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Forecasting Australian Transport

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Abstract

A systematic review of past forecasts of three areas of transport activity allows some lessons to be learned from past successes and failures. Here, a review is presented of all forecasts made by the Bureau of Infrastructure, Transport and Regional Economics since 1965 in the areas of Australian vehicle kilometres travelled, metropolitan urban public transport, and passenger movements through capital city airports.

1. Introduction

As the research arm of the federal department responsible for Australian transport, the Bureau of Infrastructure, Transport and Regional Economics (BITRE and variously-named predecessors) has long been responsible for assembling, modelling and forecasting statistics related to transport activity and its determinants. Predictions of transport activity have served to inform policy makers about the challenges for future infrastructure provision.

However, as Niels Bohr (Nobel prize winning physicist) once remarked, “Prediction is very difficult, especially if it’s about the future” (Ellis 1970).

This review of past forecasts by the Bureau in three areas seeks to look at some of these difficulties and to try to draw lessons from the success or otherwise of past forecast efforts. The three areas are some of the twenty-five or so that are being examined for a forthcoming Bureau report on past forecast accuracy.

The three areas are:

- Australian vehicle kilometres travelled,
- metropolitan urban public transport, and
- passenger movements through capital city airports.

2. Australian Vehicle Kilometres Travelled

A motor vehicle travelling one kilometre accounts for one vehicle-kilometre travelled (one vkt). To examine past forecasts, it is instructive to look at the two components of vkt per person and population, and then at the total aggregate vkt, i.e:

vkt/person * population = total vkt

The data for the components and for total vehicle kilometres (all motor vehicles) for the last 50 years in Australia are shown in Figure 1, together with forecasts with start dates ranging from 1966 to 2011. Data sources are given in the Bibliography section, labelled by start date (date of last actual data). The first thing to notice is that the pattern of growth in total vkt (Figure 1c) in the last 50 years has been such that the absolute change has been consistently slowing. This means that the percentage growth has been slowing even faster.

Figure 1a Vehicle kilometres travelled per person

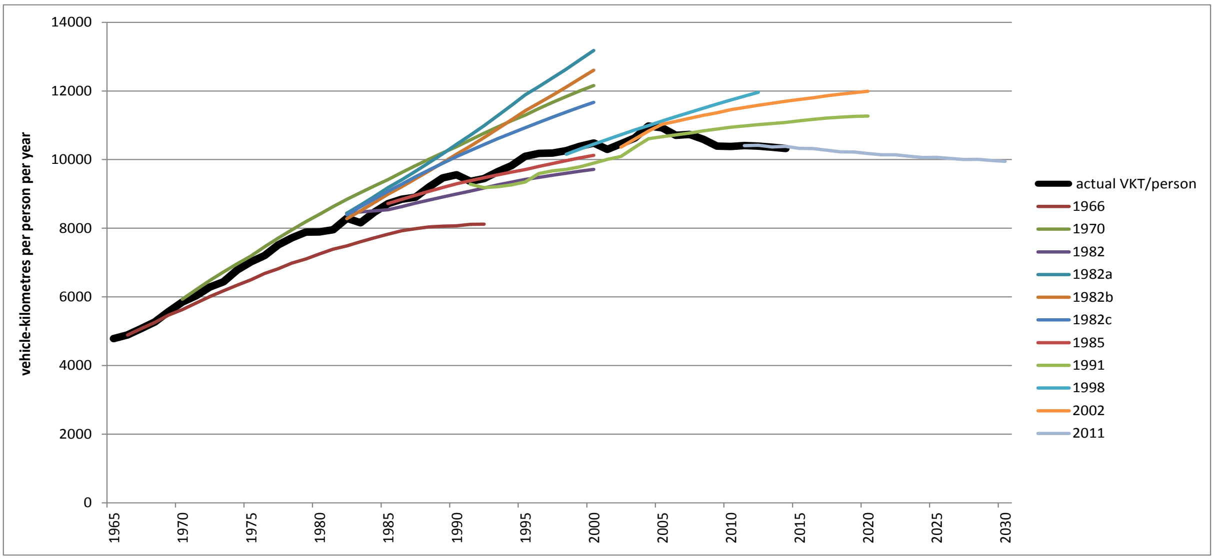


Figure 1b Australian Population

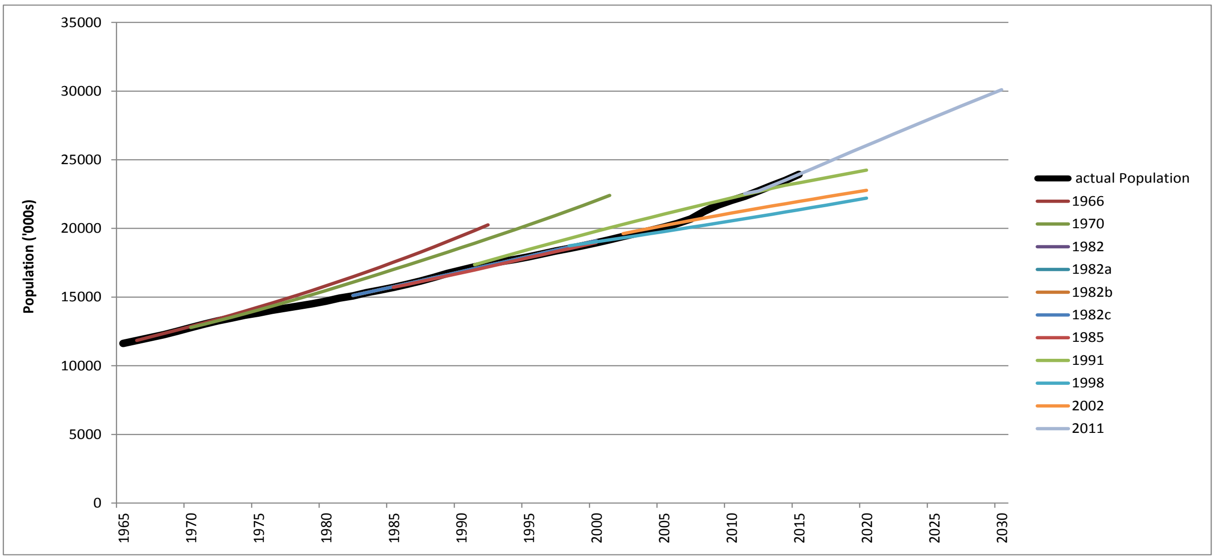
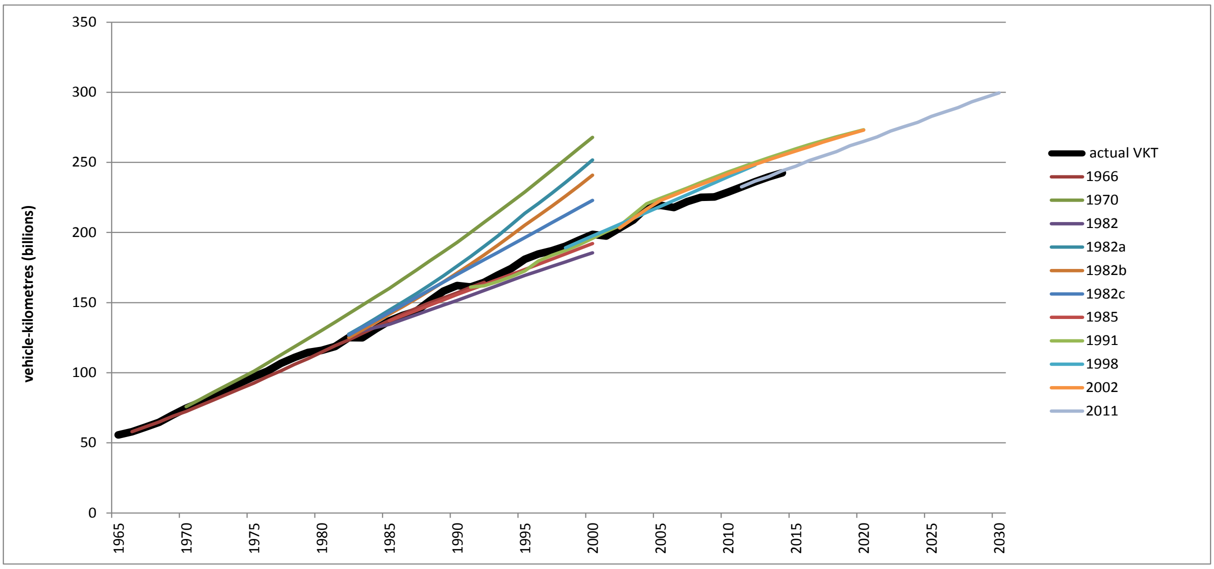


Figure 1c Australian vehicle kilometres travelled



Looking at the forecasts, it can be seen that they fall into two groups:

a) those that assumed increasing absolute change (the four high forecasts out to 2000),
b) those that correctly projected a linear or decreasing rate of absolute increase.

The difference between the two types of studies is a function of the models used. The first (incorrect) group of forecasts were based on mistaken exponentially growing aggregate models (1970, 1982a, 1982b,1982c – see Figure 1c). The second (roughly correct) group (1966, 1982, 1985, 1991, 1998, 2002 and 2011) split the aggregate into vkt per person (assumed to be constantly slowing in growth, i.e. saturating) and population growth.

The first forecast was made in 1966 and was almost spot on in its forecast of the next 25 years of traffic growth. However, it was a case of the right answer for the wrong reasons. As shown in Figures 1a and 1b, yes, the vkt per person was assumed to saturate, but at too low a level. However, this error was almost exactly cancelled out by too high a population growth forecast. Of the five forecasts of the 70s and 80s, four were the mistaken exponentially growing aggregate forecasts already mentioned. The fifth, in 1982 had a low per person forecast and a correct population forecast, resulting in a low aggregate forecast. The forecasts of the 1990s were correctly disaggregated, and with compensating errors in the two components, did well until the Global Financial Crisis – which no government modeller would have forecast in advance. However, after the fact, some variable might be found to provide a 'measure' of the effect of such system changes, allowing continuing updates over time. In the case of the GFC effect, the household savings rate has served this function well so far.

The 2011 forecast is (so far) doing very well.

The messages for forecasters from this analysis are as follows:

1. Modelling some transport features requires splitting them into components and modelling those.
2. Population forecasts for Australia can be off when immigration levels suddenly change in response to changes in policy or in the economy.
3. Unexpected system changes happen (GFC, immigration changes) and can only be dealt with in advance using scenarios that consider unlikely eventualities. After the event some proxy measure, if available, can be of value.
4. A forecast can be good for the wrong reasons (compensating errors).

3. Metropolitan urban public transport passenger kilometres

A passenger travelling one kilometre accounts for one passenger-kilometre (one pkm). 'Metropolitan' in Australia's case refers to the sum of the eight capital cities. Interest in past forecasts revolved around three facets:

1. Total metropolitan passenger-kilometres
2. The share of urban public transport, and thus
3. Urban public transport passenger-kilometres.

The data for all three components for the last 50 years in metropolitan Australia are shown in Figure 2 (see Bibliography section), together with forecasts with start dates ranging from 1977 to 2010. Actual total metropolitan passenger-kilometres in Figure 2a are a replica of Australian vehicle-kilometres travelled as shown in Figure 1c, slowly turning downwards from a straight line. Two of the forecasts were of the "exponential growth of aggregate" type (1975, 2000), and erred on the upside. The other forecasts have the trend right, if not always the level.

Figure 2a Metropolitan passenger-kilometres

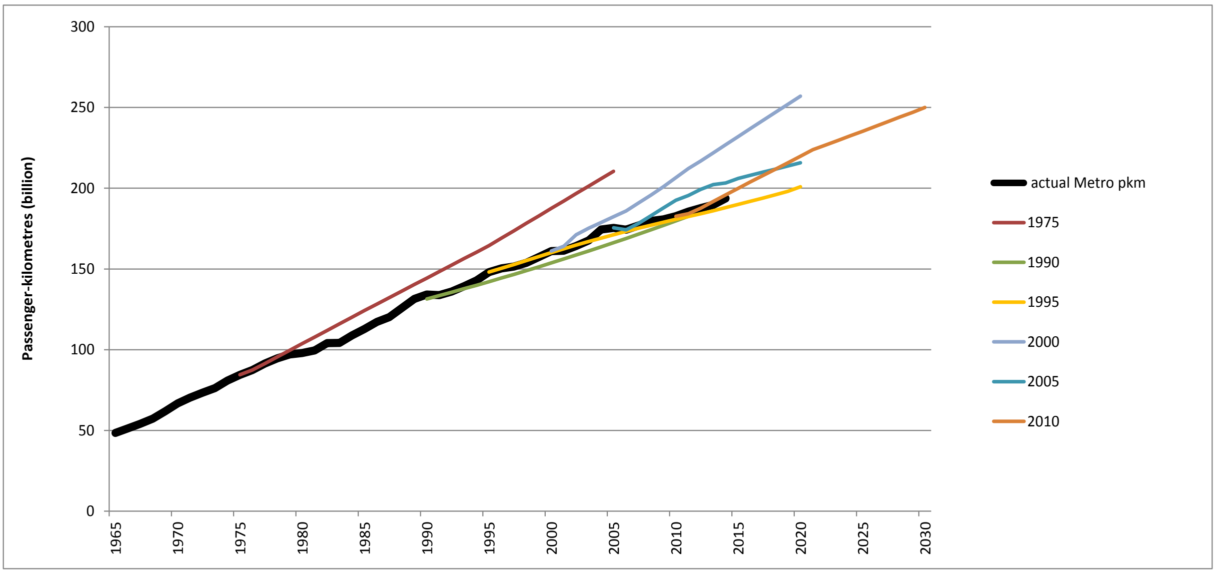


Figure 2b Urban Public Transport mode share

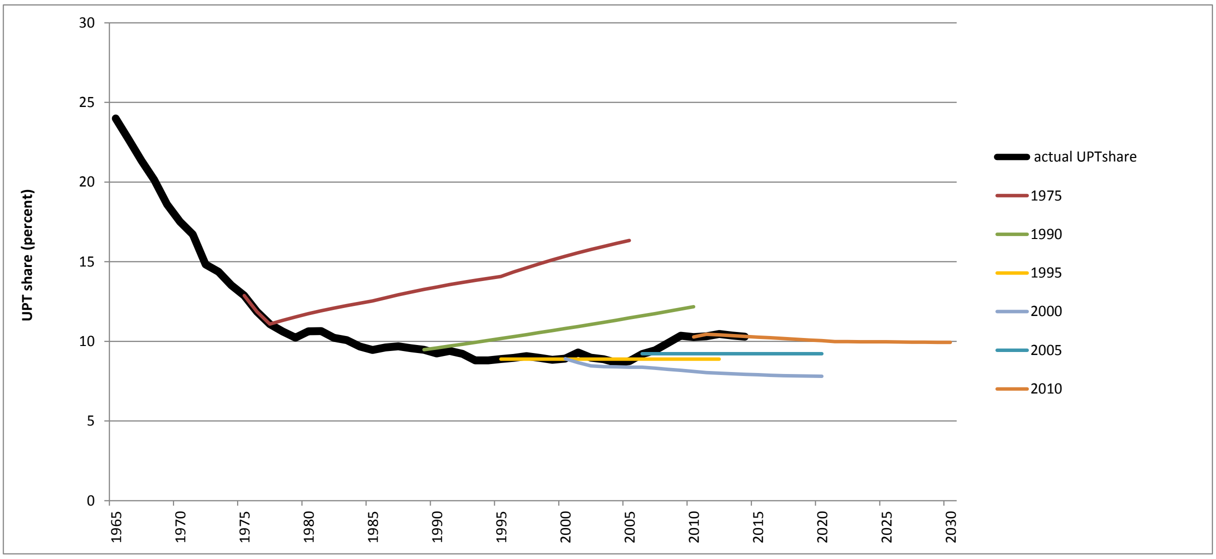
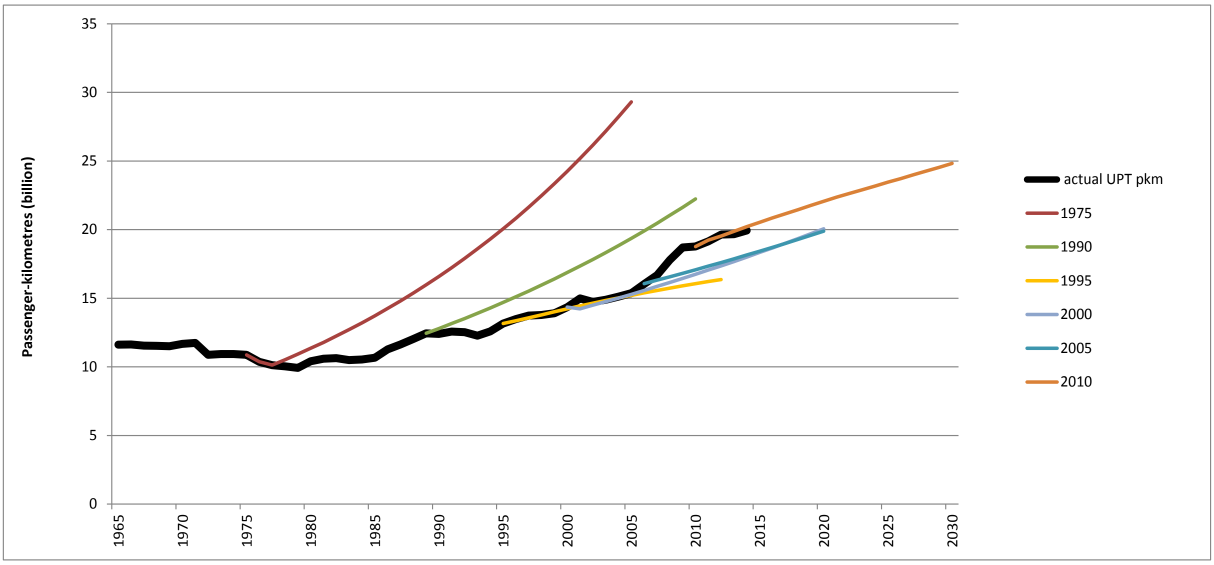


Figure 2c Urban Public Transport passenger-kilometres



Share forecasts in 1975 and 1990 erred towards assuming a recovery. In fact the UPT share of metropolitan pkm declined sharply from 1965 to 1980 and then started a period of slow decline. Forecasts from the mid-1990s captured this. Then, from 2005 to 2009, a sharp increase in cost-of living pressures saw a return to the cheaper UPT options for commuters (a move enabled by supply increases), and UPT share moved sharply upward. As pressures eased, the UPT share again levelled out, and has been well predicted by the 2010 forecast.

When, after 1980, the decline in UPT share eased off, the absolute level of UPT passenger kilometres began to trend upwards (see Figure 2c). From 2005 to 2009, the level shifted sharply upwards, and then resumed its previous trend (set by a constant share of a growing metropolitan passenger kilometre total).

The messages for forecasters from this analysis are as follows:

1. Modelling some transport features requires splitting them into components and modelling those.
2. A model of UPT has to include forecasts of cost pressures as a trigger for UPT demand surges. This is not to say these will be got right, but it is certain that when the current era of record low housing interest rates and low petrol prices ends, there will be a surge in demand for UPT.
3. Unexpected system changes happen (GFC, sharp cost of living changes) and can only be dealt with in advance using scenarios that consider unlikely eventualities.

4. Passenger movements through capital city airports

The eight capital city airports are major hubs of the domestic and international air travel network. Data has been assembled on air passenger movements, and domestic and international airfares (see Bibliography section). The pattern of growth of capital city airport passenger numbers (domestic plus international) has been one of a semi-exponential growth, split into sections (see Figure 3a). The sections were initiated by one-off events, followed by new industry players entering.

The first stage of growth was from 1965 to 1980, and ended when medium distance (320-755 km) domestic airfares rose sharply from 1980 to 1983 (see Figure 3b) and international airfares ceased their dramatic decline in the period 1965 to 1980 (see Figure 3c). The next stage ran to the pilots' strike in 1990. Then during the 1990s growth resumed, only to be interrupted in 2001-02 by the September 11 terrorist attack and the collapse of Ansett Airlines. Thereafter, the advent of cut-price airlines has progressively reduced real best discount airfares, resulting in high growth rates for airport passenger numbers. Finally, the Global Financial Crisis again interrupted growth in 2009, after which growth has resumed.

The forecasts made in the past have generally been successful only as long as the stage in which they were made lasted. In general, they were: satisfactory within the stage, above during the down-turn, and below during the subsequent upturn. The exception has been recent forecasts (so far).

The messages for forecasters from this analysis are as follows:

1. Predicting domestic airfares is difficult, international airfares less so. Probably the best forecast currently is to project the 1985-to-current trend.
2. There have been, and are likely to continue to be, stages of semi-exponential growth corresponding to changes in industry structure. Forecasters need to try to imagine the next such future industry structure, rather than rely entirely on estimated equations.
3. Unexpected system changes happen (pilots' strike, terrorist attack, Ansett, GFC) and can only be dealt with in advance using scenarios that consider unlikely eventualities.

Figure 3a Air passenger movements through capital city airports

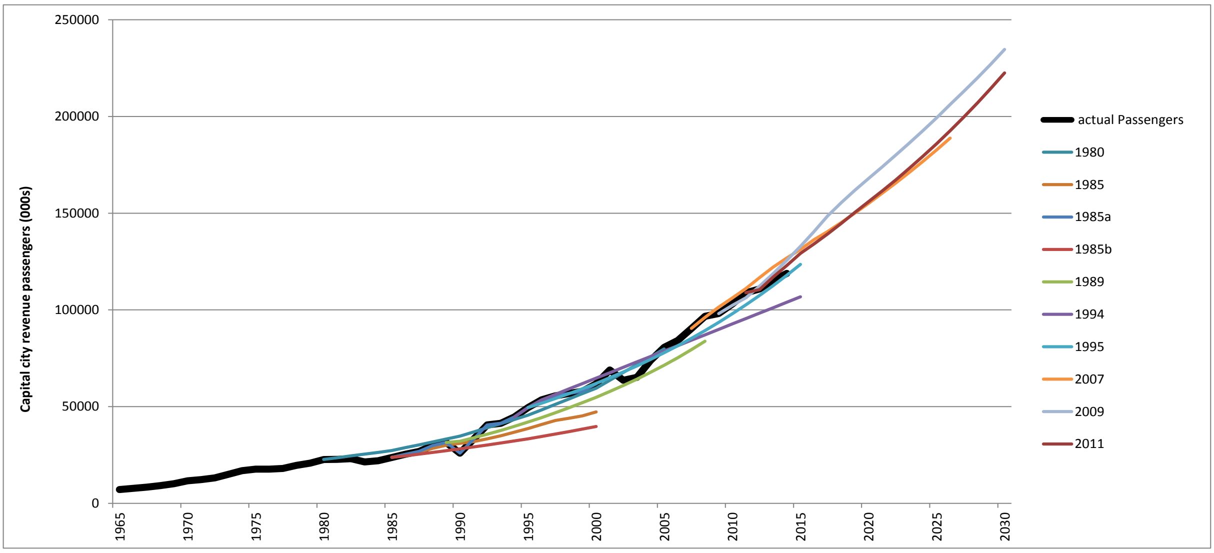


Figure 3b Real medium-distance domestic airfares (average of economy and best discount)

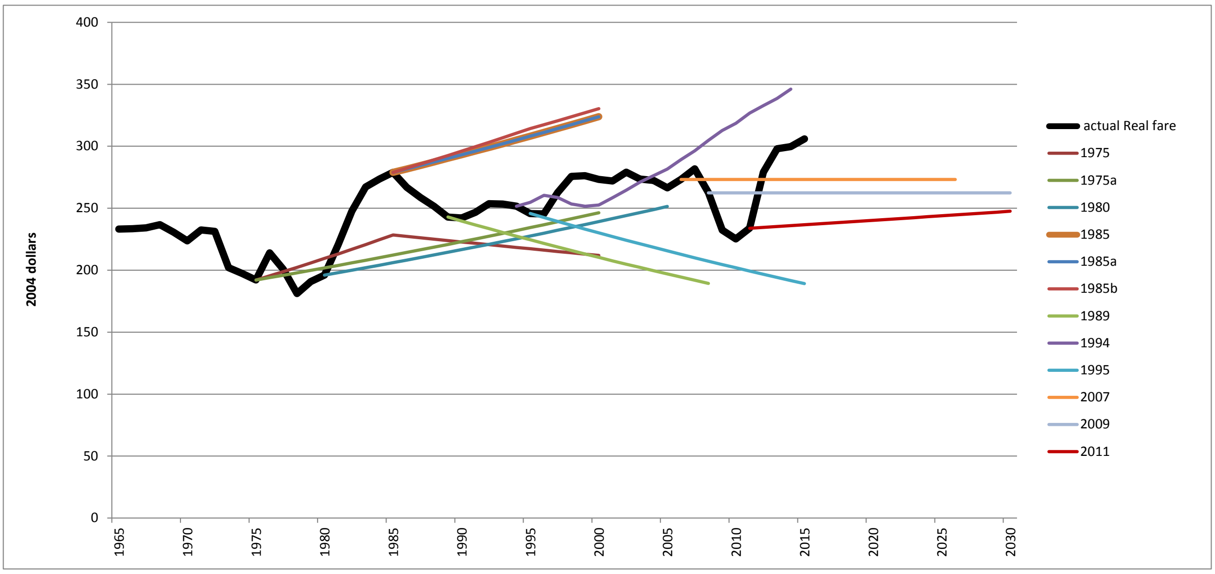
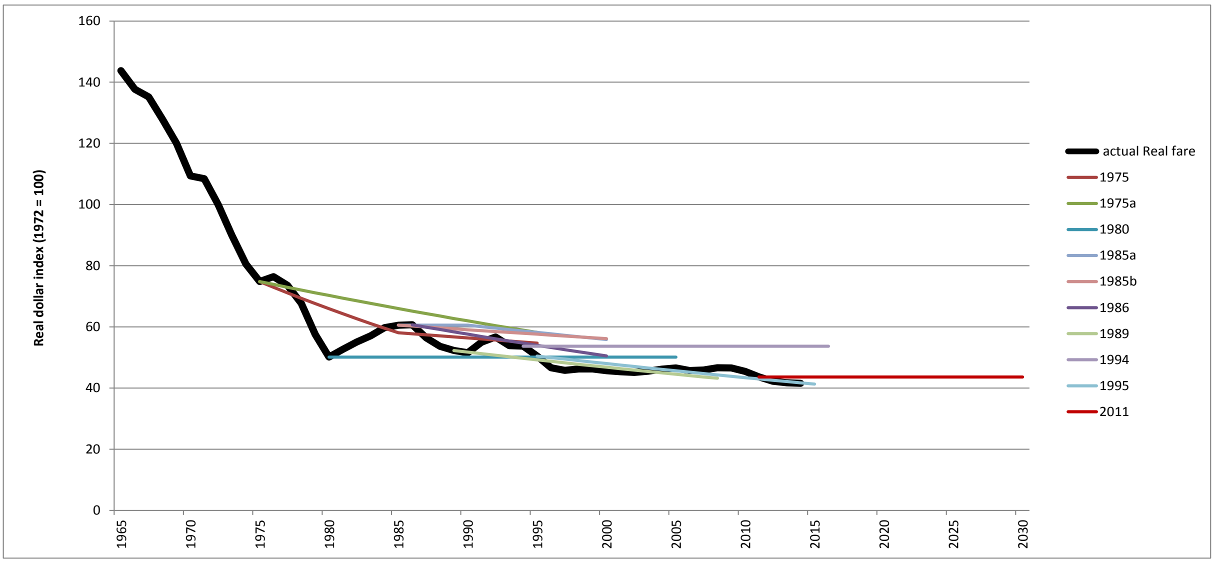


Figure 3c Real international airfares



Conclusions

Modelling some transport features requires splitting them into components and modelling those (using structural equations). In the three forecast areas reviewed, proper structural equations (usually 1990 on) gave reasonable forecasts if the independent variables had reasonable estimates.

Exceptions are where independent variables radically changed trend, for example population growth with radical changes in immigration (currently the level of immigration is dropping) or surges in the cost of living increasing the demand for UPT. Then even structural equation forecasts are threatened.

Other exceptions were after periods of unexpected system changes, such as the Global Financial Crisis, the collapse of Ansett, changes in industry structure, for example the introduction of cut-price airlines, or the end of the period of plummeting international airfares.

In spite of progress over the decades in the technology and techniques of forecasting, it remains the case that accurate long-term forecasting relies principally on assembling long-term standardised datasets for the structural components of the phenomenon of interest, and then modelling how the components fit together. Finally, the importance of understanding the dynamics of the independent variables that drive the structural components is crucial to forecast success.

Using long time series of aggregates of transport activity and their components allows one to better visualise how the long-term trends emerge. Looking at past forecasting efforts alongside these trends allows a better understanding of what works and what doesn't work in the process of forecasting Australian transport.

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