



# Bitstream access: implications of new Telecom plans on pricing imputation

PUBLIC VERSION

Final report for TelstraClear, 23 June 2005

Network Strategies Report Number 25017

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## 1 Introduction

On 8 June 2005, Telecom launched three new DSL business plans. These plans were also included in Telecom's pricing imputation methodology within its cross submission<sup>1</sup> on bitstream access.

This paper contains our comments on the implications of including these new plans within the analysis. Following this introduction, we outline the characteristics of the new plans (section 2), comment on Telecom's regression methodology (section 3), note the differences between residential and business plans (section 4) and examine the implications the new plans have on our imputation methodology (section 5). Finally, in section 6 we summarise our conclusions.

Please note that although commissioned by TelstraClear, the views contained in this report are entirely those of Network Strategies.

## 2 Telecom's new plans

The new Telecom DSL business plans are positioned between its Venture plans and full speed plans (Exhibit 1). All new plans have an upstream speed of 128kbit/s, as do the Venture plans. The full speed plans have an upstream speed of 600kbit/s.

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<sup>1</sup> Telecom New Zealand Limited (2005) *Cross submission in respect of the Commission's draft determination on the application for access to and interconnection with Telecom's fixed PDN service ('bitstream access')*, 8 June 2005.

<i>Plan</i>	<i>Downstream speed</i>	<i>Data cap (Gbytes)</i>	<i>Price excluding GST</i>
Venture 1GB	256	1	59.95
Venture 3GB	256	3	79.95
Venture Flat Rate	256	10	99.95
<b>Business 3GB</b>	<b>1024</b>	<b>3</b>	<b>119.95</b>
<b>Business 10GB</b>	<b>1024</b>	<b>10</b>	<b>149.95</b>
<b>Business 15GB</b>	<b>2048</b>	<b>15</b>	<b>299.95</b>
Jetstream 600	2000	0.6	79.11
Jetstream 1200	2000	1.2	137.78
Jetstream 1800	2000	1.8	193.78
Jetstream 3000	2000	3	309.78
Jetstream 5000	2000	5	475.78
Jetstream 10000	2000	10	905.78
Jetstream 20000	2000	20	1 617.78
Jetstream 30000	2000	30	2 417.78

**Exhibit 1:***Summary of**Telecom DSL plans**[Source: Telecom]*

The downstream speed of the Business 15GB plan is most comparable to that of the full speed Jetstream plans, however it is clear that the price is significantly cheaper, at roughly one-third that of the Jetstream 10000 plan, which has a data cap two-thirds that of the Business 15GB plan. Telecom states that the 3GB and 10GB Business plans are directly comparable to full speed plans, but we stress that this is only in terms of the data cap – the downstream speeds of these plans are approximately half that of the full speed plans.

Nevertheless, it is clear that the new plans are considerably more attractively priced than Telecom's full speed plans. This suggests that Telecom's full speed plans may indeed be excessively priced.

Note that in its comparison of the new plans with OECD benchmark prices, Telecom estimates the price for a 5GB plan by performing a linear interpolation from the 3GB and 10GB plans. This contradicts Telecom's assertion that the relationship between price and data cap is nonlinear. It is unclear why Telecom does not use its model functional form to estimate the price of such a plan, given that Telecom claims that this encapsulates its pricing principles.

The OECD benchmark figures used by Telecom in its comparison were current as at October 2003. Telecom claims<sup>2</sup> that it is unlikely that:

...the prices used for the purposes of the benchmarking survey would have declined by more than 30% since October 2003 and as such Telecom believes that its new business broadband prices would compare very favourably even as against current OECD prices.

We note that retail DSL prices in many countries have been undergoing considerable variation over the past few years, and that this is coupled with changes in service features (such as speed, contention ratios, and data caps). We have examined the prices of a small sample<sup>3</sup> of retail DSL services over the period February to December 2004, and found that retail plans with specifications unchanged over that period have undergone some substantial price decreases in monthly access fees (Exhibit 2). We conclude that there is very likely to have been a substantial change in the OECD benchmark since October 2003, and that the differentials between Telecom's new plans and current OECD prices are likely to be smaller than that quoted by Telecom.

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<sup>2</sup> *ibid*, paragraph 118.

<sup>3</sup> Our sample comprised information on retail DSL services from Australia, Denmark, France and Sweden. Services or plans were only included in our sample if they were available in both February and December 2004. A number of services were omitted as they were unavailable at either the start or end of this time period.

<i>Service provider</i>	<i>Plan</i>	<i>Monthly access fee (NZD)</i>		
		<i>February 2004</i>	<i>December 2004</i>	<i>Variation (%)</i>
Telstra BigPond	256/64K unlimited	68.50	61.16	-10.7%
	512/128K unlimited	97.88	71.37	-27.1%
France Telecom	eXtense 1024 illimité	59.23	40.77	-31.2%
	eXtense 512 illimité	46.04	35.32	-23.3%
	eXtense Pro 1024 illimité	75.01	57.08	-23.9%
	eXtense Pro 512 illimité	61.82	51.62	-16.5%
TeliaSonera	Bredband 250	35.59	33.90	-4.8%
	Bredband 500	44.64	41.19	-7.7%
	Bredband 2000	53.45	50.91	-4.7%
	Bredband 8000	53.45	54.56	+2.1%
	Business ADSL 500Kbit/s	74.40	75.94	+2.1%
	Business ADSL 1Mbit/s	148.80	75.94	-49.0%
	Business ADSL 2Mbit/s	252.95	135.94	-46.3%
	Business ADSL 8Mbit/s	252.95	227.07	-10.2%
TDC (Denmark)	Bredband 256/128	19.23	18.61	-3.2%
	Bredband 512/128	49.66	48.07	-3.2%
	Bredband 512/256	56.57	54.76	-3.2%
	Bredband 2048/128	75.94	66.81	-12.0%
	Bredband 2048/256	82.85	80.20	-3.2%
	Bredband 2048/512	93.22	90.25	-3.2%
	Bredband Professional 2048	97.69	94.56	-3.2%
	Bredband Professional 4096	138.32	133.90	-3.2%
	Bredband Professional 8064	351.84	340.60	-3.2%

**Exhibit 2:** *Variation in monthly access fees for selected retail DSL services [Source: Network Strategies]*

### 3 Telecom's regression methodology

Telecom applies a methodology in its cross submission<sup>4</sup> similar to that used for its residential services in its original submission<sup>5</sup>, and obtains the following model via linear regression:

$$price = -311.302 + 61.946 \times \ln(speed) + 30.206 \times \ln(data)$$

where *speed* is the downstream speed and *data* is the data cap. We are able to reproduce these parameter estimates by applying Telecom's methodology.

#### *Data used to develop model*

Telecom uses only the three Venture plans and the three new business plans to estimate the parameters of the model. Telecom notes:

The old Full Speed plans are still available for purchase however they are not included here. [paragraph 121]

No reason is supplied by Telecom for omitting these plans, and indeed Telecom has previously stated<sup>6</sup> that plans should not be dropped simply because they do not fit with a model hypothesis.

As in the case of the residential plans, Telecom removes the costs of the Xtra component from the retail prices prior to applying the regression analysis. This adjustment has been discussed in our previous report<sup>7</sup>.

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<sup>4</sup> *Ibid*, Section E.

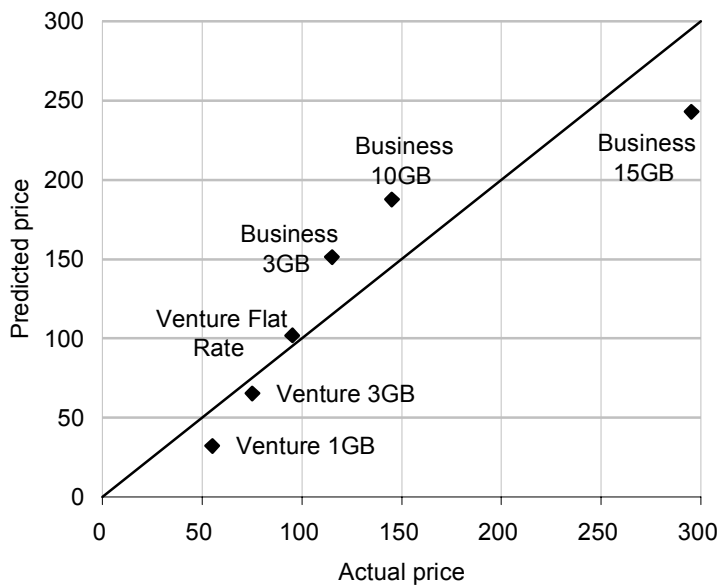
<sup>5</sup> Telecom New Zealand Limited (2005) *Submission in respect of the Commission's draft determination on the application for access to and interconnection with Telecom's fixed PDN service ('bitstream access')*, 20 May 2005.

<sup>6</sup> *Ibid*, Annex F, paragraph 2.

<sup>7</sup> Network Strategies (2005) *Bitstream access: comments on the Telecom submission*, report for TelstraClear, 7 June 2005.

*Model fit*

Telecom states that the adjusted  $R^2$  value<sup>8</sup> is 0.711. While this measure of fit is quite good if the underlying relationship is unknown or uncertain, Telecom has implied that the functional form of the model is totally compatible with the pricing strategies that are used. If this is the case, we cannot understand why the fit of the model should not be almost perfect (that is, have an adjusted  $R^2$  value close to one). We note that for the Business 3GB and 10GB plans, the difference between the actual prices and those predicted by the model is around 30%, with the model overestimating the price for both these plans, which have a common speed of 1024kbit/s (Exhibit 3).



**Exhibit 3:**  
 Comparison of the price predicted by Telecom's model against the actual price [Source: Network Strategies]

Clearly, the model does not fully explain how price is determined by Telecom. There may be other parameters or adjustments influencing price which are not presented.

We also note that Telecom's model may, under certain circumstances, give a negative price. For example if we assume a speed of 256kbit/s, a data cap of 0.34Gbytes will result

<sup>8</sup> A goodness-of-fit measure indicating how well the observed data fits the model.

in a price of -\$0.39. As the data cap diminishes further the resultant price will be a larger negative number. Clearly this is inappropriate, and suggests that the model's treatment of plans with small data caps is poor.

#### *Imputing the price for a zero data cap service*

As we described in our earlier report<sup>9</sup>, the functional form of this model is such that it is impossible to calculate the price for a zero data cap. This is a serious flaw if the objective of the imputation exercise is to determine the price for a zero data cap service.

As in the case of the residential plans, Telecom uses an adjustment to calculate a notional price for a zero data cap service. This is done for each of three speeds (256, 1028 and 2048 kbit/s) by calculating the price from the model for  $data = 1$  and  $data = 15$ , and then subtracting one-fourteenth of the difference from the  $data = 1$  price. As we have previously demonstrated, this calculation directly contradicts Telecom's assertion that the relationship between the data cap and the price is non-linear.

Due to the non-linear relationship between price and data, the imputed retail price (using Telecom's adjustment method) will differ, depending upon the value of the data cap at the upper end of the range used to calculate the adjustment. As Exhibit 4 shows, the wider the range used to calculate the adjustment, the higher the resultant imputed retail price. By its use of 15Gbytes as the upper end of the range, Telecom will achieve a much higher imputed retail price than for the same calculation based on 2Gbytes.

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<sup>9</sup> Network Strategies (2005) *Bitstream access: comments on the Telecom submission*, report for TelstraClear, 7 June 2005.

<i>Downstream speed (kbit/s)</i>	<i>Data cap lower end (Gbytes)</i>	<i>Data cap upper end (Gbytes)</i>	<i>Imputed retail price</i>
256	1	15	26.36
256	1	10	24.47
256	1	5	20.05
256	1	2	11.26
1024	1	15	112.23
1024	1	10	110.35
1024	1	5	105.92
1024	1	2	97.14
2048	1	15	155.17
2048	1	10	153.28
2048	1	5	148.86
2048	1	2	140.07

**Exhibit 4:** Variation in imputed price for selected values of the upper end data cap [Source: Network Strategies]

This result is a direct result of Telecom’s pricing principle for these plans, namely:

The principle is that each doubling of inputs results in only a linear increase in price. For example, there is the same increment in price to go from 1 to 2 units as to go from 2 to 4 units, 4 to 8 units and so on.<sup>10</sup>

If we assume that Telecom’s functional form of the pricing model is valid, we consider that the use of 2Gbytes as the upper end of the range will result in an imputed retail price closer to the ‘true’ price than if a wider range were to be used. However we emphasise that the resultant price based on 2Gbytes would still overstate the imputed price, as due to the non-linear relationship between the data cap volume and price, the per-Gbyte price of the first Gbyte within the data cap is higher than an estimate based on the price of the second Gbyte within the data cap.

<sup>10</sup> Telecom New Zealand Limited (2005) *Submission in respect of the Commission’s draft determination on the application for access to and interconnection with Telecom’s fixed PDN service (‘bitstream access’)*, 20 May 2005, Annex F, paragraph 17.

## 4 Business vs residential plans

We note that the values of the estimated parameters in Telecom's business model are very different to those of the residential model. This suggests two options:

- the residential and business plans may have differentiating factors other than speed and data cap
- Telecom assumes that residential and business customers are prepared to pay differing amounts for the two value components (speed and data cap) and prices the services accordingly.

## 5 Implications for our previous methodology

Our methodology for imputing the access price does not allow for plans of differing speeds, but was based upon Telecom's full speed plans – the plans that are most similar to the un-rate shaped wholesale service proposed by the Commission. Our methodology was based upon assessing the price differences due to differing data caps for plans of the same speed.

We note that the low end of our likely range for a zero data cap service (\$2.66<sup>11</sup>) was obtained by subtracting the difference between the prices for the Jetstream 1200 and Jetstream 600 plans (that is, the additional price due to the 600Mbyte increase in the data cap for the Jetstream 1200 service) from that of the Jetstream 600 plan.

Given Telecom's assertion that the relationship between price and data cap for business services is nonlinear, and our analysis showing that the price per Mbyte increases as the data cap decreases, our estimate as described above is likely to understate the price of the data component and thus overstate the imputed access price of the full speed service. Further, our use of the differential prices from the higher data cap full speed services would represent an even greater underestimate of the price component due to the data cap. Therefore the imputed access price for the full speed service should be no more than \$2.66.

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<sup>11</sup> Network Strategies (2005) *Bitstream access: comments on the draft determination*, report for TelstraClear, 19 May 2005.

Clearly, a price of \$2.66 (or lower) for the wholesale bitstream service would represent a very low price for the un-rate shaped service. However, this low price is a direct outcome of Telecom's own pricing strategies for the full speed service.

Two of the new plans – Business 3GB and Business 10GB – have the same downstream speed (1024kbit/s), and so we can apply our methodology to these plans. The additional 7Gbytes of the Business 10GB plan cost an extra \$30.00. If we divide this by seven, this would give a lower bound for the per-Gbyte price – as Telecom states that the relationship between price and speed is non-linear, we would expect that the true per-Gbyte price for the data cap of the Business 3GB plan to be higher than that for the additional 7Gbytes of the Business 10GB plan. Therefore the imputed retail price for these plans (including the ISP component) must be less than \$107.09 (\$119.95 less  $3 \times \$30/7$ ). We note that the imputed price for a 1024kbit/s service from Telecom's model (and including the ISP component) is somewhat higher at [ ] TCNZRI (Telecom's imputed retail price of \$112.23 plus [ ] TCNZRI).

So, why is there a difference between Telecom's imputed price for this service and that obtained via our methodology? The two approaches should give consistent results. We conclude that the difference is due to the less than perfect fit of Telecom's model, and in particular the overestimation by Telecom's model (approximately 30%, based on our analysis of the model residuals) of the price for both the 1024kbit/s plans.

## 6 Conclusions

Telecom's new business plans represent a substantial reduction in the retail price from the older full speed plans – the new plans also have a lower upstream speed (128kbit/s, as compared to 600kbit/s for the full speed plans). Telecom has used the new plans to devise a model for calculating an imputed access price for business services. We found that this model:

- is based only on the Venture and the new Business plans, omitting the older full speed plans (which are still being offered by Telecom)
- is of a functional form that is not solvable for a zero data cap

- gives negative prices for certain values of the speed and data cap components (such as a 256kbit/s service with a data cap of 0.34Gbytes)
- leaves unexplained a considerable component of the pricing – which is puzzling given that Telecom claims to use this functional form to devise pricing, and thus the model should provide an almost perfect fit.

Applying our imputation methodology as a sanity check for the new Business 3GB and 10GB plans, we found that Telecom’s model overstated the imputed retail prices for these particular plans – potentially by as much as 30%.

As the Commission has, for innovation reasons, chosen a full speed wholesale service not tightly linked to limited retail plans, a price must be imputed using existing plans, and adjusting for differences in key variables. Transparency of the Commission’s proposed methodology would potentially allow Telecom to adapt its pricing approach so as to achieve a more beneficial (for Telecom) imputed wholesale price. Hence, an imputation methodology must minimise the risk of the bitstream access price being increased by changes in the retail pricing structure. As we have seen from other OECD countries, retail DSL prices are falling, and thus it would be inconsistent for wholesale access prices to increase.

We believe that the price range previously obtained through applying the arithmetic approach we proposed to the full speed business plans should still provide a valid indication of the imputed wholesale price.

However, the range calculated by applying an arithmetic approach could be further validated by a regression analysis using a functional form corresponding to the known relationships between price and the key price drivers. Both the Commission and Telecom have previously used regression approaches, but applied to functional forms that are, to varying degrees, unsound. The Commission’s regression model assumed a linear, rather than a nonlinear, relationship between the data cap and price, and Telecom’s model contains a number of serious flaws which would affect the robustness of the resultant estimates. Nevertheless, this does not preclude the use of regression analysis as a further validation for our arithmetic approach to the imputation methodology. We recommend that the Commission examines regression models which incorporate:

- all plans, both business and residential
- functional forms for which a zero data cap is solvable and that include nonlinear relationships between price and the explanatory variables
- explanatory variables for all key factors influencing pricing, such as data caps, downstream stream, upstream speed and a business plan dummy variable.