Victorian Water Industry
Construction Price Indexes

This final report was prepared for City West Water,
South East Water, Yarra Valley Water and
Melbourne Water
by Econtech Pty Ltd

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CANBERRA HEAD OFFICE

Econtech
P.O. Box 4129
Kingston ACT 2604
Phone: (02) 6295-0527
Fax: (02) 6295-8513
E-mail:office@econtech.com.au

SYDNEY OFFICE

Econtech
Suite 304, 66 Berry Street
North Sydney NSW 2060
Phone: (02) 9929-4700
Fax: (02) 9929-4793
E-mail: sydney@econtech.com.au

Web-site: www.econtech.com.au

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Background

As part of the 2008 Water Review, the Essential Services Commission ("the Commission") will commence reviewing the prices to apply to water and sewerage services provided by Victoria's 20 water businesses for the second regulatory period from July 2007. The Commission requires businesses to submit draft Water Plans by 15 June 2007.

Against this backdrop, City West Water ("CWW"), with the full cooperation of South East Water ("SEW"), Yarra Valley Water ("YVW") and Melbourne Water ("MW"), the "four companies", commissioned Econtech to forecast construction price indexes that are relevant to core aspects of their construction projects.

Methodology

The first stage in the forecasting exercise was to forecast a broad, published indicator of relevant construction costs. Specifically, Econtech prepared forecasts of the ABS price index for non-dwelling construction in Victoria. These forecasts provide the Commission with a benchmark forecast of published ABS price data to use as a point of comparison for the more specific price forecasts prepared in the next two stages.

The second stage in the forecasting exercise was to construct price indexes for the four core construction project activities undertaken by the four companies. These four activity price indexes use weights constructed from a sample of actual contract cost data for the period 2003-04 to 2005-06 that was provided by each of the companies.

The third stage was to forecast the four construction activity price indexes that were constructed in the second stage. Regression models were developed capturing the historical relationship between the four activity price indexes and widely-used ABS data. These four regression models were then used to forecast the four construction activity price indexes out to 2013Q2. Finally, Econtech applied data on the mix of each company's construction activities to the forecasts of the four construction activity price indexes to forecast a construction price index for each company.

Key Results

Historical and forecast rates of construction price inflation are presented in full in Table A. All forecasts allow for growth in labour productivity.

The historical data shows that, over the period 1987Q4 to 2006Q3, inflation in the four construction activity price indexes of 3.2 to 4.0 per cent ran ahead of inflation in the price index for non-dwelling construction in Victoria of 3.0 per cent. This is largely attributable to the period from 2003Q1, when activities that are more dependent on key materials such as steel and oil experienced rapid price inflation. Prices of these key materials inflated rapidly with the development of the China-induced commodity price boom. For example, price inflation for water distribution of 4.0 per cent exceeded general price inflation for Victorian non-dwelling construction of 3.0 per cent, reflecting the high steel pipe content of water distribution.

The forecast data shows that price inflation for the four construction activities is expected to moderate to around the same rate as for Victorian non-dwelling construction. Specifically, forecast inflation for the four construction activities ranges between 3.0 per cent and 4.0 per cent, while forecast inflation for the broader measure is 3.5 per cent. This assumes no further increase in real commodity prices.

This forecast for Victorian non-dwelling construction price inflation of 3.5 per cent exceeds our forecast for CPI inflation of 2.6 per cent. This CPI inflation forecast is consistent with the Reserve Bank's official target. As many commentators have noted, China's booming exports of cheap manufactured consumer goods is putting a brake on CPI inflation. However, as the Reserve Bank has remarked, it is less relevant for price inflation for non-traded goods and services, such as construction, which are experiencing higher rates of price inflation.

While average price inflation for the four activities is forecast at around 3.5 per cent, it is a little lower for sewerage transfer and treatment and a little higher for water distribution and reticulation. As seen in Table A and Chart A, this represents a continuation of the historical pattern. Because the mix of construction activities varies between the four companies, this variation in price inflation between the four activities leads to variation in construction price inflation between the four companies.

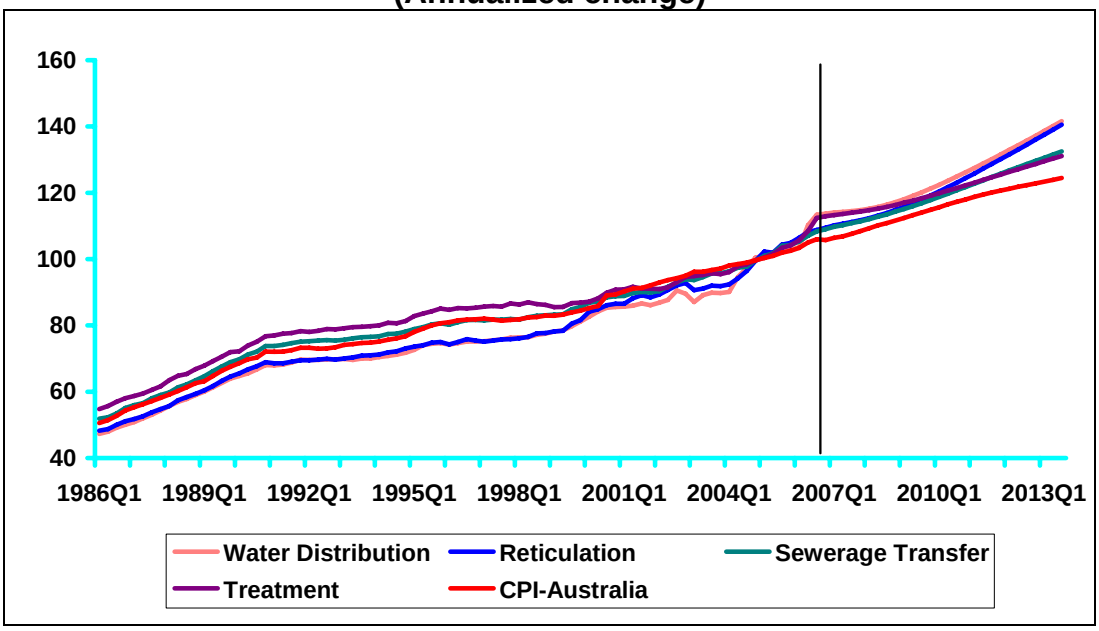
Table A
Capital Project Prices for the Four Companies By Activity
(Annualized quarterly change)

	1987Q4 to 2006Q3	2006Q4 to 2013Q3
	(Historical)	(Forecast)
Water Distribution	4.0%	4.0%
Reticulation	3.9%	3.7%
Sewerage Transfer	3.5%	3.1%
Treatment	3.2%	3.0%
Non-Dwelling Construction - Victoria	3.0%	3.5%
Engineering Construction - Victoria *	2.7%	n.a.
Private New Engineering Construction - Victoria	3.5%	n.a.
CPI - Australia	3.5%	2.6%
Price Non-Dwelling Construction	3.0%	3.5%
Average Earnings	4.3%	4.7%
GDP Deflator	3.3%	2.5%

Source: Econtech estimates and ABS 8762.0 - Engineering Construction Activity, Australia, September 2006.
*The average annualised growth rate for Engineering Construction is calculated over the period 1988Q2 to 2006Q3, due to the lack of data in the earlier quarters.

The forecasts presented in this report are judged by Econtech to be consistent with the operation of a competitive water market in metropolitan Melbourne over the period of the next Water Plan for the four companies. However, they assume the maintenance of something like current construction levels. A significant upturn of construction in the Victorian water industry in the near term would mean that these forecasts are understated.

Chart A
Capital Project Price Indexes for the Four Companies By Activity
(Annualized change)



Source: CWW, SEW, YVW and MW data and Econtech estimates.

1. Introduction

City West Water ("CWW") have commissioned Econtech to produce construction price forecasts for them, South East Water ("SEW"), Yarra Valley Water ("YVW") and Melbourne Water ("MW"). The findings of Econtech's report will be one of the inputs to the draft Water Plans that are required to be submitted to the Essential Services Commission ("the Commission") by 15 June 2007. One section of the draft Water Plans is expected to be devoted to examining the capital expenditure proposals of each business over the five year period beginning 1 July 2008 and ending 30 June 2013. These capital expenditure proposals are intended to factor in likely movements in relevant construction costs.

Three of the "four companies" (CWW, SEW, YVW) are retail water businesses in metropolitan Melbourne whose customers are households and businesses. However, MW is an intermediate supplier to retail water companies, manager of water supply catchments, and manager of rivers and creeks and major drainage systems throughout the Port Phillip and Westernport region. In addition it treats most of Melbourne's sewage. In terms of assets under management in 2005-06, CWW was the smallest with around $0.8 billion, SEW and YVW had around $1.3 billion, while MW was the largest with around $8.4 billion in assets.[1] In terms of ongoing capital investment in the core activities for the three years to 2005-06, MW had the largest outlays of $416.3 million, followed by YVW with $308.2 million, SEW with $215.4 million and CWW with $112.3 billion (Table 1.1).

Table 1.1
CAPEX by Company and Activity – 3 Year Totals
(share of $ million)

Activity/Company	CWW	SEW	YVW	MW	Total ($ million)
Water Distribution	27.3%	2.2%	22.5%	18.9%	183.4
Reticulation	31.5%	62.6%	39.5%	0.0%	292.1
Sewerage Transfer	10.7%	26.4%	9.1%	5.5%	119.8
Treatment	30.5%	8.8%	28.9%	75.6%	456.9
Total ($ million)	112.3	215.4	308.2	416.3	1052.2

Source: CWW, SEW, YVW and MW.
Note: The total figures refer to total amount of CAPEX or capital expenditure.

Each of the four companies acknowledges it is in their interests to ensure that the most accurate forecasts of construction price indexes are presented to the Commission to inform the price determination process. Better pricing decisions provide each business with the maximum flexibility to undertake necessary capital works, and for this reason the four companies have supported the development of a robust forecasting framework for construction prices as a high priority.

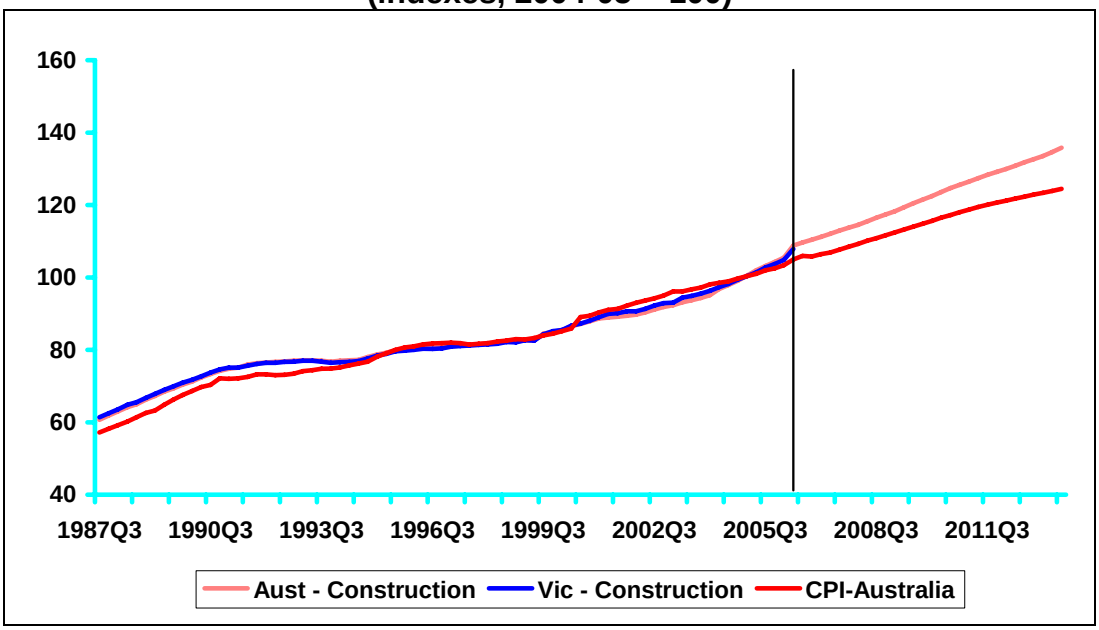
It was necessary to "start from scratch" to develop a robust methodology to forecast construction prices for the four companies. To begin with, no disaggregated actuals data is publicly available at the state level data for construction related to water activities. The most relevant data is that published by the Australian Bureau of Statistics (ABS) and refers to engineering construction costs. However, in recent times this series has been dominated by mining construction, which now accounts for around 40 per cent of the index, on the back of

[1] Typical assets of the retail businesses include: water mains; sewer pipes; water supply tanks; water pumping stations; sewer pumping stations; water pressure reducing stations; sewerage treatment and recycling plants. In addition, MW has other assets including dams, reservoirs, catchment aqueducts and roads on its balance sheet.

the mining boom. In addition, the only component of the index which incorporates state-specific price data is road construction, which accounts for only around 20 per cent of the index. Thus, using ABS data to forecast Victorian water industry construction costs is potentially misleading.

Similarly, publicly available forecasts of the engineering construction series do not necessarily reflect likely developments in the water industry in Victoria. For example, Econtech's produces detailed, long-term forecasts of ABS engineering construction data, including a price index, for the Construction Forecasting Council (http://www.cfc.acif.com.au/forecasts), as shown in Chart 1.1. The price forecasts for engineering construction show Australian engineering construction price inflation of around 3.5 per cent, until the end of the next Water Plan period, compared to forecast CPI inflation of 2.6 per cent. However, this forecast is for engineering rather than for water alone and for Australia, rather than for Victoria alone. More specific forecasts are needed.

Chart 1.1
Engineering Construction Cost Indexes and CPI – Forecasts
(indexes, 2004-05 = 100)



Source: ABS 8762.0 - Engineering Construction Activity, Australia, June 2006 and Econtech Construction Forecasts and Macroeconomic Forecasts.

The purpose of this study is to produce forecasts of construction prices that are based on the main construction activities in Victoria of the four water companies. The key output of this study is the construction of four water construction price indexes, each representing one of the major types of construction activity to be undertaken by the companies over five year period of the next Water Plan. The four activities are defined as follows.

- **Water Distribution** - All facilities relating to the general supply of water, including pump stations, pressure reducing stations, and large diameter pipes (above 300mm).
- **Reticulation** - All facilities related to the local supply of water (including recycling), especially small diameter pipes (300mm and below).
- **Sewerage Transfer** - All facilities related to the collection of sewerage small diameter pipes below 300mm in size and related sites and all facilities related to

sewer trunk mains including lift pump stations and large diameter pipes (above 300mm).

- **Treatment** - All facilities to treat sewerage (including recycling) to EPA requirements and water to potable standard, including pump stations, emergency relief structures, pipes (large and small).[2]

Forecasts of the four activity based price indexes are then weighted according to the mix of construction activities of the four companies to develop company-specific construction price indexes and forecasts.

This report is structured as follows.

- Section 2 outlines the three-stage, regression-based methodology used to forecast construction costs. The first stage is the methodology to forecast non-dwelling construction costs for Victoria in aggregate. The second stage constructs price indexes for the four water construction activities. The third stage is the methodology for forecasting these four activity price indexes and translating them to forecasts for construction costs for each company.
- Section 3 reports on the forecasts produced by the models. That is, it presents the forecasts for price inflation for non-dwelling construction costs in Victoria generally, for the four water construction activities and for the four water companies individually. It also examines the robustness of these forecasts, highlighting any limitations of the modelling approach.

While all care, skill and consideration has been used in the preparation of this report, the findings relate to the project requested by CWW with the full cooperation of SEW, YVW and MW and are designed to be used only for the specific purpose set out below.

The specific purpose of this report is to produce forecasts of engineering construction prices for participants in the Victorian metropolitan water industry which account for local operating conditions including the typical mix of inputs required for various types of water construction projects and their costs, as well as the expected profile of construction projects to be undertaken by each of the four companies over period of the next Water Plan.

The findings in this report are subject to normal statistical and only takes into account information available to Econtech up to the date of this report.

[2] Headworks were not included as an activity because they currently represent less than 5 per cent of joint annual capital expenditure and no new major projects are anticipated over the next five years. Headworks include all facilities which capture and transfer large bodies of water including dams, catchments aqueducts and associated roads.

2. Methodology

This section outlines the three-stage, regression-based methodology used to forecast construction costs. These three stages are described in turn in sections 2.1, 2.2 and 2.3.

Section 2.1 describes the methodology to forecast non-dwelling construction costs for Victoria in aggregate. Section 2.2 constructs price indexes for the four water construction activities undertaken by the four companies. Finally, section 2.3 presents the methodology for forecasting these four activity price indexes and translating them to forecasts for construction costs for each company.

2.1 Forecasting Victorian Construction Prices

The first stage in the forecasting exercise was to construct forecasts to 2013Q2 of the ABS Victorian engineering construction price index. While this forecast is not directly relevant for the Commission, it does provide a state-level benchmark for comparison. The ABS data series is widely known and accepted. In addition, a lengthy run of historical data is also available providing a sound platform for forecasting the future. The ABS historical data series for Australian and Victorian engineering construction prices from 1986Q1 along with Econtech forecasts of national engineering construction costs to 2013Q3 were shown previously in Chart 1.1.

The first challenge presented by the forecasting exercise was that there are no available forecasts of engineering construction prices for Victoria. However, engineering construction is a component of the broader series, non-dwelling construction (which also includes new commercial buildings and second hand asset purchases) which is included in the ABS National Accounts data and is forecast as part of Econtech's *Australian National, State and Industry Outlook* (ANSIO). This publication draws on Murphy Model 2 (MM2), Australia's leading national, industry and state forecasting model updated quarterly.[3] It has a highly respected forecasting track record and is used by the Federal and State Governments, industry associations, financial institutions and major companies. For more information on MM2, download the model documentation from the website (www.econtech.com.au).

The second challenge presented by the forecasting exercise is to derive a price forecast for non-dwelling construction for Victoria when this series is not currently forecast by Econtech. However, this problem was overcome by developing a simple forecasting equation that relates this price index to the price index for business investment generally, but also allows for trend-related variations and dynamics.

[3] Historically new engineering construction expenditure constitutes around 25 per cent of total non-dwelling construction expenditure, with the rest being expenditure on new commercial building.

Model Specifications

The basic model used to calculate forecasts of the price index for non-dwelling construction for Victoria was as follows.:

Model A

$$Y_t = a_0 + a_1 RBC_t + a_2 TIME_t + a_3 Y_{t-1}$$

where:

- Real Business Cycle (RBC_t) = the share of Victoria's real non-dwelling construction expenditure in Australian real business investment, as a proxy for the local balance between demand and supply in the Victorian non-dwelling construction industry;
- $TIME_t$ = Time trend;
- Y_{t-1} = Lagged value of the dependent variable; and
- t = time subscript.

The dependent variable of Model A captures the price of non-dwelling construction in Victoria relative to the price of business investment in Australia. For technical reasons associated with ensuring correct aggregation, the dependent variable is constructed as the difference between the nominal share of Victoria's non-dwelling construction in Australian business investment and the corresponding real share. Movements in this difference in shares reflect movements in the underlying relative price i.e. the price of non-dwelling construction in Victoria relative to the price of business investment in Australia.

The purpose of Model A is to model the factors that influence the relative price on non-dwelling construction in Victoria. In particular, it shows how this relative price depends on the strength of demand for non-dwelling construction in Victoria, dynamics and time-related factors. The resulting forecasts for the price index for non-dwelling construction for Victoria are presented in Section 3.1 below.

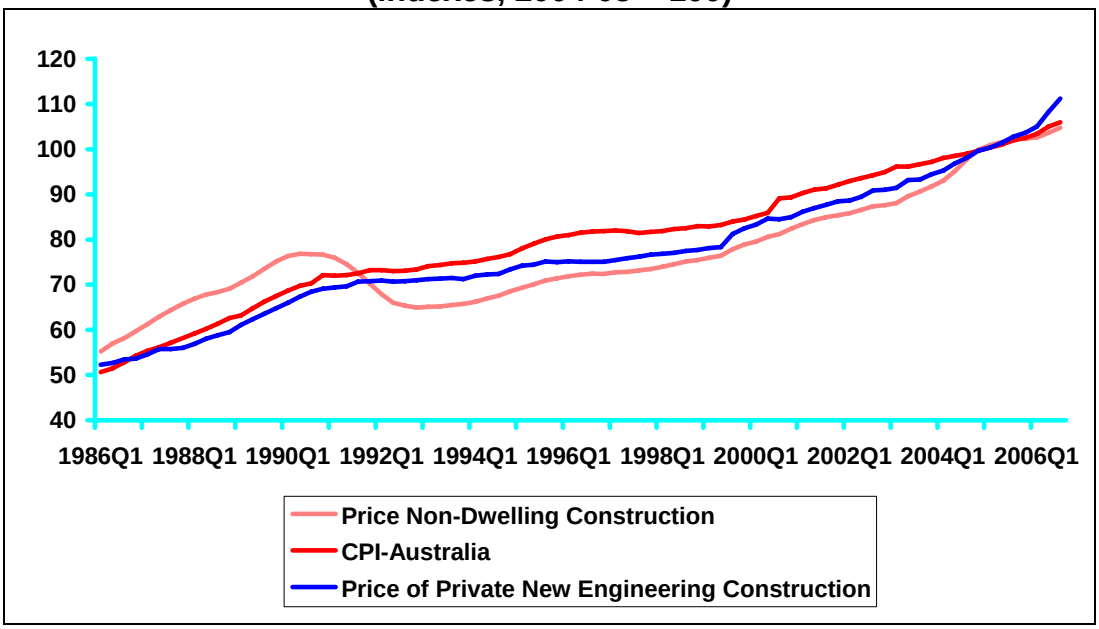
In developing the structure of Model A many different specifications were tested.[4] These different model specifications were compared to test the robustness of the each approach given the straightforward intention of the model. At the same time, diagnostic tests, such as those examining the goodness-of-fit and the error properties of the models, were also undertaken to determine the most appropriate model.

The historical values of the price index series are presented in Chart 2.1 below. Interestingly the non-dwelling construction price series for Victoria is more variable then the underlying engineering construction series. This is probably explained by the greater volatility of the business building cycle over the historical period. This includes the post-financial deregulation "boom" that existed in the mid to late 1980s, followed by the "bust" that occurred in the beginning of the 1990s after the Reserve Bank of Australia had undertaken a sharp tightening of monetary policy, the effects of which for Victoria were worsened by the collapse of the State Bank, and Pyramid Building Society. The average annual inflation over the nineteen year period to 2006Q3 for non-dwelling

[4] The structure of Model A is intended to overcome the time series trends in the underlying construction series (or non-stationary properties) through the use of differences, ratios, lagged values of the dependent variable, and a time trend. As such the estimated equation is an Ordinary Least Squares (OLS) regression model.

construction investment for Victoria was 3.0 per cent, lower than for the national accounts measure of engineering construction at 3.5 per cent. Interestingly, growth in engineering construction prices was running well ahead of non-dwelling construction prices and the CPI by the end of the period. As noted above, the forecasts for Victorian non-dwelling construction prices that were produced using model A are presented and analysed below in Section 3.1.

Chart 2.1
Victorian Construction Costs and CPI – Historical
(indexes, 2004-05 = 100)



Source: ABS National Accounts 5206.0.

2.2 Developing Activity Indexes for the Four Companies

The second stage in the forecasting exercise was to construct construction price indexes for each of the four core business activities relevant to the four companies. This involved first using contract data to construct index weights, and then applying those index weights to the ABS price data that is appropriate for each component of the index. These two steps are now considered in turn.

2.2.1 Index Weights

The first step was to collect and analyse detailed contract data from each of the four companies related to the subset of core construction activities in which each company had engaged in recent years and was likely to still engage over the next five years. Given that all of the construction activity undertaken by the four companies is contracted out to private firms, these details were not readily available. Each of the four companies was asked to provide detailed breakdowns of two or three actual contracts for capital projects related to those core activities in which it participated (where possible) for each year from 2003-04 to 2005-06. Table 2.1 summarises that number and value of contracts that were obtained from each company's contractors.

Data for 44 separate contracts was received from the four companies, comfortably in excess of a sample size of about 30 that is usually considered reasonable for statistical purposes. In addition, each of the companies considered that the contracts were typical of the bulk of

projects undertaken. All contract details are provided for the Commission in Attachment C below.

Table 2.1
Number and Value of Contracts Provided by the Four Companies – 2003-04 to 2005-06
(Number and $ million)

Activity/Company	CWW	SEW*	YVW	MW	Total ($ million)
Water Distribution	6	4	5	4	38.1
Reticulation*	1	2	3	-	20.3
Sewerage Transfer	2	5	3	2	257.7
Treatment	-	-	4	3	109.0
Total ($ million)	22.6	4.0	91.3	307.3	425.1

Source: CWW, SEW, YVW and MW.
Note: The total figures refer to the total value of the contract. Neither CWW or SEW provided contract data for Treatment activities given they have relatively small operations in this area and MW has no reticulation activity.
*SEW provided Econtech with indicative cost and margin percentages for reticulation projects sourced from two prime contractors based on the contractors assessment of "typical" projects, rather than actual contracts.

Contractors were required to provide a percentage breakdown of the construction costs and margins which applied to each project by expense categories. These categories include labour, electricity, fuel, project management and design, specific materials costs, machinery and hiring etc, and any margins where possible.

Once individual contract data was obtained, it was then possible to construct cost profiles for the four construction activities that take into account the contract experience of all four companies over the last three years. The contract data was weighted taking into account each company's share of total CAPEX by activity (see Table 1.1). The resulting cost shares or index weights for activity are summarised in Table 2.2. It is worth noting the expense categories to which each activity has the greatest exposure:

- Water distribution has a higher share of steel pipes as an input.
- Reticulation has a higher share of PVC pipes as an input.
- Sewerage transfer has a higher share of fibreglass as an input.
- Treatment has higher shares of concrete materials and mechanical equipment as input.

Table 2.2
Average Contract Cost Components and Margins, by Activity – 2003-04 to 2005-06
(share of total contracts)

Category/Activity	Water Distribution	Sewerage Reticulation	Sewerage Transfer	Sewerage Treatment
Labour	15.3%	26.7%	18.3%	25.0%
Electricity	0.0%	0.2%	0.0%	0.0%
Fuel	0.7%	3.4%	2.9%	0.4%
Project Management and Design	10.6%	3.8%	8.0%	7.6%
Materials - Fibreglass	0.0%	0.0%	15.8%	0.0%
Materials - PVC Pipes	12.5%	22.8%	8.4%	0.0%
Materials - Ceramic Pipes	0.0%	6.5%	7.9%	2.5%
Materials - Steel Pipes	31.0%	0.0%	0.0%	0.9%
Materials - Concrete	0.0%	0.0%	0.0%	12.7%
Materials - Manufactured Mechanical Equipment	1.7%	0.0%	0.0%	19.5%
Materials - Electrical materials	1.8%	0.0%	0.0%	8.1%
Materials - Other	0.0%	0.0%	1.3%	0.0%
Machinery and Equipment Hiring and Leasing	7.0%	18.5%	15.8%	8.1%
Subcontractor	0.5%	0.0%	6.2%	0.0%
Margins	6.2%	3.8%	6.9%	6.2%
Other	12.7%	7.4%	8.6%	9.1%
Other - Road Reinstatement Traffic Management	0.0%	6.9%	0.0%	0.0%
Total	100.0%	100.0%	100.0%	100.0%

Source: CWW, SEW, YVW and MW.

2.2.2 Historical Indexes

Having constructed the index weights in Table 2.2, the next step is construct historical price data for each of the four activities. This was done by matching each of the cost components in Table 2.2 to a relevant ABS producer, labour or commodity price index, and then combining those price indexes using the weights shown in Table 2.2. The matching between cost/margin categories and ABS price index is summarised in Table 2.3.

It is important to note that the labor price index was converted into a unit labour cost measure to take into account productivity growth. This involved constructing a new index using the original labour price series as detailed in Table 2.3 and adjusting it for productivity growth by dividing it by labour productivity, as measured by the ratio of real GDP to total employment. This ensures that national labour productivity trends are taken into account in activity price indexes series developed for this study.

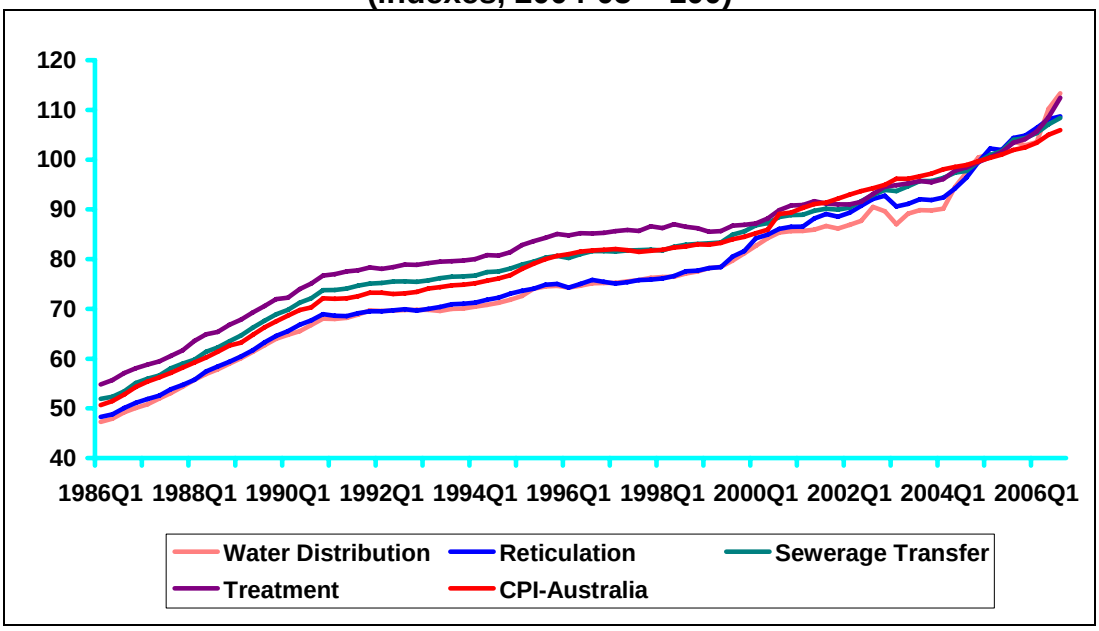
Table 2.3
Matching Contract Cost Components to ABS Price Indexes

Category/Activity	ABS
Labour	Labour Price Index - Construction - Victoria with National Accounts productivity adjustment, Total hourly rates of pay excluding bonuses, All occupations, Quarterly Index (Index Numbers)
Electricity	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 12; Electricity supply
Fuel	6401.0 - Consumer Price Index, Australia, Dec 2006; Automotive fuel; Melbourne
Project Management and Design	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 24; 7823 Consultant Engineering Services
Materials - Fibreglass	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 10; 264 Non-metalic min prod nec
Materials - PVC Pipes	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 10; 2562 Plastic extruded products
Materials - Ceramic Pipes	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 10; 2623 Ceramic tiles and pipes
Materials - Steel Pipes	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 10; 2713 Steel pipes & tubes
Materials - Concrete	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 10; 2634 Concrete pipes & culverts
Materials - Manufactured Mechanical Equipment	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 10; 2866 Pumps and compressors & 2862 Mining/constr machinery
Materials - Electrical materials	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 12; 2582 Electric cable & wire mfg
Materials - Other	Average of ABS series 2634, 2713, 2562, 2623, 2582 and 264
Machinery and Equipment Hiring and Leasing	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 10; 774 Machinery Equipment Hire
Subcontractor	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 24; 7823 Consultant Engineering Services
Margins	6401.0 - Consumer Price Index, Australia, Dec 2006; All groups ; Melbourne
Other	6401.0 - Consumer Price Index, Australia, Dec 2006; All groups ; Melbourne
Other - Road Reinstatement Traffic Management	6427.0 - Producer Price Indexes, Australia, Dec 2006; Table 24; 7823 Consultant Engineering Services

Source: ABS

The resulting historical price indexes for each of the four core activities and CPI are pictured in Chart 2.2. It is readily apparent that the price indexes for both water distribution and reticulation activities have grown in excess of CPI for the period as a whole, and since 2003Q4 in particular.

Chart 2.2
Price Indexes for the Major Construction Activities and CPI – Historical
(indexes, 2004-05 = 100)



Source: CWW, SEW, YVW and MW and Econtech Estimates.

2.3 Forecasting the Activity Indexes

In this third and final stage of the methodology, we present the methodology for forecasting these four activity price indexes and translating them to forecasts for construction costs for each company.

Model Specifications

Both for practical purposes and transparency, it is necessary that the forecasting equations for each activity price index are based on explanatory variables for which forecasts are readily available. Thus, each activity price index is modelled to depend on well-known, relevant prices including wages (representing labour costs), the GDP price deflator (representing economy-wide costs), and the non-dwelling construction price deflator (representing costs in the non-dwelling construction industry). In addition, the lagged value of relevant activity price index is included to allow for dynamic adjustment and a time trend is included to allow for labour productivity and other time-related factors.

The resulting Model B is as follows:

Model B

$$\log(\text{Activity Price Index}_t) = a_0 + a_{1*}\text{Time}_t + a_{2*}\log(\text{Wages}_t) + a_{3*}\log(\text{PGDP}_t) + a_{4*}\log(\text{PNDC}_t) + a_{5*}\log(\text{Activity Price Index}_{t-1})$$

where:

- Activity Price Index includes in turn each price index constructed in the previous section –water distribution, reticulation, sewerage transfer and treatment;
- Time_t = Time trend;

- $Wages_t$ = average earnings (excluding bonuses) of all workers on a National Accounts basis;
- $PGDP_t$ = GDP price deflator for the National Accounts which provides an indicator of economy-wide price movements;
- $PNDC_t$ = price deflator for the non-dwelling construction;
- Activity Price $Index_{t-1}$ = the lagged value of the dependent variable; and
- t = time subscript.

After estimation using historical data, the four equations of Model B show the sensitivity of each activity price index to each of the explanatory variables, captured in estimated coefficients a_0 to a_5. Forecasts for the explanatory variables are then fed into each of the four equations to generate forecasts for the four activity price indexes. Forecast values for the wages and GDP price deflator series were obtained from MM2 updated for the September quarter 2006. Forecasts values for the price deflator for non-dwelling construction were obtained from the model constructed in section 2.1.

To add economic rigour to the estimation process of Model B, we imposed the standard restriction on the coefficients a2+a3+a4+a5=1. This ensures that the forecast for the relevant activity price index can, in part, be interpreted as a weighted average of the forecasts of other prices that appear as explanatory variables. This restriction was tested statistically and could not be rejected for any of the four equations. The estimated equations were also subject to a battery of standard diagnostic econometric tests to confirm their statistical validity.

The forecasts for the four activity price indexes that were produced using model B are presented and analysed below in Section 3.2.

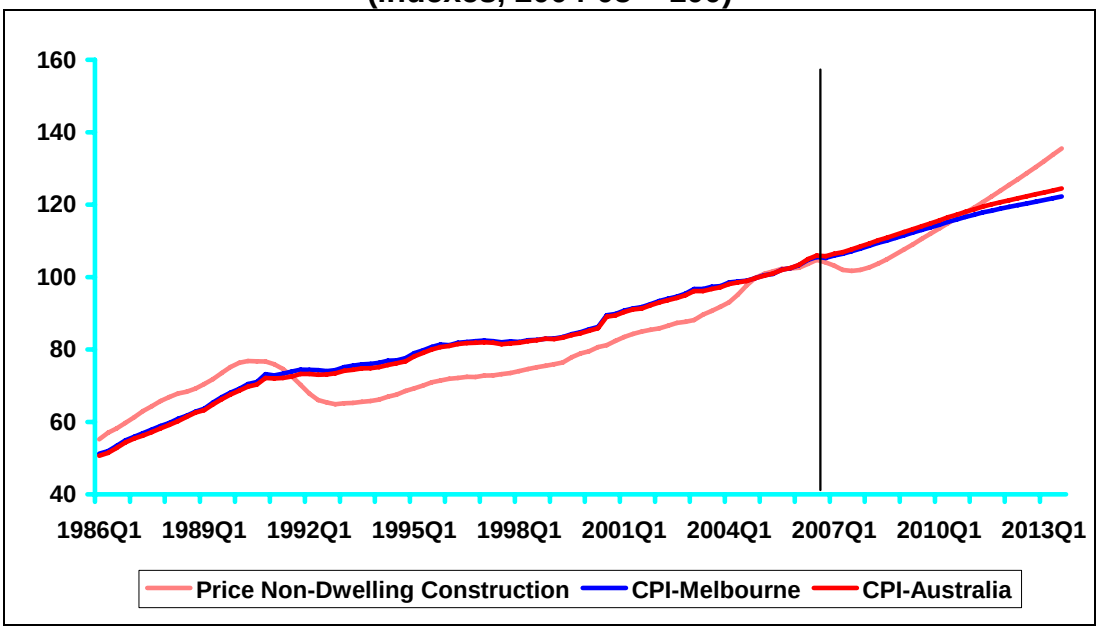
3. Forecasts of Construction Prices

This section reports on the forecasts produced by the models. In section 3.1 it presents the forecasts for price inflation for non-dwelling construction costs in Victoria generally. In section 3.2 it shows the key forecasts for the four water construction activities. These are converted to forecasts for the construction costs of each company individually in section 3.3. Section 3.4 considers the overall results. Section 3.5 discusses the limitations of the study.

3.1 Victorian Construction Price Forecasts

Forecast results for the price index for non-dwelling construction in Victoria are presented in Chart 3.1 along with the historical data for the series. Our forecasts have prices rising on average by 3.5 per cent each year until 2013Q2, in excess of CPI for the eight capital cities which is only expected to rise by 2.6 per cent per annum (in line with the RBA's target band). As many commentators have remarked, China's booming exports of cheap manufactured consumer goods is putting a brake on CPI inflation.

Chart 3.1
Victorian Non-Dwelling Construction Costs and CPI – Forecasts
(indexes, 2004-05 = 100)



Source: ABS and Econtech Estimates.

The results from the diagnostic tests of the variables indicate that this model is robust in that there are stable relationships between the dependent variable and the explanatory variables. Detailed regression and diagnostic tests results are provided in Attachment A.[5]

[5] The adjusted R^2 statistics reported in Attachment B below for each of the four activity index forecasting equations are significantly understated. Essentially the reported R^2 statistics relate to the constrained equations after adjusting the dependent variable in imposing the coefficient restriction that a2+a3+a4+a5=1. This has no bearing on the explanatory power for the unadjusted dependent variable, for which each R^2 statistic is greater than 0.99. For consistency between the four activity equations, all explanatory variables were always included, even in instances where they are not statistically significant. As noted earlier, the standard coefficient restriction that was imposed to ensure that the price coefficients could be interpreted as weights could not be rejected statistically for any of the four equations.

3.2 Activity Index Price Forecasts

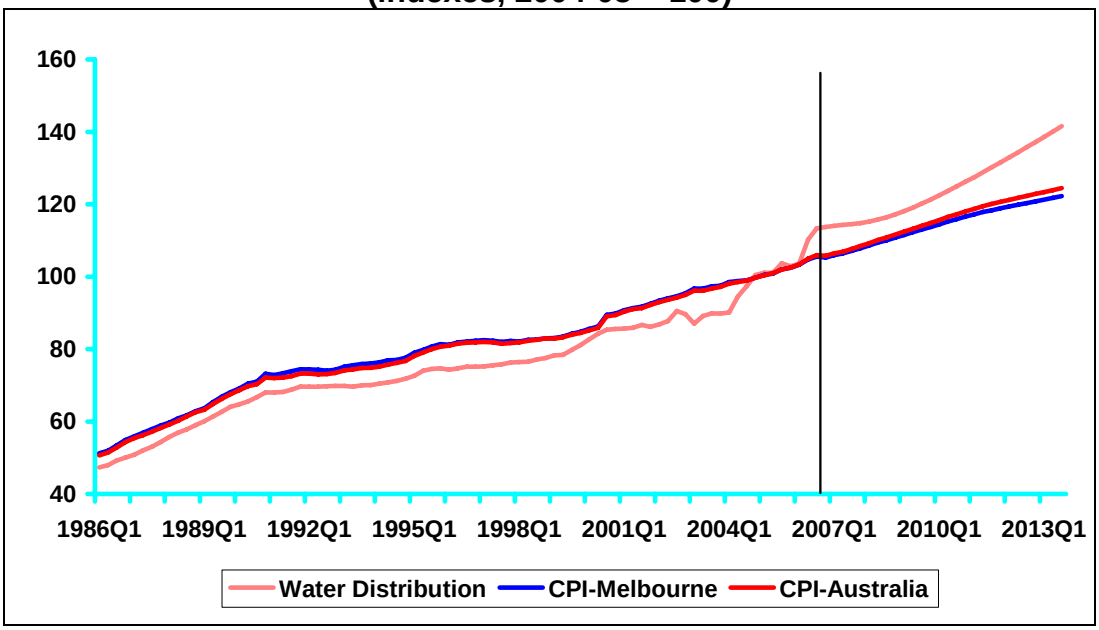
Forecast results for each price index representing the core construction activities (four company weighted averages) are presented in turn below.

Water Distribution

Forecast results for the water distribution price index (four company weighted averages) are presented in Chart 3.2a along with the historical data for the series. Our forecasts have prices rising on average by 4.0 per cent each year until 2013Q2, in excess of CPI for the eight capital cities of 2.6 per cent per annum. However, the historical growth rate of this series has also been quite high at 4.0 per cent since 1987Q4.

Growth in the historical series was close to CPI until the middle of 2003. At this time the prices of steel pipes and PVC pipes, which are key inputs to the water distribution activity, began a period of inflation driven by the underlying commodity prices of steel and oil. Our forecast assumes no further increase in real commodity prices.

Chart 3.2a
Water Distribution Prices and CPI – Forecasts
(indexes, 2004-05 = 100)



Source: ABS and Econtech Estimates.

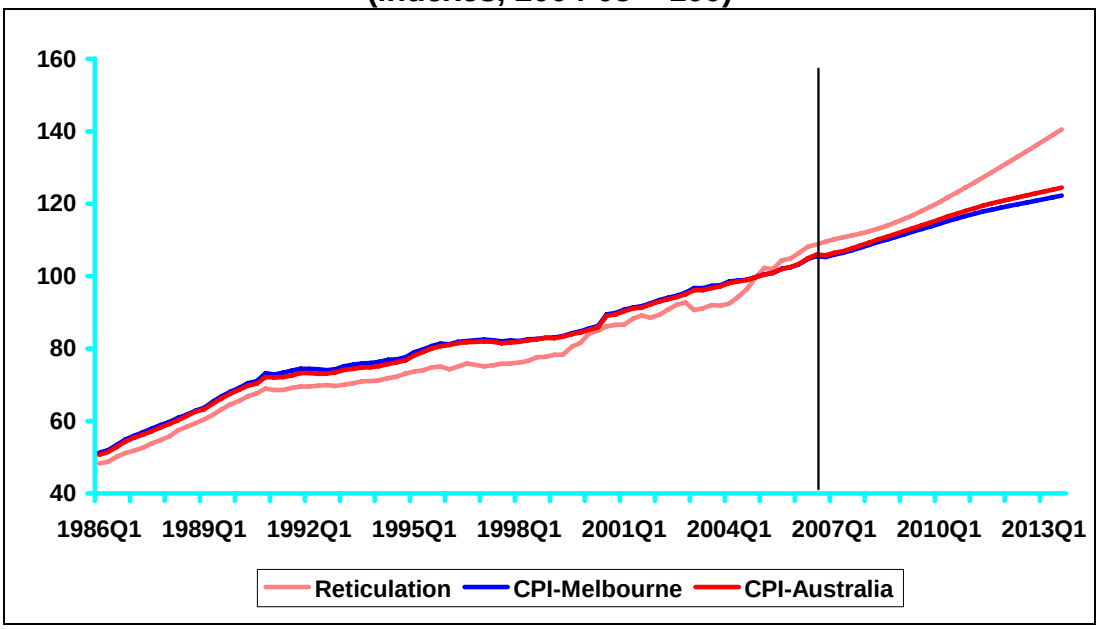
The results from the diagnostic tests of the variables indicate that this model is robust in that there are stable relationships between the dependent variable and the explanatory variables. Detailed regression and diagnostic tests results are provided in Attachment B.

Reticulation

Forecast results for the reticulation price index (four company weighted averages) are presented in Chart 3.2b along with the historical data for the series. Our forecasts have prices rising on average by 3.7 per cent each year until 2013Q2, just below the historical

growth rate of 3.9 per cent since 1987Q4. Again growth in the historical series was close to CPI until the middle of 2003 when the price of PVC pipes, a key input to the reticulation activity, began a sharp upward rise driven by the price of oil. Again while our forecast represents a moderation in the rate of increase in the activity price, and assumes no further increase in real commodity prices.

Chart 3.2b
Reticulation and CPI – Forecasts
(indexes, 2004-05 = 100)



Source: ABS and Econtech Estimates.

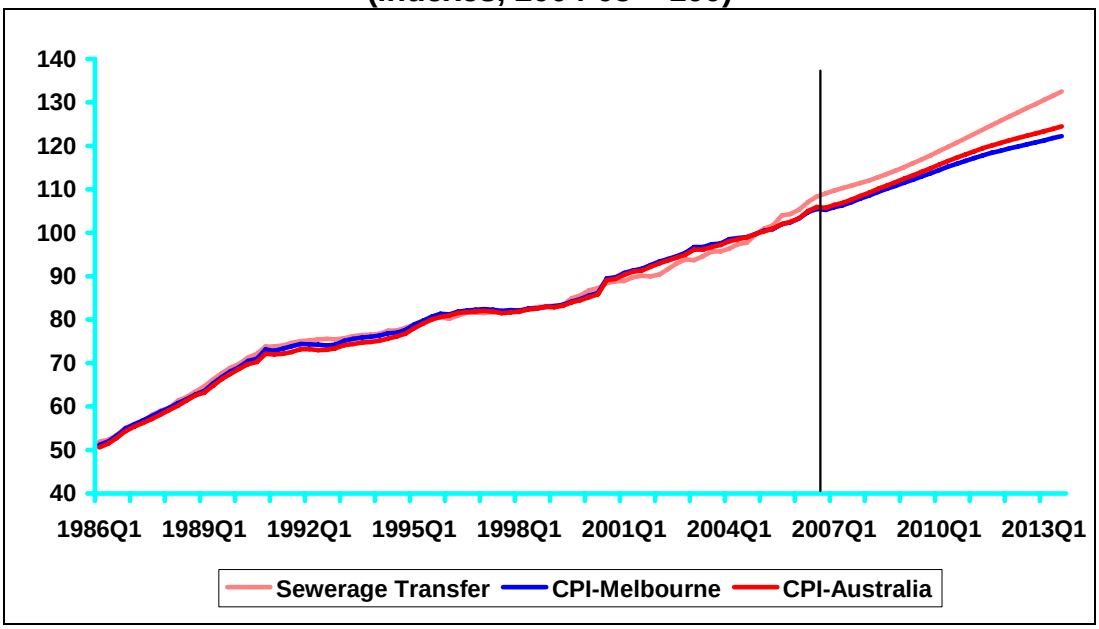
The results from the diagnostic tests of the variables indicate that this model is robust in that there are stable relationships between the dependent variable and the explanatory variables. Detailed regression and diagnostic tests results are provided in Attachment B.

Sewerage Transfer

Forecast results for the sewerage transfer price index (four company weighted averages) are presented in Chart 3.2c along with the historical data for the series. Our forecasts have prices rising on average by 3.1 per cent each year until 2013Q2, below the historical growth rate of 3.5 per cent since 1987Q4.

Inflation in the historical series remained at or below CPI until 2005 when it began to rise somewhat. The key inputs into this activity include fiberglass, labour, and machinery and equipment hire, none of which experienced rapid price increases over the period. However, the activity does employ relatively small amounts of PVC pipes and project management and design services which have experienced rapid price increases in recent years and contributed to the small rise in trend prices from 2005. While the faster rate of inflation is not expected to continue, we expect there will remain a gap between sewerage transfer prices and CPI to 2013Q2, because China's booming exports of cheap manufactured consumer goods is putting a brake on CPI inflation.

Chart 3.2c
Sewerage Transfer and CPI – Forecasts
(indexes, 2004-05 = 100)



Source: ABS and Econtech Estimates.

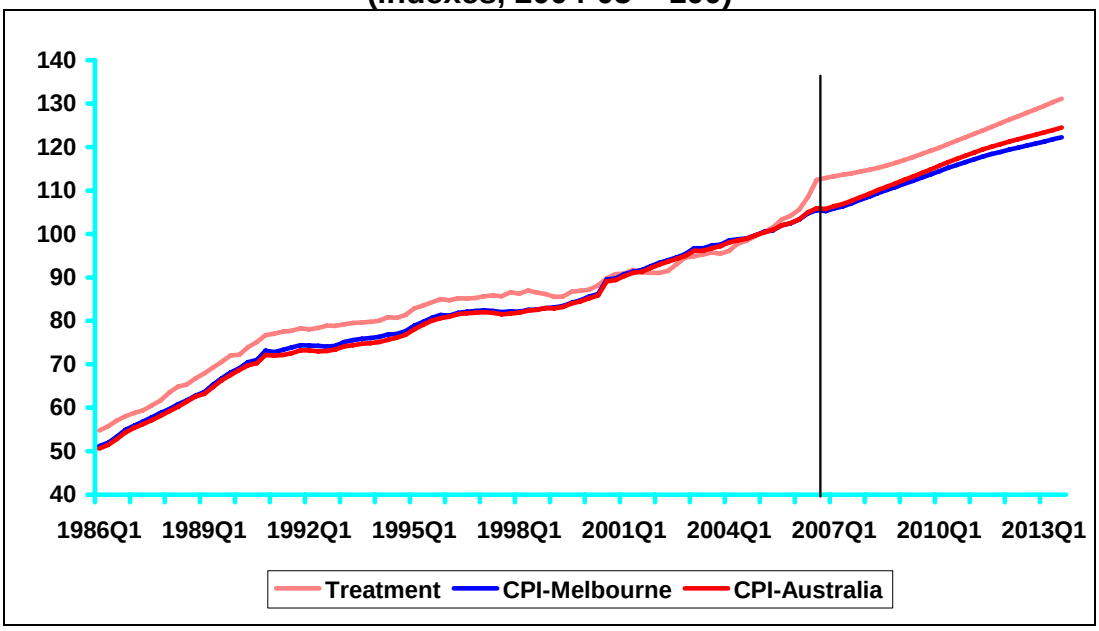
The results from the diagnostic tests of the variables indicate that this model is robust in that there are stable relationships between the dependent variable and the explanatory variables. Detailed regression and diagnostic tests results are provided in Attachment B.

Treatment

Forecast results for the treatment price index (four company weighted averages) are presented are presented in Chart 3.2d along with the historical data for the series. Our forecasts have prices rising on average by 3.0 per cent each year until 2013Q2, just below the historical growth rate of 3.2 per cent since 1987Q4.

Growth in the historical series remained at around CPI until 2005 when it began to rise somewhat on the back of sharp increases in the prices of second tier inputs such as concrete, project management and design and electrical materials. Our forecast assumes a slowdown in the rate of price inflation for this activity, especially given anticipated improvements in labour productivity. However, a gap is expected to remain between the rate of increases in prices for this activity and CPI to 2013Q2, because China's booming exports of cheap manufactured consumer goods is putting a brake on CPI inflation.

Chart 3.2d
Treatment and CPI – Forecasts
(indexes, 2004-05 = 100)



Source: ABS and Econtech Estimates.

The results from the diagnostic tests of the variables indicate that this model is robust in that there are stable relationships between the dependent variable and the explanatory variables. Detailed regression and diagnostic tests results are provided in Attachment B.

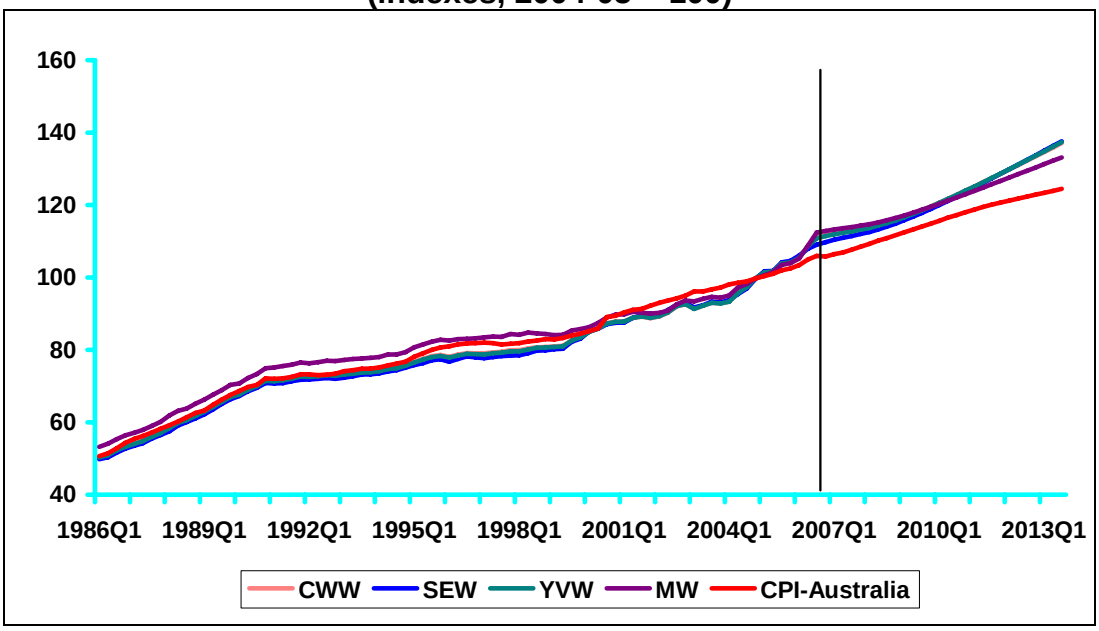
3.3 Individual Company Forecasts

Forecast construction prices for each company are presented in Chart 3.3 along with historical data for the series. These forecasts are derived by applying each company's mix of the four activities to the activity price forecasts presented in section 3.2.

The forecasts suggest that all companies will face similar price inflation for construction projects for the majority of the forecast period. However, while the three retail companies will face almost identical price inflation, MW will face lower price inflation on average as it has no exposure to the higher rate of inflation for the reticulation activity.

Overall, these results are consistent with the operation of a competitive retail water market in metropolitan Melbourne given that the four companies are expected to purchase the same quality and quantity of capital equipment over the period of the Water Plan that they purchased over the past three years. However, if for some reason there is a significant increase in water industry construction in the next few years, it is likely that capacity constraints in the local region would justify higher price increases then those forecast previously to accommodate the additional investment required.

Chart 3.3
Company Costs Based On Current Activity Profiles and CPI – Forecasts
(indexes, 2004-05 = 100)



Source: Econtech Estimates.

3.4 Overall Results

Some interesting trends emerge in the forecasts for construction price inflation for the four activity price indexes.

In terms of the historical data, over the period 1987Q4 to 2006Q3, inflation in the activity indexes ran ahead of inflation in the broader measure of non-dwelling construction prices in Victoria. This is largely attributable to the period from 2003Q1, when activities that are more dependent on key materials such as steel and oil experienced rapid price inflation. Prices of these key materials inflated rapidly with the development of the China-induced commodity price boom. For example, price inflation for water distribution of 4.0 per cent exceeded general price inflation for Victorian non-dwelling construction of 3.0 per cent, reflecting the high steel pipe content of water distribution.

Looking ahead, price inflation for the four activities is forecast to moderate to around the same rate as for Victorian non-dwelling construction of 3.5 per cent. This assumes no further increase in real commodity prices.

This forecast of Victorian non-dwelling construction price inflation exceeds our forecast for CPI inflation of 2.6 per cent. This CPI inflation forecast is consistent with the Reserve Bank's official target. As many commentators have remarked, China's booming exports of cheap manufactured consumer goods is putting a brake on CPI inflation. However, as the Reserve Bank has remarked, it is less relevant for price inflation for non-traded goods and services, such as construction, which are experiencing higher rates of price inflation.

While average price inflation for the activities is around 3.5 per cent, it is a little lower for sewerage transfer and treatment and a little higher for water distribution and reticulation. This represents a continuation of the historical pattern.

3.5 Limitations of the Study

A limitation of the study is that the weights for the four construction activity price indexes are based on a sample of contracts rather than all contracts. However, data for 44 separate contracts was received from the four companies, comfortably in excess of a sample size of about 30 that is usually considered reasonable for statistical purposes. In addition, each of the companies considered that the contracts were typical of the bulk of projects undertaken.

A further weakness of the study is the fact that ABS producer price data used in the construction of the historical activity price indexes are national price indexes and do not relate to conditions specific to the Melbourne. However, this limitation cannot be overcome with available ABS data.

While these data limitations add uncertainty to the forecasts, such uncertainties will always be present. The results of the diagnostic tests support the statistical validity of the modeling. Indeed, the forecasts are considered to be as reliable as possible given the constraints of available information.

Attachment A: Victorian Construction Price Forecasts – Regression Results

MODEL A

The basic model used to calculate forecasts of non-dwelling construction for Victoria was as follows:

Model A

$$Y_t = a_0 + a_1 RBC_t + a_2 TIME_t + a_3 Y_{t-1}$$

Dependent Variable: Y
Method: Least Squares
Date: 04/19/07 Time: 10:48
Sample (adjusted): 1986Q1 2006Q3
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.020182	0.003768	-5.355516	0.0000
TIME	0.000459	0.000121	3.796513	0.0003
RBC(-1)	0.117417	0.026786	4.383605	0.0000
Y(-1)	0.832595	0.065329	12.74459	0.0000

R-squared	0.902653	Mean dependent var	-0.022801
Adjusted R-squared	0.898956	S.D. dependent var	0.011475
S.E. of regression	0.003648	Akaike info criterion	-8.342445
Sum squared resid	0.001051	Schwarz criterion	-8.225874
Log likelihood	350.2115	F-statistic	244.1764
Durbin-Watson stat	2.171233	Prob(F-statistic)	0.000000

Equation for PNIZB

Variable Name	Coefficient Value	Standard Error	T-Statistic
C	-0.020182	0.003768	-5.355516
TIME	0.000459	0.000121	3.796513
RBC(-1)	0.117417	0.026786	4.383605
Y(-1)	0.832595	0.065329	12.744592

Attachment B: Activity Index Price Forecasts – Regression Results

MODEL B

The second set of model specifications that Econtech tested were as follows:

Model B

$$\log(\text{Activity Price Index}_t) = a_0 + a_1{*}\text{Time}_{t-1} + a_2{*}\log(\text{Wages}_t) + a_3{*}\log(\text{PGDP}_t) + a_4{*}\log(\text{PNDC}_t) + a_5{*}\log(\text{Activity Price Index}_{t-1})$$

Water Distribution

Dependent Variable: LPWDMLPWD1
Method: Least Squares
Date: 05/22/07 Time: 21:17
Sample (adjusted): 1986Q1 2006Q3
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.015745	0.015763	-0.998853	0.3210
TIME	0.001450	0.000770	1.884657	0.0632
LWMLPWD1	-0.016487	0.045342	-0.363615	0.7171
LPCMLPWD1	0.082364	0.019537	4.215685	0.0001
LPGDPMLPWD1	0.101322	0.094082	1.076953	0.2848

R-squared	0.282894	Mean dependent var	0.010750
Adjusted R-squared	0.246119	S.D. dependent var	0.012731
S.E. of regression	0.011054	Akaike info criterion	-6.113775
Sum squared resid	0.009530	Schwarz criterion	-5.968062
Log likelihood	258.7217	F-statistic	7.692628
Durbin-Watson stat	1.570154	Prob(F-statistic)	0.000028

Equation for Pwdis

Variable Name	Coefficient Value	Standard Error	T-Statistic
C	-0.015745	0.015763	-0.998853
TIME	0.001450	0.000770	1.884657
LnW	-0.016487	0.045342	-0.363615
LnPNDC	0.082364	0.019537	4.215685
LnPGDPT	0.101322	0.094082	1.076953
LnPwdis(-1)	0.832801		

Est. Period: 1986Q1-2006Q3

Reticulation

Dependent Variable: LPRETMRTPRET1
Method: Least Squares
Date: 05/22/07 Time: 21:38
Sample (adjusted): 1986Q1 2006Q3
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000877	0.011112	0.078907	0.9373
TIME	0.000539	0.000567	0.950304	0.3449
LWMLPRET1	0.045549	0.034253	1.329780	0.1875
LPCMLPRET1	0.083964	0.014316	5.864960	0.0000
LPGDPMLPRET1	0.049571	0.067889	0.730175	0.4675

R-squared	0.378332	Mean dependent var	0.010102
Adjusted R-squared	0.346452	S.D. dependent var	0.010156
S.E. of regression	0.008211	Akaike info criterion	-6.708453
Sum squared resid	0.005258	Schwarz criterion	-6.562740
Log likelihood	283.4008	F-statistic	11.86724
Durbin-Watson stat	1.653801	Prob(F-statistic)	0.000000

Equation for Pretic

Variable Name	Coefficient Value	Standard Error	T-Statistic
C	0.000877	0.011112	0.078907
TIME	0.000539	0.000567	0.950304
LnW	0.045549	0.034253	1.329780
LnPNDC	0.083964	0.014316	5.864960
LnPGDPT	0.049571	0.067889	0.730175
LnPretic(-1)	0.820915		

Est. Period: 1986Q1-2006Q3

Sewerage Transfer

Dependent Variable: LPSTMLPST1
Method: Least Squares
Date: 05/22/07 Time: 21:56
Sample: 1986Q1 2006Q3
Included observations: 83

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.012058	0.005581	2.160506	0.0338
TIME	-0.000109	0.000303	-0.359729	0.7200
LWMLPST1	0.031033	0.024402	1.271738	0.2072
LPCMLPST1	0.036349	0.012691	2.864137	0.0054
LPGDPMLPST1	0.143468	0.056319	2.547405	0.0128

R-squared	0.580488	Mean dependent var	0.009141
Adjusted R-squared	0.558974	S.D. dependent var	0.007877
S.E. of regression	0.005231	Akaike info criterion	-7.610098
Sum squared resid	0.002134	Schwarz criterion	-7.464385
Log likelihood	320.8191	F-statistic	26.98254
Durbin-Watson stat	2.057374	Prob(F-statistic)	0.000000

Equation for Psewtr

Variable Name	Coefficient Value	Standard Error	T-Statistic
C	0.012058	0.005581	2.160506
TIME	-0.000109	0.000303	-0.359729
LnW	0.031033	0.024402	1.271738
LnPNDC	0.036349	0.012691	2.864137
LnPGDPT	0.143468	0.056319	2.547405
LnPsewtr(-1)	0.789150		

Est. Period: 1986Q1-2006Q3

Treatment

Dependent Variable: LPTRMLPTR1
Method: Least Squares
Date: 05/22/07 Time: 22:01
Sample: 1986Q1 2006Q3
Included observations: 83

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.009447	0.008791	1.074572	0.2859
TIME	9.14E-05	0.000476	0.191793	0.8484
LWMLPTR1	-0.022399	0.032588	-0.687326	0.4939
LPCMLPTR1	0.029714	0.018337	1.620457	0.1092
LPGDPMLPTR1	0.140440	0.063447	2.213503	0.0298

R-squared	0.441426	Mean dependent var	0.008946
Adjusted R-squared	0.412782	S.D. dependent var	0.009025
S.E. of regression	0.006916	Akaike info criterion	-7.051734
Sum squared resid	0.003730	Schwarz criterion	-6.906021
Log likelihood	297.6470	F-statistic	15.41035
Durbin-Watson stat	1.376960	Prob(F-statistic)	0.000000

Equation for Ptreat

Variable Name	Coefficient Value	Standard Error	T-Statistic
C	0.009447	0.008791	1.074572
TIME	0.000091	0.000476	0.191793
LnW	-0.022399	0.032588	-0.687326
LnPNDC	0.029714	0.018337	1.620457
LnPGDPT	0.140440	0.063447	2.213503
LnPtreat(-1)	0.852245		

Est. Period: 1986Q1-2006Q3

Attachment C: Specifics of the Contract Data

The attached spreadsheet was prepared for the Essential Service Commission only.