From: Dr Jim Cuthbert, Public Interest Research Network, University of Strathclyde

To: Richard Gusanie, Office of Rail Regulation
Cc: Chris Littlewood, Office of Rail Regulation
Sent: Tue 23/08/2011 20:36
Subject: Response to Periodic Review 2013

Dear Mr. Gusanie,

<u>Response to Periodic review 2013: First Consultation</u>

This is a response to the above consultation: I was sent the consultation papers by Chris Littlewood of ORR, following discussions I had had with him about the RAB system for assessing the cost of capital. I am copying this response to Mr. Littlewood.

Although, as I note from E3 in the Annex to the consultation document, you are not consulting on RAB as part of the present review, nevertheless, I suggest you might wish to review that decision, given the issues surrounding RAB are so important.

As evidence for this, please see the attached paper, (1), which I submitted to the Project TransmiT review conducted by OFGEM. This paper identifies a number of serious problems inherent in the RAB methodology as applied by the regulators of most UK utilities. In particular,

- In a steady state, (that is, if capital investment is running at a constant real amount per annum, and inflation is stable,) then customers will pay significantly more each year under RAB charging, than under conventional loan finance at the same nominal rate of interest.
- The cost of capital under RAB charging greatly exceeds the financing cost of capital investment: meaning that capital investment in itself generates windfall profits for the utility operator.
- There are also dynamic implications of RAB pricing if inflation changes, which open up the possibility of further windfall profits for the utility operator.

In fact, the case for review is even stronger in relation to the use of RAB by ORR, since ORR has recently introduced the option of using a variant of the standard RAB method based on a type of mortgage approach. This mortgage version of RAB, which I understand is now almost universally applied to rail capital investment, in fact significantly exacerbates the problems identified with the standard RAB approach. To illustrate this point, the following table shows the relative annual costs, in a steady state, of RAB charges as compared with conventional loan finance at the same nominal interest rate – for both standard RAB and ORR's mortgage variant of RAB. As can be seen, the mortgage version of RAB is significantly more costly to the consumer than standard RAB: and this differential increases, the higher the rate of inflation.

Steady State Ratios of Current Cost Annual Charges to Conventional Loan Finance.

Inflation	Standard RAB	ORR mortgage version
2.5%	1.081	1.187
5%	1.149	1.262
7.5%	1.206	1.324

I also attach a technical note, (2), setting out the derivation of the figures in this table.

For the above reasons, the whole question of the question of the suitability of the RAB approach in setting rail prices urgently needs to be reviewed: and I trust you will consider this in your present review.

Yours sincerely,

Dr. James R Cuthbert

Enclosures:
1. Why the Current Cost Charging Method Used in the NG Transmission Model Needs to be Reviewed.
2. Technical Note: Steady State Charges under Current Cost Financing, as compared with Conventional Loan Finance.

Why the Current Cost Charging Method Used in the NG Transmission Model Needs to be Reviewed.

J. R. Cuthbert
November 2010

Introduction

An important element of the National Grid transmission charging model is the calculation of the Expansion Constant: that is, the estimated cost of transmitting 1MW for 1Km.

A verbal description of how the Expansion Constant is calculated is given in Appendix B of the NG document "Transmission Use of System Charges Review: Proposed Investment Cost Related Pricing for Use of System" dated June 1992. This description is not altogether clear: but it has been verified in discussion with NG that the procedure used is an application of the current cost Regulatory Capital Value pricing method as widely used by utility regulators in the UK.

As will be shown in this paper, there are serious issues and problems with this pricing method, which are likely to lead to charges being set too high. In the light of these problems, there is an urgent need to review the operation of current cost charging in its application in the NG transmission charging model.

Background

A paper by Cuthbert and Cuthbert submitted to OFGEM's RPI-X @20 review dealt with the current cost Regulatory Capital Value (CCRCV) pricing method, based primarily on the version of the model as it had been introduced in the water industry in Scotland. The Regulatory Strategy Manager at NG subsequently responded to that paper by means of another submission to the RPI-X@20 review, pointing out that the version of current cost charging analysed in our paper differed from the method applied by NG. (The difference arises because, in the NG version, the charge is worked out by applying a real rate of interest to the current cost regulatory capital value of the utility: whereas in the original Scottish version, a nominal rate of interest had been applied. The difference between these two approaches was noted in the earlier paper – but the detailed analysis was carried out on the Scottish version.)

In their comment on the Cuthbert and Cuthbert paper, NG re-worked some of the calculations in that paper. For the avoidance of doubt, it should be made clear that this paper is concerned with the NG variant of the method, and in the calculations of tables 2 and 3 below, we in fact use a spreadsheet tool provided by NG. (Copies of the original Cuthbert and Cuthbert paper, the NG comment, and the NG spreadsheet tool, can be found on the web under the OFGEM RPI-X @20 forum.)

The Current Cost Charging Method as applied by NG.

The Regulatory Capital Value, (or RCV), of a utility is an estimate of capital value used in setting charges. Under the current cost version of the RCV method used by NG, the RCV is rolled forward each year by uprating for inflation, adding in the value of new investment, and subtracting off current cost depreciation. The charge to be levied is then calculated as the sum of

a) current cost depreciation, and

b) an interest charge calculated by applying a real interest rate to the value of RCV: if i denotes nominal interest rate, and r the rate of inflation, then the real interest rate is calculated as $(i - r)/(1 + r)$.

Under this charging scheme, if there is an initial drawdown of capital (investment) in year zero, followed by a sequence of positive charges as determined by this current cost charging method in years 1 up to n, (where n is asset life), then the internal rate of return (IRR) of this sequence is the nominal interest rate i: in other words, the stream of payments, discounted at discount rate i, has a net present value equal to the original capital investment.

Current Cost Charging in the Steady State.

On of the things which was done in the original Cuthbert and Cuthbert paper was to consider the position of a utility operating in a steady state: that is, carrying out a constant amount of real investment each year. In the long run, how would charges under the variant of the CCRCV model analysed in that paper compare with what would happen if charges were set to cover historic cost interest and depreciation? In the Cuthbert and Cuthbert paper, the excess of current cost charges over historic cost charges in the steady state was expressed as a percentage for various combinations of n, i, and r. For example, table 1a calculated the excess for i = 5%, n = 10, 20, 30 or 40 years, and various values of r from 0 to 5%. In their comment on our paper, NG recalculated table 1a for their version of the current cost charging approach. The NG recalculation is as follows:

Table 1: NG recalculation of Table1a: Steady State percentage excess of Current cost charges over historic cost: nominal interest rate 5%.

Inflation	10	20	30	40 (Asset life)
0.5%	0.4%	1.4%	3.2%	5.7%
1.0%	0.6%	2.5%	5.5%	9.5%
1.5%	0.8%	3.2%	6.9%	11.9%
2.0%	0.9%	3.5%	7.6%	12.9%
2.5%	0.9%	3.6%	7.6%	12.8%
3.0%	0.9%	3.3%	7.0%	11.7%
3.5%	0.8%	2.8%	5.9%	9.7%
4.0%	0.6%	2.1%	4.3%	7.1%
4.5%	0.3%	1.1%	2.3%	3.8%
5.0%	0.0%	0.0%	0.0%	0.0%

Some of the values in this NG recalculation are in themselves fairly large: for example, they indicate that charges under the NG version of the current cost pricing method would be almost 13% above historic cost charges for the particular combination of n=40, r=2.5% and i = 5%.

In fact, however, the particular choice of parameter values considered in table 1 do not illustrate the kind of situation likely to be encountered in practice. In particular, real interest rates are likely to be set at some target value. So if the excess of current cost charges over historic cost charges is calculated for, say, a real interest rate of 3.5%, and the same combinations of asset life and inflation as considered in table 1, the results are as follows.

Table 2: Steady State percentage excess of Current cost charges over historic cost: real interest rate 3.5%.

Inflation	10	20	30	40 (Asset life)
0.5%	0.3%	1.1%	2.5%	4.4%
1.0%	0.6%	2.2%	4.9%	8.4%
1.5%	0.8%	3.2%	7.0%	12.0%
2.0%	1.1%	4.2%	9.0%	15.3%
2.5%	1.3%	5.1%	10.9%	18.3%
3.0%	1.6%	6.0%	12.6%	21.0%
3.5%	1.8%	6.8%	14.2%	23.5%
4.0%	2.1%	7.6%	15.7%	25.8%
4.5%	2.3%	8.3%	17.1%	27.9%
5.0%	2.5%	9.0%	18.4%	29.8%

If, instead, the real interest rate is 5%, the result is as follows:

Table 3: Steady State percentage excess of Current cost charges over historic cost: real interest rate 5%.

Inflation	10	20	30	40 (Asset life)
0.5%	0.4%	1.6%	3.6%	6.3%
1.0%	0.8%	3.2%	6.9%	12.0%
1.5%	1.2%	4.6%	10.0%	17.2%
2.0%	1.6%	6.0%	12.9%	21.9%
2.5%	1.9%	7.3%	15.5%	26.2%
3.0%	2.3%	8.5%	18.0%	30.0%
3.5%	2.6%	9.7%	20.3%	33.6%
4.0%	2.9%	10.8%	22.4%	36.8%
4.5%	3.3%	11.9%	24.4%	39.8%
5.0%	3.6%	12.9%	26.3%	42.5%

Note that the values in tables 2 and 3 have been calculated using the NG spreadsheet tool referred to in the preceding section, and are therefore definitely in line with NG's application of current cost pricing.

As tables 2 and 3 illustrate, the excesses of the revenues calculated in the steady state using current cost as compared with historic cost charges are very material, for several combinations of parameters which are quite likely. For example, for n = 40, and inflation = 4.5%, (that is, close to the current value), the excess is 28% when the real interest rate is 3.5%, and the excess is almost 40% when the real interest rate is 5%. In the view of the author, the excesses illustrated in tables 2 and 3 are so significant that they themselves call into question the validity of the current cost approach, and highlight the need for an urgent review.

Profile of Current Cost Charges

In the NG comment on the Cuthbert and Cuthbert paper, the argument is put forward that, despite the apparent steady state surplus, no excess revenues exist in total – because, over the life time of a given investment asset, the net present values of the income streams yielded by the historic cost and current cost approaches would be the same. To understand why this argument does not answer the concerns about the current cost approach, it is necessary to look in more detail at the actual profile of current cost charges for a given investment.

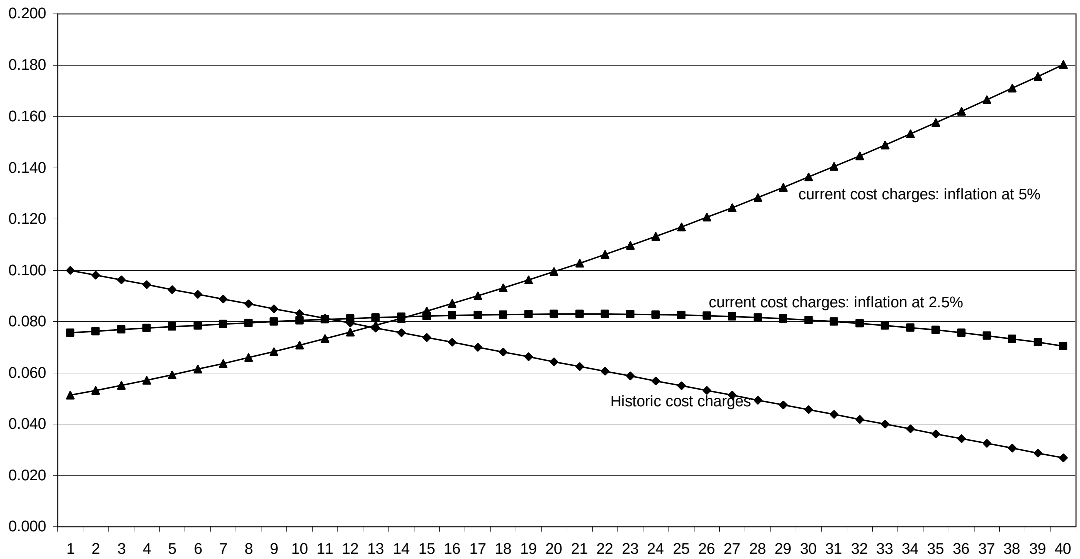
Chart 1 shows the payment streams that would result from a unit investment in year zero in a 40 year asset, if the nominal interest rate was 7.5%, under

a) historic cost charges.

b) current cost charges, with inflation at 2.5%.

c) current cost charges, with inflation at 5%.

Chart 1: Charges under different payment regimes, relating to a single unit investment in year 0: asset life 40 years: nominal interest rate 7.5%.



Since both the historic cost and current cost charging methods satisfy the net present value criterion, the net present value of each of the three payment streams, calculated at a 7.5% discount rate, will indeed equal the original investment of 1. It is clear, however, that the payment profiles of the three different payment streams are very different. In fact, under the historic cost payment profile, the interest rate of 7.5% is paid on an outstanding debt which equals 51.1% on average of the original investment over the 40 year life of the asset. For the current cost profile which would result if inflation were at 2.5%, the 7.5% interest would be paid on an outstanding debt averaging 74.1% of the original investment. While for the current cost profile which would result if inflation were at 5%, the 7.5% interest would be paid on an outstanding debt averaging 111.3% of the original investment. This case illustrates how, under current cost charging, interest can easily be paid on an average debt which actually exceeds the original investment.

While the point made in the NG paper is technically correct, namely, that the NPVs of the different payment streams are the same, this does not mean that the phasing of the different payment streams is irrelevant, for the following reasons - among others.

a) for one thing, and critically, using a discount rate equal to the nominal rate paid by the utility does not adequately represent the viewpoint of the customer. Ultimately, of course, all charges are borne by the customer. For customers, for whom real interest rates on personal savings are currently negative, the correct nominal interest rate to represent their time preference would be much lower than the nominal interest rate paid by the utility. Discounting the different payment streams in Chart 1 at a discount rate lower than 7.5% would yield different NPVs for the different profiles – with the NPV being higher the more the payment profile is weighted towards the later years. The differences are very material: for example, at a discount rate of 4%, the NPV of the historic cost payment stream would be 1.44: and the NPVs of the two current cost streams in the chart would be 1.58 and 1.78 respectively. So although the different payment streams in chart 1 are equivalent at a discount rate of 7.5%, they are far from equivalent from the point of view of the customer.

b) another aspect of concern relates to the potential dynamics of current cost charging. Suppose a company makes an investment, funded largely by borrowing from the market at a fixed nominal interest rate. If inflation subsequently rises, and the regulator maintains the same real interest rate target, then this means that the IRR the company will earn on its investment through its charges will approximate the target real interest rate plus the new rate of inflation, which is likely to be higher than the nominal interest rate at which it originally borrowed to fund the asset. Further, because the profile of current cost charges will have lengthened, the company will be earning this larger IRR on an increased averaging outstanding debt over the lifetime of the asset. Under these circumstances, the company will receive a windfall profit – potentially a very large windfall profit. Conversely, if inflation were to fall, the company could be squeezed – although the likelihood of this is reduced because of the inherent cushion which is anyway built into current cost charging, (as tables 2 and 3 demonstrate.)

Conclusion

Because of the effects identified in the preceding section, it is far too simplistic to imply that, because current cost charging satisfies the net present value criterion, issues of profiling can be neglected. Overall, it is the view of the author that issues like these, together with the likely overcharging stemming from current cost pricing, mean that an urgent review of this aspect of the transmission charging model is required.

Reference

Cuthbert, J.R., Cuthbert, M.: "Fundamental Flaws in the Current Cost Regulatory Capital Value Method of Utility Pricing": Fraser of Allander Institute Quarterly Economic Commentary, Vol 31, No.3: (2007).

Technical Note: Steady State Charges under Current Cost Financing, as compared with Conventional Loan Finance.

Jim Cuthbert
August 2011

1. Notation and Conventions

Let n (years) be the life of a capital asset:
i (as a fraction) = target real rate of return:
r (as a fraction) = annual rate of inflation:
θ = corresponding nominal rate of interest: so $\theta = i + r + ir$.

It is assumed, for simplicity, that capital is borrowed at the end of the year in which investment takes place: and repayments of interest and capital are made at the end of each of the succeeding n years.

2. Definition of Payment Schemes.

We are interested in comparing the implications of different payment schemes for charging for capital. In each case, the internal rate of return, (IRR), of the payment scheme is θ. The three payment schemes considered are as follows.

a) Conventional loan finance.

In this case, a capital investment of C in a given year gives rise to a payment of

$\frac{C}{n}[1+\theta(n+1-j)]$ in each of the succeeding j years, for j = 1…n.

b) Current cost charging, standard version.

In this case, a capital investment of C in a given year gives rise to a payment of

$\frac{C}{n}[1+i(n+1-j)](1+r)^j$ in each of the succeeding j years, for j = 1…n.

This is the standard version of current cost charging for capital as used by the regulators in most UK utilities.

c) Current cost charging: mortgage version.

In this case, a capital investment of C in a given year gives rise to a payment of

$Ci(1+r)^j/[1-(1+i)^{-n}]$ in each of the succeeding j years, for j = 1…n.

This alternative option for current cost charging was introduced for rail capital investment by the Office of Rail Regulation, (ORR), a few years ago. It is now the version almost universally employed for rail capital charging.

3. Profiles of Payment Through Time.

We now consider the specific case of n=25, and i = 0.06, (typical parameters used by ORR for rail capital investment), and r = 0.05, (the current rate if RPI inflation.) This corresponds to a nominal interest rate of 11.3%. Table 1 shows the payment profiles for the three schemes, resulting from an initial single investment of 1 in year zero.

Table 1:payment profiles from initial investment of 1 in year 0

year	historic cost	current cost	cc mortgage
1	0.153	0.105	0.082
2	0.148	0.108	0.086
3	0.144	0.110	0.091
4	0.139	0.113	0.095
5	0.135	0.115	0.100
6	0.130	0.118	0.105
7	0.126	0.120	0.110
8	0.121	0.123	0.116
9	0.117	0.125	0.121
10	0.112	0.128	0.127
11	0.108	0.130	0.134
12	0.103	0.132	0.140
13	0.099	0.134	0.148
14	0.094	0.136	0.155
15	0.090	0.138	0.163
16	0.085	0.140	0.171
17	0.081	0.141	0.179
18	0.076	0.142	0.188
19	0.072	0.144	0.198
20	0.067	0.144	0.208
21	0.063	0.145	0.218
22	0.058	0.145	0.229
23	0.054	0.145	0.240
24	0.049	0.144	0.252
25	0.045	0.144	0.265
sum	2.469	3.270	3.920

Chart 1 graphs these payment profiles: note how standard current cost charging, and even more, the mortgage version of current cost charging, give profiles which are very much more skewed to the later years of the asset’s life than conventional loan finance.

Chart 1. Payment Profiles from single investment of 1 in year zero: 6% real rate of return; 5% inflation.
Nominal interest rate 11.3% in each case.

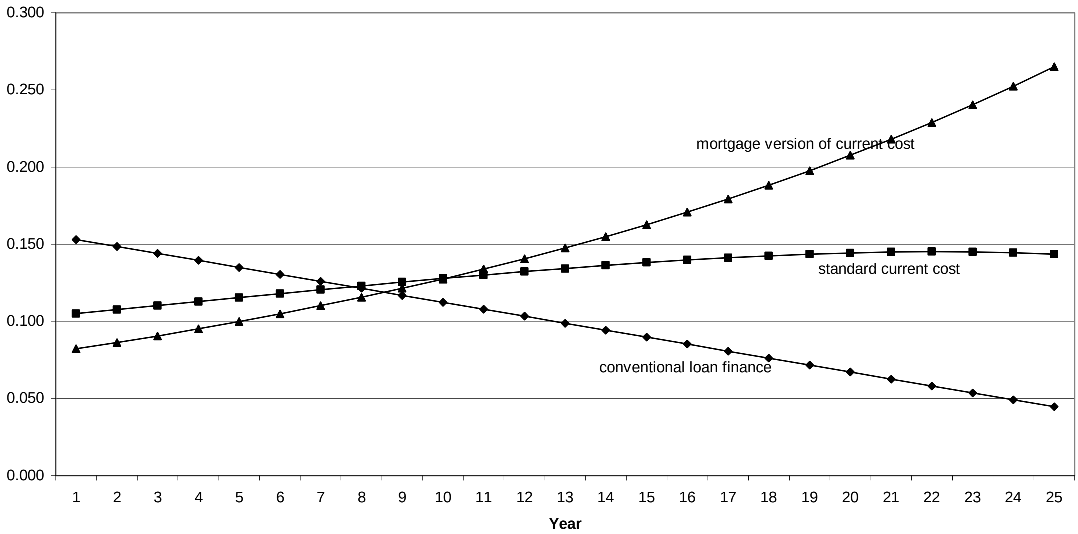


Table 2 shows the calculation of the net present values of these payment streams, discounted at a discount rate of 11.3%. In each case, the net present value of the discounted payment stream, at year zero prices, is 1: this confirms the assertion made above that each of the three payment streams indeed has the same IRR of 11.3%.

Table 2: payment profiles discounted at 11.3%

year	disc fac	historic cost	discounted current cost	cc mortgage
1	0.898	0.137	0.094	0.074
2	0.807	0.120	0.087	0.070
3	0.725	0.104	0.080	0.066
4	0.652	0.091	0.074	0.062
5	0.585	0.079	0.068	0.058
6	0.526	0.069	0.062	0.055
7	0.473	0.059	0.057	0.052
8	0.425	0.052	0.052	0.049
9	0.382	0.045	0.048	0.046
10	0.343	0.039	0.044	0.044
11	0.308	0.033	0.040	0.041
12	0.277	0.029	0.037	0.039
13	0.249	0.025	0.033	0.037
14	0.223	0.021	0.030	0.035
15	0.201	0.018	0.028	0.033
16	0.180	0.015	0.025	0.031
17	0.162	0.013	0.023	0.029
18	0.146	0.011	0.021	0.027
19	0.131	0.009	0.019	0.026
20	0.118	0.008	0.017	0.024
21	0.106	0.007	0.015	0.023
22	0.095	0.006	0.014	0.022
23	0.085	0.005	0.012	0.020
24	0.077	0.004	0.011	0.019
25	0.069	0.003	0.010	0.018
sum		1.000	1.000	1.000

4) Steady State Payments

Suppose now that a constant real amount of investment is undertaken every year, starting with a real investment of 1 in year zero: so the nominal amount of investment in year j is $(1+r)^j$.

After 25 years, the system will have settled down to a steady state, and the same real payment for capital will be made each year, consisting of contributions arising from each of the preceding 25 years of investment.

So

Nominal payment in year 25 =

$$\sum_{j=1}^{25}(\text{amount invested in year } j-1)(\text{payment resulting from a unit investment after } 25-j+1 \text{ years})$$

$$= \sum_{j=1}^{25}(1+r)^{j-1}(\text{payment resulting from a unit investment after } 25-j+1 \text{ years}) \qquad (1)$$

Substituting into equation (1) the appropriate expressions from 2(a), (b), and (c) respectively gives the following expressions for the total nominal payment in year 25:-

Conventional loan finance

$$\sum_{j=1}^{25}(1+r)^{j-1}\frac{1}{25}[1+\theta(25+1-25+j-1)]$$

$$= \sum_{j=1}^{25}(1+r)^{j-1}\frac{1}{25}[1+j\theta]$$

Current cost charging, standard version.

$$\sum_{j=1}^{25}(1+r)^{j-1}\frac{1}{25}[1+i(25+1-25+j-1)](1+r)^{25-j+1}$$

$$= \sum_{j=1}^{25}(1+r)^{25}\frac{1}{25}[1+ji]$$

Current cost charging: mortgage version.

$$\sum_{j=1}^{25}(1+r)^{j-1}i(1+r)^{25-j+1}/[1-(1+i)^{-n}]$$

$$= \sum_{j=1}^{25}(1+r)^{25}i/[1-(1+i)^{-n}]$$

Table 3 shows the individual terms in each of these sums, for the case i = 0.06, r = 0.05, (and therefore, $\theta = 0.113$). Also shown are the relevant sums, (that is, the total nominal payments in year 25), and the ratios of the total payments under the two current cost charging schemes to the total payment under conventional loan finance.

Table 3: components of total nominal payment in year 25, arising from unit real investment each year.

year j	historic cost	current cost	cc mortgage
1	0.045	0.144	0.265
2	0.051	0.152	0.265
3	0.059	0.160	0.265
4	0.067	0.168	0.265
5	0.076	0.176	0.265
6	0.086	0.184	0.265
7	0.096	0.192	0.265
8	0.107	0.200	0.265
9	0.119	0.209	0.265
10	0.132	0.217	0.265
11	0.146	0.225	0.265
12	0.161	0.233	0.265
13	0.177	0.241	0.265
14	0.195	0.249	0.265
15	0.213	0.257	0.265
16	0.234	0.265	0.265
17	0.255	0.274	0.265
18	0.278	0.282	0.265
19	0.303	0.290	0.265
20	0.330	0.298	0.265
21	0.358	0.306	0.265
22	0.388	0.314	0.265
23	0.421	0.322	0.265
24	0.456	0.331	0.265
25	0.493	0.339	0.265
sum	5.248	6.028	6.623
ratio cc/hc		1.149	1.262

As can be seen from Table 3, in the steady state, the standard current cost charging method will lead to an annual payment which is 14.9% greater than the payment under conventional loan finance: while the annual payment under the mortgage version of current cost charging will be 26.2% higher than conventional loan finance.

For completeness, Table 4 shows the corresponding ratios of current cost to conventional loan finance charging, again for $i = 0.06$, but this time for $r = 0.025$ and 0.075 as well, (corresponding to nominal interest rates of 8.76% and 13.95% respectively.)

Table 4: Steady State Ratios of Current Cost Annual Charges to Conventional Loan Finance.

Inflation	Standard current cost	Current cost mortgage
2.5%	1.081	1.187
5%	1.149	1.262
7.5%	1.206	1.324

As can be seen, the ratios increase sharply as inflation rises.