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Estimating Hidden Unemployment in Australia and the United States

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1. Introduction

In this paper, a method developed by Mitchell *et. al.* (1995) is used to provide estimates of the net discouraged worker effect for Australia and the United States. The notion of cyclical upgrading was popularised by Arthur Okun and others in the 1960s and early 1970s. The upgrading hypothesis and the related high-pressure economy model provided a coherent rationale for Keynesian policy positions. Okun (1983: 171) believed that

> unemployment was merely the tip of the iceberg that forms in a cold economy. The difference between unemployment rates of 5 percent and 4 percent extends far beyond the creation of jobs for 1 percent of the labor force. The submerged part of the iceberg includes (a) additional jobs for people who do not actively seek work in a slack labor market but nonetheless take jobs when they become available; (b) a longer workweek reflecting less part-time and more overtime employment; and (c) extra productivity - more output per man-hour - from fuller and more efficient use of labor and capital.

A vast body of literature describes the manner in which the labour market adjusts to the business cycle (see Reder, 1955; Wallich, 1956; Wachter, 1970; Okun, 1973; Thurow, 1975; Vroman, 1978). The literature also ties in with some versions of segmented labour market theory. Together they provide the basis of a theory of cyclical upgrading, whereby disadvantaged groups in the economy achieve upward mobility as a result of higher economic activity.

Two major questions are investigated in this paper:

- How does the labour force participation rates of different age and gender groups behave over the economic cycle?
- For a given arbitrary full employment level (in this paper we examine a 4 per cent and a 5 percent unemployment rate), what is the potential employment levels for groups and the economy in total, and how are the employment gaps (defined as the difference between potential and actual employment) distributed across demographic groups?[1]

A more complete analysis is contained in Mitchell (1999) and Mitchell et al (1995).

From the viewpoint of upgrading, a cyclical rise in labour force participation (indicating that the discouraged worker effect is dominant) provides marginal workers with the chance to share in the benefits of the higher output and employment. Workers who enter the labour force only when the probability of gaining work increases are often termed - *hidden unemployed*. The literature indicates that it is teenagers and to lesser extent women who exhibit the largest swings.

The paper finds that hidden unemployment is a significant problem in Australia and the United States. In Australia, the recorded unemployment rate in February 1999 was 8.1 per cent. Taking into account the estimated hidden unemployment in the same quarter, the adjusted unemployment rate (calculated by expressing the sum of hidden unemployment and recorded unemployment as a percentage of the potential labour force) would be 10.4 per cent. This gives a significantly different picture of the degree of slack in the macroeconomy and the extent to which jobs have to be created to absorb the real number of idle workers. In February 1999, for every 3.2 persons who were officially recorded as being unemployed there was another person who was hidden unemployed (at the 4 per cent unemployment rate benchmark). The increase in labour force participation resulting from moving to the benchmark would be equivalent to an increase in employment of around 2.75 per cent.

For the United States, the recorded unemployment rate in November 1998 was 4.5 per cent. Taking into account the estimated hidden unemployment in the same quarter, the adjusted unemployment ould be 4.7 per cent. Compared to Australia, hidden unemployment thus makes a trivial impact on the measured degree of slack in the macroeconomy. This is clearly because the United States labour market is closer to the 4 per cent benchmark. In February 1999, for every 20.8 persons who were officially recorded as being unemployed there was another person who was hidden unemployed (at the 4 per cent unemployment rate benchmark). This compares to a ratio of 3.2 to 1 for Australia.

Section 2 outlines the method used to estimate cyclical participation effects and then compute estimates of hidden unemployment. Section 3 generates estimates for Australia and Section 4 repeats the exercise for the USA. Concluding remarks follow.

2. Cyclical participation effects and hidden unemployment

In this section, we estimate the various demographic labour force participation responses over the business cycle and use these estimates to calculate hidden unemployment for each demographic group. The first issue concerns the derivation of a ‘full-employment’ labour force, which will serve as a benchmark upon which comparisons with the actual cyclically sensitive labour force are based.

Trend extrapolation is a popular method of deriving a benchmark labour force. An estimated trend is combined with an arbitrary full employment level of a variable designed to measure the

cycle and the regression simulated to yield labour force estimates at full employment (for example, Simler and Tella, 1968; Gordon, 1971). Typically, linear trend functions are fitted and the simulated results are often unrealistic. Alternatively, some studies have chosen an arbitrary point in time as a full employment observation, and then simply projected a trend from that point to the end of the sample on the assumption that the long-term rate of GDP growth and its relationship to the labour market was stable over the sample period (for example, Stricker and Sheehan, 1981).

We use another approach first developed by Perry (1971). We begin with a set of age-gender regressions estimating labour force participation rates on cyclical and trend factors. The models seek adequate representations of the movements in terms of secular filters and cyclical filters rather than presenting structural explanations for the complex behaviour. The econometric model of labour force participation is:

Eqn 1 $$(LFPR_i)_t = \alpha + \beta NPOP_t + \phi T + \sum_{j=1}^{3} \delta_i S_i + + \varepsilon_t$$

where $LFPR_i = (L_i / POP_i)$ and is the labour force participation rate of the i[th] age-gender group defined as the labour force divided by the total civilian population for that particular group; *NPOP* is non-farm total employment divided by the civilian population between 15-64 years, *T* is a linear time trend, *S* are seasonal dummy variables and ε_t is a stochastic error term. The trend term was included to add precision to the cyclical coefficient on the *NPOP* variable.

The β coefficient measures the degree of cyclical sensitivity of the labour participation rate. The participation gap, being the extra labour force participation that would be forthcoming if the economy was at the "full employment" level of the *NPOP*, was calculated by multiplying the β coefficient by the deviation from this full employment *NPOP* in each period. The calculation of the participation gaps is:

Eqn 2 $$PRGAP_i = \beta(NPOP^{FN} - NPOP_i)$$

where $PRGAP_i$ is the participation rate gap for the i[th] age-gender group, $NPOP^{FN}$ is the employment-population ratio at full employment, assuming some arbitrary benchmark unemployment rate as full employment, and $NPOP_i$ is the current employment-population ratio.

PRGAP thus measures the incremental variation in the relevant participation rate, which would occur if the economy moved from its current level of activity to the defined full employment level of activity.

The process of deriving potential labour forces for each demographic group begins with the regression estimates reported in Tables 7.3 and 7.4. The participation gap for each group is derived by multiplying β times the difference between the full-employment employment population ratio and the actual value of the employment-population ratio. The full-employment population ratio was calculated using the formula:

Eqn 3 $$N^* = \frac{(1-x)(L-\beta N)}{1-\beta(1-x)}$$

Where N^* is the full-employment level of employment at an unemployment rate equal to x, L is the actual labour force, N is the actual level of employment, and β measures the cyclical sensitivity of the labour force, as before (see Appendix for full derivation). The full employment employment-population ratio is then calculated using N^* and the actual civilian population. The estimation of β was based on a regression like Equation (1) except that the aggregate labour force was used as the dependent variable.

Once the employment gap is calculated, participation gaps for each age-gender group are calculated using Equation (2). The hidden unemployment for each age-gender group was then calculated as the participation gap times the appropriate civilian population.

This method is arguably superior to the trend simulation method, especially in times when participation rates exhibit trend increases quite unlike previous periods. In that case, trend simulation would seriously underestimate or overestimate the potential labour force. Using a method that is more sourced in terms of the actual data variations; the gap approach is better able to accommodate the strong trend variations in the labour force participation rates over time.

3. Hidden Unemployment in Australia

Table 1 shows the male regressions for Australia. The labour force participation rates of teenage males and males above 55 year of age are sensitive in varying degrees to the business cycle. For prime-age males (25-54 years of age) there is virtually no participation rate responsiveness

detected. All male participation rates show a downward secular movement over the sample period used. The results are in accord with the prevailing wisdom.

Table 2 shows the female regressions, which are in contrast to the male results. The participation rates for every female age group demonstrate cyclical sensitivity, with females aged between 35 and 54 showing the most responsiveness. Further, while there are variations in the trend behaviour of the different age groups, all exhibit a rising secular trend. Women under 24 and over 60 exhibit modest upward trends over the sample, while the prime-age females show pronounced trends towards higher participation rates independent of the business cycle. The results support the net discouraged worker hypothesis.

Table 3 shows the hidden unemployment calculations (described above) based on the assumed full employment unemployment rate of 4 per cent. In other words, the figures answer the question of what the extra labour force participation would be in each year for each age-gender group if the unemployment rate was held at 4 per cent. The results show in aggregate, say for 1998, when the total recorded unemployment was 686.2 thousand (see Table 4), the total hidden unemployment was 228.7 thousand. The sum of the two is a broader measure of the slack in the labour market in 1998. The groups experiencing the most hidden unemployment as a result of the economy performing below full employment are clearly, teenage boys (13.9 per cent of total hidden unemployed) and prime-age (25-54) females (48.5 per cent of total). We would expect that these groups would benefit disproportionately in an upswing of the business cycle.

Table 4 compares the actual and hidden for each age-gender group in 1983 (a recession year) and 1998. In 1983, the aggregate unemployment rate was 10.0 per cent (seasonally adjusted) and then slowly declined over the next six years to reach 6.2 per cent in 1989. In 1998, the aggregate unemployment rate was 8.0 per cent (seasonally adjusted). The level of unemployment was higher in 1998 than 1983 but the labour force also was higher (with the unemployment rate lower overall). The improved circumstances show up in lower total hidden unemployment. The outcomes for women overall has deteriorated in terms of both recorded and estimated hidden unemployment. They now account for a higher percentage of recorded unemployment (36.9 per cent from 31.7 per cent) and hidden unemployment (66.9 per cent from 63.8 per cent). It is also clear from Table 5 that women's underutilization is manifested proportionately more in terms of hidden unemployment while men have a higher tendency to remain in the labour force as unemployed. Teenage males and females have experienced improved conditions in 1998 relative to 1983, and there appears to have been no change in the fortunes of the older age groups. The

significant change is the deterioration in conditions for prime-age females, particularly the 45-54 age group.

To what extent do the estimates change our view of underutilization? If we take February 1999 as an example, the estimates show that the potential labour force (see Appendix) at 4 per cent unemployment would be 9633.9 thousand (compared to the recorded labour force of 9396.0 thousand). The total hidden unemployed is thus 237.9 thousand compared to the recorded unemployment of 763 thousand. The change in employment required to reduce the unemployment rate to 4 per cent is 590.6 thousand. These extra jobs would reduce the level of unemployment by 352.7 thousand with the remaining accounting for the rising labour force as the discouraged workers re-entered.

The recorded unemployment rate in February 1999 was 8.1 per cent. If we took into account the hidden unemployment in the same quarter, the adjusted unemployment rate (calculated by expressing the sum of hidden unemployment and recorded unemployment as a percentage of the potential labour force) would be 10.4 per cent. This gives a significantly different picture of the degree of slack in the macroeconomy and the extent to which jobs have to be created to absorb the real number of idle workers.

In February 1999, for every 3.2 persons who were officially recorded as being unemployed there was another person who was hidden unemployed (at the 4 per cent unemployment rate benchmark). The increase in labour force participation resulting from moving to the benchmark would be equivalent to an increase in employment of around 2.75 per cent.

What would be the situation if the benchmark were set at 5 per cent unemployment? Table 5 replicates the estimation found in Table 3 with the exception that the benchmark full employment unemployment rate is set at 5 per cent. Table 6 provides a sensitivity analysis of the choice of a 5 per cent benchmark compared to the 4 per cent benchmark. To move the economy from 5 per cent unemployment to 4 per cent unemployment (measured at February 1999 when the recorded unemployment rate was 8.1 per cent) would require 145.7 thousand extra jobs. However, unemployment only falls by 87 thousand because the labour force grows by a further 58.7 thousand. In other words, for every 2.5 jobs created an extra person enters the labour force seeking employment.

Table 1 Australia, Male Participation Rate Regressions, 1980 (2) to 1999 (1)

	15-19	20-24	25-34	35-44	45-54	55-59	60-64	> 65
Constant	-5.19	77.25	93.74	93.24	84.07	31.39	7.73	-2.24
	(0.40)	(14.58)	(34.37)	(27.68)	(14.23)	(2.09)	(0.39)	(0.32)
Trend	-0.133	-0.070	-0.045	-0.048	-0.053	-0.142	-0.082	-0.02
	(7.22)	(13.09)	(15.61)	(13.50)	(6.69)	(7.12)	(1.99)	(1.85)
NPOP	1.24	0.26	0.04	0.05	0.13	0.88	0.76	0.23
	(5.36)	(2.75)	(0.89)	(0.79)	(1.26)	(3.34)	(2.20)	(1.82)
R^2	0.95	0.92	0.94	0.95	0.91	0.94	0.88	0.80
% s.e. *	1.34	0.58	0.28	0.28	0.45	1.13	1.98	4.14
DW	1.98	1.96	1.90	1.99	1.96	1.95	1.89	1.97

Note: All regressions used seasonal dummy variables. All regressions were estimated using an exact Maximum Likelihood Estimator with AR(2) disturbances (see Pesaran, 1972). The figures in parentheses are are *t*-statistics.
* the % s.e. is the standard error as a percentage of the mean of the dependent variable.

Table 2 Australia, Female Participation Rate Regressions, 1980 (2) to 1999 (1)

	15-19	20-24	25-34	35-44	45-54	55-59	60-64	Over 65
Constant	29.07	44.74	16.05	20.67	-2.14	-5.86	-9.29	-2.59
	(2.84)	(3.53)	(1.54)	(1.89)	(0.17)	(3.62)	(0.89)	(1.08)
Trend	0.03	0.094	0.217	0.155	0.307	0.202	0.083	0.004
	(2.55)	(3.51)	(6.52)	(3.60)	(15.63)	(9.74)	(7.52)	(1.35)
NPOP	0.64	0.46	0.63	0.66	0.84	0.55	0.36	0.09
	(3.55)	(2.05)	(3.46)	(3.54)	(3.74)	(1.95)	(1.96)	(2.04)
R^2	0.89	0.95	0.99	0.99	0.99	0.97	0.92	0.73
% s.e. *	0.91	0.91	0.97	0.83	1.06	2.91	5.21	6.11
DW	1.98	1.98	1.98	1.98	1.89	1.98	1.96	1.92

Note: All regressions used seasonal dummy variables. All regressions were estimated using an exact Maximum Likelihood Estimator with AR(2) disturbances (see Pesaran, 1972). The figures in parentheses are are *t*-statistics.

- the % s.e. is the standard error as a percentage of the mean of the dependent variable.
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Table 3 Australia, Hidden Unemployment by Age-Gender at 4 per cent unemployment, 1979-1999, thousands

Age/Gender	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15-19																					
Males	16.1	16.0	13.3	23.7	44.3	37.2	32.3	32.6	33.7	27.0	18.4	25.1	46.2	54.6	53.9	44.5	35.0	35.6	35.8	32.0	33.3
Females	8.1	8.1	6.7	11.9	22.2	18.6	16.2	16.3	16.8	13.5	9.2	12.5	23.0	27.0	26.7	22.0	17.3	17.6	17.7	15.8	16.4
Total	24.1	24.1	20.1	35.7	66.5	55.8	48.5	48.9	50.5	40.5	27.6	37.6	69.2	81.6	80.6	66.5	52.3	53.3	53.4	47.8	49.7
20-24																					
Males	3.1	3.2	2.7	5.0	9.4	7.9	6.8	6.6	6.6	5.2	3.5	5.0	9.6	11.9	12.2	10.2	8.0	7.9	7.7	6.8	6.9
Females	5.5	5.6	4.8	8.8	16.7	13.9	11.9	11.5	11.5	9.1	6.3	8.7	16.9	21.0	21.3	17.8	14.0	13.8	13.4	11.7	12.0
Total	8.6	8.8	7.6	13.8	26.1	21.8	18.7	18.1	18.1	14.2	9.8	13.7	26.5	32.9	33.5	28.1	21.9	21.7	21.2	18.5	18.9
25-34																					
Males	1.0	1.0	0.9	1.6	3.0	2.5	2.2	2.1	2.2	1.8	1.2	1.7	3.2	3.9	3.9	3.3	2.6	2.7	2.7	2.3	2.4
Females	14.3	14.6	12.6	22.8	43.1	36.4	31.6	31.5	32.3	25.9	18.1	25.1	47.6	57.8	58.1	48.6	38.7	39.5	39.4	34.7	35.7
Total	15.2	15.6	13.4	24.3	46.0	38.8	33.8	33.6	34.5	27.7	19.3	26.8	50.9	61.7	62.1	51.9	41.4	42.2	42.0	37.1	38.2
35-44																					
Males	1.0	1.0	0.9	1.6	3.0	2.5	2.2	2.1	2.2	1.8	1.2	1.7	3.2	3.9	3.9	3.3	2.6	2.7	2.7	2.3	2.4
Females	10.9	11.2	9.8	18.6	36.4	31.5	28.1	28.6	29.8	24.3	17.1	24.1	46.5	57.0	58.1	49.1	39.8	41.1	41.4	36.9	38.3
Total	11.8	12.2	10.7	20.2	39.3	34.0	30.3	30.8	32.0	26.1	18.3	25.8	49.7	60.9	62.0	52.4	42.4	43.7	44.1	39.3	40.7
45-54																					
Males	2.0	2.0	1.7	3.0	5.6	4.8	4.1	4.1	4.3	3.5	2.4	3.5	6.9	8.7	9.1	7.9	6.5	6.8	7.0	6.3	6.6
Females	12.3	12.2	10.2	18.3	34.3	28.9	25.1	25.0	25.7	20.9	14.8	21.2	41.7	52.9	55.7	48.6	40.0	42.1	43.2	39.4	41.4
Total	14.3	14.2	11.9	21.3	39.9	33.7	29.2	29.1	30.0	24.3	17.2	24.6	48.5	61.6	64.9	56.5	46.5	48.9	50.1	45.7	48.0
55-59																					
Males	6.2	6.4	5.4	9.7	18.3	15.6	13.4	13.1	13.0	10.1	6.8	9.3	17.6	21.6	22.3	19.3	15.7	16.4	16.7	15.2	16.1
Females	4.0	4.1	3.4	6.1	11.4	9.6	8.2	7.9	7.9	6.1	4.2	5.7	10.8	13.3	13.7	11.8	9.6	10.0	10.2	9.2	9.8
Total	10.2	10.4	8.8	15.8	29.7	25.1	21.6	21.0	20.9	16.3	11.0	15.0	28.4	34.9	36.1	31.0	25.3	26.3	26.9	24.4	25.8
60-64																					
Males	4.2	4.3	3.7	6.9	13.4	11.8	10.4	10.3	10.5	8.4	5.8	8.0	15.1	18.0	17.8	14.7	11.8	11.9	12.0	10.8	11.3
Females	2.1	2.2	1.9	3.5	6.8	5.9	5.1	5.1	5.1	4.0	2.8	3.8	7.1	8.5	8.4	7.0	5.6	5.6	5.7	5.1	5.3
Total	6.3	6.4	5.6	10.4	20.2	17.6	15.5	15.4	15.6	12.4	8.6	11.8	22.2	26.5	26.3	21.7	17.3	17.6	17.7	15.9	16.7
TOTAL ALL	90.7	91.9	78.0	141.5	267.7	226.9	197.6	197.0	201.6	161.5	111.8	155.3	295.5	360.1	365.3	308.2	247.1	253.7	255.4	228.7	237.9

Source: Author's own calculations based on method explained in text. 1999 data is for February 1999 only.

Table 4 Australia, Actual and Hidden Unemployment by Age-Gender, 1983 and 1998 (thousands)

	1983				1998			
Males	**UN**		**HU**		**UN**		**HU**	
	000's	**% of total**	**000's**	**% of total**	**000's**	**% of total**	**000's**	**% of total**
15-19	95.5	15.4	44.3	16.5	80	11.7	32.0	14.0
20-24	99.5	16.0	9.4	3.5	75.7	11.0	6.8	3.0
25-34	99.5	16.0	3.0	1.1	100.8	14.7	2.3	1.0
35-44	57.1	9.2	3.0	1.1	77.6	11.3	2.3	1.0
45-54	42.2	6.8	5.6	2.1	62.4	9.1	6.3	2.8
55-59	19.5	3.1	18.3	6.8	25.6	3.7	15.2	6.7
60-64	10.4	1.7	13.4	5.0	11	1.6	10.8	4.7
Total	424.8	68.4	93.7	35.0	433.2	63.1	77.7	34.0
Females	**UN**		**HU**		**UN**		**HU**	
	000's	**% of total**	**000's**	**% of total**	**000's**	**% of total**	**000's**	**% of total**
15-19	11.9	1.9	22.2	8.3	13	1.9	15.8	6.9
20-24	57.1	9.2	16.7	6.2	55.6	8.1	11.7	5.1
25-34	64.2	10.3	43.1	16.1	66.7	9.7	34.7	15.2
35-44	40.8	6.6	36.4	13.6	64	9.3	36.9	16.1
45-54	17.8	2.9	34.3	12.8	41.1	6.0	39.4	17.2
55-59	4.2	0.7	11.4	4.3	9.9	1.4	9.2	4.0
60-64	0.7	0.1	6.8	2.5	2.6	0.4	5.1	2.2
Total	196.7	31.7	170.9	63.8	252.9	36.9	152.8	66.9
Persons	**UN**		**HU**		**UN**		**HU**	
	000's	**% of total**	**000's**	**% of total**	**000's**	**% of total**	**000's**	**% of total**
15-19	107.4	17.3	66.5	24.8	93.1	13.6	47.8	20.9
20-24	156.6	25.2	26.1	9.7	131.3	19.1	18.5	8.1
25-34	163.7	26.3	46.1	17.2	167.5	24.4	37.0	16.2
35-44	97.9	15.8	39.4	14.7	141.6	20.6	39.2	17.2
45-54	60.1	9.7	39.9	14.9	103.5	15.1	45.7	20.0
55-59	23.6	3.8	29.7	11.1	35.6	5.2	24.4	10.7
60-64	11.1	1.8	20.2	7.5	13.6	2.0	15.9	7.0
Total	621.4	100.0	267.9	100.0	686.2	100.0	228.5	100.0

Note: The estimates of hidden unemployment are based on a 4 per cent full employment unemployment rate (see Table 3).

Table 5 Australia, Hidden Unemployment by Age-Gender at 5 per cent unemployment, 1979-1999, thousands

Age/Gender	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
15-19																					
Males	8.4	8.4	5.8	16.2	36.7	29.6	24.6	24.5	25.3	18.5	9.9	16.4	37.8	46.3	45.9	36.6	27.1	27.7	27.7	23.9	25.1
Females	4.2	4.2	2.9	8.2	18.4	14.8	12.3	12.2	12.7	9.2	4.9	8.2	18.8	22.9	22.7	18.0	13.4	13.7	13.7	11.8	12.4
Total	12.7	12.6	8.7	24.3	55.1	44.4	36.9	36.8	38.0	27.7	14.8	24.6	56.6	69.3	68.5	54.6	40.5	41.3	41.4	35.6	37.4
20-24																					
Males	1.6	1.7	1.2	3.4	7.8	6.3	5.2	4.9	4.9	3.5	1.9	3.3	7.9	10.1	10.4	8.4	6.2	6.1	6.0	5.0	5.2
Females	2.9	2.9	2.1	6.0	13.8	11.1	9.1	8.7	8.7	6.2	3.3	5.7	13.8	17.8	18.1	14.7	10.8	10.7	10.4	8.7	9.0
Total	4.5	4.6	3.3	9.4	21.6	17.4	14.2	13.6	13.6	9.7	5.2	9.0	21.7	27.9	28.5	23.1	17.0	16.9	16.4	13.8	14.3
25-34																					
Males	0.5	0.5	0.4	1.1	2.4	2.0	1.6	1.6	1.7	1.2	0.7	1.1	2.6	3.3	3.3	2.7	2.0	2.1	2.1	1.7	1.8
Females	7.5	7.6	5.4	15.5	35.7	28.9	24.1	23.7	24.3	17.7	9.7	16.5	38.9	49.0	49.4	39.9	29.9	30.6	30.5	25.9	26.9
Total	8.0	8.2	5.8	16.6	38.1	30.9	25.7	25.3	25.9	19.0	10.3	17.6	41.6	52.3	52.8	42.6	32.0	32.7	32.6	27.6	28.7
35-44																					
Males	0.5	0.5	0.4	1.1	2.4	2.0	1.6	1.6	1.7	1.2	0.7	1.1	2.6	3.3	3.3	2.7	2.0	2.1	2.1	1.7	1.8
Females	5.7	5.9	4.2	12.7	30.1	25.0	21.4	21.5	22.4	16.7	9.1	15.8	38.0	48.4	49.4	40.3	30.8	31.9	32.1	27.5	28.8
Total	6.2	6.4	4.6	13.8	32.6	27.0	23.0	23.1	24.1	17.9	9.8	17.0	40.6	51.7	52.7	43.0	32.8	33.9	34.1	29.3	30.6
45-54																					
Males	1.1	1.1	0.7	2.1	4.7	3.8	3.2	3.1	3.2	2.4	1.3	2.3	5.6	7.4	7.8	6.5	5.0	5.3	5.4	4.7	5.0
Females	6.5	6.4	4.4	12.5	28.4	23.0	19.1	18.8	19.4	14.3	7.9	13.9	34.0	44.9	47.4	39.9	30.9	32.6	33.5	29.3	31.2
Total	7.5	7.5	5.2	14.5	33.0	26.8	22.2	21.9	22.6	16.7	9.2	16.2	39.7	52.3	55.2	46.4	35.9	37.9	38.9	34.0	36.1
55-59																					
Males	3.3	3.3	2.3	6.6	15.2	12.4	10.2	9.9	9.8	6.9	3.7	6.1	14.4	18.4	19.0	15.8	12.1	12.7	13.0	11.3	12.1
Females	2.1	2.1	1.5	4.2	9.4	7.6	6.2	6.0	5.9	4.2	2.2	3.7	8.8	11.3	11.7	9.7	7.4	7.7	7.9	6.9	7.3
Total	5.4	5.5	3.8	10.8	24.6	20.0	16.5	15.8	15.7	11.2	5.9	9.8	23.2	29.6	30.7	25.5	19.5	20.4	20.8	18.2	19.5
60-64																					
Males	2.2	2.2	1.6	4.7	11.1	9.3	7.9	7.8	7.9	5.7	3.1	5.3	12.3	15.3	15.2	12.1	9.1	9.2	9.3	8.1	8.5
Females	1.1	1.1	0.8	2.4	5.6	4.7	3.9	3.8	3.9	2.8	1.5	2.5	5.8	7.2	7.2	5.7	4.3	4.4	4.4	3.8	4.0
Total	3.3	3.4	2.4	7.1	16.7	14.0	11.8	11.6	11.8	8.5	4.6	7.7	18.2	22.5	22.3	17.8	13.4	13.6	13.7	11.9	12.5
TOTAL ALL	47.7	48.1	33.8	96.6	221.8	180.4	150.4	148.0	151.6	110.6	59.8	101.9	241.4	305.6	310.7	253.1	191.1	196.8	197.9	170.4	179.2

Source: Author's own calculations based on method explained in text. 1999 data is for February 1999 only.

Table 6 Australia, Sensitivity Comparisons on Benchmark Choice at February 1999

February 1999	**Benchmark**		
	5 per cent	**4 per cent**	**Changes between benchmarks**
Labour Force (000's)	9396	9396	
Actual Employment (000's)	8633	8633	
Unemployment (000's)	763	763	
Potential Labour Force	9575.2	9633.9	
Hidden Unemployment	179.2	237.9	58.7
New Employment	9077.9	9223.6	
Change in Employment (from Actual to Benchmark)	444.9	590.6	145.7
New Unemployment	497.3	410.3	
Change in Unemployment (from Actual to Benchmark)	-265.7	-352.7	-87.0
Recorded Unemployment Rate (%)	8.1	8.1	
Adjusted Unemployment Rate (%)	9.8	10.4	

4. Estimating Hidden Unemployment in the United States

Tables 7 and 8 show the male and female regressions, respectively for the United States. They are broadly similar in characteristics to those estimated for Australia and reported as Table 1 and 2. For the USA, the older males and females show strong cyclical sensitivity. For prime-age males (25-54 years of age) there is virtually no participation rate responsiveness detected. All male participation rates show a downward secular movement over the sample period used. The participation rates for every female age group demonstrate cyclical sensitivity, with females aged between 25 and 54 showing the most responsiveness. This replicates the Australian results. All the female groups, excepting the over 65-year olds exhibit a rising secular trend. The results support the net discouraged worker hypothesis.

The contrasting results are in the behaviour of the teenage (16-19) participation rates. While the male teenagers in Australia exhibit strong cyclical sensitivity in their participation rates, the US teenage males reveal stronger sensitivity. The teenage female participation rates in the US are considerably more cyclically sensitive than their Australian counterparts (1.17 compared to 0.64). As a result, teenagers will account for larger percentages of hidden unemployment in the USA than they do in Australia.

Table 9 shows the hidden unemployment calculations (described above) based on the assumed full employment unemployment rate of 4 per cent. The results show in aggregate, say for 1998, when the total recorded unemployment was 5859 thousand, the total hidden unemployment was 333.2 thousand. The sum of the two is a broader measure of the slack in the labour market in 1998. The groups experiencing the most hidden unemployment as a result of the economy performing below full employment are clearly, teenage boys and girls (32.1 per cent of total hidden unemployment) and prime-age (25-54) females (41.5 per cent of total). For Australia, the percentage for teenagers is 20.9 with teenage males accounting for 13.9 per cent of total hidden unemployed. The fact that males and female teenagers experience similar outcomes in the United States but are clearly have different fortunes in Australia is notable.) Prime-age females are also not as prominent in their share of total hidden unemployment as they are in Australia.

Table 10 compares the actual and hidden for each age-gender group in 1983 (a recession year) and 1998. In 1983, the aggregate unemployment rate was 10.0 per cent (seasonally adjusted) and then slowly declined over the next six years to reach 6.2 per cent in 1989. In 1998, the aggregate

unemployment rate was 8.0 per cent (seasonally adjusted). The level of unemployment was higher in 1998 than 1983 but the labour force also was higher (with the unemployment rate lower overall). The improved circumstances show up in lower total hidden unemployment. The outcomes for women overall has deteriorated in terms of both recorded and estimated hidden unemployment. They now account for a higher percentage of recorded unemployment (36.9 per cent from 31.7 per cent) and hidden unemployment (66.9 per cent from 63.8 per cent). It is also clear from Table 5 that women's underutilization is manifested proportionately more in terms of hidden unemployment while men have a higher tendency to remain in the labour force as unemployed. Teenage males and females have experienced improved conditions in 1998 relative to 1983, and there appears to have been no change in the fortunes of the older age groups. The significant change is the deterioration in conditions for prime-age females, particularly the 45-54 age group.

To what extent do the estimates change our view of underutilization? If we take November 1998 as an example, the estimates show that the potential labour force (see Appendix) at 4 per cent unemployment would be 138,581 thousand (compared to the recorded labour force of 138,285 thousand). The total hidden unemployed is thus 296 thousand compared to the recorded unemployment of 6,172 thousand. The change in employment required to reduce the unemployment rate to 4 per cent is 977.3 thousand. These extra jobs would reduce the level of unemployment by 681.3 thousand with the remaining accounting for the rising labour force as the discouraged workers re-entered.

The recorded unemployment rate in November 1998 was 4.5 per cent. If we took into account the hidden unemployment in the same quarter, the adjusted unemployment rate (calculated by expressing the sum of hidden unemployment and recorded unemployment as a percentage of the potential labour force) would be 4.7 per cent. Compared to Australia, hidden unemployment thus makes a trivial impact on the measured degree of slack in the macroeconomy. This is clearly because the United States labour market is closer to the 4 per cent benchmark.

In February 1999, for every 20.8 persons who were officially recorded as being unemployed there was another person who was hidden unemployed (at the 4 per cent unemployment rate benchmark). This compares to a ratio of 3.2 to 1 for Australia.

Table 7 United States, Male Participation Rate Regressions, 1952 (1) to 1998 (4)

	15-19	20-24	25-34	35-44	45-54	55-64	> 65
Constant	-15.64	57.81	92.16	96.24	90.67	92.28	13.13
	(1.40)	(6.60)	(37.27)	(34.38)	(23.18)	(12.80)	(1.88)
Trend	-0.086	-0.050	-0.036	-0.033	-0.049	-0.112	-0.160
	(4.01)	(5.47)	(12.84)	(10.76)	(11.66)	(5.55)	(7.44)
NPOP	1.37	0.55	0.11	0.05	0.12	0.74	0.48
	(6.95)	(3.44)	(2.35)	(0.89)	(1.64)	(0.61)	(4.25)
R^2	0.91	0.81	0.99	0.98	0.98	0.949	0.99
% s.e. *	1.54	0.92	0.22	0.26	0.37	0.66	1.97
DW	2.04	2.07	2.04	2.06	2.06	2.01	1.99

Note: All regressions used seasonal dummy variables. All regressions were estimated using an exact Maximum Likelihood Estimator with AR(2) disturbances (see Pesaran, 1972). The figures in parentheses are are *t*-statistics.
* the % s.e. is the standard error as a percentage of the mean of the dependent variable.

Table 8 United States, Female Participation Rate Regressions, 1952 (1) to 1998 (4)

	15-19	20-24	25-34	35-44	45-54	55-59	Over 65
Constant	-24.79	31.09	9.79	17.46	13.64	8.89	0.44
	(2.19)	(3.49)	(1.25)	(2.79)	(2.13)	(1.19)	(0.11)
Trend	0.022	0.147	0.209	0.188	0.171	0.107	-0.015
	(0.92)	(5.88)	(7.90)	(9.51)	(13.30)	(4.79)	(2.76)
NPOP	1.17	0.25	0.43	0.39	0.48	0.36	0.17
	(5.94)	(1.69)	(3.56)	(3.93)	(4.27)	(2.02)	(2.33)
R^2	0.97	0.99	0.99	0.99	0.99	0.99	0.89
% s.e. *	1.97	1.07	0.89	0.74	0.84	1.31	3.82
DW	2.05	2.01	1.99	2.01	2.02	2.02	2.04

Note: All regressions used seasonal dummy variables. All regressions were estimated using an exact Maximum Likelihood Estimator with AR(2) disturbances (see Pesaran, 1972). The figures in parentheses are are *t*-statistics.
* the % s.e. is the standard error as a percentage of the mean of the dependent variable.

Table 10 United States, Actual and Hidden Unemployment by Age-Gender, 1983 and 1998 (thousands)

	1983				1998			
Males	**UN**		**HU**		**UN**		**HU**	
	000's	**% of total**	**000's**	**% of total**	**000's**	**% of total**	**000's**	**% of total**
15-19	1003.3	9.5	577.1	18.6	676.3	11.2	58.5	17.6
20-24	1362	12.9	305.6	9.8	580.5	9.6	25.9	7.8
25-34	1812.5	17.1	110.7	3.6	698.8	11.5	10.8	3.2
35-44	944.8	8.9	110.7	3.6	608.5	10.0	10.8	3.2
45-54	610.5	5.8	68.6	2.2	418	6.9	10.5	3.2
55-64	429.5	4.1	-41.8	-1.3	196.3	3.2	-4.2	-1.3
Total	6162.6	58.2	1130.9	36.4	3178.4	52.4	112.3	33.7
Females	**UN**		**HU**		**UN**		**HU**	
	000's	**% of total**	**000's**	**% of total**	**000's**	**% of total**	**000's**	**% of total**
15-19	825.8	7.8	492.5	15.9	516.0	8.5	48.3	14.5
20-24	961.8	9.1	147	4.7	497.0	8.2	11.8	3.5
25-34	1256.8	11.9	476.1	15.3	720.3	11.9	45.7	13.7
35-44	704	6.7	320.6	10.3	649.3	10.7	47.3	14.2
45-54	427	4.0	303.9	9.8	361.0	6.0	45.4	13.6
55-64	243.8	2.3	231.9	7.5	140.3	2.3	22.4	6.7
Total	4419.2	41.8	1972	63.6	2883.9	47.6	220.9	66.3
Persons	**UN**		**HU**		**UN**		**HU**	
	000's	**% of total**	**000's**	**% of total**	**000's**	**% of total**	**000's**	**% of total**
15-19	1828.8	17.3	1069.5	34.5	1204.8	19.9	106.8	32.1
20-24	2323.8	22.0	452.6	14.6	1077.3	17.8	37.7	11.3
25-34	3068.8	29.0	586.8	18.9	1419	23.4	56.5	17.0
35-44	1649	15.6	431.3	13.9	1257.8	20.7	58.1	17.4
45-54	1037.5	9.8	372.5	12.0	779	12.8	55.9	16.8
55-64	673.3	6.4	190.1	6.1	336.7	5.6	18.2	5.5
Total	10581.2	100.0	3102.8	100.0	6062.3	100.0	333.2	100.0

Note: The estimates of hidden unemployment are based on a 4 per cent full employment unemployment rate (see Table 3).

Table 9 United States, Hidden Unemployment by Age-Gender at 4 per cent unemployment, 1979-1998, thousands

Age/Gender	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
15-19																				
Males	227.0	345.0	375.3	587.1	577.1	344.7	314.9	303.8	208.4	150.8	122.7	160.5	287.0	342.8	277.4	198.1	168.2	148.6	101.3	58.5
Females	195.5	296.9	323.2	504.0	492.5	294.3	268.6	258.8	177.3	128.0	104.3	134.5	239.6	285.6	230.3	165.1	140.0	123.1	83.5	48.3
Total	422.5	642.0	698.5	1091.2	1069.5	639.1	583.5	562.7	385.7	278.8	227.0	295.0	526.6	628.4	507.7	363.2	308.2	271.8	184.8	106.8
20-24																				
Males	108.3	167.8	188.0	302.8	305.6	188.9	169.0	159.0	104.8	73.9	60.2	81.9	151.0	182.3	144.3	100.0	80.8	67.5	45.1	25.9
Females	52.5	81.3	91.0	146.3	147.0	90.4	82.1	77.1	50.9	36.0	29.2	38.5	70.7	85.1	67.5	46.8	37.7	31.5	20.7	11.8
Total	160.8	249.1	279.0	449.0	452.6	279.4	251.1	236.1	155.7	109.8	89.4	120.4	221.7	267.5	211.8	146.9	118.5	99.1	65.8	37.7
25-34																				
Males	36.3	57.4	65.8	107.9	110.7	70.3	66.1	65.9	45.4	33.2	27.8	35.6	64.9	78.1	61.9	43.2	35.3	29.8	19.4	10.8
Females	156.8	248.0	284.3	465.4	476.1	301.3	285.0	280.6	193.5	141.6	118.3	151.5	276.5	332.0	262.5	182.6	149.7	126.9	82.4	45.7
Total	193.1	305.4	350.1	573.3	586.8	371.6	351.1	346.5	238.9	174.8	146.1	187.1	341.4	410.1	324.3	225.7	184.9	156.6	101.9	56.5
35-44																				
Males	36.3	57.4	65.8	107.9	110.7	70.3	66.1	65.9	45.4	33.2	27.8	35.6	64.9	78.1	61.9	43.2	35.3	29.8	19.4	10.8
Females	100.9	158.3	180.4	304.6	320.6	208.0	200.2	200.1	140.8	105.2	90.6	121.1	230.0	284.0	232.7	166.5	140.6	122.8	82.5	47.3
Total	137.2	215.7	246.2	412.5	431.3	278.3	266.3	265.9	186.3	138.5	118.5	156.7	295.0	362.1	294.5	209.7	175.8	152.6	101.9	58.1
45-54																				
Males	25.4	38.7	42.7	68.2	68.6	42.7	40.0	39.1	27.1	20.4	17.5	22.9	43.1	55.2	46.6	34.1	29.4	26.1	17.9	10.5
Females	113.3	172.0	189.8	302.7	303.9	188.8	176.3	172.6	119.6	89.8	77.1	99.2	186.3	239.3	201.2	147.3	127.4	113.5	77.7	45.4
Total	138.8	210.7	232.5	370.9	372.5	231.5	216.3	211.7	146.7	110.2	94.6	122.1	229.4	294.5	247.8	181.4	156.8	139.7	95.6	55.9
55-64																				
Males	-14.7	-22.7	-25.5	-41.2	-41.8	-26.0	-24.3	-23.4	-15.8	-11.4	-9.4	-11.6	-21.3	-25.8	-20.7	-14.6	-12.2	-10.6	-7.2	-4.2
Females	81.2	125.9	141.3	229.0	231.9	144.1	133.5	128.0	86.3	62.0	51.0	62.9	115.1	138.7	111.0	78.2	65.2	56.5	38.0	22.4
Total	66.5	103.2	115.9	187.7	190.1	118.1	109.1	104.6	70.5	50.6	41.6	51.3	93.8	112.9	90.3	63.6	53.0	45.9	30.9	18.2
TOTAL ALL	1119.0	1726.0	1922.1	3084.7	3102.7	1918.0	1777.4	1727.5	1183.9	862.9	717.2	932.6	1707.9	2075.4	1676.5	1190.4	997.3	865.6	580.9	333.2

Source: Author's own calculations based on method explained in text.

Conclusion

The estimates of hidden unemployment in Australia and the United States are comparable. The differences in the results are due in a large part to the benchmark that we chose. The actual unemployment rate in the United States is much closer to the benchmark and as such is by construction a tighter labour market. The cyclical behaviour of the labour force participation rates for demographic groups is comparable across countries.

The estimates indicate that many more jobs have to be created to reduce the true slack in the labour market than is indicated by the unemployment rate. Unemployment is the tip of the iceberg.

Appendix

The estimates of the employment gap requires an assumption to made about the full employment unemployment rate, which then defines the potential employment-population ratio , $NPOP^{FN}$ and implicitly the potential labour force, L^*.

Expressions can be derived for these unknown aggregates. We define the potential labour force as:

Eqn A.1 $$L^* = L + H$$

where L is the actual labour force and H is the estimated hidden unemployment.

Eqn A.2 $$H = \beta\left(NPOP^{FN} - NPOP\right)$$

Hidden unemployment is defined as the cyclical sensitivity of the labour force participation rate, β times the employment gap.

Substituting and re-arranging Eqn A.1 gives:

Eqn A.3 $$L^* = L + \beta N^* - \beta N$$

Where N^* is the level of employment at full employment and N is the actual level of employment in any period.

Define the target full employment unemployment rate, *x* as:

Eqn A.4 $$x = \left(1 - \frac{N^*}{L^*}\right)$$

Re-arranging Eqn A.4 and substituting for the potential labour force generates an expression for the potential employment level.

Eqn A.5 $$N^* = \frac{(1-x)(L-\beta N)}{1-\beta(1-x)}$$

Substituting back into Eqn A.3 provides a straightforward expression for the potential labour force:

Eqn A.6 $$L^* = L + \frac{(L-\beta N)}{x} - \beta N$$

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[1] The choice of 4 and 5 percent benchmark unemployment rates to represent full employment and conduct sensitivity analysis is not intended to indicate that the authors consider this to be the constraint facing the economy. Mitchell (1998) outlines a model of the economy, which allows the unemployment rate to be reduced to some low frictional figure.