TOTAL FACTOR PRODUCTIVITY AND WAGES POLICY

Owen Covick

DISCUSSION PAPER NO. 234

June 1990

G.P.O. Box 4, Canberra 2601, Australia
TOTAL FACTOR PRODUCTIVITY AND
WAGES POLICY

Owen Covick
Senior Lecturer in Economics, Flinders University
and
Visiting Research Fellow
Division of Economics and Politics
Research School of Social Sciences
Australian National University

DISCUSSION PAPER NO. 234

June 1990

ISBN: 0 7315 0221 3
ISBN: 0725 430X
# Table of Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abstract</td>
<td>1</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>I. The Case for a TFP wage adjustment rule</td>
<td>2</td>
</tr>
<tr>
<td>II. Key issues in the construction of a TFP indicator</td>
<td>12</td>
</tr>
<tr>
<td>III. Other considerations for TFP-based wage adjustment</td>
<td>27</td>
</tr>
<tr>
<td>Conclusions</td>
<td>35</td>
</tr>
<tr>
<td>Footnotes</td>
<td>38</td>
</tr>
</tbody>
</table>
Abstract

What role should estimates of growth in total factor productivity (TFP) play in Australian National Wage Cases? There currently seem to be two schools of thought on this issue. The BCA (and certain others) argue that TFP data should displace the role traditionally filled by estimates of average labour productivity (APL) growth. The ACTU and the Commonwealth Government have argued that TFP data have no substantive role to play in the wage fixing context.

The first section of this paper begins by outlining the traditional rationale for seeking to gear wages to APL growth. This rationale rests crucially on: (a) a competing income claims view of wage and price setting behaviour in the economy; and (b) the assumption, within that approach, that claims are determined in terms of aggregate factor shares, or by reference to the proportionate price mark-up factor implicit in those shares.

It is then demonstrated that if this same model is modified so that price mark-ups are computed to secure a particular rate of return on capital employed, and competing income claims are determined by reference to the rate of return on capital, rather than capital’s aggregate factor share, then it becomes appropriate to gear wages to TFP growth rather rather than to APL growth. The appropriate formula is, however, a multiple of TFP growth rather than “straight” TFP growth. The multiple is the reciprocal of labour’s factor share.

The paper then goes on to examine some key design features of the TFP series recently developed and published by the ABS. This examination is carried out to assess the suitability of the ABS series for use in the defined wages policy context. It is concluded that the methodology adopted in the compilation of the ABS figures is not the most appropriate for this context.
The upshot is that were a TFP wages policy rule based directly on the ABS estimates of TFP growth to be implemented, it is uncertain whether it would have the advantages over an APL rule, of the types discussed earlier in the paper. The paper concludes by suggesting certain modifications to the ABS series which, it is argued, would provide a TFP indicator with features more appropriate for wages policy debate purposes.
Introduction

Debate over the concept of total factor productivity (TFP), over how best in practice to measure it, and over its relative merits in principle vis-a-vis the average labour productivity (APL) concept, seems likely to play an important part in Australian wages policy debate in the period immediately ahead. In the March 1986 National Wage Case, Australia’s employers broke away from their previous tacit acceptance of the APL concept as defining the bounds of the statistical arena within which to debate national productivity issues in the wage determination context. The Business Council of Australia (BCA) argued forcefully that: "the most appropriate measure of productivity in the context of a national wage fixation, is the long term trend in total factor productivity for the whole economy."\(^1\) The Australian Council of Trade Unions (ACTU) and the Commonwealth Government did not agree with the BCA’s conclusion. They continued to support the use of a productivity indicator from the average labour productivity family of measures.\(^2\) Since none of these three key parties appears to have shifted its position, continued debate on the issue is to be expected at future National Wage Cases.

The position of the BCA is likely to be strengthened by the fact that the Australian Bureau of Statistics (ABS) has recently developed and published estimates of TFP.\(^3\) Previously it had published only series from the APL family.\(^4\) The cachet "official statistics" is likely to bestow enhanced credibility on the TFP concept, and also on the particular practical measurement methodology embodied in the "official" figures.\(^5\)

A third reason for expecting debate on this issue to be important in the years immediately ahead in Australia lies in the result of the March 1990 federal election. Had the government elected not been one committed to the continuation of a centrally co-ordinated system of wage-fixation, the practical role of debate on the degree of national wage adjustment warranted by national productivity growth would clearly have been diminished.
If the arguments above are valid, and the concept of TFP is to play an important part in wages policy debate in Australia in the period ahead, two key questions arise. It is with these two questions that this paper is concerned. Firstly: is there a case in principle that gearing wages to growth in TFP would have advantages as a wages policy "rule", as compared with gearing wages to growth in APL - defining both concepts in their most pure and simple (and therefore "abstract") terms? Section I demonstrates that there is such a case. We then ask the second question: do the estimates recently developed by the ABS represent a measure of TFP appropriate for direct use in seeking operationally to capture those advantages? Section II investigates five key design characteristics of the ABS figures from this standpoint. Section III goes on to comment briefly on some more detailed features of the ABS figures. The upshot of these sections is that were a TFP wages policy rule based directly on the ABS estimates of TFP growth to be implemented, it is uncertain whether it would have the advantages over an APL rule of the types discussed in section I. The paper concludes by summarizing suggested modifications to the ABS series which, it is argued, would provide a TFP indicator with features more appropriate for wages policy debate purposes.

1. **The Case for a TFP wage adjustment rule**

This section seeks to compare the properties of a TFP wage adjustment rule with the properties of an average labour productivity rule, assuming away all problems of precise definition and measurement associated with the two productivity concepts. Elimination of such problems requires the following eight assumptions:

1. Output is well-defined and countable in physical units. The quantity produced is denoted $Y$. It is sold at price $p$ per unit. Any quality change in output that occurs over time can be (and is) recorded as if it were a quantity change with unchanged quality per unit.
2. Labour is well-defined and countable in physical units. The quantity employed is denoted \( L \). All labour is performed by employees. These are paid a wage \( w \) per unit employed.

3. The quality of labour is uniform and does not change over time.

4. Only one input other than labour is used in production. It is countable in physical units. The quantity employed is denoted \( K \) ("capital"). The owners of \( K \) receive the surplus of revenue from output sales over labour costs, at an even per unit rate. Denoted \( r \), this rate is thus defined residually as \( \frac{1}{K} (pY - wL) \).

5. Newly created units of \( K \) can be purchased at a price \( p_k \) per unit. Each period's newly created units are of exactly the same quality as all the pre-existing units.

6. Units of \( K \) are indestructible. Wear and tear through use (i.e. a reduction in "quality" through use) does not occur.

7. Changes in the price of output do not occur.

8. Changes in the price of newly created units of \( K \) do not occur.

Under these circumstances average labour productivity (\( x \)) is straightforwardly and unambiguously defined as output divided by the quantity of labour input employed in its production.

\[
x = \frac{Y}{L}
\]  

Total factor productivity (\( Z \)) is defined as output divided by an index of total factor inputs employed in its production. This latter index is a weighted geometric mean. Its construction requires that \( L \) and \( K \) be converted into index number form with a common base period. This defines two new variables denoted here by (lower case) \( 0 \) and \( k \):

\[
\ell_t = \frac{L_t.100}{L_B} \quad \text{and} \quad k_t = \frac{K_t.100}{K_B}
\]

where subscript \( t \) refers to a variable's level in period \( t \), and \( B \) is the defined base period. The (arithmetic) mean of the share of labour income in the total income from production in the base period, and the share of labour income in the total income from production in period \( t \) is then taken as the weight on \( z \) in the factor input index. The share of total income going
to the non-labour factor K in the base period averaged with the share going to K in period t is taken as the weight on k. Thus

\[ Z = \frac{Y}{g(1-\alpha)} \quad \text{where} \quad \alpha = \frac{w_B L_B}{2pY_B} + \frac{w_L L_t}{2pY_t} \quad (3) \]

The percentage growth in average labour productivity over a defined period is given (approximately) by the percentage growth in output produced over that period minus the percentage growth in labour employed in its production. Using the dot superscript to denote percentage growth, and suppressing the "error" term in this approximation

\[ \dot{X} = \dot{Y} - \dot{L} \quad (3) \]

The percentage growth in total factor productivity (again suppressing the "error" term) is given by:

\[ \dot{Z} = \dot{Y} - \alpha \dot{L} - (1-\alpha) \dot{K} \quad (4) \]

which can be rewritten:

\[ \dot{Z} = \dot{Y} - \dot{K} + \alpha (\dot{K} - \dot{L}) \quad (4') \]

or:

\[ \dot{Z} = \dot{Y} - \dot{L} - (1-\alpha) (\dot{K} - \dot{L}) \quad (4'') \]

Combining (3) with (4'), we can express the relationship between the two concepts of productivity growth as:

\[ \ddot{Z} = \ddot{X} - (1-\alpha) (\ddot{K} - \ddot{L}) \quad (5) \]

Provided labour’s share of total income over the period (\alpha) was less than one hundred per cent, the two measures of productivity growth will be equal to one another if and only if the growth rate of capital employed and the growth rate of labour employed are equal. TFP growth will be greater (less) than APL growth if the growth rate of capital employed is less (greater) than the growth rate of labour employed. Where there is a differential between the
growth rates of K and L, the differential between TFP growth and APL growth will be greater the greater the value of \( 1 - \alpha \), the share of total income going to capital in the base period averaged with the share going to capital in period \( t \). Note that except where \( \alpha \) is constant through time, this will mean that recorded TFP growth is sensitive to selection of the base period. This matter is discussed further in Section III below.

We now add to the economy specified by the eight assumptions made earlier in this section a central wage fixing body (CWFB). We assume the CWFB has at its disposal fully effective sanctions to prevent enterprises from paying less than the wage rates it specifies. We examine the properties for our hypothetical economy of the CWFB pursuing each of two alternative wage adjustment rules: (a) a rule gearing wage growth to average labour productivity growth; and (b) a rule gearing wage growth to TFP growth.

Why does the CWFB exist? The principal reason for the existence of a CWFB in an otherwise market economy appears to rest on the view that "labour markets are different". At least one side of labour markets, it is held, does not consist of a congeries of individual (and individualistic) agents. In this view, in the absence of a CWFB, wage rates would not be determined by atomistic bargaining between individual employees and individual enterprises. Rather employees would seek, through collective action, to press for the wage relativities they perceive as "equitable" - relativities here meaning vis-a-vis the incomes of enterprise proprietors as well as vis-a-vis other groups of employees. Enterprise proprietors might or might not be inherently more "individualistic" than employees, but either way take a keen interest in whether their proprietorship incomes are meeting a standard they regard as "satisfactory". If not they will seek directly to raise those incomes (by marking up their prices, or cutting the wage rates of their employees) and/or will scale back their new investment spending plans. The former is more likely than the latter to involve (explicitly or tacitly) collective behaviour on the part of enterprise proprietors. Where employees' perceptions of "equitable" wage relativities and enterprise proprietors' perceptions of a satisfactory standard of property income are mutually incompatible, there is likely to be
industrial disruption, inflationary pressure, and demand-deficient unemployment until one or both parties are bludgeoned into accepting a property income/wages distribution which does not involve mutually incompatible claims. If a CWFB can divine procedures for attaining such a mutually acceptable property income/wages configuration, while obviating (or reducing) the otherwise attendant industrial disruption, inflationary pressure and unemployment, and without imposing major costs of other types on society, then society as a whole is clearly better off.  

In this context adherence by the CWFB to an average labour productivity wage adjustment rule will have attractive characteristics if the following three conditions hold. Firstly, enterprise proprietors’ perceptions of a satisfactory standard of property income are determined by reference to the aggregate shares of labour and property in total income from production, and are based on comparing the current shares with the shares pertaining in some past period now regarded as acceptable. This condition, it should be noted, is often expressed as a statement about enterprises’ pricing behaviour. Enterprises are held to formulate their prices on the basis of a proportionate mark-up on non-capital costs - the markup factor being historically determined. Provided that costs of imported raw materials do not shift relative to export prices, such a proportionate mark-up is directly equivalent to stating that the property income standard laid claim to by enterprise proprietors is determined by reference to aggregate factor shares.

Secondly, employees’ perceptions of an equitable relativity between wage rates and property incomes are determined by reference to the aggregate shares of labour and property in total income, and are based on comparing the current shares with the shares pertaining in some past period now perceived as having been acceptable. Note that another way of stating this is that employees assess the acceptability of the relativity between wages and property incomes by considering prices to be a proportionate mark-up on non-capital costs, and comparing the current size of the mark-up factor with a size of factor regarded as (historically) “fair”. Thirdly, the CWFB can identify an actual base period, or can select by
other means a "base" set of mutually consistent factors shares, that is acceptable to both sets of parties.

If the CWFB were to set wages so that wage growth between period $t$ and period $t + i$ was rendered equal to average labour productivity growth over that interval, the ratio of $w$ to $x$ would be the same in period $t + i$ as it had been in period $t$:

$$\frac{w_{t+i}}{x_{t+i}} = \frac{w_t}{x_t} \quad (6)$$

Substituting for $x$ from equation (1) and on the assumption that output prices do not change, it follows that:

$$\frac{w_{t+i} L_{t+i}}{P_{t+i} Y_{t+i}} = \frac{w_t L_t}{P_t Y_t} \quad (7)$$

In other words, setting the rate of growth of wages equal to the rate of growth of average labour productivity over a defined period serves to hold labour's share of total income constant. If the three conditions set out above hold, and factor shares at the beginning of the defined period conform to levels "acceptable" to both parties, direct application of the APL wage adjustment rule will maintain that situation. If factor shares are initially out of line with the acceptable "base" position, by setting $w$ at a rate appropriately below (or above) $x$ the CWFB can plan to move towards "restoring appropriate factor income relativities", in a controlled fashion.

This is the standard case for the role of the average labour productivity growth concept in wages policy debate. It is regarded as providing a guide on "the scope for increases in real wages consistent with long term stability in overall income distribution between factors without providing an additional source of price increases". The case rests crucially on: (a) the competing income claims approach to wage and price setting behaviour; and (b) the assumption, within that approach, that claims are determined in terms of the relativity between aggregate labour income and aggregate property income, i.e. factors shares or the extent of the proportionate price markup factor implicit in those shares.
Adherence by the CWFB to a TFP wage adjustment rule would have attractive features in the context of a competing income claims world in which those claims were determined according to different criteria. Consider a world in which the following three conditions held. Firstly, enterprise proprietors' perceptions of a satisfactory standard of property income are determined by reference to the income received per unit of K employed, and are based on comparing the current level of this variable r with the rate (r*) pertaining in some past period now regarded as acceptable. This condition could be expressed by stating that enterprises set their prices not on the basis of a proportionate price mark-up on non-capital costs, but as an absolute mark-up added onto those costs per unit of output and of a size given by taking r* multiplied by the quantity of K employed and dividing this by the quantity of output produced. Secondly, employees' perceptions of an equitable relativity between wage rates and property incomes are determined by reference to the income received per unit of K employed, and are based on comparing the current level of r with a level regarded as "a fair rate of return" on capital, a rate which prevailed in some past period. Thirdly, the CWFB can identify an actual base period, or select by other means a "base" level of r, that is acceptable to both sets of parties.

What wage adjustment rule would have properties under these three conditions, of equivalent attractiveness to the properties which the straightforward average labour productivity wage adjustment rule displayed under the set of conditions discussed earlier? From our definition of r (see page 3 above), and setting the price of output as the numeraire (i.e. p=1) we can write:

\[ Y = wL + rK \]  \hspace{1cm} (8)

The percentage growth in Y can then be expressed (suppressing the "error" term as earlier) as:

\[ \dot{Y} = \alpha \dot{w} + \alpha \dot{L} + (1-\alpha) \dot{r} + (1-\alpha) \dot{K} \]  \hspace{1cm} (9)
This can be re-arranged to:

\[ \dot{Y} - \alpha \dot{L} - (1 - \alpha) \dot{K} = (1 - \alpha) \dot{r} + \alpha \dot{w} \tag{9'} \]

Substituting equation (4) into equation (9') gives:

\[ \dot{Z} = (1 - \alpha) \dot{r} + \alpha \dot{w} \tag{10} \]

From which it follows that in order to hold \( r \) constant (that is set \( \dot{r} = 0 \)), the appropriate wage adjustment rule is:

\[ \dot{w} = \left( \frac{1}{\alpha} \right) \dot{Z} \tag{11} \]

In other words, setting the rate of growth of wages equal to a specified multiple of the rate of growth of TFP over the course of a defined period would serve to hold the rate of return on capital constant over that period. The specified multiple is the reciprocal of labour's share of total income over the period (see equation (2)). If income claims were determined by reference to a benchmark rate of return on capital as described above, and the rate of return on capital prevailing at the beginning of a defined period were "acceptable" to both parties, adherence by the CWFB to the wage adjustment rule specified in equation (11) would maintain that situation. If the rate of return on capital were initially out of line with the acceptable "benchmark" position, by setting \( \dot{w} \) at a rate appropriately below (or above) the reciprocal of the wage share multiplied by \( \dot{Z} \), the CWFB can plan to move towards "restoring an appropriate rate of return on capital", in a controlled fashion.

It might be noted that although TFP growth will be below APL growth whenever the rate of growth of "capital" employed exceeds the rate of growth of labour employed (see equation 5), the wage adjustment rule specified in equation (11) will provide a greater rate of increase in the wage rate than the straightforward average labour productivity adjustment rule whenever the rate of growth of output exceeds the rate of growth of "capital" employed. Another way of saying the same thing is that adherence to the straightforward average labour
productivity rule will depress (enhance) the average rate of return on capital whenever the rate of growth of output is less than (greater than) the rate of growth of "capital" employed. This can be seen by noting that a constant property share of total income implies $Y = r + K$.

Whether income claims are generated under conditions that render the average labour productivity wage adjustment rule attractive (via reference to "normal" levels of aggregate factor shares), under conditions that render the TFP wage adjustment rule of equation (11) attractive (via reference to a "normal" level of the rate of return per unit of "capital"), or neither, is an empirical question. But the level of the rate of return as the reference benchmark does seem sufficiently the more plausible to warrant some form of provisional acceptance. The situation is perhaps clearest concerning proprietors' decisions on new investment spending. In the words of a recent EPAC Report: "Increased profit shares, while generally positive for output and employment, will not necessarily stimulate stronger investment in the short run. What is more relevant for the investment climate are rates of return (ie a comparison of profits with funds employed)." Essentially the same argument can be put regarding the formulation of mark-ups for price-setting. The BCA, in its submission to the March 1986 National Wage Case, was willing to brook no doubt that it is rates of return and not factor shares that matter: "Blind maintenance of aggregate factor shares can distort the relative per unit returns of labour and capital. In particular, an increase in the capital intensity of production would automatically result in a reduction in the rate of return on capital invested if the aggregate profit share is not allowed to rise."

It has now been demonstrated that there is a case in principle that gearing wages to growth in TFP (via equation 11) would have advantages as a wages policy rule as compared with gearing wages to growth in APL - defining both concepts in their most pure and simple terms. In the following section we progressively relax the simplifying assumptions made at the beginning of this section and ask, under those more complex circumstances, how one ought to seek to construct estimates of TFP growth, for the purpose of providing an operational TFP indicator with properties for the wages policy context of the type discussed.
in this section. But first, one piece of unfinished business. Equation (11) sets wages growth equal to a defined multiple of TFP growth. What would be the properties of a wage adjustment rule simply setting \( w \) equal to TFP growth?

From equation (10) it can be seen that if \( w \) was set equal to \( Z \) over a defined interval, this would lead to \( r \) being equal to \( w \) over that interval. The rate of return per unit of \( K \) would grow at the same percentage rate as the rate of return per unit of labour. Such an outcome could be regarded as socially attractive if one of three sets of circumstances prevailed: if it was held that income claims are formulated by reference not to a benchmark historical level of \( r \) alone, but also on the basis that the "normal" rate of return on capital should experience secular growth at the same rate as the wage per unit of labour; if it was held that \( r \) at the beginning of the period was below its "normal" level and judged that providing for its growth in this way would push it towards its "normal" level at an appropriate pace; if it was held to be appropriate to "reserve" a defined proportion (1-\( \alpha \)) of the wage growth consistent with a constant level of \( r \) and zero downward pressure on output prices, and earmark this defined proportion towards the placing of downward pressure on prices.

The BCA’s submission to the March 1986 National Wage Case made no mention of TFP growth being multiplied by the reciprocal of the wages share of total national income to render it the "most appropriate indicator" of national productivity growth for the wage fixation context. This suggests the BCA was thinking in terms of one of the three scenarios outlined in the paragraph above. The first of the three is rather peculiar - it seems to represent an intriguing inversion of Marx. From statements made later in the BCA submission, it would appear that their implicit scenario was a mix of two and three - leaning more heavily towards three:

provided that profits yield a normal return on funds invested, where there is an option between distributing the benefits of productivity growth as lower product prices (or more realistically lower rates of growth of product prices), or as higher profits, competitive pressures will ensure that most of the productivity growth eventually goes to lower rates of price increases.10
Since the general thrust of the submission was that all of the available national productivity growth should be deployed towards these ends, however, it is hard to see why the fraction \((1-\alpha)\) of that growth should be earmarked as a first stage and then the remainder argued for as a second stage.

II  Key issues in the construction of a TFP indicator

In a real-world economy characterized by the eight assumptions set out at the beginning of Section I, the practical task of constructing a series of TFP estimates could be expected to be fairly mechanical. When any one of those assumptions does not hold, problems arise regarding the practical definition of TFP. Typically, more than one method exists for tackling each of such problems. Each method leads to a different practical definition of TFP. The straightforward “pure” TFP concept of section I thus translates into a “family” of TFP indicators. Some members of this family might be expected to be particularly appropriate for some particular applications of the TFP concept, others for other applications. This section takes the wages policy context discussed above as the “application context”, and examines how appropriate the member of the TFP family embodied in the recently published ABS series is, for this purpose.

We begin by relaxing our assumption that items of capital do not deteriorate in usefulness as a result of use (assumption 6). Instead we shall allow for depreciation to occur. We shall, however, assume that depreciation in usefulness as a result of wear and tear is well-defined and measurable. When any particular item of capital is first created it is assumed to embody some measurable number of units of “physical usefulness”. Each year’s use is assumed to generate a measurable decline in the item’s quantum of usefulness. For the economy as a whole the extent by which the existing stock of capital is reduced in “effective” quantity through use over a given period \(i\), we denote \(D_i\).

This raises two questions on which decisions need to be made in constructing a TFP indicator. Should we define the volume of output produced in a period as gross of
depreciation (GY) or net of depreciation (NY)?

\[ NY = GY - \frac{R_k}{P} \frac{D}{D} \]  

(12)

Should we define the quantity of capital employed in the production of a particular year's output on a basis that fully takes into account the effects of the depreciation process on the various items of capital first put to use at various periods in the past (ie the net capital stock, NK), or on a basis that records the various items of capital as if depreciation was not occurring for as long as an item is still in use, but then fully writes off each item in the period when it is "retired" (ie. the gross capital stock, GK)?

If our goal is to construct a TFP indicator such that the application of the TFP wage adjustment rule specified in equation (11) has the attractive properties discussed earlier, we need to address these two questions on depreciation from the standpoint of that proposed application. The essence of the proposed application is a formula which serves to hold constant a concept of the rate of return on capital at a level which is perceived as "fair" (or at least acceptably so) by both the principal sets of players in the income claims model. Constructing TFP estimates using the gross definition of output would lead to a "gross" concept of \( r \). Use of the net output definition would lead to a "net" concept of \( r \). The latter would represent the "true income" per unit of capital, accruing to enterprise proprietors. The difference between the two concepts of \( r \) would correspond to a "return of principal" flowing to enterprise proprietors. Since this latter amount of originally committed "capital" has now been returned, it would appear logical to subtract it from the denominator of the next period's \( r \) calculation, so that \( r \) is defined as the income received per unit of capital continuing to be employed. If perceptions regarding the "fairness" of the rate of return on property are determined by reference to the return per unit of K "invested", and with that return defined as the "true income" return, it follows that the TFP indicator we need for the purpose specified is one which uses the net concept of output and the net concept of the capital stock.
The TFP series recently published by the ABS conform with neither prescription.\textsuperscript{11} The output measure used is on a "gross of depreciation" basis. The capital stock series used is neither gross nor net, but a rather complex weighted average of various net and gross capital stock sub-series developed by the Bureau over the past decade.\textsuperscript{12} The rationale behind the ABS use of this weighted average approach is essentially that the estimates of depreciation (or "capital consumption") used by the ABS in compiling the published National Accounts aggregates are considered to overestimate the pace at which wear and tear through use diminish the "effective usefulness" of items of the capital stock, when the concept of "effective usefulness" required is that for constructing TFP estimates. There is not the space here to attempt to assess this argument, or the particular weightings selected by the ABS. Suffice it to say that once the series for the effective volume of "capital" in use has been defined, the estimated quantum of depreciation per year implicit in those figures should be used to adjust output from a gross to a net basis, and thence to define labour's share in total net income from production ($\alpha$). The use of one set of depreciation estimates for the one task, and of another set (or none at all) for the second task, would not in general be compatible with the resultant TFP series having the properties for wages policy purposes of the type desired.

We now turn to our assumptions that no changes occur in either the price of output ($p$) or the price at which newly created units of $K$ are available ($p_k$) - \textit{viz.} assumptions (7) and (8) from the beginning of section I. Allowing for inflation to occur at an even rate across the economy necessitates the introduction of only fairly minor complications to the model as previously specified. For the rate of return on capital to represent the true real return per unit of capital, it is necessary to transform it into constant dollar terms and also to use a measure of depreciation which is on a "current cost" and not a "historical cost" basis. In specifying our wage adjustment rule we need also to transform the variable $w$ into constant dollar terms and consider money wages to be tending to grow at the same rate as output prices unless the CWFB deliberately chooses to set the rate of growth of the money wage at a rate other than equal to the rate of growth of output prices. Henceforth the symbol $\hat{w}$ will be used to denote
the wage per unit of labour in constant dollar terms, using the output price series as the deflator.

The situation is rendered less straightforward when \( p \) and \( p_k \) grow through time at rates different to one another. This raises a question on which a choice between two possible approaches has to be made when constructing one's TFP indicator. Should the measure of depreciation implicit in one's TFP estimates seek to provide enterprise proprietors with depreciation provisions sufficient to replace each item of capital equipment, at the time it is retired, with a brand new one? Note that by assumption (5) the brand new item is of exactly the same quality as was the now-retired item when it was new. Or should the measure seek to provide proprietors with depreciation provisions such that when each item of capital is retired, the provision associated with it has purchasing power over current output equal to the purchasing power of that item's original price when new? If we adopt the latter approach and apply the wage adjustment rule specified in equation (11), using a TFP indicator constructed on this basis, we will be acting to hold constant the rate of return on capital in purchasing power over current output terms. If \( p_k \) were rising relative to \( p \), however, then other things being equal this will involve a progressively diminishing incentive for enterprise proprietors to replace capital as it wears out. If, on the other hand, we adopt the alternative approach, we would be maintaining a constant "incentive to invest", but allowing the value or \( r \) to enterprise proprietors as general purchasing power to vary. In a period when \( p_k \) was rising relative to \( p \), enterprise proprietors could be expected to be making "super-normal" returns (in general purchasing power terms) on their old investments. In a period when \( p_k \) was falling relative to \( p \), proprietors would be making "sub-normal" returns (thus defined) on their old investments.

There is clearly a clash here as far as the application context we are discussing is concerned. Wage-earners' perceptions of fairness regarding the rate of property income are likely to be determined by reference to a "retrospectively-based" concept of the denominator - the quantity of potential real consumption forgone and committed to capital formation during
the past. But seeking to provide for a continued "normal" rate of return to today's new investment requires that bygones be treated as bygones. The latter approach involves using the "replacement cost" method of estimating depreciation. It is the methodology employed in the ABS estimates of TFP.13

We now consider the implications of recognizing that the quality of newly created items of capital can vary with the passage of time. (i.e. we relax assumption (5) made at the beginning of section I). The key issue here is how to deal with what is termed "costless quality change". If something which looks and costs the same today as did a hand calculator of fifteen years ago can in fact perform the same functions as something far more expensive called a desk calculator fifteen years ago, how do we record this in the figures underlying our TFP indicator? There are two main possibilities. We can say today's hand calculator represents the same number of units of K as did the hand calculator of fifteen years ago, and (since the price of the two items is the same) that the price per unit of K has not changed. Or we can say today's hand calculator represents the same number of units of K as did the desk calculator of fifteen years ago, and we can then calculate the extent to which the price per unit has fallen. Where the quality of items of capital is improving, to an extent greater than is reflected by any increases in the prices of those items relative to the general price level, adoption of the latter approach (approach B) will clearly generate a real capital stock series which displays more rapid growth than would be the case under the former approach (approach A). From equation (4) it is clear this means recorded TFP growth would be lower under approach B than under approach A, cet. par.

What are the comparative properties of these two approaches to "costless quality change" in capital, in terms of the consequences of adopting the wage adjustment rule specified in equation (11), using a TFP indicator incorporating either the one approach or the other? If approach A is adopted, and the effects of costless quality change are not recorded as a reduction in the effective price per unit of newly created capital, the TFP wage adjustment rule of equation (11) will act as follows. It will hold the real rate of return on
funds invested in new items of capital today at the "normal" level which applied at the time on investments then being made in new items of capital in previous periods of relevant comparison. It would thus maintain from period to period a constant "incentive to new investment". But it would involve the rate of return accruing on old capital items falling progressively further below this "normal" level, as those items were left further behind in embodied quality by comparison with the "newer models".

If approach B were adopted, and the effects of costless quality change are fully recorded as a reduction in \( p_k \), the TFP wage adjustment rule of equation (11) will produce a quite different situation. Here the rate of return accruing to those with investments in old capital items is held constant through time at the rate which applied when those investments were first made. For the cohort of capital items each brand new in the base period, this rate of return which is held constant through the working lifetimes of those items is the rate deemed "normal" in that base period. Each cohort of capital items of more recent vintage accrues a progressively higher rate of return on the funds invested in that cohort, this rate then being held constant for the working lifetime of that cohort. In terms of the example cited above, approach B would protect the rate of return on funds invested in the old desk calculator at the rate regarded as "fair" fifteen years ago. It would provide the investor in today's hand calculator with a flow of income of the same total real size as the flow regarded as a fair return fifteen years ago from investment in the desk calculator.\textsuperscript{14} Because the price of today's new hand calculator is far below the price fifteen years ago of the then-new desk calculator, this same total real size of income flow will correspond to a far higher real rate of return on funds invested.

Once again there is a clear clash in terms of the application context with which this paper is concerned. For enterprise proprietors (particularly those with substantial investments in potentially long-lived items of capital under threat of being rendered outmoded) perceptions of a "fair return" are likely to be influenced by a "retrospectively based" concept of the denominator - the quantity of potential real consumption forgone and
committed to capital formation during the past. But seeking to provide a constant "incentive to new investment" requires that bygones be treated as bygones. The latter involves using what has been described here as approach A to the issue of costless quality change in capital. This is not the methodology employed in the ABS estimates of TFP. The series on the volume of capital equipment in use which the ABS employs in constructing its TFP figures is based on the alternative approach: the approach which is not consistent with those TFP figures being used via the wage adjustment rule of equation (11) to provide a constant "incentive to new investment", and (in doing so) treat bygones as bygones.

There is thus a lack of coherence, in terms of the application context we are examining here, between two of the key design features of the TFP series recently published by the ABS. The depreciation concept implicit in those figures is consistent with the figures being used as an indicator on the relativity between real factor returns which is "forward looking" in that it stresses the rate of return accruing on the most recent vintage of new capital, in each period. The approach to costless quality change in capital implicit in the ABS figures, by contrast, is consistent with an indicator of relative factor returns which is "backward looking" in that it stresses whether dollars of consumption forgone in order to buy new capital in the base period, and still "tied up" in that now-ageing capital, are today still receiving a real rate of return the same as that regarded as reasonable in the base period. To the extent that the two design features adopted in the ABS methodology tend to pull in different directions, their selection might be regarded as a "compromise". But for wages policy purposes it might make sense for the effects on the TFP figures of the alternative approaches, in the two cases, to be calculated, and for some further examination of the relative properties of the resultant series to be carried out.

Before leaving the quality change issue, a further point deserves notice. One might be inclined to regard the simpler wage adjustment rule \( w = \bar{Z} \) as taking the fruits of national productivity growth and apportioning these between capital and labour, with employees receiving the same proportionate increase in their real hourly wage rate as enterprise
proprietors receive in their return per (constant price) dollar of funds invested. Applying this rule using a TFP series compiled via the methodology preferred by the ABS for dealing with quality change in capital would not have this effect. The overall fruits of productivity growth are then effectively divided into two portions, a portion attributable directly to quality improvements in capital, and the remainder. The first portion is distributed as an increased reward to capital only. The remainder is used to provide a round-the-board equi-proportionate increase in the real hourly wage rate and the return per real dollar of funds invested. It is hard to see how wage earners would regard this as equitable if the effects of quality improvements in labour were not treated in an equivalent way. The ABS methodology does not record improvements in labour quality as increases in the effective volume of labour. Implicitly approach A is adopted in the ABS labour input indicator, while approach B is adopted in capital input indicator.16

We now consider the implications of recognizing that not all of the labour performed for pecuniary gain in the economy is performed by employees (i.e. we relax assumption (2) made at the beginning of section I). Proprietors of enterprises in the unincorporated sector of the economy derive a flow of income from their enterprises which is typically an amalgam of a return on the labour they supply for their own enterprises' use, and a return on the "property" which their ownership of those enterprises represents. As the present writer has discussed elsewhere, in the context of average labour productivity, the essential problem arising for national productivity measurement from the existence of the self-employed is the fact that in aggregate the revenue they receive from their production is typically not sufficient for them to be deemed to be earning both the same average hourly rate of return on their labour as employees, and the same average rate of return on property as proprietors in the corporate sector.17 This means either the average price of their output is lower than the average price of corporate sector output, or that one or both of the factor inputs in self-employed use are performing with lower "productivity" on average, than is the case for labour and "capital" employed in the corporate sector. To the extent that the two sectors are selling into the same market(s), the "law of one price" suggests it is a matter of productivity.
Unless (or until) one has grounds for believing that it is one in particular of the two self-employed factors which is responsible for this situation, it would appear reasonable to adopt the very simple procedure of assuming that the responsibility is shared "evenly" across the units of both self-employed labour and self-employed capital. This requires defining for each time period a fraction $s$ such that when the self-employed are deemed to be receiving this fraction of the employee hourly wage ($w$) on each hour of self-employed labour worked ($L_{u}$) in that period, and in addition the same fraction $s$ of the rate of return on corporate sector capital ($r$) on each unit of capital in self-employed use ($K_{u}$) in that period, this exactly exhausts the income recorded as flowing to the proprietors of the unincorporated sector ($U$) in that period.

$$s = \frac{U}{wL_{u} + rK_{u}}$$  \hspace{1cm} (13)

Given the application context under discussion, what is now required is to find whether, with this treatment of the unincorporated sector, it is possible to identify an operational definition of TFP such that if the CWFB were to take this particular TFP indicator $Z'_{i}$, and adjust wages according to the rule $w = Z'_{i}$, this would provide for the rate of return on capital to grow at the same percentage rate as wages (i.e. $r = w$) Consider equation (8) above. With the existence of an unincorporated sector, and under the treatment of that sector summarized by equation (13), this now needs to be replaced by:

$$Y = wL_{w} + swL_{u} + rK_{c} + srK_{u}$$  \hspace{1cm} (14)

where $L_{w}$ denotes the number of hours worked by wage (and salary) earners and $K_{c}$ denotes the volume of "capital" employed in the corporate sector of the economy.18

Now define three new variables which we shall call: adjusted labour hours; the adjusted volume of capital; and the adjusted labour share of total income, respectively.
\[ L' = L_0 + sL_n \]  
(15)

\[ K' = K_c + sK_n \]  
(16)

\[ \alpha' = \frac{wL_0 + sW}{Y} \]  
(17)

Whereas for the simple economy of section 1, we moved from equation (8) to expressing the growth in \( Y \) by equation (9), the equivalent step from equation (14) is now:

\[ \dot{Y} = \alpha' \dot{W} + \alpha' \dot{L} + (1 - \alpha') \dot{R} - (1 - \alpha') \dot{K} \]  
(18)

It follows that if we take as our definition of total factor productivity growth, under these "new" circumstances of an economy with an unincorporated sector:

\[ \dot{Z} = \dot{Y} - \alpha' \dot{L} - (1 - \alpha') \dot{K} \]  
(19)

then this operational definition of TFP has the property desired. If one sets \( \dot{W} = \dot{Z} \), as given by equation (19), this will produce through equation (18) the result \( \dot{W} = \dot{r} \). In order to hold \( r \) constant (that is; set \( \dot{r} = 0 \)) the appropriate wage adjustment rule is:

\[ \dot{w} = \left( \frac{1}{\alpha} \right) \dot{Z} \]  
(20)

The ABS, in constructing their series of TFP estimates, adopted a methodology for tackling the unincorporated sector issue based on the "scaling factor \( s \)" approach detailed above.\(^9\) While based on that approach, the ABS definition of TFP growth is not that given by equation (19). It is:

\[ \dot{Z} = \dot{Y} - \alpha' \dot{L} - (1 - \alpha') \dot{K} \]  
(19')

The ABS definition uses an "adjusted labour's share of total income" (\( \alpha' \)) as defined in equation (17)\(^2^0\) but takes as its \( L \) and \( K \) series only simple aggregates of total hours worked and the total volume of capital employed (\( L = L_0 + L_n \) and \( K = K_c + K_n \)) and not "adjusted" series as defined in equations (15) and (16). The effect of this in the application context
under discussion in this paper is as follows. Assume the CWFB adopted a wage adjustment rule akin to equation (20) but based on the ABS indicator of TFP growth. Formally,

$$\dot{w} = \left(\frac{1}{\alpha}\right) \dot{z}^*$$

(20)

If either the total hours worked by the self-employed ($L_{U}$) grows relatively more rapidly than the total hours worked by employees ($L_{W}$), or the volume of capital in self-employed use ($K_{U}$) grows relatively more rapidly than the volume of capital employed in the corporate sector ($K_{W}$), or both, this will mean that $\dot{L} > \dot{L}^*$, or $\dot{K} > \dot{K}^*$, or both, respectively. Under these circumstances TFP growth as recorded by the ABS indicator will be below TFP growth as recorded by equation (19). That is: $\dot{Z}^* < \dot{Z}$, and the wage adjustment rule based on the ABS indicator - equation (20) - will provide for the rate of return on capital to rise ($r > 0$). Note that it is both the rate of return per unit of corporate sector capital ($r$) and the rate of return per unit of self-employed capital ($sr$) which thus rise. If, on the other hand, the unincorporated sector were shrinking relative to the corporate sector (in the sense of $L_{W} < L_{W}$ or $K_{W} < K_{W}$, or both), application of the wage adjustment rule of equation (20) would cause the rate of return on capital to fall.

The bottom line here is clear. The adoption by the ABS of the methodology for dealing with the unincorporated sector summarized by equation (19) means that the resultant TFP series will not in general possess the properties for wages policy purposes described in section I as being "attractive". The alternative methodology summarized by equation (19) would be compatible with a TFP series thereby derived possessing those properties.

The final part of this section is concerned with an issue which arises when we reconsider the fourth of the simplifying assumptions made at the beginning of section I. By that assumption we restricted there to be only one factor of production other than labour. We assumed that this factor receives the surplus of production revenue over labour income in the economy, and that it can be counted in terms of (some single-dimensional scale of) physical units. We have since referred to that second factor using the terms "property" and "capital"
more or less interchangeably. In assuming that "capital" is countable and that newly created units of "capital" exist and are available at price $p_k$, we have implicitly restricted "capital" to consist of **tangible reproducible assets** in use in the production of output (buildings, structures, plant and equipment etc) plus producer inventories (of raw materials, work in progress, and output awaiting sale). What are the consequences for TFP definition and measurement if we relax this assumption and allow our economy's stock of "capital" to include two additional types of asset: **non-reproducible tangibles** (or "land", including subsoil assets etc) and **non-tangibles** (patents, brand-names, government "licences" etc)?

The answer to this question will depend on the type of application one's TFP indicator is to be used in. Consider the following two possibilities, both of which are "nested" within the application context established in section I. In scenario A the attractiveness to the CWFB of a TFP wage adjustment rule of the type defined in equation (20) rests entirely with its provision for the maintainance through time of a "normal" rate of return on new business investment spending in tangible reproducible assets and producer inventories. This is expected to provide for buoyancy and balance in aggregate demand in the economy. Under these circumstances it would seem reasonable to define the "capital" series in one's TFP equation as the volume of these two asset types in use, and to amend one's definition of income from production by netting out the sums accruing to proprietorship of non-reproducible tangible assets and intangibles. With net production income thus re-defined, the part not representing labour income represents the aggregate income flowing to the "capital" represented by the K series in one's TFP equation. The concept of "return per unit of capital" being held constant would then be the concept desired.

In scenario B, the attractiveness to the CWFB of a TFP wage adjustment rule rests with it maintaining a "normal" rate of return on the totality of assets employed in production. This might stem from the CWFB's assessment of relevant "fairness" issues as regards income from different types of property. Or it might stem from the CWFB believing it to be imprudent to expect to quarantine developments regarding one major subset of "capital" from
having effects on the whole. Under these circumstances it would be appropriate to use total income from production figures, as originally defined, in one's TFP equations but one would need to ensure that one's "capital" series was compatible with this. That is, it would need to be defined to include all relevant capital assets, and not just tangible reproducibles and producer inventories.

There are significant practical problems associated with seeking to construct TFP estimates either on the basis suggested above as appropriate under scenario A, or on the basis appropriate under scenario B. In the scenario A case, the problems arise in seeking to strip out from the National Accounts aggregate "net operating surplus" the part which can be regarded as accruing to forms of "property" other than reproducible tangible assets and inventories. When an enterprise does not own the buildings in which its operates, it typically pays a rent to the owner which covers both the use of the building and the use of the land on which the building stands. It is not easy to distinguish the return on land component of that rent from the return on reproducible tangible assets (ie building) component. When an enterprise is the owner of the buildings and land from which it operates, this problem is clearly compounded. Data on payments of royalties provide some scope for estimating the flow of income to "intellectual property" (and certain related assets) but once again if an enterprise is using an asset which it itself owns, identification problems arise. With the case of mineral royalties paid to governments, there is a conceptual problem of distinguishing these payments from indirect taxes, but either way it is clear these monies should not be treated as part of the income flow accruing to the proprietors of reproducible tangible assets and inventories.22

In the scenario B case, the problems that arise appear more tractable in the case of estimating the volume and price per unit of land (narrowly defined) employed in production than in the cases of sub-soil assets and intangibles. It is true that it is typically difficult to distinguish the price of a piece of land from the price of the building(s) standing on it, but in principle it ought to be straightforward to compile data on the two combined. Since the ABS
has already constructed data series for the current price and constant price value of the economy's stock of buildings, compatible data on the land these buildings stand on should be capable of estimation via subtraction. There is not the space here to consider the issues that arise in the intangibles area. Suffice it to say that at present the ABS makes estimates of the stock (gross and net) of only one type of intangible asset - capitalized real estate transfer expenses. The methodology used in deriving those figures could be extended to one or two other areas, such as capitalized mineral exploration expenses, and capitalized research and development (R+D) expenses. How big a proportion of the "private" intangibles area that would leave uncovered and how the area of government licences might be tackled are questions requiring further investigation.

The TFP estimates recently published by the ABS embody a methodology for dealing with this issue which is consistent with neither of the "application scenarios" described above. The ABS indicator uses a "capital" series which (for the non-farm sector) is confined to fixed reproducible tangible assets plus inventories plus capitalized real estate transfer expenses. At the same time the ABS indicator takes as its definition of the share of income accruing to "capital", the weight \((1 - \alpha)\) in equation (2), figures which include the income accruing to all "capital". It is hard to imagine any application scenario with which such a methodology would be consistent. It appears that when developing the TFP figures, the preference of the ABS was for a broader definition of "capital", but this preference foundered in the face of resource constraints. To quote Aspden: "It would have been desirable to include the capital stock of land used by industries other than agriculture, but no suitable data are available, and lack of time and resources have prevented adequate estimates being made" (op. cit. p. 21). Aspden does not mention whether the ABS investigated the alternative approach of seeking to estimate the proportion of income accruing to "capital" on a basis compatible with the definition of "capital" actually adopted.

In terms of the application context discussed in this paper, the consequences of the ABS TFP indicator embodying a K series and a definition of \((1 - \alpha)\) which are mutually incompatible
can be discerned by considering equation (4). If it is with the scenario A variant of the basic model that one is interested, the K series in the ABS indicator is essentially compatible with that application.\textsuperscript{24} But (1 - α) is biased upwards and hence recorded TFP growth is biased downwards. If it is with the scenario B variant of the basic model that one is interested, the value of (1 - α) in the ABS indicator is essentially okay.\textsuperscript{26} But one then needs to be concerned about how the growth rate of the ABS definition of K compares with the growth rate of the broader definition of "capital". If the two growth rates are equal, there is no problem. If the former exceeds (is less than) the latter, recorded TFP growth will be biased downwards (upwards). To say more would require further information on the size (and growth rate) of the stock of "missing capital" relative to the stock of K as defined by the ABS.\textsuperscript{27}

This section has examined five key design features of the TFP indicator recently developed by the ABS. The examination has been conducted to assess the suitability of that indicator for use in a particular application context, defined in section I. It should be stressed that TFP has many applications, and that the particular member of the "TFP family" best suited to one application will typically not be the member best suited to another, quite different, application. The various concerns aired in this section (and also those raised in the next section) regarding the usefulness of the ABS indicator in wages policy debate need to be read in this light. In summary, this section has concluded that of the five key design features of the ABS indicator examined, two are mutually inconsistent in terms of the properties they cause the resulting TFP estimates to possess. Defining depreciation allowances in replacement cost terms gears the figures towards being useful in the context of a CWFB seeking to maintain the "incentive to new investment". But the treatment of quality change in capital equipment gears the figures away from this and towards being useful in the context of a CWFB seeking to maintain "fair" returns on investment made in the past. Depending on the precise nature of the application context, at least one of these two design features is likely to be unsatisfactory. Unsatisfactory properties are also found to flow from the other three design features examined. Output should be defined net of depreciation, with depreciation
defined on a basis compatible with that embodied in the capital stock series employed. The treatment of the unincorporated sector is defective. And the capital stock series employed is incompatible with the definition of "capital's share of income" (or "of cost") adopted.

III Other considerations for TFP based wage adjustment

The previous section took as its starting point the highly simplified economy assumed in section I. We then progressively relaxed a number of key simplifying assumptions and asked whether it remained possible, under the thereby-heightened complexity, to define a TFP indicator which - if used for wage adjustment purposes in the manner of equation (11) - would have the "attractive properties" of TFP based wage adjustment identified in the simpler situation of section I. This section takes that process further, introducing some further complications which are significant features of the economy we live in, and examining the impact of these on the properties of a policy of TFP based wage adjustment.

We begin by reconsidering our assumption that output is countable in physical units, is sold at an identifiable price per unit, and is subject to differences of quality which can adequately be recorded and treated as if they were differences of quality (assumption (1) from the beginning of section I). Particularly where production takes the form of the provision of a service which is subject to substantial differences of quality, it is often very difficult to quantify the quality dimension(s) in such a way that the volume of service provided can be adequately distinguished from the total service-charges revenue raised on the one hand, or from the volume of the inputs used in the service's provision on the other. For certain industry sectors, the ingenuity of statistical agencies notwithstanding, official statistics for volume of output (and hence, implicitly for output prices) are based not on true attempts at measurement but on arbitrary assumptions - usually termed "conventions". In terms of the present context, the principal issue that arises is how to deal with those sectors of the Australian economy for which official statistics of output are based on "convention" rather than "measurement".
Two straightforwardly operationalized strategies are available. One can ignore the problem, take the official statistics on output at face value, and calculate TFP using economy-wide definitions of Y, K, and L. Alternatively one can delete from one’s analysis the industry sectors for which the official statistics on output in relation to factor input are viewed as unsatisfactory, and calculate TFP for the remainder of the economy. The former is the approach advocated by the BCA in the 1986 National Wage Case. It can be termed the “economy-wide” approach. The latter is the approach embodied in the TFP series recently published by the ABS. Often labelled the “market-sector” approach, it will be referred to as such here, though it should be borne in mind that this is something of a misnomer. The “market-sector” thus defined includes some production activity which is non-market, excludes much production which is marketed and has as its statistical raison d’être the quality-quantity-quantity discussed above, not the market/non-market dichotomy.

The properties of a policy of gearing wages to recorded TFP growth, where one’s TFP indicator has been constructed on the basis of the market sector approach, will depend crucially on how the rate of (unobserved) TFP growth occurring in the non-market sector compares with the rate occurring in the observed sector. If the two rates happened to be the same, then (see, e.g.) the policy would have the properties anticipated from the simpler models. Wage adjustment according to equation (11) would, under these circumstances, provide for the average rate of return on capital across the economy as a whole to be preserved at its pre-existing level. If, however, TFP growth in the (unobserved) non-market sector were less than TFP growth in the market sector, wage-adjustment according to equation (11) would serve to reduce the average rate of return on capital across the economy as a whole. Unless one believed it was feasible and appropriate to quarantine the reduced r to the non-market sector, the attractiveness of the TFP wage adjustment rule of equation (11) would be impaired. This was the basis of the BCA’s rejection of the “market-sector” approach. The BCA argued that productivity growth in the non-market sector is below that in the market sector, and the approach of simply deleting the former sector in the
construction of one statistical series thus introduces an upward bias into recorded productivity growth.\textsuperscript{31}

The properties of the alternative strategy - gearing wages to recorded TFP growth, where one’s TFP indicator has been constructed on the basis of the economy-wide approach, are more difficult to describe. As a first approximation one can regard the official statistics on the output of the non-market sector as being constructed according to the convention that average labour productivity growth in that sector is always zero.\textsuperscript{32} From equation (5) it follows that the TFP growth recorded for this sector in the official statistics will be zero if the stock of capital employed in the sector ($K_a$) grows at exactly the same rate as the volume of labour in non-market sector employment ($L_a$). More generally TFP growth in the non-market sector ($Z_a$) will be given by:

$$\dot{Z_a} = - (1 - \alpha_a) (\dot{K}_a - \dot{L}_a)$$

(21)

where $\alpha_a$ is labour’s share of the product in the non-market sector. Note that $\dot{Z}_a$ will be negative where $\dot{K}_a > \dot{L}_a$. The properties of the wage adjustment strategy under examination depend crucially on how the rate of (unobserved) TFP growth actually occurring in the non-market sector compares with the rate recorded as occurring, given by equation (21). If the two rates happened to be the same, then (cet. par.) the policy would have the properties anticipated from the simpler models. Wage adjustment according to equation (11) and based on an economy-wide TFP indicator would, under these circumstances, provide for the average rate of return on capital across the economy as a whole to be preserved at its pre-existing level. If, however, TFP growth actually occurring in the non-market sector exceeded that given by equation (21), this wage adjustment rule would serve to increase the average rate of return on capital across the economy as a whole.

The bottom line here is that the CWFB would need to form a judgement as to the likely rate of growth of TFP actually occurring in the non-market sector of the economy, if its intention was to pursue a wages policy with the property of a planned impact on the
economy-wide average rate of return on capital. Such a judgement would require information beyond that presently available in the principal series of official statistics. Given the nature of the quality-quantity quandary at the root of the problem, such information could be expected to be partial and/or "indicative" at best. Assessing it would require an exercise of "judgement" on the part of the CWFB. This exercise would probably be facilitated if the CWFB were provided with a pair of statistical guide-posts: one being a TFP series calculated on the market-sector basis; the other a TFP series covering both the market and the non-market sectors, but constructed on the assumption of zero TFP growth in the latter sector, rather than on the conventions currently employed in the national accounts. The former guide-post now exists in the form of the recently developed ABS series. The latter requires construction. It would probably assist the CWFB if this were done "officially" rather than "unofficially".

Before moving on from this issue, a reservation regarding the definition of market sector embodied in the ABS TFP series is worth raising. This concerns the ABS treatment of buildings which, having been used in one (private) industry sector, are then sold into the ownership of another (private) industry sector. The K series used by the ABS ignore such transactions. Private sector "capital" is implicitly assumed to continue to be employed in the industry of original ownership (or original "use" if subject to finance lease arrangements). Yet the data on (1-α) used by the ABS record the income of capital according to the sector of its current ownership (or "use" if under finance lease). The fact that the Finance sector is defined by the ABS to the part of the non-market sector means there is the potential for a problem here. To quote Walters and Dippelusman:

Transactions in existing buildings may be quite large in relation to new buildings. Generalised structures such as offices could change industries readily. One could speculate that many such transfers occur within an industry or are occurring in both directions between industries (and therefore tend to cancel each other out in aggregate). However, this has not been the case. For example, there has been a trend in recent years towards property operators, unit trusts, superannuation funds etc owning a greater proportion of shopping centres and industrial premises for lease. For this reason in particular, non-dwelling construction capital stock and depreciation estimates by industry should be interpreted with caution.
In the final section of their paper Walters and Dippelsman stated that in the further development of the ABS capital stock estimates: "A survey of second hand asset transactions would be of significant benefit". The ABS has not so far conducted such a survey. It is not clear whether it plans to. Any work which did shed light on the likely extent of the errors in the TFP figures for the market sector arising from the non-recognition of such transactions would clearly be useful.

We now turn to an issue we have so far ignored - the role of cycles in aggregate demand. So far it has implicitly been assumed that the entire net capital stock in existence in each time period i is "employed" in that period. We have not allowed for capital to be "unemployed" or for its degree of utilization to vary from period to period. A priori one would expect cyclical downturns in aggregate demand to be associated with increased underutilization of the existing capital stock, and upturns in aggregate demand to be associated with decreased underutilization of the capital stock. Gearing wages to movements in TFP along the lines of equation (11), during the course of a cycle but using a TFP indicator which ignored the effect on capital utilization of the cycle, would have the property of holding constant the average rate of return on the extant capital stock irrespective of the degree of utilization of that capital. Wage earners could be expected to perceive this as inequitable to labour during the troughs of cycles (with unemployed labour ceasing to be paid, but unemployed capital still receiving r* per unit). Enterprise proprietors might perceive the arrangement as unsatisfactory to them during cyclical booms (with labour being paid for its "overtime", but capital not).

Two possible responses to this issue are apparent. One is to seek to construct a reliable time series of figures for the degree of utilization of the economy's capital stock, and to use these figures to adjust the K series in one's TFP calculation onto an "effectively employed" basis. Alternatively one can proceed with the TFP calculation as before, but then adjust the resulting TFP estimates to smooth out the cyclical influences (i.e. "cyclically
adjust the final TFP series by some appropriate method). The latter approach is more
parsimonious in its requirements for data. It has the additional advantage of simultaneously
adjusting for those cyclical variations in the degree of utilization of labour not already picked
up by the use of the "hours worked" definition of labour input (i.e. labour hoarding effects).
The ABS counsels this approach to the use of its TFP estimates in the notes accompanying
those figures, but indicates it is investigating the feasibility of pursuing the alternative
approach.

Others such as the [US] Bureau of Labor Statistics have tried to get round the
problem by estimating average annual growth rates between MFP values at
cyclical peaks. Providing the utilisation rates at the cyclical peaks are the
same this should give estimates free of the effects of changing capital and
labour utilisation. The ABS has adopted [this] approach in producing the
estimates in this paper, but is undertaking research into the possibility of
estimating annual MFP estimates free of the effects of such changes in input
utilization.35

In Australian National Wage Cases there has been a tradition of focussing on the trend
growth rates displayed by productivity indicators rather than year to year movements.
Provided the period for which the trend growth in TFP is calculated is one over which the
degree of utilization of K displays no marked up trend or down trend, a CWFB seeking to
gear wages to TFP growth should not need to worry further about this issue. The present
ABS approach on this score can then be regarded as sufficient. Further data on utilization
rates would, however, clearly be useful in verifying this.

A related issue concerns cyclical variations in factor shares. In section I, the "weight"
on the factor input labour in the calculation of TFP growth over the interval from the base
period to a period t was defined as the simple arithmetic means of the factor share accruing to
labour in the base period and the factor share accruing in period t. The weight on K was
defined equivalently. It is well known that such an approach overcomes the bias which
tends to be associated with the use of "fixed" weights, whether these be base period or end
period, when the growth rates of the factors employed are not equal. The ABS, in
constructing its TFP series, has defined the weights in each year to be the arithmetic means
of the factor shares prevailing in that year and in the immediately preceding year. If factor
shares were subject to an underlying cyclical pattern (or perhaps to certain other types of non-CWFB-condoned variations) and if one was seeking to gear wages to "short-period" movements in TFP, this procedure would warrant further investigation. Once again though, the Australian NWC tradition of focussing on the trend growth rates displayed by productivity indicators means that the returns, in the wages policy context, to heightened sophistication on this front are unlikely to be great.

One final question is addressed in this section. This is the question of the rate of return on publicly owned "capital". So far it has been implicitly assumed that in terms of their setting of their output prices and of their willingness (or otherwise) to engage in new investment spending, decision-making by public enterprises and decision-making by private-sector corporations are based on exactly the same criterion - how the rate of return currently being earned on capital compares with a historically determined benchmark level \( r^* \). Let us now investigate the consequences, for the application context under discussion, of relaxing this assumption. Imagine that during some defined period what the relevant decision-makers in the public sector regard as an appropriate or acceptable rate of return on public capital is at a level \( r_p^* \) substantially below that regarded as satisfactory/acceptable in the private sector \( r_p^* \). If public capital was in fact earning \( r_p^* \) and private sector capital \( r_p^* \) the economy-wide average rate of return would be given by a weighted average of the two, and (cet par.) would be at a level compatible with an absence of upward pressure on output prices, and with "bucancy" in investment spending. A policy of providing for the economy-wide average rate of return on capital to remain constant will not, however, necessarily be an attractive policy under these circumstances. If the weight of private sector capital relative to public sector capital rises, or if the decision-makers in the public sector revise upwards their view as to what represents an appropriate level of \( r_p^* \) relative to \( r_p^* \), a wage adjustment rule providing for \( r = 0 \) would then tend to cause upward pressure on output prices and downward pressure on investment spending (assuming \( r_p^* \) remains constant).
A change in the weights, with an unchanged relativity between \( r_p^* \) and \( r_p^* \) could be handled fairly mechanically. One possibility would be to redefine the K series used in the TFP calculations to:

\[
K^* = K_p + \beta K_g
\]  

(22)

where \( K_p \) is one's series for the capital stock in private sector employment, \( K_g \) is the stock of publicly owned capital, and \( \beta \) is defined as \( r_g^* \) divided by \( r_p^* \). This is clearly analogous to the means of dealing with self-employed capital discussed earlier.\(^{37}\) The analogy should not be taken too far, however. Here the level of \( \beta \) needs to be set through an exercise of judgement by the CWFB, whereas "factor s" in equation (16) was defined directly from the data. Where there are grounds for suspecting that the relativity between \( r_g^* \) and \( r_p^* \) has been changing, the requirement for an "exercise of judgement" is extended. Little scope for a "mechanical" approach then remains.

In essence the situation of competing income claims by two parties, as discussed in section I, has here been complicated by the introduction of a third party ("the government") which is laying claim to a larger portion of the available income than has "traditionally" been the case. If the CWFB is to play the role in this three party situation equivalent to the role described in section I for the two party situation, it will need to find a new three-way division of the "national cake" that is mutually acceptable to the three parties. To discuss this further would take us beyond the scope of the present paper. Suffice it to say that under the circumstances described above, for the CWFB to persevere with adjusting wages directly according to the TFP rule of equation (11) would amount to a decision that the increased income claim of "the government" should be accommodated entirely at the expense of the proprietors of capital employed in private sector enterprises, with labour being called upon to concede nothing. Whether the CWFB wishes to act with this effect is clearly a matter which requires consideration when the extent of wage rises warranted by TFP growth is at issue.\(^{38}\)
Conclusions

This paper has argued that the total factor productivity concept does have advantages over the average labour productivity concept in providing a statistical base for gearing wages to national productivity growth. This conclusion does, however, require that wage adjustment be conducted by reference to a defined multiple of TFP growth, rather than simply to TFP growth itself. The relevant multiple is the reciprocal of the factor share accruing to labour in the economy. This argument is spelt out in section I, with equation (11) providing the favoured wage adjustment "rule". The advantage of this rule over the more familiar average labour productivity wage adjustment rule is that it provides for the rate of return on capital to be maintained at a level deemed appropriate both in terms of equitable relativities in incomes and in terms of the incentive to new investment spending. If firms set prices through an additive mark-up strategy geared to attaining a "satisfactory" rate of return on capital employed, the TFP rule will have advantages over the APL rule in terms of its properties for the degree of inflationary pressure in the economy.

Section II investigated the TFP indicator recently developed by the ABS. It was found that that indicator possesses a number of features which render questionable its direct use in the wage adjustment context. Recommendations were made which, it was argued, would provide TFP data more attuned to a harnessing of the advantages of the TFP concept for wage adjustment purposes. The recommended modifications to the methodology applied by the ABS can be summarized as:

(a) Both output and capital stock should be defined on a net-of-depreciation basis, using compatible depreciation estimates;

(b) The treatment of costless quality change in capital equipment, used in defining the volume of capital employed, should be re-examined;

(c) The treatment of factor inputs employed in the unincorporated enterprises sector should be amended;
(d) The definition of "capital" and the definition of "capital's share of income" need to be made compatible with one another.

In section III some further issues concerning TFP based wage adjustment were considered. This led to a further recommendation regarding the construction of TFP data for use in the wage adjustment context:

(e) To provide a second "guide-post", a set of economy-wide TFP estimates should be constructed using not the official national accounts statistics on the output of the non-market sector, but figures constructed on the basis of the "assumption" that TFP growth occurring in the non-market sector is zero.

The principal issues discussed in section III were not in the main susceptible to resolution through further modification or "fine-tuning" in one's TFP estimates. Questions regarding the productivity growth actually occurring in the non-market sector, variations in the degree of utilization of capital between (rather than within) business cycles, and the push by decision-makers in the public sector for a bigger rate of return on publicly owned capital, it was concluded, are all likely to require exercises of judgement on the part of the wage-fixing authorities - with these exercises needing to take place alongside a consideration of TFP data.

These conclusions from section II and III should not however be taken as indicating that the use of the TFP concept in the productivity gearing of wages is fatally flawed. It has long been recognized by participants in Australian National Wage Cases that the APL concept provides a family of operational indicators of APL, and that care needs to be taken in the wages policy context to select for attention the family member(s) most appropriate to that context. It has also long been appreciated, in the context of gearing wages to APL growth, that considerations beyond the APL data need to be taken into account, and the direct application of the APL wage-rule formula possibly departed from, if the fundamental objectives of productivity-based wage fixing are to be most efficaciously pursued. Sections
II and III of this paper have simply raised equivalent issues in the TFP context. The basic conceptual advantages of TFP over APL for the productivity-gearing of wages, it is argued, remain.
FOOTNOTES

1 BCA, Submission to March 1986 National Wage Case (Exhibits CAI 63), "Productivity Case: Productivity and National Capacity, May 2, 1986", p. 6. The sentence continues, "not just for the market sector, with labour's contribution based on hours worked not persons employed, and with no adjustment for the terms of trade". Some comments on these more detailed issues are made in Section III of this paper.


4 The ABS commenced publishing annual estimates of gross product at constant prices per person employed for selected industries, groupings of these industries, and the total economy, in 1975. Publication of data on a "per hour worked" basis commenced in 1988, at which time the publication of quarterly data was also begun. See ABS, Australian National Accounts: Gross Product, Employment and Hours Worked (Cat. no. 5213.0), for more details.

5 Note, for example, that the ABS Consumer Price Index has rarely, in the context of National Wage Cases, been challenged as the appropriate indicator of changes in the purchasing power per dollar of money wages.


9 BCA, op. cit., p. 22. Professor Isaac indicated his sympathy for this view in J. E. Isaac, op. cit., p. 2, when as a part of his discussion of the "measure of productivity most relevant as a guide for wage fixing purposes", he noted: "Consideration also needs to be given to changes in the volume of capital involved in production to ensure that an adequate rate of return on capital is maintained".

10 BCA, op. cit., p. 11.

11 See footnote 3. The ABS has published two series, one including and one excluding the farm sector. The issue of whether to include or exclude the farm sector is not discussed in this paper, and the two ABS series are henceforth referred to in the singular. For a discussion of the issue in the average labour productivity context see Owen Coykendall, "Relative Wage Shares in Australia", in K Hancock, Y Sato, B Chapman and P Payne (eds) Japanese and Australian Labour Markets: A Comparative Study, Australian-Japan Research Centre, Canberra, 1983.

12 The weights (gross and net) are essentially 1:1 for buildings and structures, and 1:3 for equipment.
See ABS Information Paper, paragraph 5.16. It is not stated what weights are used for the stock of capitalized real estate transfer expenses. For the inventories component of the ABS definition of the capital stock, the net/gross distinction does not arise. For the treatment of intangibles other than (capitalized) real estate transfer expenses, and of "fixed" assets see pp25 ff.


This assumes the base period is the year in which the desk calculator was new. Note that by "funds invested in old capital" we mean the original purchase price expressed in "constant" dollars, net of accumulated real depreciation. Precise definition of this will thus depend on what concept of depreciation is being used in one's TFP estimation methodology (discussed above). For more on the "costless quality change" issue, see Walters and Dippelman op cit, particularly paragraphs 19 to 26, pp 7-8.

Note that the real rate of return regarded as "normal" will contain an element of risk premium to compensate investors for the risk of unexpectedly rapid obsolescence of capital items. If the degree of this risk were perceived as having increased in a society, then allowing $r$ to shift upwards by the extent of the requisite rise in risk premium would be the policy with the properties attributed earlier to the "constant r" policy.

Note, however, that if hours of labour of different qualities (e.g. training/experience) are paid at different wage rates, and improved labour quality results in more of the total hours worked being paid the higher rates, then this will cause the overall average w to rise, see p9. If the CWPS ignores this increase in w and provides for a wage rise (on top of this) calculated on the basis of recorded productivity growth, it will be labour that is getting "two bites of the cherry". It might then be argued that providing capital with a second "bite of the cherry" (via an ABS-type definition of the volume of capital) would represent a countervailing move - tending towards improving equity in relative factor returns.


Note that $r$ is now defined by $r = \frac{1}{k_c} (Y \cdot W_L - U)$.

See Charles Aspden, op cit., Appendix 4

Sec. Note that Aspden's formula for $\alpha$ and $\delta$ are rendered more complex than the formulae given here as a consequence of effects arising from the ABS treatment of depreciation and of changes in $p_q$. Abstracting from these complications, the ABS definitions of $\alpha$ and $\delta$ are as given here.

Includes broadcasting licences, taxi-plates, import quotas, government sponsored monopoly rights etc.

Similarly the component of net operating surplus represented by "net third party insurance transfers" should not be treated as part of the income flowing to proprietors of assets employed in production. See Owen Covick, "Relative Wage Shares in Australia": pp402-405.

For details see Walters and Dippelman op cit.

Note that if this was done, comparability with the output measure would require the treatment of the expenditure flows creating these assets as "investment spending", thus raising the level of gross product. For a discussion of this in the context of average labour productivity measurement, see Owen Covick, "Productivity-gearde wages policies: some problems arising from the growth in intermediate services", paper presented to ANZAS congress, Macquarie University, May 1982.
Note though its inclusion of capitalized real estate transfer expenses.

Note though its inclusion as part of the income of capital of third party insurance transfers and mineral royalty payments made, (see above).

The constant price stock of land (narrowly defined) in use in the non-farm market sector of the economy should not be regarded as fixed. Land (with buildings or vacant) can be bought from (or sold into) use in the farm sector, the dwelling sector, or the public administration/defence/community services sector. A pointer to the possible relative magnitude of the value of the land in use in the non-farm market sector vis-a-vis the value of the buildings and structures which stand on it, can be derived from data on the dwellings sector. John Piggott, in "The Nation’s Private Wealth - Some New Calculations for Australia", March 1987, pp. 61-79, estimated the value of residential land plus housing in Australia in June 1984 at $383.6 billion. The comparable figure from Walters and Dippelma, op. cit., for the housing stock excluding land was $138.1 billion.

The traditional justification of the use of gross product figures in the estimation of average labour productivity rests on reservations about the quality and reliability of available estimates of depreciation. Given the key role of the depreciation data in the construction of the capital stock figures employed in the ABS TFP indicator, however, the use of this defence of the employment of gross product figures in this context would appear to vitiate the whole exercise by the ABS of developing and publishing the TFP series.

see footnote 1.

See ABS, Information Paper, paragraphs 2.4, 2.5 and 3.5 for details of the ABS definition of the "market sector". Examples of non-market activity included are government printing, and production of television programmes by the ABC. Meanwhile stockbroking services, private schools and hospitals, real estate agents' services etc all fall into the "non-market sector".

This is true, individually, for three of the four sub-sectors comprising the non-market sector (Finance, insurance, real estate and business services; Public administration and defence; and Community services - ASIC divisions I, J and K, respectively). It is not true for the fourth, the "Ownership of dwellings" industry, which, by assumption, employs no labour.

In both senses of the word.

Walters and Dippelma, op. cit., p37. Note that where property is leased, the national accounts treatment of the lease payments depends on whether the lease is a finance lease or an operating lease. Where a property was sold from the market sector to a property operator and leased back into market sector use on a lease, the potential problem discussed in the text would not arise. But the same transaction under an operating lease would trigger that problem.

ABS, Information Paper, paragraphs 5.26-5.27.

Note that this ignores complications arising from the unincorporated sector (see above). It also ignores complications arising from the existence of publicly owned capital used in providing non-charged-for services e.g. roads, police stations, tax-office computers etc). Official statistics on gross product are constructed using the that the net capital stock thus employed earns a rate of return of zero. The same convention applies in the case of capital employed by "private non-profit organizations serving persons". See ABS, Australian National Accounts: Concepts, Sources and Methods (Cat No 5216.0), for more details.

This same method could be extended to handle the issue raised in the previous footnote. Restricting $K_p$ and $K_r$ to include only capital with a "measured" rate of return, and denoting the "other" capital $K_\theta$, one could take as one's K series: $K = K_p + \beta_{K_p} + \gamma K_\theta$ where $\gamma$ is $r_p$ divided by $r_p$, which for statistical consistency has to be zero.
The interaction of the move to "equal pay" for women and a gearing of wages to productivity growth raises a not dissimilar issue - viz. whether any of the cost should be expected to be borne by enterprise proprietors, through today's r/c being lower than that of the 1960s.
Discussion Papers, which are free of charge, are available from The Publications Officer, Centre for Economic Policy Research, Research School of Social Sciences, Australian National University, GPO Box 4, Canberra ACT 2601. Discussion Papers marked with an * are out of print. A full list of papers is available on request.

201 Tai-Tee Chia, Has the Value of a Degree Fallen?

207 Haig, B.D., Manufacturing Employment and Tariffs in Victoria and New South Wales 1861-1911
208 Leung, S., Financial Liberalization in Australia and New Zealand
210 Chapman, Bruce J. and Peter J. Stemp, Government Intervention in the Provision of On-the-job Training
211 Forsyth, P.J., Airline Competition and Contestability: The Prospects for Domestic Deregulation
213 Chapman, B. J. and Tai-Tee Chia, Financing Higher Education: Private Rates of Return and Externalities in the Context of the Tertiary Tax
214 Pitchford, J.D., (Two papers) Does Australia Really Have a Current Account Problem? (a shortened version of this paper is published in Policy; Centre for Independent Studies, Winter, 1989) and A Sceptical View of Australia’s Current Account and Debt Problem, now published in Australian Economic Review, 2nd Quarter 1989.
Buckle, Robert A. and Peter J. Stemp, Reserve Bank Autonomy and Government Objectives in New Zealand: Can Tensions Be Resolved?


Phillips, Robert W., Import Demand Patterns and Relative Prices During the 1980s

Armit, H.W., Australia’s Current Account and Debt Problem: A Sceptical View of the Pitchford Thesis

Hamilton, Clive, A Model of the Gains from Intra-Industry Trade: The Benefits of the Australia-New Zealand Free Trade Agreement

Chapman, B.J. and F.H. Gruen, An Analysis of the Australian Consensual Incomes Policy: The Prices and Incomes Accord

Discussion Papers Nos. 222-225 contain the revised papers from the Joint CEPR-Treasury Conference Fiscal Policy and the Current Account, June 1989.

Paper 1: Nguyen, D.T., Fiscal Policy and the Current Account: Historical, Theoretical and Policy Perspectives


Paper 1: Freebairn, J., Some Results From the ORANI-F Model

Paper 2: Hughes, Barry, Twin Deficits in the IMP Model. With a Comment by John Perkins, NIEIR.

Parsell, Bruce P., Alan A. Powell and Peter J. Wilcoxen, The Effects of Fiscal Restraint on the Australian Economy as Projected by the Murphy and MSG2 Models: A Comparison. With a Comment by Chris W. Murphy, ANU, and a Note by Warwick McKibbin and Graham Elliott, Reserve Bank of Australia.

Gregory, R.G. and A.E. Daly, Can Economic Theory Explain why Australian Women are So Well Paid Relative to Their U.S. Counterparts?

Fane, C.G., The Development of Monetary Institutions in Australia from Federation to the Second World War

Forsyth, Peter J., Competitiveness, Macroeconomic Reform and the Current Account Deficit

Wells, Graeme, Economic Reform and Macroeconomic Policy in New Zealand

231 Metcalf, David, Industrial Relations and the "Productivity Miracle" in British Manufacturing Industry in the 1980s


233 Alexina, Alberto, David W.R. Gruen and Matthew T. Jones, Fiscal Adjustment, The Real Exchange Rate and Australia’s External Imbalance

234 Covick, Owen, Total Factor Productivity and Wages Policy

235 Teal, Francis, General Equilibrium Models, Australia’s Terms of Trade, and the Real Exchange Rate: 1970-1989