Does Encouragement Differ From Discouragement? A Study of Asymmetry in the Australian Labour Force

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Abstract

In this study, a time series analysis of the relationship over the business cycle between labour force participation and unemployment in Australia is presented using the sample period extending from 1978Q1-2000Q4, with the purpose of testing for the presence of asymmetry. Seasonal adjustment of the variables is performed using the method outlined by Harvey (1989), and the seasonally adjusted data is then detrended using the HP filter. The remaining cyclical components of the series are then utilised for the purposes of testing, producing estimates far more robust than those in antecedent studies. It is found that there is no presence of asymmetry in most cases, in complete contrast to other similar recent studies using Australian data. The only exception to this finding is the detection of the presence of asymmetry for males in the deepness type test.

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Introduction

In this paper, the relationship between labour force participation and employment in Australia, both expressed as a proportion of the working age population, is investigated using data that is seasonally adjusted applying the Harvey (1989) procedure. The magnitude of the correlation between these variables over the business cycle is estimated via the Hodrick and Prescott (1997) (HP) filter, which is employed to extract the cyclical components of these series in a methodology similar to that used by Lenten (2001). This relationship is then tested for the presence of asymmetry over the business cycle, to find whether the ‘degree of discouragement’ is significantly different than the ‘degree of encouragement’.

While empirical studies of this relationship date back to Long (1953) testing the ‘discouraged worker’ effect, asymmetry in the specific areas of employment or participation were virtually non-existent until the classical work of Neftci (1984), who was really the first to perform rigorous econometric testing of macroeconomic variables. Presence of asymmetry of the variables was found, of the description that the path into recession is usually severe (steep) but brief, whereas the path out of recession to boom is sluggish but elongated.[1] The strongest evidence was found on the U.S. unemployment rate in particular. This evidence was later supported by Rothman (1991) and Hussey (1992), who both focussed exclusively on the U.S. unemployment rate.

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[1] Even though asymmetry in macroeconomic variables of this nature had been earlier proposed and observed long before by Burns and Mitchell (1946).

More recently, Baldwin *et al*. (1998) found that job destruction is more cyclically sensitive than job creation. This, coupled with the possibility of job destruction exhibiting steepness, is a possible explanation of asymmetry in unemployment. Although, while asymmetric, Bodman (1998) found that the unemployment rate (in Australia) is not duration dependent. However, little research has been performed internationally on asymmetries in participation or its explicit relationship with employment.

For Australia, the literature is more substantial. Dixon (1995) found evidence of asymmetry in the discouraged worker effect. Dixon used labour force/population and employment/population data in first differences, separating employment/population observations above and below the mean – a form of deepness. It was found that participation is more sensitive to employment when changes when employment is rising (i.e. encouragement is greater in magnitude than discouragement). This is an alternative explanation of asymmetry in the unemployment rate – heading into a boom, an increase in employment causes previously discouraged workers to re-enter the workforce at a rate faster than they exited earlier, making falls in the unemployment rate more protracted than increases. Wooden (1996) (deepness for males and females) and Connolly (1997) (steepness for males only), derived similar results that implied asymmetry in discouragement, although there was no explicit coefficient restriction testing.

The methodology follows in the next section, including a representation of the seasonal adjustment procedure, a justification of the HP filter, and the model used including the types of asymmetry tested for. The results section fully explains the data, as well as the test statistics used and a breakdown of the results. Finally, some analytical and reflective remarks are concluded with.

Methodology

The first order of business is to seasonally adjust all data used in this study. To accomplish this task, all data is taken in original form, and then seasonally adjusted using the univariate version of the basic structural time series model of Harvey (1989), which is model-based. This method is used here in preference to the more commonly utilised X-11 procedure developed by Shiskin *et al.* (1967) because of the highly mechanical nature of the X-11 procedure, and its inability to treat different time series with varying characteristics flexibly, while model-based seasonal adjustment is tailor-made to suit the particular series in question. A more comprehensive argument in favour of model-based seasonal adjustment over the X-11 procedure is forwarded by Moosa and Lenten (2000). The Harvey (1989) model may be represented by

$$x_t = \mu_t + \phi_t + \gamma_t + \varepsilon_t \tag{1}$$

subject to the restrictions: $\text{cov}(\mu_t, \phi_t, \gamma_t) = 0$ and $\varepsilon_t \sim NID(0, \sigma_\varepsilon^2)$, where x_t is the actual observed series, ϕ_t is the cyclical component of the series, μ_t is the trend component of the series, γ_t is the seasonal component of the series, and ε_t is the irregular component of the series. The resulting seasonally adjusted time series, y_t, is obtained by subtracting the estimated seasonal component from the original series, producing the following

$$y_t = x_t - \gamma_t = \mu_t + \phi_t + \varepsilon_t \tag{2}$$

The trend component of the series, which represents the long-term movement of the series, is written in its most general form as a stochastic linear process. Hence

$$\mu_t = \mu_{t-1} + \beta_{t-1} + \eta_t \tag{3}$$

$$\beta_t = \beta_{t-1} + \zeta_t \tag{4}$$

where $\eta_t \sim NID(0,\sigma_\eta^2)$ and $\zeta_t \sim NID(0,\sigma_\zeta^2)$. This representation implies that μ_t follows a random walk with a drift factor, β_t (equation 3), which in turn follows a first-order autoregressive process (equation 4). The μ_t process will collapse to a simple random walk with drift if $\sigma_\zeta^2 = 0$, a simple random walk with no drift if $\beta_t = 0$ as well, and a deterministic linear trend if $\sigma_\eta^2 = 0$. On the other hand, μ_t will change relatively smoothly if $\sigma_\eta^2 = 0$ and $\sigma_\zeta^2 \neq 0$.

Of the most significance, however, is the form that the seasonal component takes. Of the numerous specifications the seasonal component can take, the one employed in this study is the stochastic specification (see Harvey, 1989, Chapter 2; Koopman *et al*., 2000), which means that the seasonal component is specified as

$$\gamma_t = \sum_{j=1}^{s/2} \gamma_{j,t} \tag{4}$$

where $\gamma_{j,t}$ is given by the following

$$\gamma_{j,t} = \gamma_{j,t-1} \cos\lambda_j + \gamma^*_{j,t-1} \sin\lambda_j + \kappa_{j,t} \tag{5}$$

$$\gamma^*_{j,t} = -\gamma_{j,t-1} \sin\lambda_j + \gamma^*_{j,t-1} \cos\lambda_j + \kappa^*_{j,t} \tag{6}$$

where $j = 1,...,s/2-1$, $\lambda_j = 2\pi j/s$ and

$$\gamma_{j,t} = -\gamma_{j,t-1} + \kappa_{j,t}, \qquad j = s/2 \tag{7}$$

where $\kappa_{j,t} \sim NID(0,\sigma_\kappa^2)$ and $\kappa^*_{j,t} \sim NID(0,\sigma_{\kappa*}^2)$.

Once seasonally adjusted, the HP filtering technique is applied to the labour force/population and employment/population series, so as to decompose the series into their trend and cyclical components, for which the cyclical components only are used to estimate the model. In accordance with the suggestion of Prescott (1986), a value of 1,600 is used here for the smoothing parameter, λ, which is standard for quarterly data. Provided that the error terms are relatively small, the HP filter is an empirically optimal method of estimating a ‘smoothly varying’ trend component of a time series, which can then be extracted leaving only the detrended series. Hence, the coefficients of the regression are estimated only on the basis of the business cycle, which has the advantage of removing any distortionary long-term structural effects that may be contained in the trend component, such as the fundamental increase in female participation and fall in male participation in the labour force over the sample period.

The basic static univariate model used can be represented by the following set of equations

$$\frac{L}{P}\Big|_{t,i}^{C} = \beta \frac{E}{P}\Big|_{t}^{C} + \xi_t \tag{8}$$

$$\frac{E}{P}\Big|_{t}^{C} = \frac{E}{P}\Big|_{t} - \frac{E}{P}\Big|_{t}^{H} \tag{9}$$

$$\frac{L}{P}\Big|_{t}^{C} = \frac{L}{P}\Big|_{t} - \frac{L}{P}\Big|_{t}^{H} \tag{10}$$

where L is the total civilian labour force in Australia, E is the total number of employed civilians, and P is the total civilian population aged between 15-64 (i.e. working age). For either ratio, $(.)_{t,i}^{H}$ is the HP filtered trend series observed at time t for subgroup i (total, male female), $(.)_{t,i}^{C}$ is the corresponding cyclical component of series, and ξ_t is a $\text{n.i.d}(0,\sigma^2)$ error term. The degree of discouragement is determined by the estimated value of $\exists$ in equation (8) from an Ordinary Least Squares (OLS) regression, where the independent variable in (8) is the total (not subgroup) employment-population ratio, which is more highly visible and influential on the working age population.[2]

Equation (8) can be altered to include a dynamic specification with a constant term to overcome the common problem of misspecification due to serial correlation contained in that type of static equation. Doing so will produce the following

$$\frac{L}{P}\Big|_{t,i}^{C} = \alpha + \beta\,\frac{E}{P}\Big|_{t}^{C} + \gamma\,\frac{L}{P}\Big|_{t-1,i}^{C} + \varepsilon_t \qquad (11)$$

Testing for asymmetry in (11) involves the separation of $\frac{E}{P}$ observations into their plus and minus series, deriving

$$\frac{L}{P}\Big|_{t,i}^{C} = \alpha + \beta\,\frac{E}{P}\Big|_{t}^{C+} + \gamma\,\frac{E}{P}\Big|_{t}^{C-} + \delta\,\frac{L}{P}\Big|_{t-1,i}^{C} + \varepsilon_t \qquad (12)$$

The Wald (1943) test statistic for coefficient restrictions is then used to test equation (12) for the null hypothesis that $\beta = \gamma$.

In this paper, two different specific types of asymmetry are tested for, in a manner similar to the methodology used by Sichel (1993). The first could be thought of as the less conventional type of asymmetry – that where the independent variable describes a

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[2] Within the context of this study, discouragement can be defined in the classical sense – that is, where an unemployed labour force participant exists the labour force completely as a result of discouragement from being able to find work (either full-time or part-time). Alternatively, encouragement defined is where a non-participant enters the labour force completely as a result of encouragement from the renewed possibility of being able to find work (either full-time or part-time).

situation of boom on the one hand, or recession on the other hand, depending on whether the value of the independent variable is positive or negative, respectively. This type of testing can be thought of as a test of deepness, since Sichel (1993) defines deepness to be the characteristic that '…troughs are further below the trend than peaks are above' (p.224), which is similar in nature to this test. Hence

$$\frac{E}{P}{}_{t}^{C+} = \begin{cases} \frac{E}{P}{}_{t}^{C} \, if \, \frac{E}{P}{}_{t}^{C} \geq 0 \\ 0 if \, \frac{E}{P}{}_{t}^{C} < 0 \end{cases} \tag{13}$$

and

$$\frac{E}{P}{}_{t}^{C-} = \begin{cases} \frac{E}{P}{}_{t}^{C} \, if \, \frac{E}{P}{}_{t}^{C} < 0 \\ 0 if \, \frac{E}{P}{}_{t}^{C} \geq 0 \end{cases} \tag{14}$$

The second is the more conventional type of asymmetry – that where the independent variable describes a situation of either economic expansion or contraction, depending on whether the value of the independent variable is greater or less than it's value in the previous period, respectively. This type of testing can be thought of as a test of steepness, since Sichel (1993) defines steepness to be the characteristic that '…contractions are steeper than expansions' (p.225), which again is similar in nature to this test. Thus

$$\frac{E}{P}{}_{t}^{C+} = \begin{cases} \frac{E}{P}{}_{t}^{C} \, if \, \frac{E}{P}{}_{t}^{C} \geq \frac{E}{P}{}_{t-1}^{C} \\ 0 if \, \frac{E}{P}{}_{t}^{C} < \frac{E}{P}{}_{t-1}^{C} \end{cases} \tag{15}$$

and

$$\frac{E}{P}_{t}^{C-} = \begin{cases} \frac{E}{P}_{t}^{C} \ if \ \frac{E}{P}_{t}^{C} < \frac{E}{P}_{t-1}^{C} \\ 0 if \ \frac{E}{P}_{t}^{C} \geq \frac{E}{P}_{t-1}^{C} \end{cases} \qquad (16)$$

The dynamic specification in equation (12) also allows for the calculation of the long-run degree of both encouragement and discouragement Since $P_{t,i}^{C} = P_{t-1,i}^{C}$ in the long-run. These long-run coefficients are calculated by substituting $P_{t,i}^{C}$ for $P_{t-1,i}^{C}$ in equation (12) and then rearranging. This generates the final representation

$$\frac{L}{P}\Big|_{t,i}^{C} = \frac{\alpha}{1-\delta} + \frac{\beta}{1-\delta}\,\frac{E}{P}\Big|_{t}^{C+} + \frac{\gamma}{1-\delta}\,\frac{E}{P}\Big|_{t}^{C-} + \frac{\varepsilon_t}{1-\delta} \qquad (17)$$

Where the long-run parameters of encouragement and discouragement are given respectively by

$$\theta = \frac{\beta}{1-\delta} \qquad (18)$$

and

$$\kappa = \frac{\gamma}{1-\delta} \qquad (19)$$

Naturally, of principal interest within this framework is the relative values of $\exists$ and γ from (12), which represent the degree of encouragement and discouragement respectively in the ‘short-run’ (within the same quarter), and also the relative values of 2 and κ from (18) and (19) which represent the degree of encouragement and discouragement respectively in the ‘long-run’. Therefore, asymmetry can be also tested in terms of long-run parameter values by formally testing the hypothesis that $\theta = \kappa$.

Results

In acquiring the data necessary to perform all empirical work in this study, the E, L, and P series, where all variables are measured as according to Australian Bureau of Statistics (ABS) definitions, were all obtained from *The Labour Force, Australia (Monthly)* (ABS Cat. No. 6203.0).[3] The quarterly sample extends over a 23-year period from 1978Q1-2000Q4. Since these variables tend to exhibit $I(1)$ characteristics, the $\frac{L}{P}$ and $\frac{E}{P}$ ratios should be stationary, and are hence expressed in levels, not logarithms.

The actual $\frac{L}{P}$ and $\frac{E}{P}$ data used in the testing of equation (12) in this study is displayed in figure 1, which plots the seasonally adjusted data (solid lines) against the corresponding HP trend data (dashed lines) for total, males and females over the sample period, and shows the behaviour of the cyclical components of these ratios. While it is very difficult to determine anything about the likelihood of the presence of asymmetry from a visual inspection of the graphs, what is most conspicuous is the disparate time-path of the HP trend of the ratios between the total, male and female groups, highlighting the importance of using only the detrended series for testing.

The leading objective of this investigation is to test for coefficient values and conventional t-statistics for equation (12). Initially, equation (11) is tested – that is, without splitting the series for asymmetry testing purposes. Here, in terms of goodness-of-fit, the unadjusted coefficient of determination, R^2; and the standard error of the equation, SE, are reported. In association with these, the following

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[3] All data were downloaded from *ABS Time Series Statistics Plus*, DX Database. All extracted data were in original form.

diagnostic tests are also disclosed: the Breusch and Godfrey (1981) test for first- and second-order serial correlation in ε_t, which is an *F*-statistic, *SC*; Ramsey's (1970) RESET test for functional form with 2 fitted terms, which is also an *F*-statistic, *FF*; the Jarque and Bera (1980) test for normality of ε_t, which follows a $\chi^2(2)$ distribution, *NO*; and the White (1980) test for heteroscedasticity in ε_t, which is an *F*-statistic as well, *HE*. Ultimately, equation (11) is tested for asymmetry. Here, the Wald (1943) test for the coefficient restrictions, distributed as $\chi^2(1)$, is also included, along with the accompanying probabilities.

The initial results, those without series splitting for asymmetry, are shown for total, males and females in table 1. As can be seen, the results are more than satisfactory, with the goodness-of-fit tests reflecting a very strong relationship, and all three groups passing each of the diagnostic tests. All other findings are consistent with previous studies – the constant term is insignificant, the values of *∃* and *(* are both significantly positive and are both higher for females than for males, due in part to the traditional roles of men and women in society (see Lenten, 2001, p.10).

Table 2 shows the estimates from testing equation (12) for the presence of both types of asymmetry by total and by sex. Again, the results illustrate the very strong fitting nature of the relationship (R^2 varying between 0.65 to 0.80), and no problems with the diagnostics. The results show that, on average over the sample period, that in terms of deepness, that when Australia is in a state of economic boom, for every 100 people that gain employment in net terms, approximately 50 other people will be induced to enter or re-enter the labour force due to encouragement, with 34 of these people entering within the same quarter. On the other hand, when the Australian economy is in a state of recession, for every 100 people that lose their employment in net terms, a further 39 other people will exit the labour force due to discouragement, with 27 of these people exiting within the same quarter. Results derived from the coefficient restriction tests show there to be no asymmetry in these numbers.

Alternatively, in terms of steepness, as Australia heads into a relative economic expansion, as 100 people become newly employed, a further 48 further people will enter the labour force due to encouragement, 32 of these in the same quarter. On the other hand, as Australia heads into a relative economic contraction, as 100 people lose their jobs, a further 42 people will exit the workforce due to discouragement, 28 of these in the same 3-month period. Similarly as before, the coefficient restriction test results prove there to be no asymmetry in these numbers.

Looking at the remainder of the results, no real clear patterns emerge with respect to the comparison between the deepness and steepness-style tests, nor is it possible to conclude that the encouragement coefficients are always greater in magnitude than the discouragement coefficients (or *vice-versa*). Although, the coefficient estimates are substantially higher for females. One thing that does emerge, however, is the finding of the presence of asymmetry for both coefficient restriction tests for males in the deepness-style test; in fact, encouragement is shown to be over twice as influential in magnitude during boom time than discouragement in recessions. This case is the only exception to the otherwise universal conclusion of no asymmetry. Although this is the exception, that particular result is in line with the earlier findings of Dixon (1995) and Connolly (1997).

Conclusion

This paper has had the express purpose of using a simple OLS regression model to test data seasonally adjusted using the Harvey (1989) technique and detrended using the HP filter, for the presence of asymmetry between encouragement and discouragement in the relationship between employment and the labour force. It is found that with only one exception, the relationship between encouragement and discouragement is in fact symmetrical, meaning that increases in employment lead to the same number of further entries into the labour force as there are further exits from the labour force when employment falls.

Should the opposite conclusion had been found, like in previous Australian studies, this would have had important implications for the timing of employment policy initiatives. Since this is not the case, these policy initiative should therefore concentrate more on targeting the demographic groups for which discouragement is more pronounced, as suggested by Lenten (2001).

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Table (1)

Aggregate Results and Breakdown According to Sex

	Total	Male	Female
α	$-3.62\text{x}10^{-5}$ (0.0002)	$-4.44\text{x}10^{-5}$ (0.0002)	$-1.98\text{x}10^{-5}$ (0.0003)
β	0.3049* (0.0315)	0.2236* (0.0298)	0.3766* (0.0449)
γ	0.3234* (0.0656)	0.3275* (0.0756)	0.3339* (0.0719)
θ	0.4507* (0.0374)	0.3325* (0.0384)	0.5654* (0.0537)
R^2	0.78	0.65	0.74
SE	0.002	0.002	0.003
SC	1.31	0.70	1.22
FF	0.46	0.26	0.95
NO	3.59	0.67	2.95
HE	1.20	0.20	0.50

*Significant at the five per cent level.

Table (2)

Asymmetry Results and Breakdown According to Sex

	Total (1)	Total (2)	Male (1)	Male (2)	Female (1)	Female (2)
α	-0.0003 (0.0003)	$-6.82\text{x}10^{-5}$ (0.0002)	-0.0006 (0.0003)	$-6.73\text{x}10^{-5}$ (0.0002)	$3.46\text{x}10^{-5}$ (0.0005)	$-4.39\text{x}10^{-5}$ (0.0003)
β	0.3409* (0.0510)	0.3244* (0.0392)	0.3097* (0.0511)	0.2366* (0.0372)	0.3682* (0.0717)	0.3921* (0.0573)
γ	0.2710* (0.0501)	0.2836* (0.0406)	0.1432* (0.0489)	0.2072* (0.0410)	0.3853* (0.0730)	0.3613* (0.0571)
$*$	0.3160* (0.0662)	0.3203* (0.0658)	0.2959* (0.0759)	0.3289* (0.0760)	0.3346* (0.0725)	0.3301* (0.0727)
θ	0.4983* (0.0654)	0.4773* (0.0496)	0.4398* (0.0646)	0.3525* (0.0523)	0.5534* (0.0960)	0.5853* (0.0708)
6	0.3949* (0.0712)	0.4172* (0.0539)	0.2033* (0.0691)	0.3088* (0.0556)	0.5791* (0.1058)	0.5393* (0.0794)
R^2	0.79	0.79	0.67	0.65	0.74	0.74
SE	0.002	0.002	0.002	0.002	0.003	0.003
SC	1.15	1.33	0.19	0.67	1.20	1.10
FF	0.41	0.52	1.12	0.68	0.72	0.67
NO	3.51	3.06	1.19	0.70	2.96	2.62
HE	1.17	0.76	0.07	0.67	0.54	0.84
CR ($\beta=\gamma$)	0.80 (0.371)	0.70 (0.403)	4.21* (0.040)	0.34 (0.560)	0.02 (0.880)	0.19 (0.662)
CR ($\theta=6$)	0.81 (0.367)	0.70 (0.402)	4.39* (0.036)	0.34 (0.562)	0.02 (0.880)	0.19 (0.660)

*Significant at the five per cent level.