A TEMPORAL AND SPATIAL ANALYSIS OF THE PRICES OF GENERAL PRACTITIONER SERVICES UNDER MEDICARE, 1984-1996[*]

by

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1. INTRODUCTION AND POLICY BACKGROUND

In recent years there has been some attention paid to the general practice industry in Australia. Generally, it can be said that general practice has been a "black hole" in the Australian health landscape. For example, compare the minuscule literature on general practice to the voluminous literature on hospitals. For a recent general overview of general practice see Knight (1996).

The recent focus on general practice can be explained by the advent of vocational registration (VR) of general practitioners (GPs), a long-sought goal of the Royal Australian College of General Practitioners (RACGP) (Bollen, 1990). After lengthy negotiations, in 1989 the Commonwealth Government had reached an agreement with the RACGP to introduce a vocational register for GPs. To remain on the vocational register GPs were to undertake continuing medical education courses and be involved in quality assurance procedures.

Legislation to give effect to these arrangements was introduced in the House of Representatives on 10 May 1989, and passed on 25 May 1989. The (then) Minister for Community Services and Health (Dr N. Blewett) described the new arrangements as "... the most far reaching advances which have ever been achieved in general practice in this country" (House of Representatives, *Parliamentary Debates*, No.6 (1989) 10 May, p.2386). The new GP arrangements were not universally welcomed by the medical profession, and the "medical politics" associated with the new arrangements were reflected in the Senate debates. In fact the Senate referred the VR arrangements (along with some other health-related amendments) to a Select Committee (the Senate Select Committee on Health Legislation and Health Insurance) for inquiry and report. In August 1989 the Select Committee reported back to the Senate unanimously supporting the new arrangements (Senate Select Committee on Health Legislation and Health Insurance, 1989), and the Commonwealth Government responded by accepting all the recommendations (Department of Community Services and Health, 1989). See Crowley (1990) for an account of the parliamentary background and the deliberations that led to the Select Committee's Report.

In July 1992, following negotiations between the Commonwealth Government, the RACGP and the Australian Medical Association (AMA), there was an agreement between these parties on "an integrated package of proposals for consideration by the profession and the Government" (General Practice Consultative Committee, 1992). Within months, in the 1992-93 Budget, the Commonwealth announced a Rural Incentives Package ($8m in 1992-93 and an indexed $15.19m thereafter) to encourage GPs to relocate in rural areas; Local Divisions for GPs to "broaden their role beyond the level of individual patient care"; a (voluntary) system of Practice Accreditation as "recognition of the costs of providing high quality services; an additional $3m (indexed) to fund training places to enable vocational registration to accelerate, a further $3m (indexed) for evaluation of the changes in general practice; a further $16.5m in "program funds" to develop other initiatives relating to continuity of care, pharmaceuticals, information management, and to undertake preliminary work on "a relative value study of Medicare Schedule fees" (Commonwealth of Australia, 1992, pp.37-8).

In addition to these budgetary decisions, the Commonwealth Government announced

decisions relating to restrictions of the supply of medical practitioners that are non-budgetary in nature. The 1992-93 emphasis was on restrictions of overseas trained practitioners relating to labour force agreements "to find ways of replacing [overseas trained medical practitioners] with ones already resident in Australia", as well as restrictions on the numbers of medical practitioners permitted to sit the Australian Medical Council clinical examination (Commonwealth of Australia, 1992, p.37). Supply restriction was given a major focus with the 1996 announcements involving the restriction of Medicare Provider Numbers to medical practitioners who are formally recognised as GPs (Department of Health and Family Services, 1996, Section 2.1).

The purpose of this paper is to analyse time series data on gross prices of medical services provided under Australia's fee-for-service medical arrangements. Here, the term gross prices refers to the total prices received by GPs for their services, i.e. the sum of the patient out-of-pocket (net) price and the Medicare rebate (subsidy) for each service. For a detailed discussion of the relationship between gross prices, net prices and rebates under Medicare see Connelly and Doessel (1995).

The attention on gross prices in this paper is not serendipitous. There are two policy-relevant issues in Australia relating to the prices of medical services. First, with respect to GP services in particular, the Commonwealth Government has introduced a system of "blended prices", currently called "Better Practice Payments". Essentially, this means having a mechanism of financial remuneration for GPs **in addition to** the fee-for-service remuneration mechanism. For a critique, see McCallum and Raymond (1996). Second, the Commonwealth Government has reached a common position with the AMA to review/reform the prices of medical services specified in the *Medicare Benefits Schedule Book* (Commonwealth Department of Human Services and Health and the Australian Medical Association, 1994).

Issues *re* medical prices (and rebates), as specified in the *Medicare Benefits Schedule Book*, have been "on the agenda" for some time. These matters were referred to at the time of the introduction of vocational registration and were subject to recommendation by the Senate Select Committee (Senate Select Committee on Health Legislation and Health Insurance, 1989). Furthermore, review of relative prices was specifically mentioned in the document issued by the General Practice Consultative Committee (General Practice Consultative Committee, 1992).

Generally, the (now) *Medicare Benefits Schedule Book* has its origins in the Gorton Government's health insurance changes of the late 1960s and early 1970s. One of the key features to these changes was "the most common fee" concept which arose from the Nimmo *Report* (Committee of Enquiry into Health Insurance, 1969). Since that time, *ad hoc* reforms and/or changes have been made to the *Schedule* as a result of changes and developments in medical practice over time. In addition to new medical services being added to the *Schedule* adjustments to existing items/codes have also been made. The administrative mechanisms for these changes have been via consultative committees, e.g. the Medicare Benefits Consultative Committee and the Pathology Services Table Committee, which include representatives of the medical profession.

However, the review that was agreed to in 1994 is not *ad hoc* in nature: it is a "more fundamental reassessment" which includes the following:

" i) a process to objectively (*sic*) assess the relativities between the various procedural areas,

ii) a process to assess the structure and relativities of consultation items,

iii) a process for comparing the relativities between procedural and consultation items, and

iv) for an ongoing, fair review and update process" (Commonwealth Department of Human Services and Health and the Australian Medical Association, 1994, pp. 4-5).

It is clear from this general statement of the objectives of the "relative value study" that GP services are not being addressed in isolation. This is unsurprising, since the essence of a relative value study is the comparison of different categories of medical services.

This paper is concerned with an analysis of the behaviour of the gross prices of GP services under Medicare, both across geographical space, and over time. The paper analyses time series data on the gross prices of GP services in the states/territories of Australia, to determine if those prices have risen or fallen through time. In determining the temporal movement in gross prices for GP services attention is also directed to institutional changes which may affect the data employed, e.g. vocational registration and restructuring of the schedule fee, plus seasonal factors. The analysis begins in Section 2, in which the behaviour of the gross prices of GP services since the introduction of Medicare is considered in detail for each Australian state and territory. The empirical results in Section 2 essentially reveal that there are significant differences in gross prices of GP services between regions (states/territories) of Australia, despite the uniform operations of Australia's health care funding mechanism, Medicare.

The analyses presented in Section 3 are concerned, specifically, with the behaviour of GP prices in the post-vocational registration period. In this section, the focus is on the differences in prices charged by VR and non-VR medical practitioners. In the post-VR period it is found that there is only one region (the Australian Capital Territory) in which there is a statistically significant difference between VR and NVR prices. The results generally indicate that VR GPs receive, on average, no higher gross price per consultation than their NVR counterparts.

Section 4 presents the conclusions of the study.

2. GROSS PRICES FOR GP SERVICES BY STATE/TERRITORY

2.1 Some Characteristics of the Data

This section is concerned with an empirical analysis of the outcome of the Medicare system in terms of gross prices of GP services. More specifically an answer is sought to the following questions: are there significant differences in the gross prices of GP services provided in the Australian states/territories and have the gross prices of GP services risen, fallen, or stayed the same, over time?

Data, which are a by-product of the Medicare system, have been provided, by state/territory, by the Commonwealth Department of Health and Family Services. The data are quarterly from the September Quarter, 1984, 1984(3), to the September Quarter, 1996, 1996(3), thus giving 49 observations, for GP services. The data are also disaggregated into VR GP and NVR GP services for the relevant (post-VR) period.

Since the Medicare data were provided in current prices, the first step in the analysis is was to convert all data into constant 1989-90 prices using the Consumer Price Index (Australian Bureau of Statistics, various). Table 1 presents some illustrative data on (real) average gross prices, for Australia and the States/Territories, for GP services. The seven quarters chosen include the 1984(3) and 1996(3) quarters, the first and last observations in the time series data. Casual observation suggests two phenomena characterise these gross price data: gross prices differ through time and also by geographical region, i.e. state/territory. Not only are there absolute differences in the gross prices by region, but their movements over time are also apparently different. While temporal fluctuations are clear, when one considers the first and last columns of Table 1, the real gross prices of GP services have fallen appreciably over time. In New South Wales ($22.43-$20.14) and Victoria ($21.58-$20.61); but have risen appreciably over time in Queensland ($19.53-$20.04), South Australia ($19.72-$20.38), Western Australia ($19.77-$20.36), and the Northern Territory ($20.60-$22.13). However, for Tasmania and the Australian Capital Territory, the end-points of the time series are virtually identical ($20.97-$20.98 and $21.95-21.97, respectively). Another feature of the data presented in Table 1 is that gross prices decline for all regions, between the last two columns of Table 1, i.e. between the September quarter, 1994 and the September quarter, 1996.

A more detailed account of the spatial differences in GP gross prices is provided by Table 2 which presents summary statistics (means, standard deviations and ranges) of the GP gross price data being considered here. These statistics have been calculated on the entire time series, so the means represent the average GP real gross prices charged over the period 1984(3) to 1996(3), and the standard deviations provide summary measures of their variation over the sample.

The data In Table 2 confirm that spatial and temporal differences in mean gross prices are typical. Some spatial differences in the mean gross prices are evident: the minimum mean gross price for GP services occurs in Queensland ($19.97) and the maximum mean price in the Australian Capital Territory ($21.47). However, it is also apparent that, for some inter-state comparisons of the mean there are only small (if any) differences in magnitude. For example, the means for New South Wales ($20.60), Victoria ($20.89), and Tasmania ($20.86) are quite similar in magnitude, while the means for South Australia ($20.24) and Western Australia ($20.24) are identical. The means for the Australian Capital Territory ($21.47) and the Northern Territory ($21.26) are quite similar in magnitude too, especially when one considers their standard deviations ($0.62 and $1.14, respectively).

The ranges presented in Table 2 indicate that GP real gross prices have not been static under Medicare. The smallest temporal range in Table 2 is that for Victoria, where the minimum mean price for the time series was $19.93, and the maximum mean price was $21.79, i.e. a (maximum) temporal variation of around nine per cent over the sample period. The largest temporal range is for South Australia, where the temporal minimum was $17.94

TABLE 1
AVERAGE GROSS PRICES OF GENERAL PRACTITIONER SERVICES, SELECTED QUARTERS FOR THE STATES/TERRITORIES AND AUSTRALIA 1984(3) TO 1996(3) QUARTER, 1996 $s (1989-90 prices)

	1984(3)	1986(3)	1988(3)	1990(3)	1992(3)	1994(3)	1996(3)
AUSTRALIA	21.27	19.49	19.99	19.76	21.28	21.16	20.14
NSW	22.43	20.29	19.79	19.51	21.08	21.16	20.14
Vic	21.58	19.93	20.54	20.23	21.50	21.40	20.61
Qld	19.53	18.17	19.54	19.50	21.13	20.84	20.04
SA	19.72	17.94	19.96	20.00	21.36	21.19	20.38
WA	19.77	18.07	19.92	19.32	21.34	21.36	20.36
Tas	20.97	19.34	20.24	20.46	21.94	21.85	20.98
ACT	21.95	20.67	20.63	21.07	22.04	22.28	21.97
NT	20.60	19.97	20.37	20.82	22.33	22.70	22.13

Notes: (i) The average gross prices referred to here relate to all GP services, including vocationally-registered and unreferred services.

(ii) The notation "1984(3)" refers to the September (third) quarter of 1984, and so on.

(iii) The GP services referred to here relate to the following Item numbers in the *Medicare Benefits Schedule Book*: 1-84, 86, 87, 89-93, 95-98, 101, 160-173, 980, 996-998 and 17600.

Sources: Calculated from data supplied by the Commonwealth Department of Health and Family Services (1997) and the Australian Bureau of Statistics (various).

TABLE 2
SOME SUMMARY STATISTICS FOR GROSS PRICE DATA FOR GENERAL PRACTITIONER SERVICES FOR THE AUSTRALIAN STATES/TERRITORIES, 1984(3) TO 1996(3), $s (1989-90 Prices)

	NEW SOUTH WALES	VICTORIA
Mean	20.60	20.89
SD	0.73	0.48
Range	19.06-22.43	19.93-21.79
	QUEENSLAND	SOUTH AUSTRALIA
Mean	19.97	20.24
SD	0.83	0.94
Range	18.17-21.29	17.94-21.67
	WESTERN AUSTRALIA	TASMANIA
Mean	20.24	20.86
SD	0.91	0.85
Range	18.07-21.78	19.34-22.22
	AUSTRALIAN CAPITAL TERRITORY	NORTHERN TERRITORY
Mean	21.47	21.26
SD	0.62	1.14
Range	20.32-22.50	19.73-23.03

Note: SD is the standard deviation.
Sources: As for Table 1.

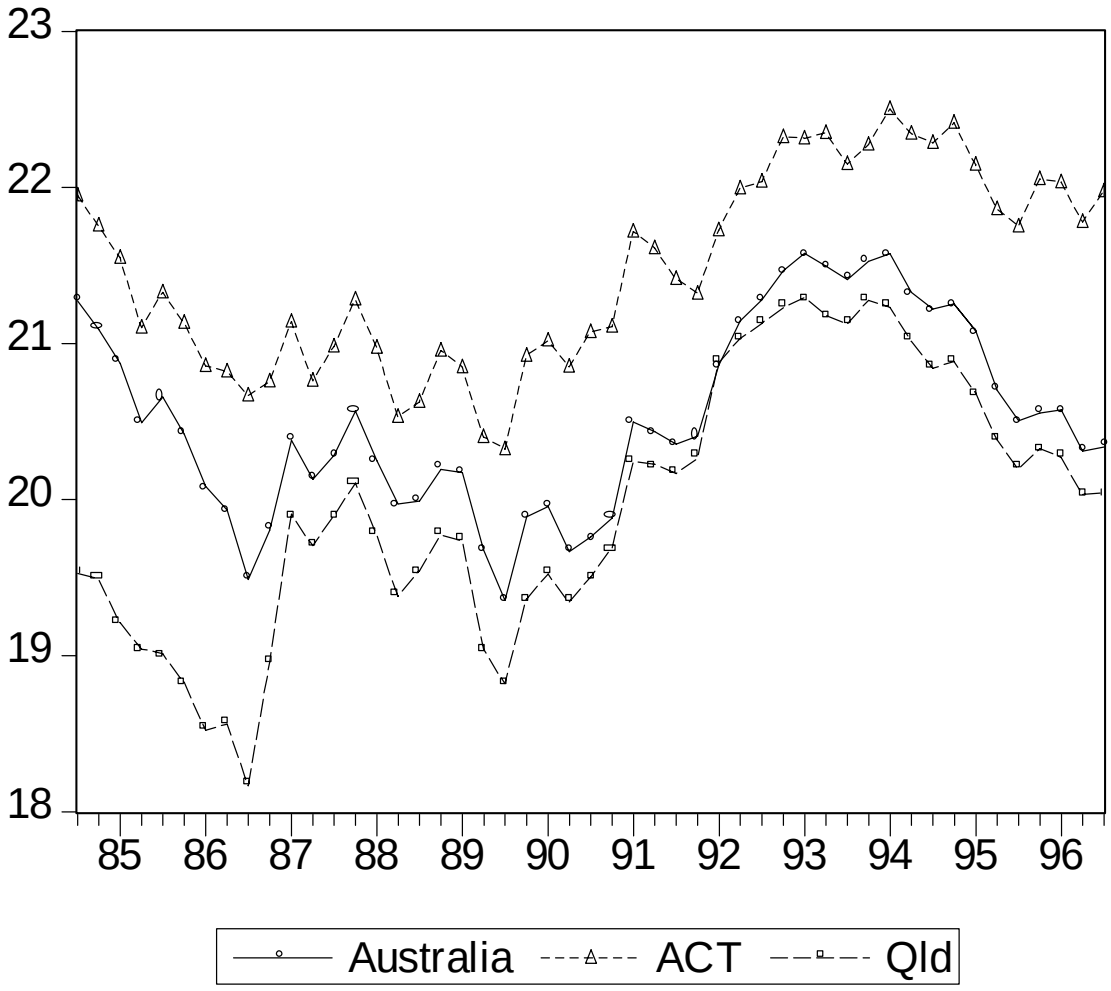
and the maximum, $21.67, i.e. a (maximum) temporal variation of around 21 per cent over the sample period.

An alternative method of considering the temporal behaviour of GP gross prices is via plots of the time-series data. Figure 1 presents the quarterly data on mean gross prices for GP services for Queensland, the Australian Capital Territory, and for Australia as a whole. Figure 1 provides both a visual indication of the temporal activity of prices in Australia and an indication of the spatial ranges of GP gross prices. Queensland and the Australian Capital Territory were chosen because these two regions generally have the lowest and highest gross prices, respectively, over the period 1984(3) to 1996(3).

It is also useful to consider plots of GP gross prices for each specific region of Australia. Figure 2 provides plots for the six states and two territories for the period 1984(3) to 1996(3). These plots suggest first, that the temporal activity of GP prices is apparently different between the regions. Second, for the period being analysed, cyclical patterns in the data are evident. The existence of cyclical patterns suggests that linear time trends would provide very poor fits to the data. Third, there are some systematic differences between some quarterly observations. This suggests that any statistical analysis of the data may have to recognise that they may be affected by temporal recording.

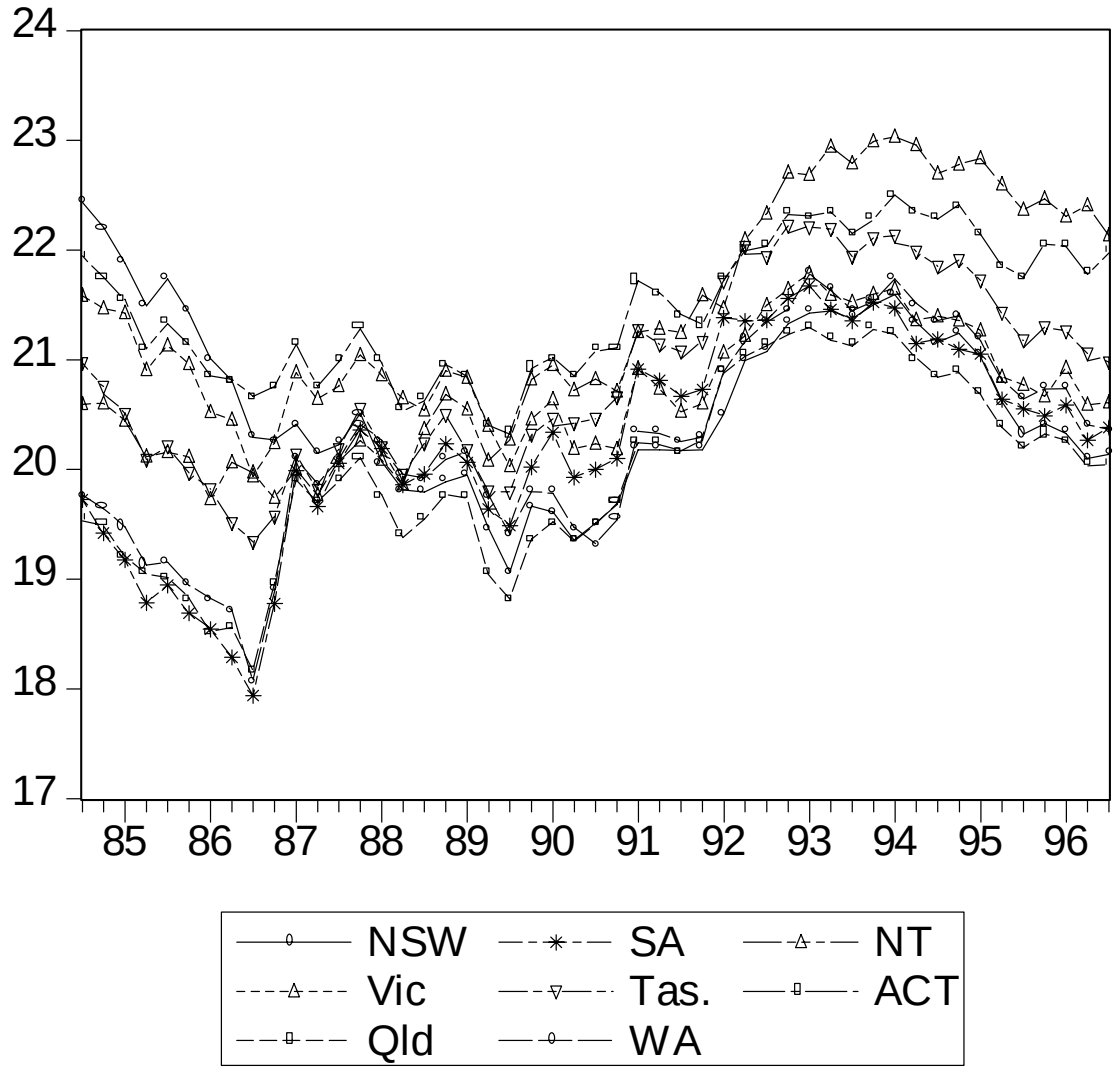
The summary statistics and plots presented in this section provide some information about GP price behaviour under Medicare. However, the information conveyed is somewhat limited. Attention is now directed to a more detailed analysis, via multiple regression, of GP price behaviour over time and by region, under Medicare.

FIGURE 1
AVERAGE GROSS PRICES OF GENERAL PRACTITIONER SERVICES, AUSTRALIA AND SELECTED STATES, 1984(3) TO 1996(3)
$s (1989-90 Prices)



Notes: As for Table 1.
Sources: As for Table 1.

FIGURE 2
GROSS PRICES OF GENERAL PRACTITIONER SERVICES FOR THE AUSTRALIAN STATES AND TERRITORIES, 1984(3) TO 1996(3)
$s (1989-90 Prices)



Notes: As for Table 1.
Sources: As for Table 1.

2.2 The Method of Analysis

An appropriate method via which to find concrete answers to the questions posed at the beginning of this section is to estimate and test, time trend regression equations on GP prices. The data plots above revealed some non-linearities in the time-series. However, prior to considering issues of functional form, it is useful to start by considering the simple (linear) time trend models:

$$P_{GP(i)t} = \alpha_1 + \alpha_2 t + \alpha_k X_k + \mu_t \quad (1)$$

$$P_{GP(j)_t} = \beta_1 + \beta_2 t + \beta_k X_k + e_t \quad (2)$$

where $P_{GP(i)t}$ is the gross price of GP services in region i in period t,

t is time,

X_k is a vector of other variables that may affect $P_{GP(i)t}$,

u_t is a well-behaved error term,

$P_{GP(j)t}$ = is the gross price of GP services in region j in period t,

e_t is a well-behaved error term, and

α_1, α_2, α_k, β_1, β_2 and β_k are parameters to be estimated.

The primary purpose of estimating equations like (1) and (2) above is, in the context of this paper, to determine the magnitudes of the slope coefficients, $\forall_2$ and $\exists_2$, in various regions. The importance of the slope coefficients in such models is as follows: if a slope coefficient is positive and statistically significant, then there is an upward trend in gross prices; if a slope coefficient is negative and statistically significant, there is a downward trend in gross prices; whereas if a slope coefficient is either zero numerically, or statistically so, there is no trend, i.e. there is no change in gross prices over time.

Estimation of such equations also provides a simple means of answering the following question: "is there a significant difference in the gross prices of GP services provided in regions i and j?" Statistical tests on the intercept coefficients (α_1 and β_1) and the slope coefficients (α_2 and β_2) will provide the answer to that question.

An alternative procedure is to estimate, rather than linear trend models, the following semilog (or more specifically log-linear) models:

$$\ln P_{GP(i)t} = \alpha_1 + \alpha_2 t + \alpha_k X_k + u_t \quad (3)$$

$$\ln P_{GP(j)t} = \beta_1 + \beta_2 t + \beta_k X + e_t \quad (4)$$

Equations (3) and (4) differ from equations (1) and (2) only in the dimension that the regressand is in the logarithmic form (to base *e*). This difference creates an important distinction in terms of the interpretation of the estimated slope coefficients in (1) and (2) compared to (3) and (4). In equations (1) and (2) the slope coefficients indicate the **absolute** change in gross prices. However, in equations (3) and (4) the slope coefficients measure the **constant proportional** or **relative** change in gross prices. Note that the slope coefficients in equations (3) and (4) can be interpreted as percentage growth rates by multiplying the coefficients by 100. Such coefficients in equations (3) and (4) indicate instantaneous, not compound, growth rates. For details see Gurajati (1995, pp.165-71).

2.2 Some Empirical Results

As expected, the estimation of linear time trends (see equations (1) and (2)) produced very poor fits in terms of adjusted R^2. Furthermore diagnostic tests indicated serious problems such as serial correlation and heteroscedasticity. Attempts to fit cubic and quartic equations produced better fits but the econometric "pathologies", as manifested by diagnostic tests, especially the Durbin-Watson test statistic remained. Estimation of log-lin models (see equations (3) and (4)) also produced better fits but serial correlation remained a problem. A plot of the residuals also confirmed that autocorrelation was a problem. The next step involved treating the serial correlation directly via the insertion of an autoregressive process in the equation. This modelling exercise, generally, solved the serial correlation problem.

With respect to the $\mathbf{X_k}$ variables, three factors were considered likely to have a substantial affect on the price data. First, the systematic differences associated with the temporal recording of the (quarterly) data were addressed via the insertion of the quarterly dummies, DUMJUN, DUMSEP and DUMDEC. Second, a dummy variable, USFRDV, was inserted for the movement to a nationally uniform system of schedule fees in the *Medicare Benefits Schedule Book* in 1986. Third, the advent of vocational registration on 1 December 1989 was also modelled with a dummy variable (VRDV).

Table 3 presents the results of these equations as estimated for the eight geographical regions considered in this study. The eight equations reported in Table 3 perform quite well in terms of adjusted R^2 and all equations pass the *F*-test. The data on which all eight equations have been estimated are subject to a first order autoregressive process. The AR(1) coefficients reported in Table 3 are the first order coefficients of autocorrelation, and all are statistically significant at the one per cent level. The Augmented-Dickey Fuller test has been applied to the residuals of each equation and the test results indicate that the residuals of each equation are integrated of order zero (I(0)), i.e. the residuals are stationary. This gives some confidence that the regression results are not spurious.

While the primary focus in this study is on the estimated coefficients on time, it is worthwhile first, to consider the results on the seasonal and institutional dummy variables. First, it is apparent that seasonality affects the price data in all regions, since at least one of the seasonal dummies (DUMJUN, DUMSEP, DUMDEC) is statistically significant in every region. The estimated coefficients on the dummy variable for the introduction of vocational registration (VRDV) are all positive, four are significant at the five per cent level, two more are significant at the ten per cent level, and two are not significant at the ten per cent level.

The magnitude of the coefficients on VRDV is small in every region. In fact, the coefficient is +0.02 in six of the eight regions. Since the model estimated is a lin-log model, the effect of VR on the price of GP services in each region can be calculated by multiplying the estimated coefficient on the variable VRDV by 100. For example, for regions where the estimated coefficient on VRDV is +0.02 and significant, the interpretation of the coefficient is that VR increased the mean gross prices of GP services by around two per cent. Thus, the estimated coefficients and *t*-statistics on VRDV indicate that vocational registration had a positive and significant influence on GP gross prices in every region except Victoria and Western Australia.

The uniform schedule fee revision dummy variable, USFRDV, was included in three of the equations estimated on GP gross prices, *viz.* the equations for Queensland, South Australia and Western Australia since *Schedule* fees in those states were affected by the 1986 revisions. The coefficient on USFRDV is positive in all three equations, but statistically significant only in Queensland and South Australia. Again, the semilog specification means that multiplication of the estimated coefficient by 100 provides an estimate of the proportional impact of the uniform *Schedule* fee revision. The relative magnitude of the effect of the revision varies quite substantially: in Western Australia the literal increase in gross prices was zero, since the coefficient on USFRDV is statistically insignificant in that state; in Queensland the revision gave rise to a 1.7 per cent increase in GP gross prices; and in South Australia the revision had the largest impact, increasing the average GP gross price per consultation by around three per cent.

TABLE 3

SEMILOG (LOG-LIN) EQUATIONS OF GROSS PRICES OF GENERAL PRACTITIONER SERVICES IN AUSTRALIAN STATES/TERRITORIES, 1984(3) TO 1996(3), *In* $s (Constant 1989-90 Prices)

	Intercept	Time	June DV	Sept DV	Dec DV	VRDV	USFRDV	AR(1)	$\overline{R}^2$	B-G Serial Correlation	Order of integration of the residuals
NSW	2.94* (39.34)	0.001 (0.73)	-0.007** (-2.21)	-0.008** (-2.32)	-0.002 (-0.63)	0.02** (2.16)	-	0.91* (20.51)	0.91	77.59*	1.90 I(0)
Vic	3.02* (123.14)	0.0004 (0.52)	-0.012** (-3.73)	-0.01* (-3.68)	-0.008** (-2.60)	0.02 (1.20)	-	0.82* (10.39)	0.74	23.85*	0.43 I(0)
Qld	0.38*** (1.85)	-0.0005 (-1.67)	-0.01** (-2.49)	-0.008 (-1.42)	0.003 (0.65)	0.018** (2.53)	0.017** (2.49)	0.87* (12.53)	0.92	66.39*	0.51 I(0)
SA	2.99* (100.95)	0.002 (1.55)	-0.02* (-4.83)	-0.02* (-3.95)	-0.01* (-3.03)	0.02** (2.10)	0.03* (3.69)	0.89* (11.63)	0.92	79.93*	1.11 I(0)
WA	0.36 (1.61)	0.0004 (0.94)	-0.02* (-3.30)	-0.02* (-2.89)	-0.003 (-0.55)	0.007 (0.67)	0.01 (1.60)	0.88* (11.57)	0.89	52.93*	0.47 I(0)
Tas	2.96* (96.53)	0.002** (2.23)	-0.009** (-2.81)	-0.01** (-2.65)	-0.003 (-0.96)	0.02*** (1.73)	-	0.85* (12.24)	0.93	93.49*	1.22 I(0)
ACT	3.01* (149.34)	0.001** 2.29	-0.009* (-3.42)	-0.009 (-2.70)	-0.003 (-0.97)	0.02** (1.98)	-	0.08* (11.11)	0.89	62.39*	0.53 I(0)
NT	2.96* (108.90)	0.003* (3.61)	-0.003 (-1.008)	-0.003 (-0.82)	0.001 (0.44)	0.02*** (1.71)	-	0.84* (10.82)	0.95	155.14*	0.5 I(0)

Notes:
(i) The average gross prices referred to here relate to all GP services, including vocationally-registered and unreferred services.
(ii) AR(1) is the first-order coefficient of autocorrelation.
(iii) JUNEDV, SEPTDV and DECDV are quarterly intercept dummy variables (DV).
(iv) VRDV is a dummy variable = 0 for the period 1984(3) to 1989(3); and =1 for the period 1989(4) to 1996(3) to take account of vocational registration of GPs.
(v) USFRDV is a dummy variable = for the period 1984(3) to 1986(2); and =1 for the period 1986(3) to 1996(3) to take account of the introduction of the uniform schedule fee revision.
(vi) B-G Serial Correlation is an *F*-test of the hypothesis that the residuals of the regression are serially correlated for up to order p=4.
(vii) I(0) indicates that the residuals are integrated of order zero. Asterisks attached to I(0) indicates that the Augmented Dickey-Fuller (ADF) test statistic is statistically significant at the one, five and ten per cent levels, respectively.
(viii) One, two and three asterisks indicate statistical significance at the one, five and ten per cent levels, respectively.
(ix) Data in parentheses are *t*-statistics.
(x) The GP services referred to here relate to the Item numbers listed in the Notes to Table 1.

Attention is now directed to the coefficients that are of primary interest in the context of this paper, i.e. those estimated on time. In five states (New South Wales, Victoria, Queensland, South Australia and Western Australia) these coefficients are not statistically different from zero. Thus, in Victoria and Western Australia, where the impact of VR was (statistically) zero, it may be said that GP gross prices have not fallen or risen over the period 1984(3) to 1996(3). In New South Wales, Queensland and South Australia it may be said that there has been no temporal change in prices, with the exception of the VR-induced shock of approximately +2 per cent. By contrast, the time coefficients are statistically significant and positive for three regions, *viz*. Tasmania, the Australian Capital Territory and the Northern Territory. These coefficients are 0.002, 0.001 and 0.003 for the three regions respectively. What these coefficients indicate is that in the period 1984(3) to 1996(3) gross prices of GP services increased at the rate of 0.2 per cent per quarter in Tasmania, 0.10 per cent per quarter in the Australian Capital Territory, and 0.30 per cent per quarter in the Northern Territory. The price growth that has occurred in each of those regions is additional to the VR-induced shock of approximately +2 per cent in each of those regions.

Table 4 provides a comprehensive indication of the instantaneous and compound growth rates of GP gross prices, the proportional increase in prices due to the introduction of the vocational register, and the total change in GP mean gross prices over the period 1984(3) to 1996(3). The compound growth rates presented in Table 4 have been calculated by multiplying the instantaneous growth rates, or growth rates per quarter that were derived from the estimated coefficients on time in Table 3, by the number of quarters in the sample, i.e. 49. The third column of Table 4, labelled VR Shock is the percentage price shock associated specifically with the introduction of VR, and was calculated from the estimated coefficients on VRDV in Table 3. The summation of the compound growth rate and VR Shock statistics provides an estimate of the overall growth of GP mean gross prices over the sample period.

Table 4 shows that GP prices have not risen or fallen in two states, *viz.* Victoria and

TABLE 4
APPROXIMATE COMPOUND GROWTH RATES OF GENERAL PRACTITIONER REAL (MEAN) GROSS PRICES FOR THE PERIOD 1984(3) TO 1996(3)

	Instantaneous Growth Rate (%)	Approximate Compound Growth (%)	VR Shock (%)	Total Price Growth (=Compound Price Growth + VR Shock) (%)
NSW	0.0	0.0	2.0	2.0
Vic	0.0	0.0	0.0	0.0
Qld	0.0	0.0	1.8	1.8
SA	0.0	0.0	2.0	2.0
WA	0.0	0.0	0	0.0
Tas	0.2	9.8	2	11.8
ACT	0.1	4.9	2	6.9
NT	0.3	14.7	2	16.7

Notes: (i) The instantaneous growth rate is the growth rate of GP mean gross prices per quarter and is calculated by multiplying estimated coefficients on time (Table 3) by 100.

(ii) The compound growth rate is the total growth of GP gross prices over the entire sample period, 1984(3) to 1996(3) and is calculated by multiplying the instantaneous growth rate (i.e. the growth rate per quarter) by the number of quarters (49).

(iii) The VR Shock referred to here is the estimated percentage influence of the introduction of vocational registration on GP mean gross prices and is calculated by multiplying the estimated coefficient (Table 3) on the vocational registration dummy variable, VRDV, by 100.

(iv) Total Price Growth is the total change in GP prices over the period 1984(3) to 1996(3), and is calculated as the sum of the compound growth rate and the VR shock.

Source: Calculated from Table 3.

Western Australia. The data also reveal that GP price growth in New South Wales, Queensland and South Australia over the sample period was entirely due to the introduction of VR, i.e. there is no temporal price effect. In the remaining regions, however, substantial temporal price growth has occurred. In Tasmania, GP mean gross prices have grown 11.8 per cent, and 9.8 per cent of that growth is unrelated to the introduction of VR. GP real price growth in the Australian Capital Territory for the period 1984(3) to 1996(3) was 6.9 per cent and 4.9 per cent of that statistic is unrelated to the introduction of VR. Price growth was greatest in the Northern Territory, where price growth from 1984(3) to 1996(3) was approximately 16.7 per cent, 14.7 per cent is the temporal effect, i.e. the effect unrelated to the introduction of a vocational register for GPs. These data, again, suggest that substantive spatial differences in price outcomes exist under Medicare, and that temporal price behaviour is not uniform across space.

The next step in the analysis is to ask the following question: is the equation describing the time-series of gross prices in a particular state/territory different from an equation describing the time-series of gross prices in another state/territory? To answer this question, a Wald coefficient restriction test has been applied. For an explanation of the Wald coefficient restriction test see e.g., Hall, Lilien, Sueyshi *et al.* (1995, pp.216-20). Emphasis here is placed on the intercept coefficient and the coefficient of proportional change through time. In this context, it is not necessary to use the Chi-square statistic for the Wald test, since the use of that statistic is only necessary if there is non-linearity in the parameters. The Wald test statistics used for the analyses presented here are *F*-statistics.

Table 4 presents the results of 28 pairwise comparisons of equations of time-series data on gross prices of GP services by state/territory. The structure of this table is such that the results are presented in seven "blocks" (of diminishing size) for New South Wales, Victoria, Queensland, South Australia, Western Australia, Tasmania and the Australian Capital Territory. The table provides a comparison of each state/territory with all others. For example the first row of this table compares the equation for New South Wales with that of Victoria. It is then superfluous to compare Victoria with New South Wales in the second "block" of the table. Thus the 28 rows in Table 4 represent 56 (literal) pairwise comparisons of equations (or, equivalently, 112 intercept and trend comparisons).

There is a large amount of information in Table 5. However, it is convenient for the purposes of discussion and reasons of space, to focus on the last column Table 5. That column reveals that, of the 28 pairwise comparisons, 24 of the equations involved in those comparisons are different. Put otherwise, only four of the equations are statistically equivalent. Thus, it is clear that spatial differences in GP gross prices dominate in the time-series data considered here.

TABLE 4
WALD COEFFICIENT RESTRICTION TESTS ON ESTIMATED INTERCEPT AND SLOPE PARAMETERS FOR PRICES OF GENERAL PRACTITIONER SERVICES, AUSTRALIAN STATES AND TERRITORIES, 1984(3) TO 1996(3)

State/ Territory	Comparison with	Intercept (Wald *F*)	Slope (Wald *F*)	Are Coefficients Different?		Are Equations Different?
				Intercept	Slope	
NSW	VIC	8.07* (0.007)	0.02 (0.923)	Y	N	Y
	QLD	156.91* (0.000)	2.79 (0.102)	Y	N	Y
	SA	135.32* (0.000)	1.59 (0.215)	Y	N	Y
	WA	133.31* (0.000)	0.01 (0.943)	Y	N	Y
	TAS	0.56 (0.460)	4.98** (0.031)	N	Y	Y
	ACT	12.71* (0.001)	5.27** (0.027)	Y	Y	Y
	NT	0.35 (0.56)	2.68 (0.11)	N	N	N
Vic	QLD	166.55* (0.000)	2.79 (0.102)	Y	N	Y
	SA	144.29* (0.000)	1.59 (0.215)	Y	N	Y
	WA	141.44* (0.000)	0.01 (0.943)	Y	N	Y
	TAS	3.16*** (0.083)	4.98** (0.031)	Y	Y	Y
	ACT	0.08 (0.783)	5.27** (0.027)	N	Y	Y
	NT	5.42** (0.025)	13.01* (0.001)	Y	Y	Y
Qld	SA	0.81 (0.374)	1.59 (0.215)	N	N	N
	WA	0.01 (0.930)	0.01 (0.943)	N	N	N
	TAS	7087.52* (0.000)	4.98** (0.031)	Y	Y	Y
	ACT	17045.73* (0.000)	5.27** (0.027)	Y	Y	Y
	NT	9012.65* (0.000)	13.01* (0.001)	Y	Y	Y
SA	WA	138.15* (0.000)	0.01 (0.943)	Y	N	Y
	TAS	0.59 (0.45)	4.98** (0.031)	N	Y	Y
	ACT	1.60 (0.213)	5.27** (0.027)	N	Y	Y
	NT	1.40 (0.244)	13.01* (0.001)	N	Y	Y
WA	TAS	7190.53* (0.000)	4.98 (0.031)	Y	Y	Y
	ACT	17288.85* (0.000)	0.01 (0.943)	Y	N	Y
	NT	0.36* (0.000)	13.01 (0.001)	Y	Y	Y
Tas	ACT	5.90* (0.020)	0.76 (0.388)	Y	N	Y
	NT	0.10 (0.754)	1.55 (0.221)	N	N	N
ACT	NT	4.50** (0.040)	3.59 (0.065)	Y	Y	Y

Notes: (i) "Y" (YES) in this table means that there is a statistically significant difference between the intercept or

slope coefficient in the equation for the specified state/territory (column (1)) compared with the states/territories in column (2).

(ii) "N" (NO) in this table means that there is no statistically significant difference between the intercept or slope coefficient in the equation for the specified state/territory (column (1)) compared with the states/territories in column (2).

(iii) Column (7) summarises the results indicated in columns (3) to (6): a "Y" (YES) in column (7) indicates that there is either a statistically significantly different intercept or slope term, thus indicating that the relevant equations being compared, are different, and "N" (NO) in column (7) means that neither the intercept nor the slope coefficients are statistically different in the equations being compared.

(iv) One, two and three asterisks indicate statistical significance at the one, five and ten per cent levels, respectively.

(v) Statistics reported in this table are Wald *F*-statistics. Statistics in parentheses are probabilities.

(vi) The services here relate to the Item numbers listed in the Notes to Table 1.

Source: Calculated from the results presented in Table 3.

3. THE POST-VOCATIONAL REGISTRATION PERIOD

The introduction of VR involved the specification of different schedule fees for GP services provided by vocationally registered GPs, compared to schedule fees for services provided by GPs who were not on the vocational register. In the previous analysis this institutional change was modelled by an intercept dummy variable, the coefficients on which generally indicated that VR had a positive influence on GP gross prices.

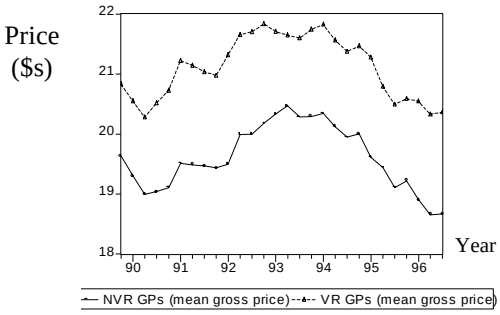
This section is concerned, however, with specific comparisons of the gross prices charged by VR and NVR GPs over time and across space. In order to examine these categories of services, the analysis is restricted to the period 1989(4) to 1996(3), since VR was introduced on 1 December, 1989. The restricted sample represents 28 quarterly observations.

To begin, it is useful to consider plots of the data for the two categories of GP services for each of the Australian states/territories since 1989(4), which are provided in Figure 3. Casual inspection of the plots suggests that there are some differences between gross prices for VR and NVR GP services between the regions of Australia. Thus, the plots in Figure 3 essentially confirm, albeit at a more disaggregated (VR and NVR) level, the general impression conveyed by Figure 2: spatial differences in prices and their behaviours over time, exist. There is, perhaps, little point in investigating inter-state differences in the prices of VR services and the prices of NVR services separately in any more detail, since the previous section provided a detailed inter-state analysis of GP mean gross prices. However, two questions that do bear further investigation is are NVR and VR GP gross prices (statistically)

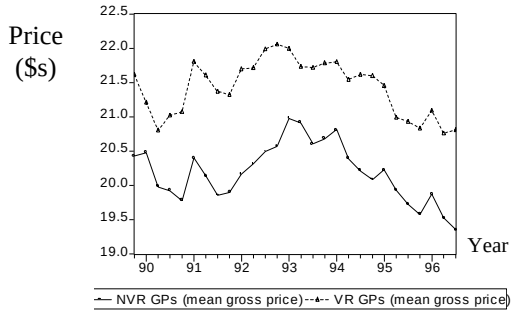
FIGURE 3

GROSS PRICES OF VOCATIONALLY REGISTERED AND NON-VOCATIONALLY REGISTERED GENERAL PRACTITIONER SERVICES, AUSTRALIAN STATES/TERRITORIES, 1989(4) TO 1996(4), $s (Constant 1989-90 Prices)

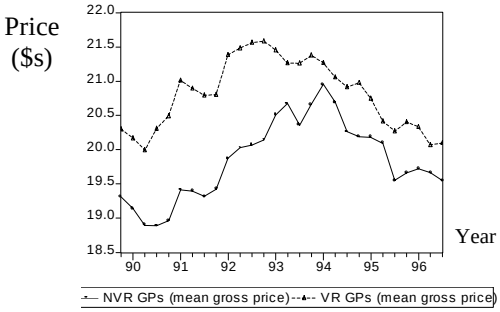
NEW SOUTH WALES



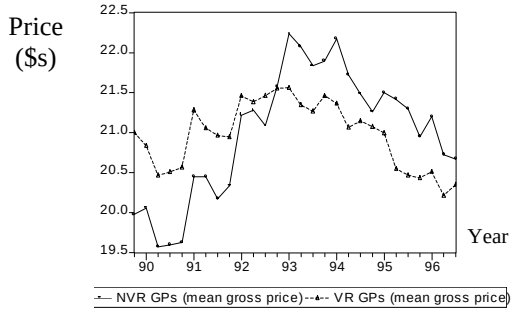
VICTORIA



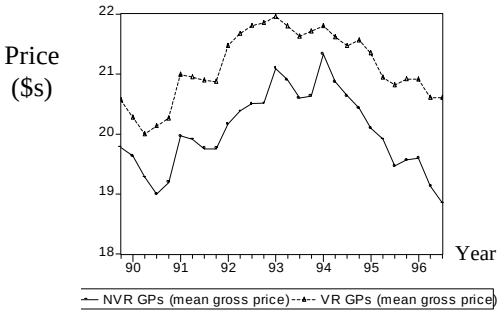
QUEENSLAND



SOUTH AUSTRALIA



WESTERN AUSTRALIA



TASMANIA

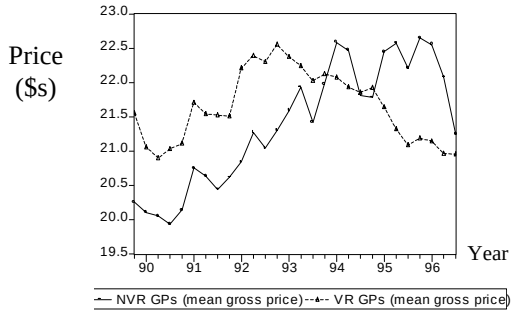
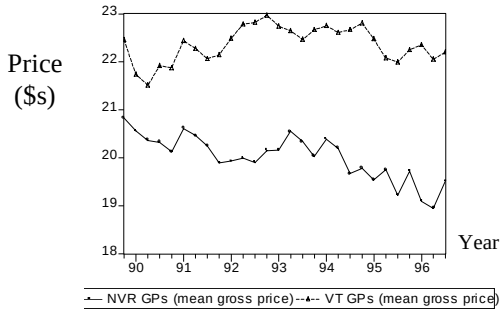
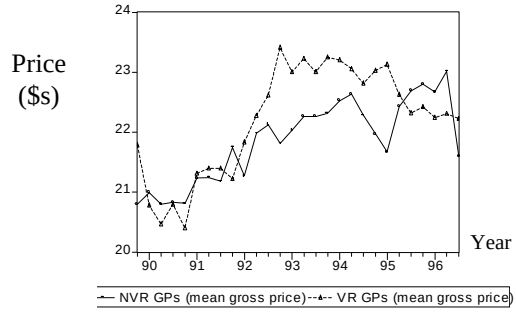


FIGURE 3 (cont'd)

AUSTRALIAN CAPITAL TERRITORY



NORTHERN TERRITORY



Notes: As for Table 1.
Source: As for Table 1.

significantly different within regions? and is the temporal behaviour of VR and NVR gross prices (statistically) significantly different within the regions of Australia?

Attention is now directed to answering the preceding questions by analysing intra-state prices for VR GP services and for NVR GP services. The analysis involves the estimation of semi-log (log-lin) multiple regression equations with the (general) functional form of equations (3) and (4), on VR and NVR gross price data, by region, through time. Statistical tests are then conducted to test for differences (in terms of both intercepts and slopes) between the VR and NVR equation for each region, with the following interpretation of results: if the intercepts of the VR and NVR equations are different, then the mean gross prices charged by VR and NVR GPs are statistically different; if the slope coefficients of the VR and NVR equations are different, then VR and NVR mean gross prices have behaved differently over time.

Table 6 presents the results of 16 estimated equations. As with Table 3, the equations here are "growth models" and the functional form has been chosen for the same reasons as were indicated for Table 3. However, unlike the data on which the equations of Table 3 were estimated, the data for the Table 6 equations are subject to AR(1) processes only. Furthermore, given the time period since the introduction of VR, the uniform schedule fee dummy variable is irrelevant. However, the data are (generally) subject to seasonal effects, as indicated by the statistical significance of a number of the coefficients on the seasonal dummy variables, DUMJUN, DUMSEP and DUMDEC.

The equations perform quite well in terms of $\overline{R}^2$ and all but one of the equations passes the *F*-test at the one per cent level. The exception is the VR equation for the Australian Capital Territory which passes the *F*-test at the five per cent level. The Breusch-Godfrey test statistic indicates that the residuals of the equations have been purged of serial correlation by the inclusion of the AR(1) term. Furthermore, the Augmented Dickey-Fuller (ADF) test reveals that the residuals of the equations reported in Table 6 are integrated of order zero, and hence the error term is stationary.

TABLE 6

LOG-LINEAR (LOG-LIN) EQUATIONS OF GROSS PRICES OF VOCATIONALLY REGISTERED AND NON-VOCATIONALLY REGISTERED GENERAL PRACTITIONER SERVICES, AUSTRALIAN STATES/TERRITORIES, 1989(4) TO 1996(3)

ln $s (Constant 1989-90 Prices)

	Intercept	Time	JUNE DV	SEPT DV	DEC DV	AR(1)	$\overline{R}^2$	*F*	B-G	Order of Integr. of Residuals
NSW										
(VR)	3.50*	-0.01	-0.01***	-0.01***	-0.002	0.95*	0.83	26.50*	1.44	I(0)***
	(3.00)	(-0.52)	(-1.88)	(-1.89)	(-0.60)	(11.28)				
(NVR)	3.66**	-0.01	-0.001	-0.005	0.002	0.96*	0.81	24.19*	0.06	I(0)***
	(1.81)	(-0.46)	(-0.42)	(-1.03)	(0.54)	(10.85)				
Vic										
(VR)	3.13*	-0.002	-0.01*	-0.008**	-0.006	0.87*	0.68	12.28*	1.29	I(0)*
	(31.61)	(-0.70)	(-3.02)	(-1.82)	(-1.69)	(7.17)				
(NVR)	3.20*	-0.004	-0.01*	-0.02*	-0.015*	0.91*	0.79	21.23*	0.22	I(0)***
	(10.73)	(-0.76)	(-3.35)	(-4.38)	(-4.50)	(8.95)				
Qld										
(VR)	3.45*	-0.008	-0.008**	-0.007**	-0.003	0.94*	0.86	32.31*	0.55	I(0)*
	(5.01)	(-0.76)	(-2.56)	(-1.96)	(-0.81)	(12.32)				
(NVR)	3.34*	-0.006	-0.004	-0.015	-0.009**	0.95*	0.88	38.82*	0.26	I(0)***
	(3.15)	(-0.39)	(-1.09)	(-3.70)	(-2.57)	(11.43)				
SA										
(VR)	3.17*	-0.003*	-0.01*	-0.01**	-0.007**	0.91*	0.78	19.97*	0.51	I(0)**
	(16.33)	(-0.77)	(-3.77)	(-2.75)	(-2.30)	(9.07)				
(NVR)	3.92	-0.01	-0.01*	-0.02*	-0.02*	0.97*	0.90	47.80*	0.32	I(0)*
	(1.07)	(-0.31)	(-3.11)	(-4.49)	(-4.78)	(11.51)				
WA										
(VR)	3.60**	-0.009	-0.008**	-0.01**	-0.006	0.96*	0.84	28.49*	0.81	I(0)*
	(1.85)	(-0.38)	(-2.22)	(-2.20)	(-1.69)	(11.23)				
(NVR)	10.19	-0.06	-0.009***	-0.02*	-0.02*	0.99*	0.83	27.47*	0.16	I(0)*
	(0.09)	(-0.12)	(-2.07)	(-3.61)	(-3.36)	(11.25)				
Tas										
(VR)	3.24*	-0.003	-0.005	-0.008	-0.002	0.92*	0.77	17.98*	0.15	I(0)**
	(9.98)	(-0.61)	(-1.33)	(-1.62)	(-0.54)	(9.29)				
(NVR)	3.18**	-0.001	-0.001	-0.02*	-0.01**	0.94*	0.94	50.61*	0.18	I(0)*
	(2.52)	(-0.07)	(-0.31)	(-4.33)	(-2.58)	(4.80)				
ACT										
(VR)	3.09*	0.0005	-0.007	-0.005	0.0007	0.73*	0.48	5.86**	0.58	I(0)*
	(71.06)	(0.49)	(-1.43)	(-1.01)	(0.16)	(4.79)				
(NVR)	3.08*	-0.002*	0.002	-0.003	0.0004	0.33	0.61	9.31*	0.24	I(0)*
	(159.32)	(-4.38)	(0.28)	(-0.43)	(0.06)	(1.64)				
NT										
(VR)	2.98*	0.003	-0.002	-0.004	0.0003	0.83*	0.77	18.90*	0.86	I(0)*
	(23.83)	(0.98)	(-0.28)	(-0.50)	(0.04)	(6.38)				
(NVR)	2.99*	0.003*	0.01	-0.001	-0.001	0.46***	0.70	13.87*	0.86	I(0)*
	(91.12)	(3.01)	(1.37)	(-0.16)	(0.17)	(1.85)				

Notes: As for Table 3.

In terms of the estimated VR and NVR intercepts and coefficients, quick inspection reveals that the estimated intercept parameters for VR and NVR equations are typically of similar magnitudes. The exception is the intercept estimated on non-VR prices in Western Australia where the numerical value (10.19) is abnormally high but is statistically insignificant. In relation to the estimated VR and NVR slope (time) coefficients it may be said that generally the estimated coefficients are statistically insignificant at conventional levels, with the exception of the coefficients estimated on the non-VR equations in the Australian Capital Territory and the Northern Territory.

The existence or otherwise of differences is most accurately determined by statistical tests on the estimated parameters and the Wald coefficient restrictions test is a useful statistical tool in this context.

Table 7 presents Wald *F*- tests of the hypotheses that the intercept and slope coefficients of the VR or NVR equations (reported in Table 7) are statistically equal. The results are striking and unambiguous: with the exception of one region, *viz.* the Australian Capital Territory, there are no differences between **either** the VR and NVR intercept and slope parameters. Thus, in seven of the eight regions VR and NVR prices are no different on average, and have not behaved in statistically distinguishable manners over time. In the Australian Capital Territory, it may be said that the prices of VR and NVR services are not statistically different (at the intercept), but have behaved differently over time. From the slope coefficients reported for the VR and NVR equations in Table 7, one may conclude that mean NVR gross prices have fallen in that Territory, in comparison with reasonably stable mean VR gross prices.

TABLE 7

WALD COEFFICIENT RESTRICTION TESTS ON ESTIMATED INTERCEPT AND SLOPE PARAMETERS FOR GROSS PRICES OF VOCATIONALLY REGISTERED AND NON-VOCATIONALLY REGISTERED GENERAL PRACTITIONER SERVICES, AUSTRALIAN STATES/TERRITORIES, 1989(4) TO 1996(3)

State/ Territory	Comparison	Intercept (Wald *F*)	Slope (Wald *F*)	Are Coefficients Different?		Are Equations Different?
				Intercept	Slope	
NSW	VR and NVR	0.006	0.02	N	N	N
		(0.94)	(0.88)			
Vic	VR and NVR	0.049	0.22	N	N	N
		(0.83)	(0.65)			
Qld	VR and NVR	0.01	0.15	N	N	N
		(0.92)	(0.70)			
SA	VR and NVR	0.04	0.1	N	N	N
		(0.84)	(0.76)			
WA	VR and NVR	0.004	0.01	N	N	N
		(0.95)	(0.91)			
Tas	VR and NVR	0.002	0.005	N	N	N
		(0.96)	(0.94)			
ACT	VR and NVR	0.368	19.19*	N	Y	Y
		(0.55)	(0.0002)			
NT	VR and NVR	0.0002	0.47	N	N	N
		(0.99)	(0.50)			

Notes: (i) As for Table 3.
(ii) Data in parentheses are *P*- (probability) values**.**

Source: Calculated from the results presented in Table 5.

4. CONCLUSION

Although Medicare operates in a uniform manner across space, the GP price outcomes produced under Medicare are not generally characterised by spatial uniformity. While Australia's fee-for-service health care financing arrangements influence the outcomes in markets for GP services, the analyses presented here indicate that their influence is not absolute. Instruments of health care policy, such as amendments to the *Schedule* are also subject to the moderating influence of markets. For example, the analyses presented in Section 2 showed that the introduction of VR generally increased average price of GP services in most regions of Australia (i.e. the coefficients on VRDV were positive and statistically significant). However, the results in Section 3 show that the effect of VR has not been to introduce a constant VR-NVR price differential, but to increase the prices of both VR and NVR services, the absolute levels of which are (statistically) equal. Thus, it appears that both VR and NVR GPs may have, on average, gained equally in a price-sense from the introduction of the vocational register, despite the non-investment of NVR GPs in the continuing medical education program of their VR counterparts.

This study sheds some light on a number of price-related issues that affect general practice and may inform health care policy relating to general practice. The central conclusion of the paper is that the price outcomes produced in GP markets under Australia's health care financing arrangements do not reflect the uniformity of the Medicare institution.

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