Roaming: Probabilities & Retail Prices

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This note considers the probability that the customers of a partially built mobile network with roaming rights incur roaming charges through their calling behaviour. It also addresses the potential for roaming charges, in combination with retail prices, to constitute a vertical price squeeze.

Roaming Probabilities

The following analysis is based on the commonly used "balanced calling" assumption, which implies that if there are N customers, the probability of any call being placed to any particular one of them is 1/N. This assumption excludes pricing strategies that are effective in generating on-net or within-coverage calling. To the extent that such strategies are able to limit roaming, the probabilities below will be over-stated.

There are six different types of outgoing calls made by an entrant's customer. These are illustrated in the table below:

Call Type	From	To	Roaming Legs
1	E's customer in coverage	E's customer in coverage	0
2	E's customer in coverage	E's customer roaming	1
3	E's customer in coverage	I's or O's customer	0
4	E's customer roaming	E's customer in coverage	1
5	E's customer roaming	E's customer roaming	2
6	E's customer roaming	I's or O's customer	1

The likelihood of each type of call depends on the market share and market coverage of the entrant. This can be best illustrated by an example, for which we assume the entrant has 5% market share and 25% coverage (by population). The probability of each call type is itemised below

Call Type 1. The probability that the entrant's customer is in coverage (25%) and calls another entrant's customer (5%) who also in coverage (25%) is **0.3%** (25% x 5% x 25%).

Call Type 2. The probability that the entrant's customer is in coverage (25%) and calls another entrant's customer (5%) who is roaming (75%) is **0.9%.** (25% x 5% x 75%)

Call Type 3. The probability that the entrant's customer is in coverage (25%) and calls an incumbent's or other's customer (95%) is **23.8%**.

Call Type 4. The probability that the entrant's customer is roaming (75%) and calls another entrant's customer (5%) who is in coverage (25%) is **0.9%**.

Call Type 5. The probability that the entrant's customer is roaming (75%) and calls another entrant's customer (5%) who is also roaming (75%) is **2.8%**.

Call Type 6. The probability that the entrant's customer is roaming (75%) and calls an incumbent's or other's customer (95%) is **71.3%**.

These probabilities sum to one as required. Overall, the probability of any given call involving

- No roaming is 24.1%,
- One roaming leg is 73.1%,
- Two roaming legs is 2.8%.

As the entrant's market share and coverage changes, so does the likelihood of roaming calls. For example:

- If market share is held constant and coverage increases, the probability of roaming decreases because a greater proportion of the entrant's customers are covered.
- If market share increases and coverage is held constant, the probability of roaming increases because a smaller share of the entrant's customers are covered.

Realistically, there is a positive relationship between market share and coverage. So as coverage increases, so does market share. As the market share and coverage have opposite affects on roaming likelihoods, the net impact is complex. Another example will assist to understand the overall effect.

Assume that in order for the entrant to add 5% to its market share it needs to add 25% to its population coverage. Now we can trace out the way roaming probabilities change with the entrant's coverage. The calculations for each call type are identical to above, and are summarised in the following table.

Market Share/Coverage	5%/25%	10%/50%	15%/75%	20%/100%
No Roaming	24.1%	47.5%	72.2%	100.0%
One Roaming	73.1%	50.0%	26.9%	0.0%
Two Roaming	2.8%	2.5%	0.9%	0.0%
TOTAL (as a check)	100.0%	100.0%	100.0%	100.0%

These probabilities are consistent with what intuition would suggest. As the entrant increases its coverage, its market share increases and the likelihood of any particular call involving roaming decreases.

Incoming Calls

In addition to the above, the entrant's customers will also incur roaming charges on incoming calls when they are out of coverage. A similar analysis can be done to estimate the probability of incurring roaming charges in this way. It also shows that the probability of incurring roaming charges declines with the extent of network build.

Price Squeeze

In any situation where a firm sells wholesale inputs to one of its retail rivals, there is potential for a vertical price squeeze. That occurs when the gap between the retail and wholesale prices is smaller than the access seeker's cost for the component they supply. In that case, the access seeker is unable to compete with the access provider. Depending on the circumstances, that outcome could be viewed as restricting competition in a market.

When products are undifferentiated and prices are linear, it is relatively straightforward to test for the existence of a price squeeze. Neither of those features apply in the case of mobile telephony however. An inquiry into whether a price squeeze exists must therefore be guided by the principles of anti-trust analysis. Market definition is critical to that process. Simple indicators can be very misleading unless they derive from a more complete and disciplined analysis.

As noted above, roaming charges apply with different probabilities depending on the entrant's investment behaviour and pricing structures. In my view it is potentially dangerous to ignore that information when forming views as to the existence or otherwise of a price squeeze.