Addiction to Work: An Inelastic Wage Elasticity of Labour Supply Equals Long Hours of Work

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Abstract
A phenomenon of the last twenty years is the growth of ‘very long hours’ of work, especially amongst high-skilled labour. This is an unexpected reversal of a long trend in the opposite direction. This paper criticises the Beckerian analysis of labour-leisure choice. It argues that the more time is consumed in paid work, the more are preferences for paid work affected by it; thereby creating a vicious cycle of consumption patterns which lead to longer than expected hours of work.

1. Introduction
The availability of opportunities in the labour market in general, combined with a process of deregulation of the workplace, facilitate the matching of workers’ and jobs’ characteristics and promote flexibility in hours and job tasks. However, flexibility and deregulation have also delivered long hours of work, especially amongst highly-skilled workers. High wages and high education are the elements which, ‘ceteris paribus’, should lead to more hours of leisure for every increase in the wage rate. However, the Australian statistics reveal that this is not the case.

In Australia, from 2001 to 2007, evening, public holiday and weekend work increased steadily. In this period, 23 per cent of employees worked both on weekdays and weekends. While 48.8 per cent of male employees work between 41 to 50 hours a week, only 21.1 per cent of female employees work between these hours (excluding the self employed) (Van Wanrooy et al., 2007). Nowadays, highly skilled workers spend an average of 48.4 hours a week in paid employment, 5.6 hours per week commuting to and from work, 4.2 hours doing extra work at home in the evening and on weekends, 9.0 hours a week in home chores activities, five hours per week in child care, one hour per week in elder care, and two hours per week to career development.

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These Australians devote an average of 75.7 hours per week to work and family activities; and they enjoy only about 11 hours per week in leisure (Duxbury and Higgins, 2008). Leisure time is the residual time that a person has, after they have attended to the necessities of life (ABS, Cat. 4160.0, 2006).

This group of skilled workers that work very long hours are at the top-end of the earnings distribution represent a third of the total full-time working population (ABS, Cat. 4120, 2006; Van Wanrooy, et al., 2007). However, the majority of skilled workers extend their working hours to perform more work at home. Highly skilled workers spend about six hours each week in unpaid overtime.

The Australian data on working hours shows that preferences play a major role in the decision to work overtime (paid and unpaid). Changed preferences are given as the main reason for long working hours (Wooden and Drago, 2007; Tseng and Wooden, 2005; ABS Cat. 4102, 2006), as a consequence of positive economic outlook, education, greater job opportunities and flexibility in working conditions (Campbell, 2002; Bray et al., 2005).

Long hours of work are not just an Australian phenomenon. The same pattern of work is experienced in the U.K., U.S. and Japan (Schor, 1998; Hamermesh and Slemrod, 2008). Working longer is argued to be desirable for an efficient life-consumption pattern, in a way that educated individuals achieve their preferred careers to retirement (Moen and Roehling, 2005). Consumerism is also a reason for working longer, especially given the variety of market goods available to individuals (Schor, 1998). Whether it is for shopping reasons, career and wealthy retirement reasons, or simply for the satisfaction from work, highly-skilled high-income earners work well above 48 hours a week (ABS, Cat. 4102.0, 2006; Tseng and Wooden, 2005). Even if they enjoy a high degree of discretion (flexibility) in the choice of their working hours (Duxbury and Higgins, 2008), they prefer to work fewer hours (ABS, Cat. 4102.0, 2006) for every increase in the wage rate – however, they do not choose more time in leisure. Their choices reveal a discrepancy between what the theory holds and what their preferences state.

This paper argues that what prevents high-income earners from choosing more leisure is addiction to work effort. Work effort affects the ratio of labour endowment to actual labour supply (the ratio between total hours of potential work and total hours of actual paid work). The measure of work effort is given by ‘extra’ hours of work (Cavagnoli, 2008). Work effort and the ratio of labour endowment to actual labour supply affects the difference between the initial position and the post-wage rise position on the endowment point (the reservation wage) of high income earners in this analysis. If the ratio between labour endowment for paid work and actual labour supply increases, then the elasticity of substitution between consumption of market goods and leisure time also increases; thereby leaving high income earners with a decreased budget constraint (less time for leisure), a lower (than previous period) reservation wage, and so, a lower real wage.

Work effort, along with hours of work, is an unacknowledged joint input and output of labour. Work effort, if not accounted for, leads to market imperfections and

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1The conventional accepted limit of long hours of work is 48 hours a week (Jacobs and Gerson, 2000).
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negative externalities, such as addiction to work effort. Addiction to work effort is reflected in an inelastic wage elasticity of labour supply. This paper is divided in the following sections. Section 2 presents some statistics on overtime in Australia; section 3 discusses the analysis of leisure demand; section 4 investigates the Beckerian model of utility, which includes addiction; section 5 presents some estimates of labour supply elasticities and section 6 is the conclusion.

2. Hours of Work

In Australia, since 2001, evening, public holiday and weekend work has increased steadily, and since then, 23 per cent of employees are always working both weekdays and weekends. 48.8 per cent of men work between 41 to 50 hours a week, while 21.1 per cent of women work between 41 to 50 hours a week (excluding the self employed). Average working hours for full-timers have decreased from 46 hours in 2001 to 45 hours in 2007, with managers, administrators, and associate professionals working 50 hours or more, the longest average weekly hours (Van Wanrooy et al., 2007; ABS, Cat. 4120, 2006). In the aggregate, average working hours per week are well above the 38 hours per week, or the ‘standard working week’ of 20 years ago (Heiler, 1998).

Table 1 - Employed Persons, Average Weekly Hours Usually Worked

<table>
<thead>
<tr>
<th></th>
<th>Male Hours</th>
<th>Females Hours</th>
<th>Persons Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time workers</td>
<td>45.4</td>
<td>41.4</td>
<td>44.1</td>
</tr>
<tr>
<td>Part-time workers</td>
<td>18.1</td>
<td>18.4</td>
<td>18.3</td>
</tr>
<tr>
<td>All workers</td>
<td>41.1</td>
<td>30.9</td>
<td>36.7</td>
</tr>
</tbody>
</table>

Source: Labour Force, Australia (ABS Cat. 6291.0.55.001, 2005-6)

In 2005-06, managers and administrators had the highest average weekly usual hours for full-time employed men (51.0 hours per week) and women (46.3), followed by associate professionals (47.3 and 43.6) (ABS, Cat. 1301.0, 2007), but while their earnings are great, they show dissatisfaction with their workloads as indicated in tables 2 and 3.

Table 2 - Employees’ Working Hours Preference, by Status in Main Job

<table>
<thead>
<tr>
<th></th>
<th>Part-time</th>
<th>Full-time</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td>Thousand persons</td>
<td>%</td>
</tr>
<tr>
<td>Happy with current hours</td>
<td>74</td>
<td>2,028</td>
<td>70.6</td>
</tr>
<tr>
<td>Would like to work fewer hours</td>
<td>5.4</td>
<td>147</td>
<td>26.5</td>
</tr>
<tr>
<td>Would like to work more hours</td>
<td>20.6</td>
<td>564</td>
<td>2.9</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>2,739</td>
<td>100</td>
</tr>
</tbody>
</table>

Source: Van Wanrooy et al. (2007)
Table 3 - Working Hours Control and Preferences by Occupation (per cent)

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Agree: I have control over my work hours</th>
<th>Working Hours Preference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Same</td>
</tr>
<tr>
<td>Managers</td>
<td>71.7</td>
<td>61.7</td>
</tr>
<tr>
<td>Professionals</td>
<td>59.1</td>
<td>69.2</td>
</tr>
<tr>
<td>Technicians and trades workers</td>
<td>56.7</td>
<td>72.5</td>
</tr>
<tr>
<td>Community and personal service workers</td>
<td>61.3</td>
<td>73.1</td>
</tr>
<tr>
<td>Clerical and administrative workers</td>
<td>67.6</td>
<td>75.7</td>
</tr>
<tr>
<td>Sales workers</td>
<td>67.9</td>
<td>69.4</td>
</tr>
<tr>
<td>Machinery operators and drivers</td>
<td>48.1</td>
<td>68.4</td>
</tr>
<tr>
<td>Labourers</td>
<td>53.1</td>
<td>72.0</td>
</tr>
</tbody>
</table>

Source: Van Wanrooy et al. (2007)

The statistics in the above tables suggest that many part-time workers want to work more hours, while many full-time workers want to work fewer hours. While 36 per cent of managers want to work fewer hours, only 18 per cent of both clerical and administrative workers, and sales workers, want to work more hours. Many responses of managers in particular lack internal consistency. This is evident with 71 per cent of managers claiming control over their working hours, so apparently no-one else is preventing the 36 per cent who want to work fewer hours from so doing. These statistics suggest that there has been a change in how Australians plan their allocation of time, and that this change is even greater for the group of high-skilled high-income earners, but who, contrary to the theoretical expectations, work longer rather than fewer hours.

3. Leisure

According to the Australian Bureau of Statistics (Cat. 4160.0, 2006):

Leisure time can be said to be the residual time a person has after they have attended to the necessities of life (e.g. work, family care, self care). This time can be described as ‘free time’ - meaning that during this time a person is free of obligation or duty, and free to choose the way in which the time is spent (i.e. what activities they undertake in that time).

During the period 1965-1981, the daily average leisure time was about eight hours. Between 1992 and 1997 the average decreased to nearly four hours a day, with little difference between men and women. In 1992 and in 1997, people who spent time at home in leisure activities spent an average of nearly four hours a day, with little difference between men and women (ABS, Cat. 4102.0, 1995-7). In 2008, however, Australians enjoy only about 1.57 hours per day, or 11 hours per week, in leisure, but devote an average of 10 hours a day, or 75.7 hours per week, to work and family activities (Duxbury and Higgins, 2008).

In Australia, the proportion of leisure time to paid-work time has not remained constant since the early 1960s. Since 1964, long hours of work per person have
increased. The number of persons reporting working more than 48 hours per week rose from 13.6 per cent in 1978 to 20.6 per cent by 1994 (ABS, Cat. 6203.0, 6204.0). Long hours of work have increased across cohorts, and in particular amongst managers, administrators and professionals (50 hours or more), and even with technological change, leisure time has decreased. High income earners seem to have preferences for long hours of work, a preference reversal from their counterparts of the 1960s.

In the labour-leisure choice framework, this means that the elasticity of substitution between consumption and leisure in the 1990s is greater than in the 1980s. However, this real-world change represents a discrepancy with the theory of labour supply, which assumes that the elasticity of substitution between consumption and leisure, from period to period, is constant (Ashenfelter and Layard, 1986, chapter 1; Becker and Murphy, 1988). ‘Bad’ addictions are usually given as an explanation for a stronger income effect in period 1 (preferences for less work effort) which lead to working more in period 2. The substitution effect is therefore stronger in period 2 (Becker and Murphy, 1988).

The next section investigates a two-period utility model based on the assumption of a forward-looking individual (good addiction). However, it includes addiction to work effort, which is an unacknowledged type of ‘drug’. Work effort should be accepted as a ‘good drug’, as it increases earnings; therefore, the assumption of a forward looking individual should hold and explain the reason why high-income earners work harder and longer today, compared to their counterparts in the previous period. This next section leads to the conclusion that this assumption of a constant elasticity of substitution between consumption and leisure does not hold.

4. Utility
Utility is maximized where the marginal utility of leisure gives the additional utility received from consuming an extra hour of leisure. This ‘extra hour’ costs ‘w’ (wage) dollars; therefore, maximization occurs when the last dollar spent on leisure activities gives the same utility as the last dollar spent on consumption goods. This ratio equals the wage rate, or the marginal rate of substitution between leisure and consumption. However, the phenomenon of long hours of work reveals that amongst high income earners, this condition does not hold.

The marginal utility of consumption (substitution effect), of today’s high-income earners, is greater than the marginal utility of income (income effect). Therefore, the substitution effect seems to be greater than the income effect. If this is the case, then the inter-temporal elasticity of substitution (consumption and earnings) for cohorts of high income earners is not constant. The required assumption for the inter-temporal hypothesis to hold is a constant inter-temporal substitution elasticity (Ashenfelter and Layard, 1986, chapter 1; Becker and Murphy, 1988).

If this assumption does not hold, it represents a major discrepancy in the theory of labour supply advanced by the leading economist in this field, Gary S. Becker, which assumes forward looking preferences (expected price change, rather then unexpected). The following model of utility refers to a two-period utility maximisation within a Beckerian framework:
\[ U^i = (y_1, y_2, r_i) \]

Where:

- \( r_i = \text{recreation} \)
- \( i = \text{periods} : 1, 2 \)
- \( y_i = \text{income} \)

First period: \( u^1(y_1, r_i) \)

Budget:

\[ y_i = (24 - r_i) w_i \]
\[ = u^1((24 - r_i) \bar{w}_i, r_i) \]
\[ w_i = \text{wage} \]

Second period: \( u^2(y_2, r_2, s) \)

Where:

- \( s = (24 - r_1) \)

Budget:

\[ y_2 = (24 - r_2) w_2 \]
\[ w_2 = w_1 + F(24 - r_1) + A \]
\[ = u^2((24 - r_2) w_2, r_2, 24 - r_1) \]
\[ = u^2((24 - r_2)(( F(24 - r_1) + A ))(24 - r_2), r_2, (24 - r_1)) \]
\[ = u^2((24 - r_2)(( F(24 - r_1) + A ), r_2, (24 - r_1)) \]

Maximize: \( u^1(y_1, r_i) + \delta u^2(y_2, r_2, s) \)

Where:

- \( y_1 = (24 - r_1) w_1 \)
- \( y_2 = (24 - r_2) w_2 \)
- \( s = (24 - r_1) \)
- \( w_2 = w_1 + F[24 - r_1] + A \)

Where leisure is used interchangeably with the word recreation ‘\( r \)’; ‘\( s \)’ is the stock of addiction; ‘\( A \)’ refers to an autonomous effect on the wage rate in period 2 (or extra substitution effect). The Beckerian assumption is that recreation \( r \), for both cohorts (1 and 2), is the difference between total time and time at work, \( r (24 - w_1) \), and \( r (24 - w_2) \), where time at work is a positive function \( F \) of the wage rate in each period. Firstly, it is important to note that this definition is not the same as the definition given by the ABS. Leisure time is the residual time that a person has, after they have attended to the necessities of life (ABS, Cat. 4160.0, 2006). Within this definition, recreation ‘\( r \)’, or ‘leisure’ time, should be defined as \( r = T - w - uw \), where \( T \) is total time, \( w \) is paid work time, and \( uw \) is unpaid work time. Only if we value (or measure) unpaid
work time in the same way as paid-work time, then \( r = T - w \), or \( r = 24 - w \). The difference in the definition of \( r \) has important implications for measuring the reservation price of time, over time. The value of the initial stock of time is the reservation wage, which equals the marginal rate of substitution between hours of work and consumption.

In the Beckerian approach the initial (internal) reservation price of time, determines the degree of addictive behaviour. For ‘bad’ addictions (and low income earners), the initial (internal) reservation price of time ‘s’ is assumed to be higher than the rate of interest, in the first period. The stock of addiction for standard ‘bad’ addictive goods ‘s’ equals the wage rate in period 1, \( s = w_1 \). Standard bad addictive goods are intended to be alcoholic drinks and cigarettes (Becker, 1992). Preferences for bad addictive consumption over investments in the first period, are assumed to bring about lower wages and more work in period 2. The marginal utility of ‘bad’ addiction decreases with time: \( \partial u^2 / \partial s < 0 \).

The condition for long-term equilibrium, assumes that peoples’ expectations about future prices do not change overtime (i.e. the internal rate of return to capital ‘\( r_c \)’ equals the interest rate ‘\( i \)’, in the long-term). If addiction is ‘good’ in period 1, then the internal rate of return to capital \( r > i \) (the highest present value is preferred). If addiction is ‘bad’ in period 1, then the internal rate of return to capital \( r < i \).

If addiction is good, then in period 1, hard work and investments are preferred and made in order to enjoy greater earnings and more leisure in period 2. The future will bring about a consumption pattern (bundle of goods; and budget) that displays more leisure and less work. Therefore, in period 2, the income effect is greater than the substitution effect, for every increase in the wage rate. Vice-a-versa if addiction is ‘bad’. High-income earners are assumed to have ‘good’ addictions. In period 2, the income effect should be greater than the substitution effect.

The above statistics, however, reveal a greater substitution effect in period 2. To investigate the effects of a change in the wage given by \( A \) (extra substitution effect), on the choice to work or leisure, we need to consider a dynamic or inter-temporal utility maximisation.

\[
\text{Discounted } U = U'(24 - r_1) w_1, r_1] + \delta [(24 - r_2)(F(24 - r_1) \bar{A}, r_2, (24 - r_1)] \\
\phi[r_1, r_2, w_1, \bar{A}] 
\]

The maximisation process of leisure is the following:

\[
\text{Max, } r_1; r_2: U = u_1^1 + \delta u_2^1; \delta u^2; \leq 1 
\]

First derivative: \( r_1; r_2 \)

\[
\frac{\partial U}{\partial r_1} = 0 \\
= -w_1 u_1^1 + u_2^1 + \delta [-u_1^1 (24 - r_2) F' - u_2^1] = 0 
\]

\[
\frac{\partial U}{\partial r_2} = 0 \\
= \delta [-u_1^2 (F + \bar{A})] + u_2^2] = 0 \\
= \delta u_2^2 - \delta u_1^2 w_2 = 0 \\
= -u_1^2 w_2 + u_2^1 = 0
\]
Second period, first condition:
\[ \frac{u_2^2}{u_1^2} = w_2 \]
\[ w_2 = \text{wage} \]
\[ u_2^1 = \delta u_1^2 (24 - r_2) F' + \frac{u_2^3}{u_1^3} u_1^1 \]
\[ u_2^1 / u_1^1 = [\delta (u_1^2 (24 - r_2) F' + u_3^3) / u_1^3] + \bar{w}_1 \]

Second period, second condition:
\[ \frac{u_2^1}{u_1^1} = \bar{w}_1 + [\delta (u_1^2 (24 - r_2) F') / u_1^3] + u_3^2 \]

Where \( u_1^1 \) is the marginal utility of consumption in period 1; \( u_1^2 \) is the marginal utility of leisure in period 1; \( u_2^1 \) is the marginal utility of consumption in period 2; \( u_2^2 \) is the marginal utility of leisure in period 2; and \( u_3^2 \) is the marginal utility of addiction in period 2; and where \( u_1^1 > 0; r_2 > 0; F' > 0; u_1^2 > 0 \). To maximise utility in period 2, the first condition is that the ratio between the marginal utility of consumption (paid work time) and the marginal utility of leisure (unpaid and ‘free’ time), equals the wage rate in period 2, or \( u_2^2 / u_1^2 = w_2 \). The wage rate \( w_2 \) is equal to the marginal rate of substitution between the marginal utility of leisure (recreation) and consumption in period 2, which can also be expressed as \( w_2 = F (24 - r_2) + A \).

The second condition is that the marginal rate of substitution between the ratio of marginal utility of leisure time and consumption in period 1, \( u_2^1 / u_1^1 \), equals: i) the wage rate in period 1, plus ii) the discounted ‘\( \delta \)’ marginal rate of substitution between the marginal utility of consumption in period 2, \( u_1^2 (24 - r_2) F' \), and the marginal utility of consumption in period 1, \( u_1^1 \), plus iii) the marginal utility of addiction in period 2, \( u_3^2 \). The notation \( u_1^2 (24 - r_2) F' \) reflects the effect of work on the marginal utility of consumption in period 2, and \( u_3^2 < 0 \) represents the addiction effect in period 2.

The marginal rate of substitution (MRS) in period 2 \( u_2^1 / u_1^1 = \bar{w}_1 + [\delta (u_1^2 (24 - r_2) F') / u_1^3] + u_3^2 \) refers to two effects on utility in period 2. The first effect is given by the discounted hours of work in period 2, \( [u_1^2 (24 - r_2) F'] / u_1^3 \) > 0. This term is positive. It represents a substitution effect, which increases (function \( F' \)) with the wage rate. Hours of work \( (24 - r_2) > 0 \) must increase in period 2. The second effect is given by the stock of addiction ‘\( s \)’. The effect of addiction on the wage rate is \( u_3^2 < 0 \), if it is a ‘bad’ addiction. Bad addiction decreases the marginal utility of recreation (non-labour income) in period 2. It represents preferences for more recreation in period 1 (an income effect), which decreases in period 2. By simplifying the second condition:

\[ u_2^1 = \delta [u_1^2 (24 - r_2) F' + u_3^3] + u_1^1 \bar{w}_1 \]
\[ u_2^1 / u_1^1 = \bar{w}_1 + [\delta (u_1^2 r_2 F' + u_3^3) / u_1^3] \]

Where:
\[ = u_2^2 / u_1^2 = w_2 \]
\[ u_2^1 / u_1^1 = \bar{w}_1 + [\delta (u_1^2 r_2 F' + u_3^3) / u_1^3] \]
\[ = \bar{w}_1 + (\delta u_1^2 r_2 F') / u_1^3 + \delta u_3^2 / u_1^3 \]
The term \((\delta u_1^2 r_2 F')/u_1^1\) is the discounted effect of hours of work on the wage (the marginal rate of substitution) in period 1, which also corresponds to the reservation wage in period 1. The term \(\delta u_1^2 /u_1^1\) represents the discounted effect of addiction on work hours in period 1. The term \(\delta u_1^2 /u_1^1\) decreases the marginal utility of recreation hours. A greater discounted effect of addiction implies that in period 1, individuals have an internal rate of return that is lower than the rate of interest, so that, in period 1, recreation is preferred to paid work (bad type of addiction).

The implications are that, if addiction increases in second period, then it is a ‘good’, rather than a ‘bad’ type of addiction (i.e. addiction to work). In that event, the discounted effect of addiction on work hours in period 1 is higher than for ‘bad’ addiction. In the first period, the internal rate of return to capital is higher than the interest rate. This means that good addictions reflect preferences for paid work and for investments in human capital today for greater earnings tomorrow. The substitution effect is greater in period 1, and the marginal utility of consumption is greater in period 1 than in period 2. To note that this is the case only if bad addiction refers to standard addictive goods (alcohol and cigarettes) and good addiction refers to work effort. According to the Beckerian analysis addiction to work effort cannot be a ‘bad’.

The first term \((\delta u_1^2 r_2 F')/u_1^1\) is the discounted effect of hours of work on the wage; it also represents an increase in the market value of paid work (work hard for higher wage). In period 2, the wage rate increases from \(w_1\) to \(w_2\). The second effect, \(\delta u_1^2 /u_1^1\), is the discounted effect of addiction on work hours; it determines whether there is good or bad addiction, and hence, whether the substitution or the income effect is stronger in period 1. The movement of the indifference curve towards low effort in period 1 reflects bad addictions and a lower (than high income earners) wage. Low effort in period 1 reflects the difference in preferences and in earning capacities between low and high income earners. Good addictions display a positive discounted marginal utility \(\delta u_1^2\) in period 1. The substitution effect has to be strong in period 1, as greater work effort in period 1 leads to greater wages and recreation time in period 2. The income effect is stronger in period 2. If the discounted effect of addiction on the second period wage, \(\delta u_1^2 r_2 F'/u_1^1\), is positive and greater than the effect of addiction on the stock of addiction, \(0 < \delta u_1^2 /u_1^1\), then there is a movement along the indifference curve for preferences towards less work (low work effort) in period 1. The discounted marginal utility of addiction, if bad, is negative in period 1, \(\delta u_1^2 /u_1^1 < 0\); hence, the substitution effect dominates in period 2.

In summary, high-income earners are assumed to have ‘good’ addictions, and so to have preferences for greater work hours in period 1 and to leisure in period 2. However, if high income earners worked hard in period 1, and are working even harder in period 2, then perhaps: i) an element in the discounted effect of addiction \(\delta u_1^2 r_2 F'/u_1^1\) on the second period wage does not have a positive sign, ii) the discount rate on the stock of addiction is not constant (a reversal of preferences for good addiction to a bad addiction), iii) the endowment itself (reservation price of time) was mis-measured; or iv) addiction to work effort can become a ‘bad’, in which case, work effort needs to be re-defined.

The Australian statistics presented in the previous sections reveal that for high-income earners, which are assumed to have good addictions, the substitution effect in
period 2 overwhelms the income effect in period 2. Thus, there is a misspecification in
the theory. The two propositions argued here are that: i) hours in recreation and (paid
and unpaid) work are not substitutes; and ii) work effort is a joint input of labour,
which, if unacknowledged, lead to long hours of work and over-consumption of goods
and services.

Following the first proposition, the analysis of labour supply in the future
should focus on the neoclassical relationship between income and time in ‘free’
recreational activities, rather than between the wage rate and time at work as in the
Beckerian theory. However, another important assumption needs to be recognised.
Activities for recreation are not a normal good, as assumed by the neoclassical theory
and by Becker. They are a necessity. Recreation activities are a necessity rather than a
normal good and they represent a fixed ration of total time.

The time in recreational activities is the difference between total time and
time allocated to paid and unpaid activities. Activities that are not spent in paid or
unpaid work should be measured as a fixed ratio of total time, which should remain
fixed over time, or more specifically, addiction to work effort decreases the reservation
price of time and increases the internal rate of return to capital over time. Unlike
Becker, it is argued here that addiction, per se, is always a ‘bad’. It renders the own-
price elasticity of demand for goods and services inelastic, and the own-wage elasticity
of labour supply inelastic. This has policy implications that need to be explored.

Discussion
The proposition that work effort acts like a drug, which decreases the reservation time
and the wage rate over time is very plausible. Generally overworkers (Peiperl and
Jones, 2001), and workaholics (Snir et al., 2006) are, for different reasons, unhappy
outside the workplace, but satisfied in the workplace, which means that paid work
time is not a disutility. Addiction, therefore, decreases the disutility of work, and
decreases the marginal utility of non-labour income, rather than decreasing the marginal
utility of labour income (as in Becker, 1985; Becker and Murphy, 1988).

The argument here is that work effort is an unrecognised input and output of
labour that acts like a ‘drug’, it leads to an unforeseeable, and hence, uninsured risk. If
unrecognised, information is incomplete, and the risk is not compensated for. If this
constraint is not recognised, then high income earners cannot foresee the effect of
work effort on their work-leisure choices, in period 1. They cannot foresee a change in
prices, between the internal rate of return to capital and the rate of return from the
market. This difference increases the gap between the value of the reservation wage
today and tomorrow, and hence, between the value of the market wage today and
tomorrow (lower).

In period 2, the indifference curve of high income earners is, therefore, on a
suboptimal steeper budget constraint, where the price elasticity of demand for goods
and services (or the wage elasticity of labour supply) in period 2 is inelastic. Because
of addiction to work effort, the demand for goods and services becomes inelastic in
period 2 (substitution effect greater than the income effect); but in this position, their
endowment point in period 2 is lower than what it was in period 1: the autonomous
(endogenised) change ‘A’ on the wage rate in period 2. A lower reservation wage
means that the real wage is also lower that it would be at the optimal equilibrium point in period 2.

To make it visually clear, in figure 1 these effects are analysed using a transposition of the budget line formula \( C = \frac{(wT + V)}{P} - \frac{(wL)}{P} \); where \( C \) = consumption; \( w \) = wage rate; \( V \) = non-labour income, \( T \) = total hours available; \( P \) = price of goods. In period 2, for high-income earners, an increase in the market wage and addiction interact with the income and substitution effects. An increase in the wage is paralleled by an increase in the subjective (internal rate of return to capital) price of time (addiction), which leads to more work, less leisure, and a steeper than optimal budget constraint in period 2. The difference between the initial position (thick line) and the post-wage rise and addiction position (dotted line, b') is shown on the endowment point (reservation wage)\(^2\) in figure 1.

1) Effect of addiction (dashed line): a subjective (internal rate of return) price rise equals a decrease in both \( \frac{(wT)}{P} + \frac{V}{P} \) and \( \frac{(wL)}{P} \). The intercept \( wT \) of the budget line falls, \( \frac{V}{P} \) decreases (reservation wage), \( \frac{wL}{P} \) decreases (the slope becomes flatter). If we draw a new indifference curve for the same person (\( U_2 \)) at the tangent to the new budget line, we have to move to the right of the initial position (a), at point (b).

In this position, we are on a flatter budget constraint, where consumption and the reservation wage are lower, but more hours are worked. The reservation wage is the slope of the indifference curve at the endowment point (E1). The slope on the indifference curve becomes flatter at the endowment point, as the slope on the budget line is flatter. Therefore, the reservation wage is lower (E2). An unobserved (unacknowledged) increase in the subjective price of leisure time is equal to a fall in the reservation wage. This effect is captured by a change of sign in the ratio between the marginal utility of addiction \( s, u_3^2 < 0 \), in period 2 and the marginal utility of consumption, \( u_1^1 > 0 \) in period 1: \( u_3^2 / u_1^1 \), given by addiction on the reservation price \( A \).

Figure 1 - Consumption, Leisure, and Reservation Wage

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\(^2\)Borjas (2005, p. 64) defines the reservation wage as ‘the wage that makes a person indifferent between working and not working’, and states that ‘a person enters the labour market when the market wage rate exceeds the reservation wage’.
The expected sign of \( u_1 > 0 \) is positive, while the expected sign of \( u_2 < 0 \) is negative. This is true only if \( [(24 - r_2) - (24 - r_1)] \), is positive, so that \( F' \) is > 0 and the discount rate is therefore, greater or equal to 1 \( (\delta \leq 1) \). However, \( (24 - r_2) \) can still be positive, but lower than \( (24 - r_1) \) when discounted. Time for recreation \( r \) depends on how much time we spend at work; \( r_1 (24 - w_1) \) for period 1, and \( r_2 (24 - w_2) \) for period 2.

If the difference is negative then, in period 2, individuals find themselves in a sub-optimal position (greater earnings, but less leisure time than period 1). Time at work depends on the price elasticity of demand for goods and services, on the elasticity of substitution between consumption and leisure, but also on the income elasticity of demand. For example, addiction to drugs and alcohol in general reveals an inelastic price elasticity of demand (Clarke, 2000). Addicted people are not responsive to changes in prices, but only to changes in the quantity of the good sought.

When the price elasticity of demand is inelastic, individuals find themselves on an income elasticity of demand which is negative, and all income (or available time) is spent on the drug. Therefore, the addictive good (or what produces it) becomes a necessity, and any increase in earnings and savings (even of time) will be consumed on this drug.

When time at work depends on the price elasticity of demand for goods and services, on the elasticity of substitution between consumption and leisure, but also on the income elasticity of demand, and the price elasticity of demand is inelastic, time for recreation decreases in proportion to the movement towards greater high effort, when \( \delta u_2^2 r_2 F'/lu_1 > 0 \), and in proportion to the change in \( w_2 \). As \( w_2 F (24 - w_2) + A \), then either the functional form \( F \), which relates work effort to the wage, or the autonomous change of \( A \), or both, decrease time for recreation in period 2, thereby affecting the discount rate.

This unexpected constraint given by \( A \), is not compensated for by the increased wage, which means that the discount rate in \( Max, r_1; r_2; U = u_1 + \delta u_2; with :\delta \leq 1 \) is greater than 1. Considering that the phenomenon of long working hours is a reversal of a long-term trend in the opposite direction (since the 1980s), it seems reasonable to propose that structural change, given by reformed labour market and industrial relations policies, has had a negative impact (externality) on the value of market time \( w \) and the subjective price of time (the internal rate of return) (i.e. term \( A \) on the wage), which affects both the discount rate and the stock of non-labour income. Therefore, the effect of a wage rise (in thin-dotted line) is the following: there is an increase in both \( (wT + V)/P \) and \( (w/L)/P \). The new indifference curve (thin-dotted line, \( b' \)) for the same person (\( U_2 \)) at the tangent to the new budget line (\( T' \)), is to the right of the initial position (a), at point (c); again in order to not intersect.

In this position, individuals are on a steeper budget constraint, where the opportunity for consumption is greater, but at a lower reservation wage (\( E' 2 \)) and with more hours at work (\( b' \)). As the budget line is steeper, there is a greater degree of substitution between consumption and leisure; but there is also another point for the consumption bundle to be optimal. A steeper than before budget line reveals an increased income tax.

Given that the reservation wage is lower than period 1, it is clear that at point b the same individual is at a net loss. It means that in period 2 there is a greater (than
period 1) degree of substitution between consumption today and consumption tomorrow, which, once again, is contrary to the theory of a forward-looking choice. In both cases the probability of entering the labour force increases. Where the reservation wage is low, less enticement is needed to encourage workers to enter the labour force, and they will be more likely to participate. These persons will certainly be more likely to work longer, but also more likely to be exploited, as the reservation wage decreases as a proportion of the market wage, and real wages are therefore, at a lower equilibrium market wage, than what it was before the change.

The ratio $u_2^2 / u_1^2 (= w_2)$ < $u_2^1 / u_1^1 (= w_1)$ by the extra substitution given by addiction (the difference between $u_2^2$ and $u_2^1$), as well as A, the autonomous change of non-labour income on $w_2$. Addiction affects the price elasticity of demand for goods and services, and hence, for time at work (wage elasticity); while A affects the amount of labour time devoted to paid work (the labour endowment to actual labour supply ratio). In other words the labour endowment to actual labour supply ratio increases as the elasticity of substitution between consumption and leisure increases over time; which, contrary to the standard mainstream analysis of labour supply, in the long term, it affects the income elasticity of demand for goods and services.

Given the structural change in the Australian labour market of the early 1990s (in which the recession led to more flexibility in wages and conditions of work), and given that the trend in overtime is generally increasing, in particular for high income earners, then the effect of A on $w_2$ becomes important. Also the sign of the ratio between the marginal change in utility in period 2 and the marginal change in the stock of addiction, $\partial u^1 / \partial s$ should be negative (as $s = w_1$). Therefore, either the marginal utility of addiction does not decrease with time, or there is another constraint on the use of leisure. This constraint leads to the unrecognised effect of work effort on behaviour.

Addiction to work effort is promoted by a flexible and deregulated labour market as well as rising higher education participation, greater job opportunities, and increased flexibility in working conditions (Cavagnoli, 2008). Work effort is an unrecognised addictive ‘drug’. Addiction to work effort is an unrecognised negative externality.

The effect of addiction to work effort can be measured by the change in the labour endowment to labour supply ratio, before and after the structural change of the late 1980s. Average weekly hours of work have increased from 40 hours in the 1980s, to 44 hours in 2007. High income earners in particular are now working an average 50 hours a week. If this ratio increases, and no institutional limit is placed on it (the only limit on work hours is given by physiology (sleep) and the maximum time limit (24 hours in a day), then long hours of work are compensated by over-consuming market time-saving goods, and by substituting away from leisure activities, such as parenting (e.g. buying child-care services).

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3 The judgment granting the 40-hour week was in 1947 (September 8) and instigated by the A.C.T.U. Congress. This is in stark contrast to the current accepted limit of long hours of work of 48 hours a week (Jacobs and Gerson, 2000). Moreover, from the period 1965 to 1981, average daily leisure time of about 8 hours has decreased to about 4 hours a day in 1997 (ABS, Cat. 4102.0, 1995-7).

4 Pocock (2003) explains that the sense of guilt that hard working parents feel about their time away from the family, lead them to overspend in market goods to compensate for this lack of time for the family.
An increased labour endowment to labour supply ratio and the unrecognised effect of work effort on behaviour (and, in turn, on firm’s productivity), leads to an increased rate of substitution between consumption and leisure, over time. This then results in an increased substitution between labour inputs in firms (Cavagnoli, 2008; Magnani and Prentice, 2006) which is not counterbalanced by an increase in market compensation. Therefore, an increase in the wage rate of high-income earners is paralleled by an increase in their subjective price of time (addiction to work effort, or internal rate of return to capital). This leads to a difference between the high-income earner’s initial position and the post-wage rise and addiction position, at a lower endowment point (reservation wage).

The conclusion from this is that the ratio of labour endowment to labour supply has risen over time. The elasticity of substitution between consumption of market goods and leisure time has risen also. However, this also means that the MRS (marginal rate of substitution) does not equal the MRT (marginal rate of transformation).

The condition for efficiency is that all consumers equate their MRS to the price ratio, when the price ratio equals the ratio of marginal costs, which in turn must equal the MRT (marginal rate of transformation). If the ratio of labour endowment to actual labour supply has risen over time, the net effect of a wage rise is a substitution effect (outweighing the income effect) that places today’s generation of high income earners on a lower budget constraint, with less time for recreation activities than their previous generations, and a lower than expected wage rate.

5. Labour Supply Elasticities

If the ratio of labour endowment to actual labour supply has risen over time, then the own-price elasticity of labour supply has decreased over time. The elasticity of labour supply measures the responsiveness of hours of work, and/or labour force participation, to a change in the wage rate. It measures the price elasticity of demand for goods and services. The price elasticity of labour supply (σ) is defined as the percentage (%) change in hours of work divided by the percentage (%) change in the wage rate.

This ratio equates to the MRS between marginal utility of leisure time and marginal utility of consumption, which also equates to the marginal utility of work by the share of earnings per hour. In simple, but relevant terms: \((\Delta h/h)/(\Delta w/w) = (\Delta h/\Delta w)\) *(w/h) (Borjas, 2005). The left side of this formula also represents the ratio between the own-price elasticity of hours, and the own price elasticity of (work time) goods and services; and the right side, the cross-price elasticity of time (in leisure and work) by the fraction of hours in paid work (hourly market wage).

Consider therefore the price elasticity of labour supply in terms of own- and cross-price elasticity of time in various activities: leisure and consumption of goods and services (work). Time in leisure and in consumption of goods and services are gross substitutes (work). The marginal rate of substitution between consumption and leisure equals the cross-price elasticities of time (in leisure and work) by the hourly market wage (or shadow wage), where the hourly wage is given by the market price of goods and services.

The proportion of employees without paid leave entitlements has been increasing since the early 1990s (ABS, Cat. 6105.0, 2007; Cat. 6105.0, 2008)
If the change in cross-wage elasticity of supply is negative, \( \Delta h/\Delta w < 0 \), the own-price elasticity of leisure time is lower than the own-price elasticity of goods and services, and the labour supply curve is backward bending. In this case, hours of work are not affected by a change in the wage rate; and the cross-price elasticity of labour supply is inelastic and less than 1. Vice-a-versa, if the supply is upward-sloping. That is, when hours of work are greatly affected by a change in the wage, the cross-wage elasticity of labour supply is elastic and greater than 1. It means that the own-price elasticity of leisure time is greater than the own-price elasticity of goods and services, and the labour supply curve is upward sloping.

For time in leisure and work to be substitutes, the cross-wage elasticity of supply must be positive, so that as the price of one increases as the quantity demanded of the other increases. This principle is very important, in particular if leisure is a normal good. If leisure is a normal good, and if leisure and work hours are substitutes, then the cross-wage elasticity of supply and the cross-price elasticity of demand for leisure time will be positive.

Empirical estimates of labour supply elasticities of men and women vary according to methods of estimation. Generally they are categorised according to first, second, and third generation models (Borjas, 2005; Birch, 2005; Murray, 1997; Buddelmeyer, Creedy and Kalb, 2007; and Breunig, Cobb-Clark and Gong, 2005). The focus here is crucially on the decision to work overtime rather than on the decision to participate in the labour force. This is a phenomenon primarily related to male high-skilled high-income earners, and their elasticities of labour supply; but this analysis can easily be applied to females’ elasticities of labour supply too.

In Australia, estimates of the males’ responsiveness to hours of work, following a change in the wage rate, vary between: i) first generation, ii) second and third generation models. Third generation models found that wage elasticities (for married and single males), range between 0.24 to 0.22 (Creedy and Kalb, 2007). For high-income earners, they range between 0.03 to 0.09 (Kalb, 2000), and for high-skilled married men, they range between 0.07 to 0.17 (Breunig et al., 2005). This means that males’ labour supply is (wage) inelastic: there is little change in hours of work for a given change in the wage rate.

When the wage-elasticity of labour supply is inelastic (i.e. between 0.7 and 0.22), the own-price (wage) elasticity of goods and services is lower than the own-price (wage) elasticity of leisure. However, for high-income earners, if leisure is a normal good, and if time in leisure and work are substitutes, the own-wage elasticity of leisure must be lower than the own-wage elasticity of goods and services. Moreover, when the wage-elasticity of labour supply is inelastic the income elasticity of demand for goods and services is negative. This final remark has been overlooked in all models of labour supply. There is a great gap in the literature, as the elasticity of labour supply (\( \sigma \)) is only defined in terms of the wage (price) elasticity and not in terms of the income elasticity.

\(^6\)Briefly, women seem unresponsive to changed hours of work due to a change in the wage rate, but their participation is responsive to changes in the wage rate; and they reduce their hours of work as income (pooled-income) rises. The substitution effect dominates (\( \Delta h/\Delta w > 0 \)). Their supply curve is upward sloping. Hence, the decision to participate (substitution effect) seems to be more important than the decision to increase the number of hours.
If the income elasticity of demand for goods and services is negative, then the compensated demand elasticity is lower than the uncompensated demand elasticity. For leisure to be a normal good, its compensated demand must be greater than its uncompensated demand. The cross-price elasticity of demand for leisure must be positive. However, this is not reflected in the above estimates. Therefore, either leisure is not a normal good, or time in leisure and work are not substitutes. In both cases there is a misspecification in the theory. This means that there are two elasticities of substitution to consider and to maintain constant: (i) the elasticity of substitution between consumption and leisure within periods (ii) the constant elasticity of substitution between consumption and leisure (income effect) over time.

A novel measure of labour supply is required which has never been done before. Generally, the elasticity of labour supply is defined in terms of the wage (price) elasticity and the income elasticity, where the income elasticity is defined in terms of property income (Mincer, 1958, 1972; Becker, 1967, 1975, 1981; Killingsworth, 1983; Breunig et al., 2005; Buddelmeyer et al., 2007; Birch, 2005; Ashenfelter and Layard, 1986, chapter 1). For analysis that reflects the real-world situation, the proposal is that the income elasticity should be defined in terms of the income elasticity of demand for goods and services (consumption-expenditures, i.e. Robbins, 1930).

Investigating the elasticities in a more general way can be done through credible estimates based on studies of how taxes affect the cross-wage elasticity. The consensus is that the estimate is close to – 0.1, where the income effect dominates ($\Delta h/\Delta w > 0$), and the supply curve is backward bending. However, the labour supply curve can still be backward bending even if the wage (price) elasticity is inelastic. The cross-wage elasticity has been used to explain the dominance of the income effect on male’s hours of work. That is, in the standard neoclassical interpretation, for every increase in the wage rate, males do not increase their hours of work; and most importantly, to explain that, at higher earnings, males choose more leisure time and hence, the decline in working hours in the 1980s.

Having found this discrepancy in the neoclassical theory, an alternative theory needs to begin with a wage inelastic supply which specifies both a positive and a negative income elasticity of demand for consumption goods. Therefore, everything depends on whether the good in question is normal, inferior or superior. If leisure is a normal good, a wage inelastic supply implies a negative income elasticity of demand for goods and services, and the substitution effect always dominates the income effect.

The effect of addiction to work effort is a lower reservation wage, which increases the elasticity of substitution between consumption and leisure over time, and the result is an increase in the ratio of labour endowment to actual labour supply. These joint effects have not yet been acknowledged, but the net effect of a wage rise is a substitution effect (outweighing the income effect) that places today’s generation of high income earners on a lower budget constraint, lower real wage, and with fewer options than their previous generation.

6. Conclusion
Since the 1980s overtime has increased. From a neoclassical perspective, this is an unexpected reversal of a very long trend in the opposite direction. Based on this real-world situation, the Beckerian analysis of labour-leisure choice is critiqued. The growth
of ‘very long hours’ in Australia is particularly strong amongst professional high-income earners. Neoclassical assumption ensures that these individuals expect to work hard in the first period of their career for achieving their goals of greater earnings and greater leisure in the second period of their lives.

Under investigation in this paper, high-income earners reveal that their expectations are not fulfilled. The reason proposed is that their wages cannot compensate for an additional constraint on leisure time that was unacknowledged in the first period of their lives: addiction to work effort. Therefore, high income earners in period 2 need more, rather than less, substitution between consumption and leisure, in order to compensate for this additional constraint. The cross-wage elasticity of labour supply is inelastic.

The discount factor proposed by the Beckerian theory would explain this decrease in the reservation price of time but in period 1, rather than in period 2, which is contrary to the empirical evidence. This investigation finds that in period 2, people need to re-allocate their total amount income (labour and non-labour) as they unexpectedly find themselves on a steeper and sub-optimal budget constraint. They need to ‘borrow’ time from the future (by decreasing savings and increasing debts).

The cross-wage inelastic of labour supply reflects an over-compensation of labour effort (hours) to the market sector. This leads people to allocate more, than expected, hours to paid work. These choices create a vicious cycle of consumption patterns that are not efficient, even though they are necessary in order to adapt to an unacknowledged (and hence, uncompensated by the market) constraint on leisure time. However, if time for recreation is recognised as a necessity, then time and work effort (scarce resources) have to be proportionally divided between market and non-market activities according to a constant ratio of labour endowment to actual labour supply.

A change in this ratio endogenises the elasticity of substitution between consumption goods and leisure, which affects the difference between compensated and uncompensated demand for goods and services. By including this ratio not only will the substitution between market and non-market time be limited, but also the substitution between labour inputs in market production. This increases earnings per unit of time, and hence, assists in achieving the expected income effect in the second period for the hard-working people. Up-to-date, studies of labour supply have overlooked the importance of this ratio of labour endowment to actual labour supply.

This is the reason for the analysis of the income elasticity of demand for goods and services (rather than the price elasticity of demand), for it is a measure of the demand of leisure time. A positive income elasticity of demand would ensure that: i) there is compensation and equilibrium between working hard in first period, and enjoying more leisure in second period; and ii) that this equilibrium is maintained in the long term. This would be the first step to admitting to the problem of addiction to work.

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