Capital Stock Conference
March 1997
Agenda item VII

Australian capital stock estimates as input into multi-factor productivity analysis: a 'wages policy' perspective.

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Paper presented for Conference on Measurement of Capital Stock,

Canberra, 10-14 March 1997

During the thirteen years prior to the federal election of March 1996, the Australian government was committed to a policy of seeking to centrally co-ordinate wages growth. The 'motor' for such co-ordination was bilateral discussion and agreement-making between the Australian government and the Australian trade union movement. This was known as the Accord process. The Accord evolved over the thirteen year period. At first Australia's system of Conciliation and Arbitration tribunals played a key role in the co-ordination process. This role had been much diluted by the time of the change of government in March 1996, and the consequent termination of the Accord.

During the Accord period, there was ongoing discussion and debate in Australia about what degree of wages growth could be regarded as 'justified', or 'warranted', on the basis of the productivity growth being experienced within the economy. Such debate included argument as to whether the relevant concept of productivity growth should be average labour productivity or multi factor productivity, and how exactly the measure should be constructed and interpreted. (See Owen Covick, 'Total Factor Productivity and Wages Policy', *Journal of Industrial Relations*, December 1990, pp 488-512).

Since March 1996, the Australian government has turned away from any attempt to centrally co-ordinate wages growth. But the inflation target of the Reserve Bank of Australia (RBA) means that the relationship between wages growth and productivity growth continues to be a prime focus of attention. The RBA has warned organised labour in Australia that if the degree of upward pressure on wages is viewed as being incompatible with the maintenance of inflation within the targeted band, the RBA will tighten monetary policy. The key question of the Accord period - what degree of wages growth is 'warranted' on the basis of productivity growth'? - is thus still a key policy question today. Now it is the RBA that needs to worry about what concept and measure of productivity is most appropriate to that question.

1. The case for a multifactor productivity concept.

It is well known that, in the absence of certain defined complicating features, if real wages grow at exactly the same rate as average labour productivity (ALP), that will maintain a constant labour share of the product - and hence a constant factor share for the factor inputs other than labour (ie. 'capital', in a two factor only conception). If wage and price setting behaviour is the outcome of 'competing income claims' behaviour; if the relevant competing claims are pitched (and outcomes evaluated) in terms of factor shares; and if beginning-of-period factor shares are acceptable to the various parties - then having real wages grow at the same pace as ALP is compatible with stability.

But it seems somewhat implausible to conceive of the income claim made by the owners of 'capital' as being pitched in terms of a share of output, independent of the **quantity** of 'capital' contributed to the production of that output. It seems similarly implausible to view labour suppliers as evaluating whether their wages are acceptable by reference to the factor share going to 'capital', independently of any reference to the rate of return being received per unit of capital employed in production.

Consider now 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 that prevailed in some past period. Thirdly, the beginning-of-period level of r is acceptable to both sets of parties.

Under these conditions, and abstracting for the moment from the various complicating features discussed in later parts of this paper, it can be demonstrated that having real wages grow at a specified multiple of multi-factor productivity growth ($\dot{z}$) now represents the relevant stability criterion. The specified multiple is the reciprocal of labour's share of total income (α)

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

For a proof of this see O. Covick (1990), pp. 494-95.

It might be noted that although multi factor productivity growth will be below average labour productivity growth whenever the rate of growth of 'capital' employed exceeds the rate of growth of labour employed, the wage adjustment rule of equation (1) 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. 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 (exceeds) the rate of growth of 'capital' employed. This can be seen by noting that a constant property share of total incomes implies $\dot{Y} \equiv \dot{r} + \dot{K}$.

Whether income claims are generated under conditions that render the average labour productivity wage adjustment rule attractive (by reference to 'normal' levels of aggregate factor shares), under conditions that render the multi factor productivity wage adjustment rule of equation (1) attractive (by 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 investment spending. To quote the Office of the Economic Planning and Advisory Council (1988): '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 Business Council of Australia, at the March 1986 National Wage Case, was adamant that it is rates of return, 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 '.

There is thus a case in principle that assessing wages growth by reference to growth in multi factor productivity (through equation (1)) would have advantages, as compared with assessing wages growth by reference to growth in average labour productivity - defining both concepts in their most pure and simple terms. In the next section we ask how one ought to seek to

construct estimates of multi factor productivity growth, for the purpose of providing an operational multi factor productivity indicator with properties for the wages policy context of the type discussed above.

2. Key issues in the construction of a multi factor productivity indicator

As soon as one moves from simple algebra to the actual construction of a series of multi-factor productivity estimates, a number of practical complications arise. Typically, more than one method exists for tackling each such problem. Each method leads to a different practical definition of multi factor productivity. The straightforward 'pure' multi factor productivity concept thus translates into a 'family' of indicators. Some members of this family might be expected to be particularly appropriate for some applications of the multi factor productivity concept, others for other applications. This section takes the wages policy context discussed above as the 'application context', and examines how appropriate the multi factor productivity family-member embodied in the published ABS series is, for this purpose.

Consider first the issue of capital deteriorating in usefulness as a result of use. 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. This raises two questions on which decisions need to be made in constructing a multi factor productivity indicator. Should we define the volume of output produced in a period as gross of depreciation (GY) or net of depreciation (NY)? 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 (that is, 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 (that is, the gross capital stock, GK)?

If our goal is to construct a multi factor productivity indicator such that the application of the assessment criterion embodied in equation (1) 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 that application is a formula that serves to hold constant a concept of the rate of return on capital at a level perceived as 'fair' (or at least acceptably so) by both the principal sets of players in the income claims model. Constructing multi factor productivity estimates using the gross definition 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' to enterprise proprietors.

Since this 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 r are determined by reference to the return per unit of K 'invested', with that return defined as the 'true income' return, the multi factor productivity indicator we need for the purpose specified is one that uses the net concept of output and the net concept of the capital stock.

The multi factor productivity series published by the ABS conform with neither prescription. 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. The rationale behind the ABS use of this weighted average approach is essentially that the estimates of 'capital consumption' used by the ABS in compiling the published National Accounts aggregates are considered to overestimate the pace at which use diminished the 'effective usefulness' of items of capital, when the concept of 'effective usefulness' required is that for constructing multi factor productivity estimates. There is not the space here to assess this argument, or the particular weights 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 hence to define labour's share in the total net income from production (α). The use of one set of depreciation estimates for the one task, and another set (or none at all) for the second task, would not in general be compatible with the resultant multi factor productivity series having the properties for wages policy purposes of the type desired.

Consider secondly the issue of changes occurring in the price at which newly created units of K are available (p_k). Allowing for inflation to occur at an even rate across the economy as a whole necessitates the introduction of only fairly minor complications. 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 that is on a 'current cost' and not a 'historical cost' basis. In specifying our wage assessment rule, we need also to transform the variable w into constant dollar terms.

The situation is rendered less straightforward when p (the 'general' price level) 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 multi factor productivity indicator; should the measure of depreciation implicit in one's multi factor productivity 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? 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 general output equal to the purchasing power of that item's original price when new? If we adopt the latter approach and apply the wage assessment rule of equation (1) using a multi factor productivity indicator constructed on this basis, we will be acting to hold constant the rate of return on capital in purchasing power over general output terms. If p_k were rising relative to p, however, all else being equal, this will involve a progressively diminishing incentive for enterprise proprietors to replace capital as it wears out. If, instead, we adopt the alternative approach, we would be maintaining a constant 'incentive to invest', but allowing the value of 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 in 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. This involves using the 'replacement cost' method of estimating depreciation. It is the methodology employed in the ABS estimates of multi factor productivity.

Consider thirdly the issue of the quality of newly created items of capital varying with the passage of time. The key issue here is how to deal with 'costless quality change'. If something that looks and costs the same today as did a hand calculator of twenty years ago can in fact perform the same functions as something then far more expensive and called a desk calculator, how do we record this in the figures underlying our multi factor productivity indicator? There are two main possibilities. We can say that today's hand calculator represents the same number of units of K as did the hand calculator of twenty 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 that today's hand calculator represents the same number of units of K as the desk calculator of twenty 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 that displays more rapid growth than would be the case under the former approach (approach A). Recorded multi factor productivity growth would be lower under approach B than under approach A, all else being the same.

What are the comparative properties of these two approaches to 'costless quality change' in capital, in terms of the consequences of adopting the wage assessment rule of equation(l) using a multi factor productivity 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 multi factor productivity wage assessment rule of equation (1) will operate as follows. It will indicate what pace of wage growth will hold the real rate of return on funds invested in new items of capital today at the 'normal' level that 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 'new models'.

If approach B were adopted, and the effects of costless quality change are fully recorded as a reduction in p_k, the multi factor productivity wage assessment rule of equation (1) will operate quite differently. Here it will indicate what pace of wage growth would cause the rate of return accruing to those with investments in old capital items to be held constant through time at the rate that 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 it, this rate then being held constant for the working lifetime of that cohort. In terms of the example above, approach B would protect the rate of return on funds invested in the old desk calculator at the rate regarded as 'fair' twenty 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 twenty years ago from investment in the desk calculator. Because the price of today's new hand calculator is far below the price twenty years ago of the then-new desk calculator, this same total real size of income flow will represent a far higher real rate of return on funds invested.

Again, there is a clash in terms of the application context under consideration. For enterprise proprietors (particularly those with substantial investments in potentially long-lived items of capital under threat of being rendered out-moded) 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 in the past. But seeking to provide a constant 'incentive to new investment' requires that bygones be treated as bygones. This 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 multi factor productivity. The series on the volume of capital equipment in use which the ABS employs is based on the approach that is not consistent with those multi factor productivity figures being used by means of the wage assessment rule of equation (1) 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 multi factor productivity series published by the ABS. The depreciation concept implicit in those figures is consistent with the figures being used as an indicator of the relativity between real factor returns that 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 that 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 multi factor productivity 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 rule $\dot{w}=\dot{Z}$ 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 multi factor productivity series compiled using 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 the capital input indicator.

Consider fourthly the complication that not all of the labour performed for pecuniary gain in the economy is performed by employees. Proprietors of enterprises in the unincorporated sector of the economy derive a flow of income from their enterprises that is typically an amalgam of a return on the labour they supply for their own enterprises' use, and a return on the 'property' that their ownership of those enterprises represents. As the present writer has discussed elsewhere, in the average labour productivity context, 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. (See Owen Covick (1981), and (1984)). This means either that 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 that is responsible for this situation, it would appear reasonable to adopt the simple procedure of assuming that responsibility is shared 'evenly' across the units of both self-employed labour and self-employed capital. This requires defining for each period (i) 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 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.

$$s \equiv \frac{U}{wL_u + rK_u} \qquad (2)$$

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 multi factor productivity (Z') which can be used as an indicator of whether wages pressure is compatible (or incompatible) with stability in the average rate of return accruing to K.

This requires that a number of new variables be defined. Let L_w denote the number of hours worked by wage (and salary) earners and K_c denote the volume of 'capital' employed in the corporate sector of the economy. 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.

$$L' = L_w + sL_u \qquad (3)$$

$$K' = K_C + sK_u \qquad (4)$$

$$\alpha \equiv \frac{wL_w + swL_u}{Y} \qquad (5)$$

If a multi factor productivity series Z' is constructed using 'adjusted' data thus defined, it can be demonstrated (see Covick (1990) pp. 503-4) that when wages growth equals Z' growth multiplied by the reciprocal of or', this will hold constant the average rate of return on capital employed in the corporate sector, defined as:

$$r' \equiv \frac{1}{K_c}(Y - wL_w - U) \qquad (6)$$

The ABS, in constructing their multi factor productivity series, adopt a methodology for

tackling the unincorporated sector issue based on the 'scaling factors' approach. See Aspden (1990), Appendices 3 and 4. While based on that approach, the ABS definition of multi factor productivity growth is not that defined above:

The ABS definition uses an 'adjusted labour's share of total income' (α') as defined in equation (5), but takes as its L and K series only simple aggregates of total hours worked and the total volume of capital employed ($L \equiv L_w + L_u$ and $K \equiv K_c + K_u$) and not 'adjusted' series as defined here. The effect of this in the application context under discussion is as follows. Assume that wages growth was equal to the reciprocal of (α') multiplied by the ABS indicator of multi factor productivity growth, $\dot{Z}''$. If either the total hours worked by the self-employed (L_u) had grown relatively more rapidly than the total hours worked by employees (L_w), or the volume of capital in self-employed use (K_u) had grown relatively more rapidly than the volume of capital employed in the corporate sector (K_c), or both, this will mean that $\dot{L} > \dot{L}'$, or $\dot{K} > \dot{K}'$, or both, respectively. Under these circumstances multi factor productivity growth as recorded by the ABS indicator will be below multi factor productivity growth as recorded by the preferred measure. That is: $\dot{Z}'' < \dot{Z}'$, and the wage assessment rule based on the ABS indicator will provide for the rate of return on capital to rise ($\dot{r} > 0$). 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 unincoporated sector were shrinking relative to the corporate sector (in the sense of $\dot{L}_u < \dot{L}_w$ or $\dot{K}_u > \dot{K}_c$, or both), application of the wage assessment rule based on the ABS indicator would provide for the rate of return on capital to fall. The bottom line here is clear. The adoption by the ABS of its chosen methodology for dealing with the unincorporated sector means that the resultant multi factor productivity series will not in general possess the properties for wages policy purposes described in section I as being 'attractive'.

Consider fifthly the complication that 'capital' may not be the only non-labour factor of production. We have thus far referred to the 'non-labour' factor using the terms 'property' and 'capital' 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, plant, equipment and so on) and producer inventories. What are the consequences for multi factor productivity 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 sub-soil assets and so on) and non-tangibles (patents, brand-names government 'licences' and so on)?

The answer to this question will depend on the type of application one's multi factor productivity indicator is to be used in. Consider two possibilities, both 'nested' within the application context of section I. In scenario A the attractiveness of a multi factor productivity wage assessment rule of the type defined rests entirely with its provision for the maintenance 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 multi factor productivity 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 redefined, the part not representing labour income represents the aggregate income flowing to the 'capital' represented by the K

series in one's multi factor productivity equation. The concept of 'return per unit of capital' being held constant would be that desired. In scenario B, the attractiveness of a multi factor productivity wage adjustment rule rests with it maintaining a 'normal' rate of return on the totality of assets employed in production. This might stem from it being judged 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 data as originally defined, in one's multi factor productivity equations, but one would need to ensure that one's 'capital' series was compatible with this. It would need to be defined to include all relevant capital assets, not just tangible reproducibles and producer inventories.

There are significant practical problems associated with seeking to construct multi factor productivity 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 viewed as accruing to forms of 'property' other than reproducible tangible assets and inventories. When an enterprise does not own the premises in which it 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 (that is, the building) component. When an enterprise is the owner of the premises 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 again if an enterprise is using an asset it itself owns, identification problems arise. With the case of mineral royalties paid to governments, there is a conceptual problems of distinguishing these payments from indirect taxes, but either way they clearly should not be treated as part of the income flow accruing to the owners of reproducible tangible assets and inventories.

In scenario B, 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 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 then be available via subtraction. There is not the space here to consider the issues that arise in the intangibles area. At present the ABS makes estimates of the stock (gross and net) of only one type of intangible asset -- capitalised real estate transfer expenses. The implementation of the new SNA in the Australian National Accounts will see this extended to capitalised mineral exploration expenses, and capitalised 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 multi factor productivity estimates published by the ABS embody a methodology for dealing with this issue that is consistent with neither of the 'application scenarios' described above. The ABS indicator uses a 'capital' series that (for the non-farm sector) is confined to fixed reproducible tangible assets plus inventories plus capitalised real estate transfer expenses. At the same time, the ABS indicator takes as its definition of $(1-\alpha)$ the share of income accruing to 'capital', 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 multi factor productivity 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 also 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' (Aspden [1990] p.6). 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, what are the consequences of the ABS's multi factor productivity indicator embodying a K series and a definition of $(1-\alpha)$ that are mutually incompatible? If one is interested in the scenario A variant of the basic model, the K series in the ABS indicator is essentially compatible with that application. But $(1-\alpha)$ is biased upwards; hence, recorded multi factor productivity growth is biased downwards. If one is interested in the scenario B variant of the model, the value of $(1-\alpha)$ in the ABS indicator is essentially okay. 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 multi factor productivity 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.

This section has examined five key design features of the multi factor productivity indicator 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 1. It should be stressed that multi factor productivity has many applications, and that the particular member of the 'multi factor productivity 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 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 design features of the ABS indicator examined, two are mutually inconsistent in terms of the properties they cause the resulting multi factor productivity estimates to possess. Defining depreciation allowances in replacement cost terms gears the figures towards being useful in the context of 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 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 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.

Conclusions

Section 2 investigated the multi factor productivity indicator developed by the ABS. It was found that that indicator possesses a number of features which render questionable its direct use in the wage assessment context. Recommendations were made which, it was argued, would provide multi factor productivity data more attuned to a harnessing of the advantages of the multi factor productivity concept for wage assessment purposes. These can be summarised:

(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.

There are further issues that are not in the main susceptible to resolution through modification or 'fine-tuning' of one's multi factor productivity estimates. The ABS series are published only for the market sector of the Australian economy, and the present writer is totally persuaded of the wisdom of that approach, pending breakthroughs in the measurement of real output in the non-market sector. But this does cause problems when the capital stock data are compiled using perpetual inventory methods. The available data on the transfer of already-existing items of capital across the market sector/non-market sector divide (or between industries more generally) in Australia are poor. Seeking to record a new capital item's location of 'use' by reference to whether its taxation treatment is 'operating lease' rather than 'finance lease', exposes the data to distortion over time as tax minimisation gains in sophistication and spread, or is clamped down upon by the taxation authorities. Finance and insurance lie outside the ABS definition of Australia's market sector, as does property and real estate (see Covick (1995)). So whether K is 'located' in one of these areas or in the market sector is important to the overall data series. A periodic census of capital would provide for some check on the PIM estimates, and allow for periodic benchmarking. That would significantly improve credibility in multi-factor productivity estimates using those capital figures as input.

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