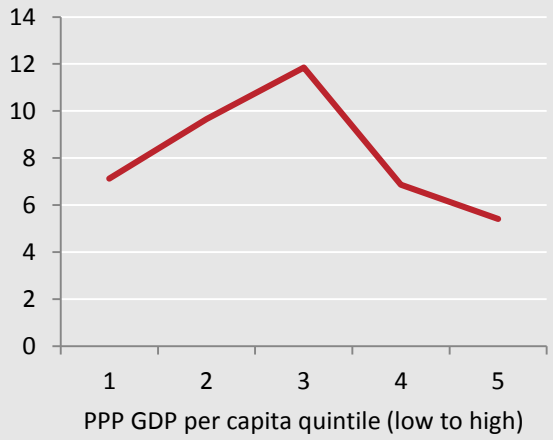
The fixed broadband database covers 247 ISPs and 1,983 tariffs. This is a smaller number of operators than in the mobile database, largely because in many less developed markets there is not material fixed broadband competition. In such markets mobile is the predominant mode of broadband consumption, offering more widespread coverage and faster page loads.[10] Fixed broadband is less used, and may be dominated by the incumbent fixed operator. As a consequence, fixed broadband pricing from second or third operators was unavailable in several lower-GDP markets.

Figure 11 : Fixed ISPs and tariffs by GDP Quintile

PPP GDP per capita Quintile	ISPs	Tariffs
1 -Low	23	164
2	49	473
3 - Medium	52	616
4	43	295
5 - High	71	384
N/A	9	51
Total	247	1,983

Figure 12 shows the average number of tariffs per ISP, by GDP quintile. Both the poorest and richest markets have a relatively low range of offers. For poorer markets this is for the reasons discussed above. Smaller, less competitive markets likely result in less segmented and varied product offerings.

Figure 12: Tariffs per ISP by GDP Quintile



For richer markets, this apparent relative lack of diversity is likely a result of the focus of the database on broadband-only offers. In richer markets differentiation increasingly arises from bundled offers, combining broadband with a landline, TV or mobile service. In Europe, for example, 64% of broadband subscriptions are bought bundled with one or more other services.[11] As such, rich variation of broadband attributes (such as speed and data allowance) has become somewhat less important in many such markets.

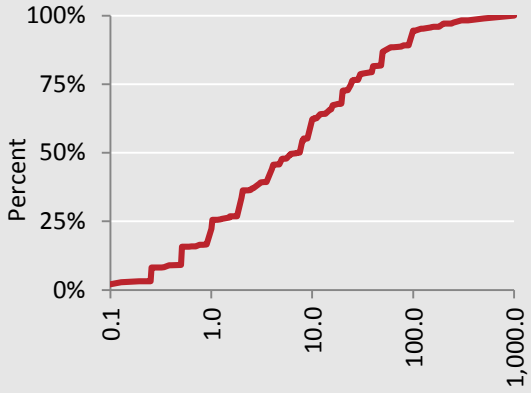
[10] For a comparison of fixed to mobile web pageload times, see Akamai, *State of the Internet Q3 2014*, 8 January 2015

[11] European Commission, *E-Communications and Telecom Single Market Household Survey*, March 2014

Downstream speed

Bundled products aside, key attributes of broadband offers are downstream and upstream speed and data allowance. Virtually all (99.1%) of the offers in our database specify downstream speed. It is also an important differentiator of products within ISPs. All but eight ISPs offer more than one speed.[12]

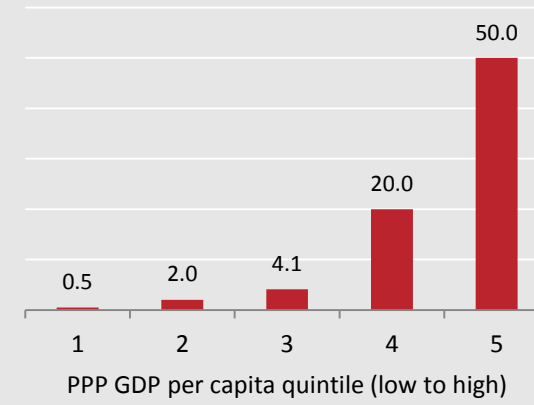
Figure 13: Cumulative distr'n of downstream speed



The median speed across the offers in the database is 7.5 Mbps (Figure 13). Just 21% of offers exceed 30 Mbps. Thus while there is (in richer markets) considerable focus on superfast broadband, the vast majority of offers available today globally are well below this level.[13] Just 5% of offers are 100 Mbps or more.

As might be expected, the availability of higher speeds varies dramatically by GDP per capita. While the richest fifth of countries have a median offer speed of 50 Mbps, in the poorest fifth the median is just 0.51 Mbps (Figure 14) - 98x difference.

Figure 14: Median downstream speed (Mbps) of offers by GDP per Capita Quintile



Greater wealth means that a given household is likely to have more to spend on higher broadband speeds. However, at least two other factors are relevant here.

Firstly, as we have noted, fixed broadband penetration is lower in poorer markets. This means there is a smaller pool of customers from which to recover the fixed cost of rolling out improved broadband to a particular neighbourhood.

Secondly, the lower competitive intensity, and in particular the absence of cable TV networks in poorer countries, means there is less pressure to roll out faster networks to retain market share. (Cable networks are particularly relevant, since they can upgrade to superfast speeds at relatively low cost, and have often been market leaders in this regard).

[12] Of those offering more than one tariff. A further three ISPs offer one broadband product only

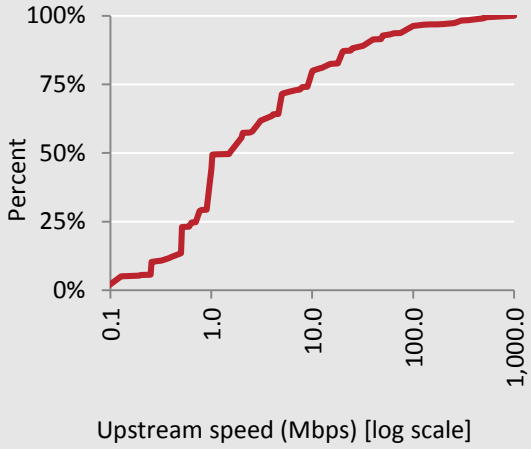
[13] There is considerable debate as to what represents 'superfast' broadband. 30 Mbps is one potential threshold, though certainly not the only one

Upstream speed

Currently upstream speed appears to be a less important part of the fixed broadband proposition. Of the offers in the database, 54% did not specify an upstream speed, suggesting that ISPs did not see them as an important part of the marketing proposition. Amongst those which did have specified upstream speeds, the median speed was 1.5 Mbps (Figure 15).

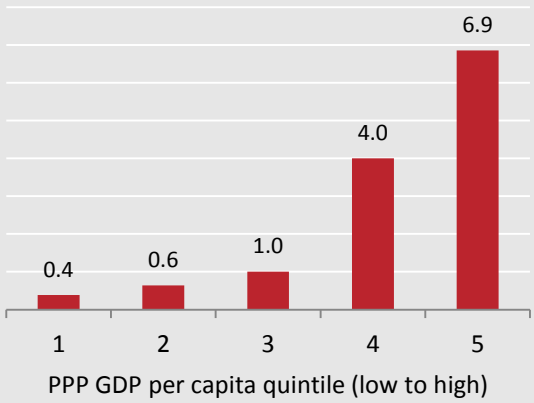
In the great majority of cases, the downstream speed is less than the upstream. In just 8% of offers is the upstream speed equal to the downstream.[14]

Figure 15: Cumulative distr'n of upstream speed



As with downstream speeds, there is significant variation in upstream speeds across GDP per capita quintiles (for those products which report them). The richest fifth of countries have a median offer speed of 6.9 Mbps, in the poorest fifth the median is just 0.4 Mbps (Figure 16) - a 17x difference. While substantial, this is a lesser magnitude than the difference in download speeds. This suggests that richer countries have focused relatively more on enhancing download rather than upload speeds.

Figure 16: Median upstream speed (Mbps) of offers by GDP per Capita Quintile



Data allowance

As with upstream speed, data allowance is unspecified for a large number of plans: 39%. For these plans there may be a cap that is not evident on the operator's website, or they may be unlimited. A further 25% specify unlimited usage, and 36% have a limited number of GB per month.[15]

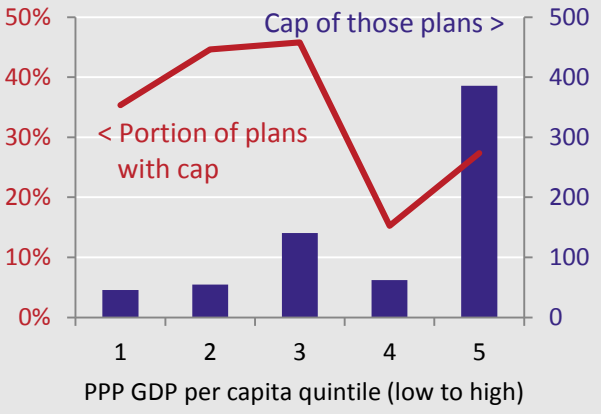
Note that even plans advertised as unlimited may have a Fair Usage Policy which puts a (high) upper bound on data consumption. Where such FUP caps were evident, they were entered into the database (as a limited plan). Some of the plans shown as 'unlimited' may also have FUP caps which were not shown. Thus the distinction between unlimited and limited plans is not as stark as it might seem.

[14] We assume that in cases where the upstream speed is not specified, it is less than the downstream speed
[15] Four tariffs in the database have usage capped by a limited number of hours rather than GB

Wealthier markets have significantly higher data caps - an average of 385GB in the top quintile, by comparison to 46GB in the bottom quintile. Moreover, a lower percentage of plans are capped - 27% vs 35%. That said, even the caps in the poorest quintile are relatively substantial.

Note that a significant majority (68%) of ISPs do not vary data allowance between their offers - all their offers have a uniform data allowance (generally either unlimited or unspecified).

Figure 17: Portion of capped plans and cap level by GDP per capita Quintile[16]



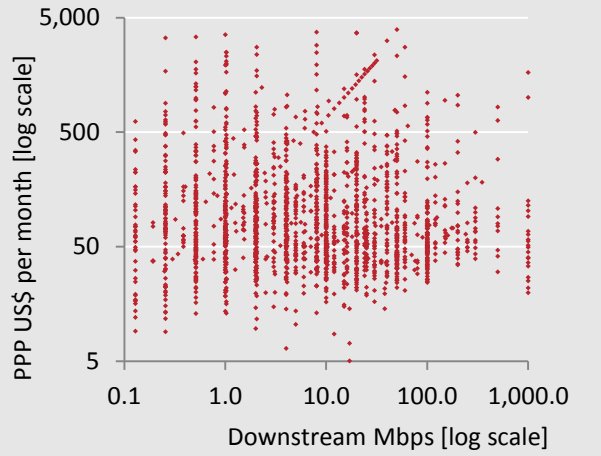
Pricing levels

We now turn to the cost of fixed broadband. As with mobile, we work on rates including tax (as far as possible) and use PPP exchange rates.

Figure 18 shows monthly subscription cost versus the downstream bandwidth of the service. There is enormous variation in price for services with identical bandwidth, driven by some of the factors discussed above, such as data allowance.

Thus at an international level, there is little evidence that those getting higher bandwidths pay more to do so. Indeed, some of the higher prices are actually for the lower bandwidths.

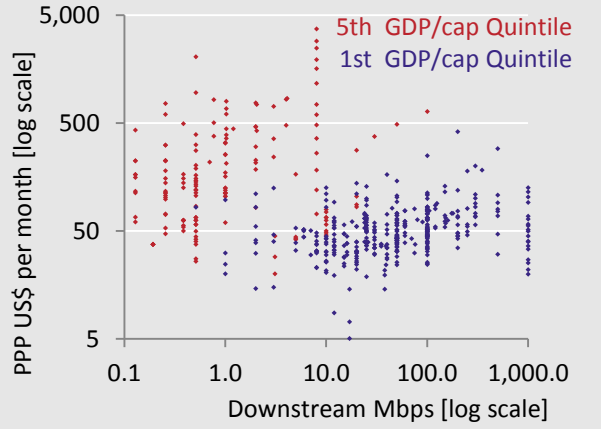
Figure 18: Price vs downstream bandwidth



However, at a more detailed level a somewhat different picture emerges. Figure 19 focuses on the prices in the quintiles with the lowest GDP per capita (the first) and the highest (the fifth). The plans in the first quintile are both lower bandwidth and higher cost than those in the fifth. Within each quintile, there is a pattern of greater expense for higher bandwidth, as might be expected.

However, in the poorest quintile even the lowest bandwidth products are relatively expensive.

Figure 19: Price vs downstream bandwidth (first and fifth quintiles)

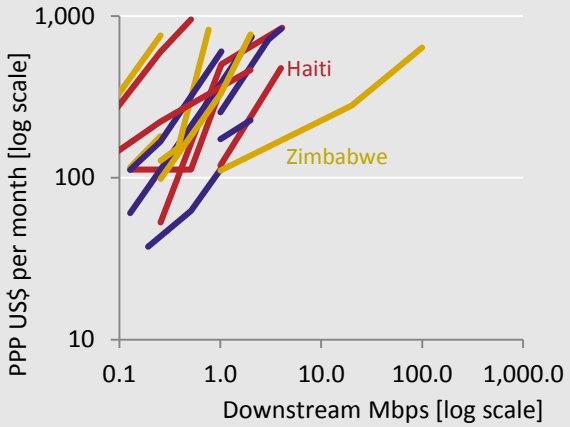


[16] Averaged across country averages in quintile rather than across all tariffs in quintile

This suggests that fixed broadband may primarily be used by businesses in these markets, rather than by consumers.

Zooming in even further, Figure 20 shows price plots for the individual countries in the poorest quintile. Each country is represented by a three point line, with the points showing the median price for each of that country's lowest, median and highest bandwidth offers. To focus on the relationship between bandwidth and price, we have limited the offers to those without data caps.

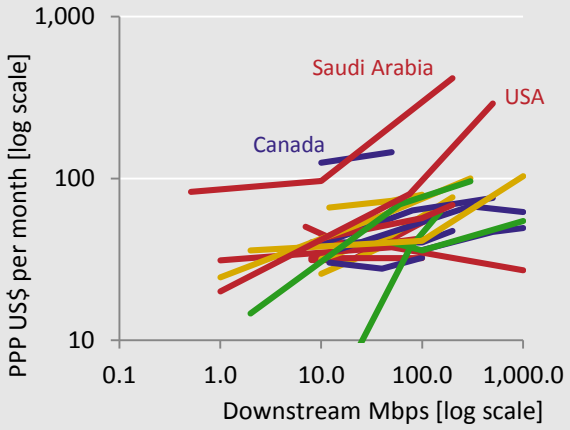
Figure 20: Price vs downstream bandwidth (by country for first quintile - uncapped plans)



Clearly in these markets even quite small increases in bandwidth come at a significantly higher cost. For instance, in Haiti stepping up from 1 Mbps to 3 Mbps costs an incremental $238 per month (PPP basis).

Figure 21 plots the richest quintile countries on the same scale. Prices are lower in this group, and generally there is less of an increase in price for higher bandwidths in any given market. (The US is a notable exception - high bandwidth products are significantly more expensive than the median product in that market, but conversely low bandwidth products are significantly cheaper).

Figure 21: Price vs downstream bandwidth (by country for fifth quintile - uncapped plans)



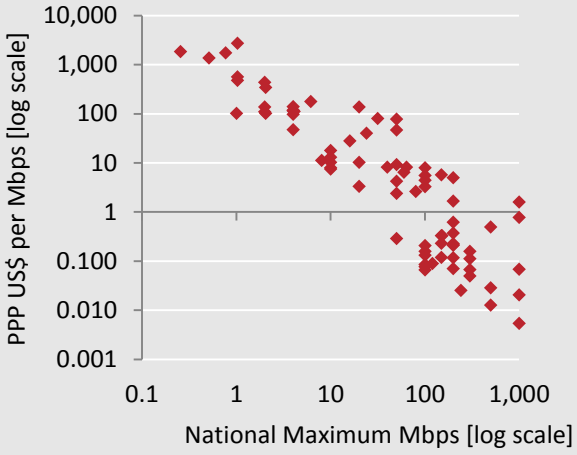
Canada's apparent expense in Figure 21 may be a result of our focus on uncapped plans. Most Canadian plans are capped, albeit with high allowances (the median is 250GB). Thus those Canadian consumers selecting unlimited plans may be those with particularly intense usage, driving higher traffic costs which need to be recovered through the tariff.

Finally in our discussion of fixed broadband pricing we consider the incremental cost per Mbps of the fastest broadband offer in each market, calculated based on the same median figures as above For example if a country had a median speed of 10 Mbps, for which the median price was $10, and a maximum speed of 20 Mbps, for which the median price was $30, the incremental cost per Mbps for the maximum speed offer would be $2/Mbps.[17]

[17] ($30-$10)/(20 Mbps - 10 Mbps)

Figure 22 shows a clear pattern of diminishing returns. For countries with a low maximum speed, the incremental cost per Mbps to step up to that maximum is very high. Conversely, for countries with very high maximum speeds, the incremental cost per Mbps for consumers to acquire those speeds is low.

Figure 22: Unit cost of incremental bandwidth

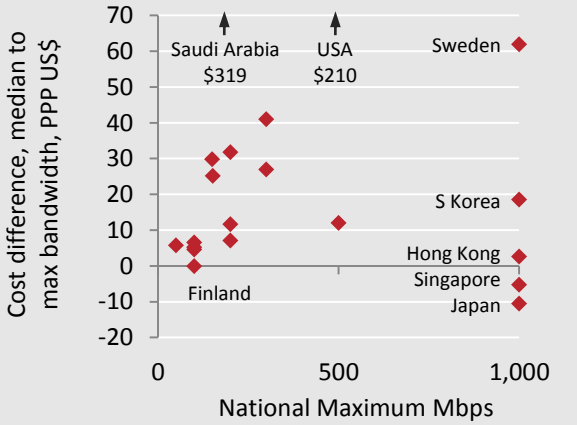


This is perhaps natural - stepping up from (say) 0.5 Mbps to 5 Mbps enables a host of applications, in particular those involving video. Conversely, stepping up from 100.5 to 105 Mbps is unlikely to make any practical difference for most users, and thus it is harder to extract a price premium from those users.

From the operators' perspective, the incremental cost is also likely low. An operator offering 1000 Mbps has deployed fibre. Whether the produced offered on that fibre is indeed 1000 Mbps, or just 100 Mbps makes virtually no difference to that operator's cost.

Another way to look at the data is to consider the absolute cost of stepping up to the maximum speed (rather than the cost per incremental Mbps). Figure 23 shows this absolute cost against the national maximum speed for countries in the richest quintile. The median cost difference is $12, but there is great variation. In three countries (Finland, Singapore and Japan) the median tariff with maximum bandwidth is the same price *or cheaper* than the median tariff with median bandwidth.

Figure 23: Incremental cost of max bandwidth (fifth quintile countries)[18]

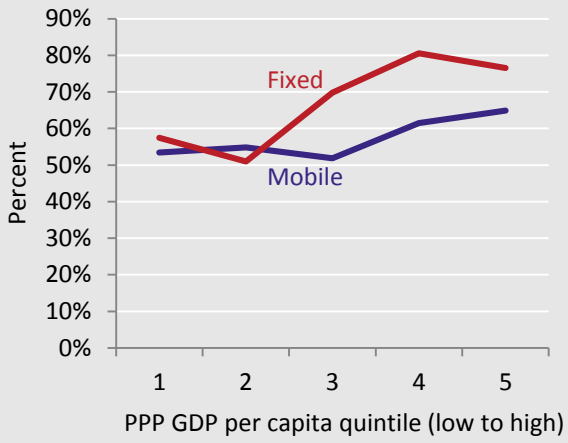


[18] Note that maximum bandwidth is amongst offers without usage caps from those operators included in the database. Thus in some cases higher speeds may be available than are shown on this chart

Market Dynamism

Finally we look at market dynamism (as measured by portion of tariffs which are new compared to a year prior). Fixed broadband shows a similar pattern to mobile, with greater apparent dynamism in the richer markets. Indeed, the pattern is stronger for fixed broadband, with a greater difference between poorer and richer markets. As we have noted, in several poorer markets there is relatively little competition in fixed.

Figure 24: New tariffs as portion of total

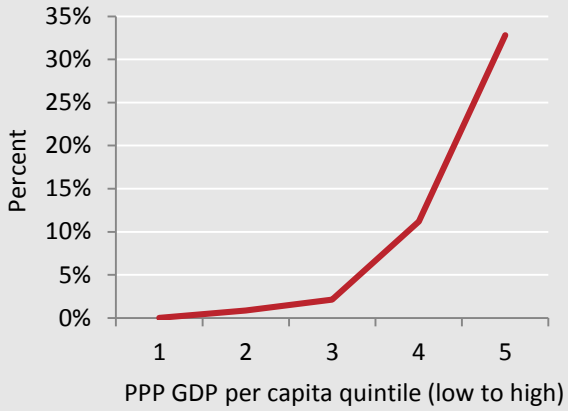


Perhaps surprisingly, in richer markets there seems to be a somewhat higher level of dynamism in fixed rather than mobile markets.

Another indicator of dynamism is the number of introductory offers. In markets with switching barriers, it is common to offer an initial discounted period to persuade customers to go to the trouble of changing suppliers.[19] Overall 9% of the tariffs in the database carry such an introductory offer, with an average value of just over two months free service.

However the prevalence of such offers varies dramatically with GDP quintile. In the wealthiest quintile, one third of tariffs carry such discounts, whereas in the poorest two quintiles they are almost unknown.

Figure 25: Tariffs with introductory discount as portion of total



[19] For a more detailed discussion, see Robert Kenny & Aileen Dennis [Communications Chambers], *Consumer lock-in for fixed broadband*, 3 July 2013

4. Conclusions

This brief survey has considered only some of the key tariff variables in the Google broadband pricing database, and has taken only a high level view of them. However, based on the above analysis, we tentatively draw the following conclusions.

Mobile

- In lower income markets, pre-paid plans and plans with lower data allowances are more common
- Both pre-paid and lower allowance plans are more expensive per GB
- As a consequence, consumers in poorer markets are paying more per GB for their data (even though like-for-like plans are not priced that differently between richer and poorer markets)
- Mobile markets are dynamic (and somewhat moreso in richer markets) with 57% of tariffs in the database new since last year.

Fixed

- Downstream speed remains a critical marketing attribute for broadband (alongside price), and is much more likely to be specified than any other attribute.
- The median global downstream speed is 7.5 Mbps, with just 21% of offers exceeding 30 Mbps
- Available speeds vary dramatically with wealth - the median offer in the richest quintile of countries is almost 100 times faster than that in the poorest quintile
- Data allowances are far less important for fixed than mobile. Caps are specified in only one third of tariffs, and in many cases these are very high (set as fair usage policies rather than at a level likely to constrain many users)
- However, caps are more likely in poorer markets, and are tend to be lower there
- The price premium for higher speeds is much greater in lower income markets
- In richest quintile markets, the premium for maximum speed over median speed averages $12, though with considerable variation on either side
- Fixed markets look to be somewhat more dynamic than mobile markets (particularly in wealthier markets), with 68% of tariffs being new in the last year