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LABOUR TAXES AND WORK HOURS IN AUSTRALIA

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Abstract

In the 1970s, work hours in Europe were similar to work hours in America, but today Europeans work less than Americans. Prescott (2004) attributes the decline in European work hours to an increase in the effective marginal tax rate on labour income. The Australian labour market experience confirms that the taxation of labour income is an important determinant of the decision to work. In Australia taxes and work hours did not change much in the long-run, but Australian work hours rebounded after a temporary increase in taxes in the 1980s. The resilience of Australian work hours suggests that a return to the tax rates of the 1970s would restore the European labour supply.

1. Introduction

As recently as in the 1970s, work hours in Europe exceeded work hours in America, yet today Europeans spend less time at work than Americans. The reversal of European and American work hours in the last quarter of the 20th century provides an opportunity to study the effect of labour market institutions on national labour supplies. Institutional factors that are commonly thought to influence the decision to work include the tax system, unemployment benefits, the degree of unionisation and other labour market institutions.

Table 1 illustrates the dramatic shift that occurred in weekly work hours in Europe and America. In the early 1970s, work hours per person aged 15 to 65 years averaged 24.4 hours in France and 24.6 hours in Germany, whereas Americans worked 23.5 hours. By the mid-1990s, average work hours had fallen to 17.5 hours in France and 19.3 hours in Germany, whereas American work hours had risen to 25.9 hours. This amounts to a decrease in labour supply of 28 percent in France and 22 percent in Germany, and an increase of 10 percent in America. Between the 1970s and the 1990s, weekly work hours fell in all G-7 countries, except in America and Canada.

Prescott (2004) developed a labour market model that highlights the relationship between weekly work hours and taxes on labour income. He concludes that "virtually all of the large differences between the U.S. labour supply and those of Germany and France are due to the differences in the tax system." Surprisingly, national differences in labour market institutions, including the system of unemployment benefits and the degree of unionisation, matter little. The distortionary effect of the high European taxes on labour income produces a substantial welfare loss. Prescott (2004) estimates

that if France were to reduce its taxes on labour income to the U.S. level, the welfare of French workers as measured by lifetime consumption equivalents would increase by 19 percent.

Table 1. Work Hours per Week for the G-7 Countries

Country	1970-74	1993-96
Canada	22.2	22.9
France	24.4	17.5
Germany	24.6	19.3
Italy	19.2	16.5
Japan	29.8	27.0
United Kingdom	25.9	22.8
United States	23.5	25.9

Note: Weekly work hours per person aged 15 to 65 years. Source: Prescott (2004).

Davis and Henrekson (2005) conduct a cross country analysis of the effect of taxes on work effort. They concur with Prescott "that tax rate differences among rich countries explain much of the international variation in work activity outcomes." Still, the findings of Prescott (2004) and Davis and Henrekson (2005) remain controversial. Olovsson (2004) shows that work hours in Sweden exceed work hours in France and Germany, although Sweden has the highest tax rate in the world. Nickell (2004) reckons that unemployment accounts for about half of the difference in labour supply between Europe and the United States. Nickell, Nunziata and Ochel (2005) consider the effect of the tax system, unemployment benefits, employment protection, the system of wage determination and barriers to labour mobility on unemployment.

Alesina, Glaeser and Sacerdote (2006) also reject Prescott's claim that taxes explain most of the low work hours in Europe. They argue that a regression of work hours on taxes that omits the degree of unionisation overestimates the effect of taxes because tax rates are positively correlated with the degree of unionisation. Once the degree of unionisation and employment protection is included among the explanatory variables, the tax effect becomes insignificant. Rogerson (2006), however, finds no relationship between work hours and the degree of unionisation and employment protection. He also points out that country and time dummy variables account for most of the explanatory power in the regressions conducted by Alesina, Glaeser and Sacerdote (2006).

Ljungqvist and Sargent (2007) hold that generous government transfers, which are conditional on recipients not working, account for low European work hours. Prescott (2007) rejects their model because, unlike his own, it does not provide "a quantitative general equilibrium analysis ….. that is restricted to be consistent with the national account statistics." Yet, Prescott recognises that Ljungqvist and Sargent's approach sheds light on the implications of labour indivisibility. Employed Europeans work similar hours per day and week as Americans. In Europe average weekly work hours of the working age population are low because people take longer vacations, more sick days and there are more public holidays. In addition, Europeans start to work later in life and they retire earlier than Americans.

In this paper, the quantitative general equilibrium model of Prescott (2004) is used to analyse the relationship between taxes on labour income and work hours in Australia. Section II presents Prescott's labour market model. Section III details how Australian national accounts data were transformed to fit the labour market model and

how the effective marginal tax rate on labour income was calculated. Section IV compares actual and predicted work hours in Australia with work hours in the G-7 countries. As in the United States, in Australia taxes on labour income and work hours did not change much in the long-run, but a short-lived increase in Australian taxes temporarily reduced work hours in the 1980s. Section V considers whether other factors besides labour taxes affected work hours. Section VI concludes with some remarks on taxation and labour supply in Australia.

2. Labour Market Model

Prescott (2004) developed a labour market model that explains how a person allocates time between work and leisure. The distinction between work and leisure depends upon whether an activity is taxed or not. Market work is subject to taxation, whereas leisure comprises all tax-free non-market work, in particular home work and work in the shadow economy, together with ordinary leisure activities. The available time for work and leisure is 100 hours per week, the remaining time being used for sleep and other necessities of life. In period *t*, the preferences of the representative worker are:

$$\log c_t + \alpha \log(100 - h_t) \qquad (1)$$

c is consumption, *h* represents weekly work hours, and (100-*h*) measures leisure time. The parameter α is a weight that determines the subjective value of leisure. The worker allocates time between market work and leisure subject to the budget constraint:

$$(1+\tau_c)c_t + (1+\tau_x)x_t = (1-\tau_h)w_t h_t + (1-\tau_k)(r_t - \delta)k_t + \delta k_t + T_t \qquad (2)$$

x denotes gross investment, w the real wage, k the capital stock and δ the depreciation rate. The taxes are: τ_c consumption tax rate, τ_x investment tax rate, τ_h marginal labour tax rate and τ_k capital income tax rate. The budget equation states that the sum of wage income, capital income, depreciation allowances and government transfers T_t must equal expenses for consumption and gross investment, with all items being adjusted by the pertinent tax rate. The government uses taxes to finance public services, which, except for military expenses, are assumed to be perfect substitutes for private consumption. Any excess of taxes over expenses for public services is returned to households as lump-sum transfer payments.

Output y_t is produced with a Cobb-Douglas technology:

$$y_t = A_t k_t^{\theta} h_t^{1-\theta} \qquad (3)$$

Assuming workers are paid the marginal product, the parameter θ is the capital share in income. A_t is a productivity parameter. Since the Cobb-Douglas production function has constant returns to scale, the size of the productive unit does not matter; it may be a single worker or a firm.

The effective marginal tax rate on labour income captures the combined effect of labour and consumption taxes on the work decision. Differentiating the budget equation with regard to consumption and labour income yields:

$$\Delta c_t = \frac{1-\tau_h}{1+\tau_c}\Delta(w_t h_t) \qquad (4)$$

In this expression the fraction $(1-\tau_h)/(1+\tau_c)$ represents the effective marginal increase in labour income, unencumbered by labour and consumption taxes. Setting $(1-\tau) = (1-\tau_h)/(1+\tau_c)$, the effective marginal tax rate τ is:

$$\tau = \frac{\tau_h + \tau_c}{1+\tau_c} \tag{5}$$

The first optimum condition requires that the marginal rate of substitution between consumption and leisure is equal to the after-tax real wage, using the effective marginal tax rate on labour income.

$$\frac{\alpha/(1-h_t)}{1/c_t} = (1-\tau_t)w_t \tag{6}$$

The marginal rate of substitution, which is shown on the left-hand side of the optimum condition, can be derived from equation 1. The second optimum condition states that the real wage must equal the marginal product of labour.

$$w_t = (1-\theta)y_t / h_t \tag{7}$$

Substituting equation 7 into equation 6 yields the key equilibrium relationship between work hours, the effective marginal tax rate on labour income and the consumption-income ratio.

$$h_t = \frac{1-\theta}{1-\theta+\frac{c_t}{y_t}\frac{\alpha}{1-\tau_t}} \tag{8}$$

This equilibrium relationship contains two endogenous variables, work hours *h* and the consumption-income ratio *c*/*y*, whose values depend on the effective marginal tax rate τ and all other factors that determine the path of the economy in a dynamic

macroeconomic model. The equation splits the effect of a change in the tax rate into a present-time substitution effect and an intertemporal substitution effect. An increase in τ lowers the incentive to work because the after-tax wage falls, reducing the relative price of leisure in the first optimum condition. If the increase in τ is expected to be temporary, the *c/y* ratio rises because people work less and, maintaining consumption, save less as long as the higher taxes persist. Consequently, a temporary increase in τ reduces *h* because $(1-\tau)$ falls and the intertemporal substitution effect increases the *c/y* ratio. A permanent tax increase cannot be avoided by postponing work effort. As there is no intertemporal substitution effect, a permanent tax increase reduces *h* only by lowering $(1-\tau)$, without affecting the *c/y* ratio. Since extra tax revenues are returned to households through lump-sum transfer payments, there are no wealth effects in this analysis. Prescott (2004) uses equation 8 to measure the effect of taxes on work hours.

3. Australian Taxes

Prescott (2004) calculates the effective marginal tax rate on labour income for the G-7 countries, using United Nations System of National Accounts data (SNA). The following calculations for Australia follow Prescott's method as far as possible.[1] Since SNA data are unavailable for Australia after 1998, OECD data have been used for the period from 2001 to 2003.

[1] The Appendix to the electronic version of this paper includes spreadsheets with the Australian data and calculations.

Most indirect taxes are consumption taxes, although some indirect taxes are levied on investment goods, for example in the transport sector and in the building industry. Prescott assumes that in the G-7 countries two thirds of total indirect taxes net of subsidies are consumption taxes, and the other third falls evenly on consumption and investment goods. Then, net indirect consumption taxes are:

$$IT_c = \left[2/3 + 1/3 \frac{C}{C+I} \right] IT. \tag{9}$$

IT and IT_c denote total indirect taxes and indirect consumption taxes net of subsidies, and C and I are consumption and investment from the national accounts. Capital letters indicate national accounts data.

Indirect taxes are computed on final products in the budget equation because they are assigned to households in the model. Therefore, indirect taxes must be removed as a cost component of GDP and consumption. The model variables for aggregate output y and consumption c are:

$$y = GDP - IT \tag{10}$$

$$c = C + G - G_{military} - IT_c \tag{11}$$

(G–$G_{military}$) stands for the government's civilian public services. Aggregate consumption is composed of private consumption and civilian public services, which are assumed to be perfect substitutes.

The consumption tax rate τ_c is calculated as:

$$\tau_c = \frac{IT_c}{C - IT_c} \tag{12}$$

The model considers two taxes rates associated with labour income, the marginal social security tax rate τ_{ss} and the income tax rate τ_{inc}. The estimate for τ_{ss} is:

$$\tau_{ss} = \frac{\text{Social Security Taxes}}{(1-\theta)y} \tag{13}$$

Social security taxes include contributions for pension funds, unemployment insurance, health insurance and a number of other provisions. (1–θ) is the labour share of income in the Cobb-Douglas production function if workers earn the marginal product in a competitive labour market.

The average income tax rate is:

$$\bar{\tau}_{inc} = \frac{\text{Direct Household Taxes}}{\text{GDP} - \text{IT} - \text{Depreciation}} \tag{14}$$

The average income tax rate is transformed into the marginal tax rate by the formula

$$\tau_h = \tau_{ss} + 1.6\bar{\tau}_{inc} \tag{15}$$

The average tax rate is multiplied by the factor 1.6 because the marginal tax rate exceeds the average tax rate in a progressive income tax system. Prescott (2004) derives the figure from a study by Feenberg and Coutts (1993), who use a sample of U.S. tax records to determine the marginal tax rate on labour income. The effective marginal tax rate on labour income τ (equation 5) combines the consumption tax rate τ_c (equation 12) with the marginal income tax rate τ_h (equation 15).

The effective marginal tax rate on labour income is low in Australia compared to most G-7 nations (Table 2). In the 1970s and 1990s, taxes in Australia absorbed close to one third of an extra dollar of labour income. In the G-7 countries, marginal tax

rates between 40 and 50 percent were common in the 1970s, and above 50 percent in the 1990s. The only exception is Japan with a marginal tax rate of 25 percent in the 1970s and 37 percent in the 1990s. The effective taxation of labour income is less onerous in Australia than abroad because both the marginal labour tax rate and indirect consumption taxes are low. Australians did not pay a general consumption tax until the introduction of the goods and services tax (GST), which became operational on July 1, 2000. Even after the introduction of the GST, the effective marginal tax rate remained low because the GST, which is set at 10 percent, replaced a host of indirect taxes, and basic food items as well as some other goods and services are exempted.

Table 2. Effective Marginal Tax Rates for Australia and the G-7 Countries

Country	1970-74	1993-96
Australia	0.32	0.34
Canada	0.44	0.52
France	0.49	0.59
Germany	0.52	0.59
Italy	0.41	0.64
Japan	0.25	0.37
United Kingdom	0.45	0.44
United States	0.40	0.40

Source: G-7 countries (Prescott 2004), Australia (see text).

Table 2 documents the increase in taxes in continental European countries from the early 1970s to the early 1990s. The effective marginal tax rate on labour income rose from 49 percent to 59 percent in France and from 52 percent to 59 percent in Germany. Meanwhile, tax rates remained virtually unchanged in Australia and the United States. This substantial increase in the tax wedge forms the basis of Prescott's

explanation of the labour supply divide that has occurred between America and Europe since the 1970s. The American labour supply remained stable because the tax rate did not change, whereas in Europe rising taxes provided a disincentive for work. As will be seen in the next section, the Australian labour market experience was similar to that of the United States.

4. Actual and Predicted Work Hours

In this section equation 8 is used to predict work hours for Australia during the past four decades. The predicted work hours are compared with actual values, which are calculated from labour market data of the Groningen Growth and Development Centre and the OECD Database on labour force statistics. The capital share parameter $\theta = 0.3224$ and the leisure parameter $\alpha = 1.54$ are the same as in Prescott (2004). The value of θ is the average for the G-7 countries, and the value of α brings the predicted work hours near the actual value for most G-7 countries in Prescott's study. If Prescott's hypothesis on the importance of taxes in determining labour supply is correct, then Australian work hours should be similar to those in other countries with comparable tax rates, the predicted number of work hours should match actual work hours, and actual and predicted work hours should move in the opposite direction of the tax rate from one period to the next.

In the early 1970s, actual work hours were similar in Australia, America, France and Germany. In all four countries, 15 to 65 year olds on average worked about 24 hours per week (Tables 1 and 3). From the 1970s to the 1990s, tax rates and actual work hours remained stable in Australia and the United States, while taxes increased

and work hours fell below twenty hours in France and Germany (Tables 1, 2 and 3). This observation supports Prescott's hypothesis that the tax rate determines work hours. Between the 1970s and 1990s, work hours remained stable in Australia and the United States where taxes did not change, while the increase in European taxes accounts for the decline in European work hours. But the model fails to explain work hours in the 1970s. Actual work hours were similar in Australia, America, France and Germany, although the effective marginal tax rate on labour income was considerably less in the first two countries.

Table 3. Actual and Predicted Labour Supply for Australia

Period	Tax Rate	*c*/*y* Ratio	Predicted Work Hours (*h*)	Actual Work Hours	Difference
1970-74	0.32	0.68	30.3	24.2	6.1
1986-88	0.39	0.72	27.0	22.9	4.1
1993-96	0.34	0.76	27.6	23.5	4.1
2001-03	0.33	0.74	28.6	24.0	4.6

In Table 3 predicted Australian work hours exceed actual work hours by about 4 to 6 hours. Prescott (2004) provides a somewhat better fit between predicted and actual work hours for the G-7 countries, with an average absolute error of 4.1 hours in the 1970s and 1.6 hours in the 1990s. One explanation for the divergence between predicted and actual work hours in Australia is that actual work hours may be too low. Since OECD data are unavailable until 1978, Australian work hours were calculated using data from the Groningen Growth and Development Centre. After 1978, actual work hours increase between 0.7 and one hour if OECD data is used instead of the

Groningen data. Prescott (2004) also suggests that the model overpredicts work hours for countries with a low tax rate because the curvature of the logarithmic utility function with respect to leisure may be too low. Since the Australian tax rate was low, a more strongly curved utility function would reduce predicted work hours.

In Table 3 predicted and actual work hours always move in the same direction, reflecting changes in the Australian tax rate. Between the early 1970s and the late 1980s, the Australian tax rate increased from 32 percent to 39 percent, leading to a decline in predicted work hours from 30.3 to 27.0 hours and in actual work hours from 24.2 to 22.9 hours. Between the late 1980s and the early 1990s, the movement in the tax rate reversed and work hours rebounded. The tax rate dropped to 34 percent in the early 1990s and stayed at that level afterwards. The lower tax rate accounted for an increase in predicted work hours from 27.0 to 28.6 hours and in actual work hours from 22.9 to 24.0 hours. After high taxes in the 1980s, the tax rate returned to a level that was only one percentage point higher than thirty years earlier, and actual work hours differed by only 0.2 hours from the previous level. Thus, the Australian experience supports Prescott's policy recommendation that if France and Germany reversed the increase in their tax rates since the 1970s, then they would move toward their previous labour supply outcomes. In Australia the reversal of the tax rate after a period of high taxes indeed restored the original labour supply.

5. The Consumption-Income Ratio

Of course, the taxation of labour income is not the only factor that determines labour supply. Equation 8 contains two endogenous variables, work hours h and the consumption-income ratio c/y, which depend on the effective marginal tax rate on

labour income τ and on all other factors that are relevant in a dynamic macro-economic model. These other factors include the current capital stock, expected future tax rates and productivity shocks. It is possible that movements in these other factors cause simultaneous changes in work hours and the *c*/*y* ratio, without a change in the marginal tax rate. For example, a temporary increase in the marginal product of labour provides an incentive to work more and to save, raising work hours and reducing the *c*/*y* ratio. Ljungqvist (2006) shows that the tax rate explains about two thirds of the change in work hours in France and Germany between the 1970s and 1990s, the remaining third being accounted for by productivity shocks and other factors that affect the *c*/*y* ratio.

Ljungqvist (2006) measures the effect of a change in the effective marginal tax rate on work hours by holding the *c*/*y* ratio constant in equation 8. This yields the effect of a permanent tax change on work hours that does not produce an inter-temporal substitution effect, providing the minimum effect of a tax change on work hours. Table 4 compares the predicted work hours for Australia, using the actual *c*/*y* ratio in each period and holding the *c*/*y* ratio constant at the level of the preceding period; the *c*/*y* ratio is given in Table 3. Between the 1970s and 1980s, predicted work hours fell by 10.9 percent, but they would have fallen by 7.3 percent if the *c*/*y* ratio had been constant. Thus, the increase in the tax rate from 32 percent to 39 percent accounted for two thirds of the reduction in labour supply, and maybe more if people perceived the tax hike to be temporary, as it indeed turned out to be. Between the 1980s and 1990s, predicted work hours increased by 2.0 percent, but they would have increased by 5.9 percent if the *c*/*y* ratio had been constant. In this interval, an increase in the *c*/*y* ratio dampened the positive effect of the fall in the tax rate on work hours. Between the 1990s and the early 2000s, the tax rate accounted for one third of the

increase in predicted work hours. In the last interval, the effect of the tax rate was modest because it did not change much. These calculations confirm that the Australian labour supply responds strongly to changes in the effective marginal tax rate on labour income.

Table 4. Decomposition of Predicted Work Hours for Various Periods

Period	Predicted Work Hours	% Change
1970-74	30.3	
1986-88 (86-88 *c/y* ratio)	27.0	-10.9
1986-88 (70-74 *c/y* ratio)	28.1	-7.3
1986-88	27.0	
1993-96 (93-96 *c/y* ratio)	27.6	2.0
1993-96 (86-88 *c/y* ratio)	28.6	5.9
1993-96	27.6	
2001-03 (01-03 *c/y* ratio)	28.6	3.6
2001-03 (93-96 *c/y* ratio)	27.9	1.2

6. Conclusion

The taxation of labour income has a decisive influence on labour supply in the G-7 countries and Australia. Thirty years ago, average work hours were similar in Australia, America and continental Europe. Prescott (2004) attributes the subsequent decline in European work hours to an increase in the effective marginal tax rate on labour income. The Australian labour market experience fits the pattern observed among the G-7 countries. As in America, Australian taxes and work hours did not change much in the long-run, but a short-lived increase in taxes temporarily reduced

work hours in the 1980s. The resilience of the Australian labour supply suggests that Prescott is right that a return to the tax rates of the 1970s would restore the European labour supply.

Remarkably, the same values for the leisure parameter α and the capital share parameter θ yield a reasonable fit between predicted and actual work hours for Australia and all G-7 countries. It seems that idiosyncratic differences among households average out at the aggregate level, both nationally and internationally. For this reason, the same representative household can be used to model aggregate labour supply in Australia and the G-7 countries. Even so, choosing slightly different parameter values for each country would improve the model fit. In particular, the progression of income taxes almost certainly differs across countries. Therefore, using distinct values for the Feenberg-Coutts parameter would improve the model fit at the national level.

This model can be used to ascertain the sensitivity of the labour supply to changes in the effective marginal tax rate on labour income. In Australia, an increase in the tax rate from 32 percent to 39 percent reduced predicted work hours by 10.9 percent between the 1970s and 1980s. Thus, work hours fell by 1.6 percent for a one percentage point increase in the tax rate. The increase in European taxes had a somewhat stronger effect on work hours. Using Prescott's figures, predicted work hours fell by 2.3 percent in France and by 3.0 percent in Germany for every one percentage point increase in the tax rate between the 1970s and 1990s. This information is useful in a tax reform that affects the effective marginal tax on labour income, either by changing the marginal labour tax rate or the consumption tax rate (GST). Using 2001-03 figures, a revenue neutral increase in the GST from 10 percent to 12

percent would increase the effective marginal tax rate by 1.1 percentage points, reducing Australian work hours by 1.2 percent. If Australia adopted the German consumption tax rate of 19 percent, work hours would fall by 5.3 percent.

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Table A1. Australian Effective Marginal Tax Rate and Predicted Work Hours, 1970-74

National Accounts Data ($ million)

Year	Consumption (C)	Investment (I)	Government Expenditures (G)	Defence (Gmilitary)	GDP	Depreciation	Indirect taxes (IT)	Direct Household Taxes	Social Security Taxes
1970	20837	9572	4899	1035	35111	4571	3677.41	2642	710
1971	23170	10130	5591	1091	39288	5164	3709.18	3114	844
1972	26001	10726	6357	1152	44793	5849	4058.65	3223	1074
1973	30730	14096	7954	1380	53610	6910	4757.59	4402	1312
1974	37446	16163	10780	1469	64750	9049	6584.38	6312	1654

Model Data

Leisure Parameter (α):	1.54
Income Share of Capital (θ):	0.3224
Feenberg-Coutts Parameter:	1.6

	Indirect Con-sumption Tax (ITc)	Consumption (c)	GDP (y)	c/y Ratio	Consumption Tax Rate (τc)	Social Security Tax Rate (τss)	Average Income Tax Rate (τinc)	Marginal Income Tax Rate (τh)	Effective Marginal Tax Rate (τ)
1970	3291.55	21409.45	31433.59	0.6811	0.1876	0.0333	0.0984	0.1907	0.3185
1971	3333.06	24336.94	35578.82	0.6840	0.1680	0.0350	0.1024	0.1988	0.3141
1972	3663.54	27542.46	40734.35	0.6761	0.1640	0.0389	0.0924	0.1867	0.3013
1973	4258.90	33045.10	48852.41	0.6764	0.1609	0.0396	0.1050	0.2076	0.3174
1974	5922.66	40834.34	58165.62	0.7020	0.1879	0.0420	0.1285	0.2476	0.3666
			Average c/y:	0.6839				Average τ:	0.3236

Predicted Work Hours (h):	30.32
Actual Work Hours:	24.20

Table A2. Australian Effective Marginal Tax Rate and Predicted Work Hours,1986-1988

National Accounts Data ($ million)

Year	Consumption (C)	Investment (I)	Government Expenditures (G)	Defence (Gmilitary)	GDP	Depreciation	Indirect taxes (IT)	Direct Household Taxes	Social Security Taxes
1986	157324	64360	49043	6683	264575	42592	25725.95	29143	9718
1987	175657	72300	52497	6617	299642	46733	28855.32	32487	10277
1988	196364	85089	56662	7381	339881	51372	29816.37	37614	10877

Model Data

Leisure Parameter (α):	1.54
Income Share of Capital (θ):	0.3224
Feenberg-Coutts Parameter:	1.6

	Indirect Con-sumption Tax (Itc)	Consumption (c)	GDP (y)	c/y Ratio	Consumption Tax Rate (τc)	Social Security Tax Rate (τss)	Average Income Tax Rate (τinc)	Marginal Income Tax Rate (τh)	Effective Marginal Tax Rate (τ)
1986	23236.34	176447.66	238849.05	0.7387	0.1733	0.0600	0.1485	0.2976	0.4014
1987	26050.75	195486.25	270786.68	0.7219	0.1741	0.0560	0.1450	0.2880	0.3936
1988	26811.67	218833.33	310064.63	0.7058	0.1581	0.0518	0.1454	0.2844	0.3821
			Average c/y:	0.7221				Average τ:	0.3924

Predicted Work Hours (h):	27.02
Actual Work Hours:	22.92

Table A3. Australian Effective Marginal Tax Rate and Predicted Work Hours, 1993-1996

National Accounts Data ($ million)

Year	Consumption (C)	Investment (I)	Government Expenditures (G)	Defence (Gmilitary)	GDP	Depreciation	Indirect Taxes (IT)	Direct Household Taxes	Social Security Taxes
1993	269502	89729	76838	9320	432436	65166	36274	38883	13246
1994	286830	100507	79341	9230	460291	66799	39943	41906	14370
1995	306369	102525	83437	9136	492113	69530	42958	47102	15721
1996	318480	104124	86419	8720	516306	72407	43935	51861	16475

Model Data

Leisure Parameter (α):	1.54
Income share of Capital (θ):	0.3224
Feenberg-Coutts Parameter:	1.6

	Indirect Consumption Tax (Itc)	Consumption (c)	GDP (y)	c/y Ratio	Consumption Tax Rate (τc)	Social Security Tax Rate (τss)	Average Income Tax Rate (τinc)	Marginal Income Tax Rate (τh)	Effective Marginal Tax Rate (τ)
1993	33253.82	303766.18	396162.00	0.7668	0.1408	0.0493	0.1175	0.2373	0.3314
1994	36488.17	320452.83	420348.00	0.7624	0.1458	0.0505	0.1185	0.2401	0.3368
1995	39367.61	341302.39	449155.00	0.7599	0.1474	0.0517	0.1241	0.2502	0.3465
1996	40326.67	355852.33	472371.00	0.7533	0.1450	0.0515	0.1297	0.2589	0.3528
			Average c/y:	0.7606				Average τ:	0.3419

Predicted Work Hours (h):	27.57
Actual Work Hours:	23.50

Table A4. Australian Effective Marginal Tax Rate and Predicted Work Hours, 2001-2003

National Accounts Data ($ million)

Year	Consumption (C)	Investment (I)	Government Expenditures (G)	Defence (Gmilitary)	GDP	Depreciation	Indirect Taxes (IT)	Direct Household Taxes	Social Security Taxes
2001	424829	162447	127325	17831	713229	113593	60883	64584	16146
2002	453202	186975	136848	18954	758147	119407	67137	68613	17153
2003	484935	203925	145836	20331	813225	125982	71781	74234	18559

Model Data

Leisure Parameter (α):	1.54
Income Share of Capital (θ):	0.3224
Feenberg-Coutts Parameter:	1.6

	Indirect Consumption Tax (Itc)	Consumption (c)	GDP (y)	c/y Ratio	Consmption Tax Rate (τc)	Social Security Tax Rate (τss)	Average Income Tax Rate (τinc)	Marginal Income Tax Rate (τh)	Effective Marginal Tax Rate (τ)
2001	55269.36	479053.91	652346.00	0.7344	0.1496	0.0365	0.1199	0.2283	0.3287
2002	60600.82	510495.51	691010.00	0.7388	0.1544	0.0366	0.1200	0.2287	0.3318
2003	64697.83	545742.55	741444.00	0.7361	0.1540	0.0369	0.1206	0.2299	0.3327
			Average c/y:	0.7364				Average τ:	0.3311

Predicted Work Hours (h):	28.56
Actual Work Hours:	24.00

Excel Formulas for Table A-1

	A	B	C	D	E	F	G	H	I	J
1	**Table A1. Australian Effective Marginal Tax Rate and Predicted Work Hours, 1970-74**									
2										
3	**National Accounts Data ($ million)**									
4										
5	Year	Consumption (C)	Investment (I)	Government Expenditures (G)	Defence (Gmilitary)	GDP	Depreciation	Indirect taxes (IT)	Direct Household Taxes	Social Security Taxes
6										
7	1970	20837	9572	4899	1035	35111	4571	3677.40561740891	=3352-J7	710
8	1971	23170	10130	5591	1091	39288	5164	3709.17586032389	=3958-J8	844
9	1972	26001	10726	6357	1152	44793	5849	4058.64853238866	=4297-J9	1074
10	1973	30730	14096	7954	1380	53610	6910	4757.59387651822	=5714-J10	1312
11	1974	37446	16163	10780	1469	64750	9049	6584.38284412955	=7966-J11	1654
12										
13										
14	**Model Data**									
15										
16	Leisure Parameter (α):			1.54						
17	Income Share of Capital (θ):			0.3224						
18	Feenberg-Coutts Parameter:			1.6						
19										
20		Indirect Consumption Tax (ITc)	Consumption (c)	GDP (y)	c/y Ratio	Consumption Tax Rate (τc)	Social Security Tax Rate (τss)	Average Income Tax Rate (τinc)	Marginal Income Tax Rate (τh)	Effective Marginal Tax Rate (τ)
21										
22	1970	=((2/3) + (1/3)* (B7/(B7+C7)))*H7	=B7+D7-E7-B22	=F7-H7	=C22/D22	=(B22)/(B7-B22)	=J7/((1-$D$17)*(D22))	=I7/(D22-G7)	=$D$18*H22+G22	=(F22+I22)/(1+F22)
23	1971	=((2/3) + (1/3)* (B8/(B8+C8)))*H8	=B8+D8-E8-B23	=F8-H8	=C23/D23	=(B23)/(B8-B23)	=J8/((1-$D$17)*(D23))	=I8/(D23-G8)	=$D$18*H23+G23	=(F23+I23)/(1+F23)
24	1972	=((2/3) + (1/3)* (B9/(B9+C9)))*H9	=B9+D9-E9-B24	=F9-H9	=C24/D24	=(B24)/(B9-B24)	=J9/((1-$D$17)*(D24))	=I9/(D24-G9)	=$D$18*H24+G24	=(F24+I24)/(1+F24)
25	1973	=((2/3) + (1/3)* (B10/(B10+C10)))*H10	=B10+D10-E10-B25	=F10-H10	=C25/D25	=(B25)/(B10-B25)	=J10/((1-$D$17)*(D25))	=I10/(D25-G10)	=$D$18*H25+G25	=(F25+I25)/(1+F25)
26	1974	=((2/3) + (1/3)* (B11/(B11+C11)))*H11	=B11+D11-E11-B26	=F11-H11	=C26/D26	=(B26)/(B11-B26)	=J11/((1-$D$17)*(D26))	=I11/(D26-G11)	=$D$18*H26+G26	=(F26+I26)/(1+F26)
27										
28				Average c/y:	=SUM(E22:E26)/5				Average τ:	=SUM(J22:J26)/5
29										
30	Predicted Work Hours (h):			=(1-$D$17)/(1-$D$17 + E28*$D$16/(1-J28))*100						
31	Actual Work Hours:			24.2						
32										

Excel Formulas for Table A-2

	A	B	C	D	E	F	G	H	I	J
1	**Table A2. Australian Effective Marginal Tax Rate and Predicted Work Hours,1986-1988**									
2										
3	**National Accounts Data ($ million)**									
4										
5	Year	Consumption (C)	Investment (I)	Government Expenditures (G)	Defence (Gmilitary)	GDP	Depreciation	Indirect taxes (IT)	Direct Household Taxes	Social Security Taxes
6										
7	1986	157324	64360	49043	6683	264575	42592	25725.954200404	29143	9718
8	1987	175657	72300	52497	6617	299642	46733	28855.3231275304	32487	10277
9	1988	196364	85089	56662	7381	339881	51372	29816.3729757085	37614	10877
10										
11										
12	**Model Data**									
13										
14	Leisure Parameter (α):			1.54						
15	Income Share of Capital (θ):			0.3224						
16	Feenberg-Coutts Parameter:			1.6						
17										
18		Indirect Consumption Tax (Itc)	Consumption (c)	GDP (y)	c/y Ratio	Consumption Tax Rate (τc)	Social Security Tax Rate (τss)	Average Income Tax Rate (τinc)	Marginal Income Tax Rate (τh)	Effective Marginal Tax Rate (τ)
19										
20	1986	=((2/3) + (1/3)* (B7/(B7+C7)))*H7	=B7+D7-E7-B20	=F7-H7	=C20/D20	=(B20)/(B7-B20)	=J7/((1-$D$15)*(D20))	=I7/(D20-G7)	=$D$16*H20+G20	=(F20+I20)/(1+F20)
21	1987	=((2/3) + (1/3)* (B8/(B8+C8)))*H8	=B8+D8-E8-B21	=F8-H8	=C21/D21	=(B21)/(B8-B21)	=J8/((1-$D$15)*(D21))	=I8/(D21-G8)	=$D$16*H21+G21	=(F21+I21)/(1+F21)
22	1988	=((2/3) + (1/3)* (B9/(B9+C9)))*H9	=B9+D9-E9-B22	=F9-H9	=C22/D22	=(B22)/(B9-B22)	=J9/((1-$D$15)*(D22))	=I9/(D22-G9)	=$D$16*H22+G22	=(F22+I22)/(1+F22)
23										
24				Average c/y:	=SUM(E20:E22)/3				Average τ:	=SUM(J20:J22)/3
25										
26	Predicted Work Hours (h):			=(1-$D$15)/(1-$D$15 + E24*$D$14/(1-J24))*100						
27	Actual Work Hours:			22.9156578157842						

Excel Formulas for Table A-3

	A	B	C	D	E	F	G	H	I	J
1	**Table A3. Australian Effective Marginal Tax Rate and Predicted Work Hours, 1993-1996**									
2										
3	**National Accounts Data ($ million)**									
4										
5	Year	Consumption (C)	Investment (I)	Government Expenditures (G)	Defence (Gmilitary)	GDP	Depreciation	Indirect Taxes (IT)	Direct Household Taxes	Social Security Taxes
6										
7	1993	269502	89729	76838	9320	432436	65166	36274	=52129-J7	13246
8	1994	286830	100507	79341	9230	460291	66799	39943	=56276-J8	14370
9	1995	306369	102525	83437	9136	492113	69530	42958	=62823-J9	15721
10	1996	318480	104124	86419	8720	516306	72407	43935	=68336-J10	16475
11										
12										
13	**Model**									
14										
15	Leisure Parameter (α):			1.54						
16	Income share of Capital (θ):			0.3224						
17	Feenberg-Coutts Parameter:			1.6						
18										
19										
20		Indirect Consumption Tax (Itc)	Consumption(c)	GDP (y)	c/y Ratio	Consumption Tax Rate (τc)	Social Security Tax Rate (τss)	Average Income Tax Rate (τinc)	Marginal Income Tax Rate (τh)	Effective Marginal Tax Rate (τ)
21										
22	1993	=((2/3) + (1/3)* (B7/(B7+C7)))*H7	=B7+D7-E7-B22	=F7-H7	=C22/D22	=(B22)/(B7-B22)	=J7/((1-$D$16)*(D22))	=I7/(D22-G7)	=$D$17*H22+G22	=(F22+I22)/(1+F22)
23	1994	=((2/3) + (1/3)* (B8/(B8+C8)))*H8	=B8+D8-E8-B23	=F8-H8	=C23/D23	=(B23)/(B8-B23)	=J8/((1-$D$16)*(D23))	=I8/(D23-G8)	=$D$17*H23+G23	=(F23+I23)/(1+F23)
24	1995	=((2/3) + (1/3)* (B9/(B9+C9)))*H9	=B9+D9-E9-B24	=F9-H9	=C24/D24	=(B24)/(B9-B24)	=J9/((1-$D$16)*(D24))	=I9/(D24-G9)	=$D$17*H24+G24	=(F24+I24)/(1+F24)
25	1996	=((2/3) + (1/3)* (B10/(B10+C10)))*H10	=B10+D10-E10-B25	=F10-H10	=C25/D25	=(B25)/(B10-B25)	=J10/((1-$D$16)*(D25))	=I10/(D25-G10)	=$D$17*H25+G25	=(F25+I25)/(1+F25)
26										
27				Average c/y:	=SUM(E22:E25)/4				Average τ:	=SUM(J22:J25)/4
28										
29	Predicted Work Hours (h):			=(1-$D$16)/(1-$D$16 + E27*$D$15/(1-J27))*100						
30	Actual Work Hours:			23.5						

Excel Formulas for Table A-4

	A	B	C	D	E	F	G	H	I	J
1	**Table A4. Australian Effective Marginal Tax Rate and Predicted Work Hours, 2001-2003**									
2										
3	**National Accounts Data ($ million)**									
4										
5	Year	Consumption (C)	Investment (I)	Government Expenditures (G)	Defence (Gmilitary)	GDP	Depreciation	Indirect Taxes (IT)	Direct Household Taxes	Social Security Taxes
6										
7	2001	424829	162447	127325	=0.025*F7	713229	113593	60883	64584	16146
8	2002	453202	186975	136848	=0.025*F8	758147	119407	67137	68613	17153.25
9	2003	484935	203925	145836	=0.025*F9	813225	125982	71781	74234.25	18558.5625
10										
11										
12	**Model Data**									
13										
14	Leisure Parameter (α):			1.54						
15	Income Share of Capital (θ):			0.3224						
16	Feenberg-Coutts Parameter:			1.6						
17										
18		Indirect Consumption Tax (Itc)	Consumption (c)	GDP (y)	c/y Ratio	Consmption Tax Rate (τc)	Social Security Tax Rate (τss)	Average Income Tax Rate (τinc)	Marginal Income Tax Rate (τh)	Effective Marginal Tax Rate (τ)
19										
20	2001	=((2/3) + (1/3)* (B7/(B7+C7)))*H7	=B7+D7-E7-B20	=F7-H7	=C20/D20	=(B20)/(B7-B20)	=J7/((1-$D$15)*(D20))	=I7/(D20-G7)	=$D$16*H20+G20	=(F20+I20)/(1+F20)
21	2002	=((2/3) + (1/3)* (B8/(B8+C8)))*H8	=B8+D8-E8-B21	=F8-H8	=C21/D21	=(B21)/(B8-B21)	=J8/((1-$D$15)*(D21))	=I8/(D21-G8)	=$D$16*H21+G21	=(F21+I21)/(1+F21)
22	2003	=((2/3) + (1/3)* (B9/(B9+C9)))*H9	=B9+D9-E9-B22	=F9-H9	=C22/D22	=(B22)/(B9-B22)	=J9/((1-$D$15)*(D22))	=I9/(D22-G9)	=$D$16*H22+G22	=(F22+I22)/(1+F22)
23										
24				Average c/y:	=SUM(E20:E22)/3				Average τ:	=SUM(J20:J23)/3
25										
26	Predicted Work Hours (h):			=(1-$D$15)/(1-$D$15 + E24*$D$14/(1-J24))*100						
27	Actual Work Hours:			24						

	A	B	C
1	**Calculations for Table 4:**	**Decomposition of Predicted Work Hours for Various Periods**	
2			
3	Period	Predicted Work Hours	% change
4			
5	1970-74	30.32	
6	1986-88 (86-88 c/y ratio)	27.02	=(B6/B5-1)*100
7	1986-88 (70-74 c/y ratio)	=(1-0.3224)/(1-0.3224+0.6839*1.54/(1-0.3924))*100	=(B7/B5-1)*100
8			
9	1986-88	27.02	
10	1993-96 (93-96 c/y ratio)	27.57	=(B10/B9-1)*100
11	1993-96 (86-88 c/y ratio	=(1-0.3224)/(1-0.3224+0.7221*1.54/(1-0.3419))*100	=(B11/B9-1)*100
12			
13	1993-96	27.57	
14	2001-03 (01-03 c/y ratio)	28.56	=(B14/B13-1)*100
15	2001-03 (93-96 c/y ratio)	=(1-0.3224)/(1-0.3224+0.7606*1.54/(1-0.3311))*100	=(B15/B13-1)*100