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On the Theory of Cash Flow Taxes on "Rents"

by

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Textbook explanations of the theory of rent seem so clear and simple that an outsider might be surprised to discover that economists have muddled into controversy over this subject. Experienced readers of the public finance literature will be less surprised. In fact, on closer examination, we find that the theory of rental taxation is sufficiently subtle to allow numerous opportunities for fallacy and that these opportunities have not gone unexploited. Taxation of "rents" to minerals deposits has been a subject of debate in many countries in recent years. Australia, for example, is considering the possibility of replacing some of its current royalties on mineral extraction by a "resource rent tax". Particularly interesting contributions to the discussion have been made by Swan (1976) and by Garnaut and Clunies-Ross (1975). In this paper, I attempt to sort out a number of issues that I have found puzzling in my own thinking and reading on the subject. Particular attention will be paid to the cash-flow tax on "rents" proposed by E. Cary Brown (1948) and to variants of this tax which have been proposed by Swan and by Garnaut and Clunies-Ross for taxation of Australian minerals

Static Analysis with Certainty

The simplest treatments of the theory of rent are partial equilibrium, static, and have no uncertainty. In the world of introductory textbook economics it is easy to identify rent to a perfectly inelastically supplied factor and to set about taxing it. Figure 1 illustrates the usual argument. Quantities of land are represented on the horizontal axis and the price received by the owners of land is represented on the vertical axis. Since land is assumed to be in fixed supply, the supply curve is vertical. The demand curve in the absence of a tax on land is DD. If a tax is imposed

*I am indebted to Douglas Hocking and Michael Porter of the Centre of Policy Studies, Monash University and to Peter Hartley of Princeton University and the Centre of Policy Studies for fruitful discussions about theoretical issues and for guidance about Australian rules taxation. Though these gentlemen have profoundly influenced my thoughts on taxation, the views expressed here, including any mistakes, are my own.

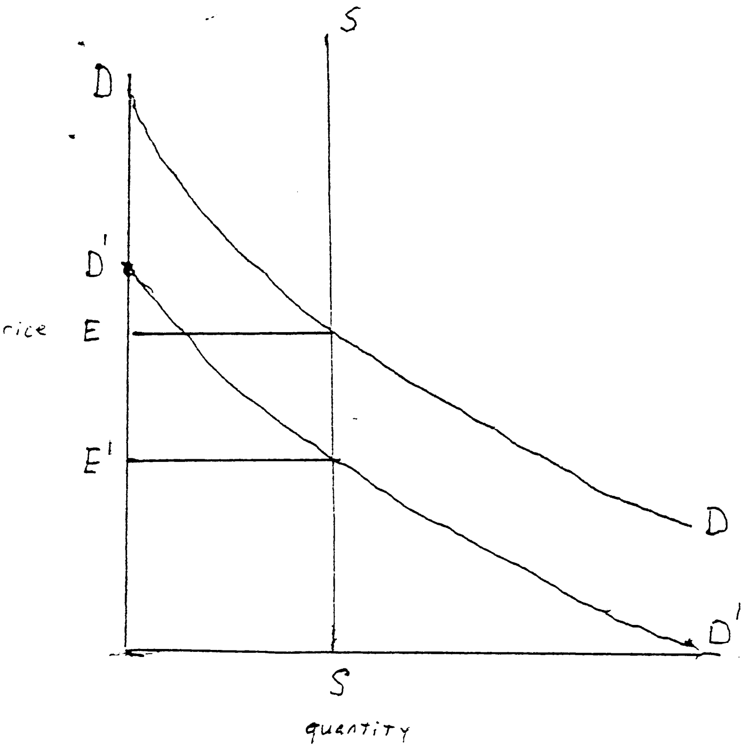

Figure 1

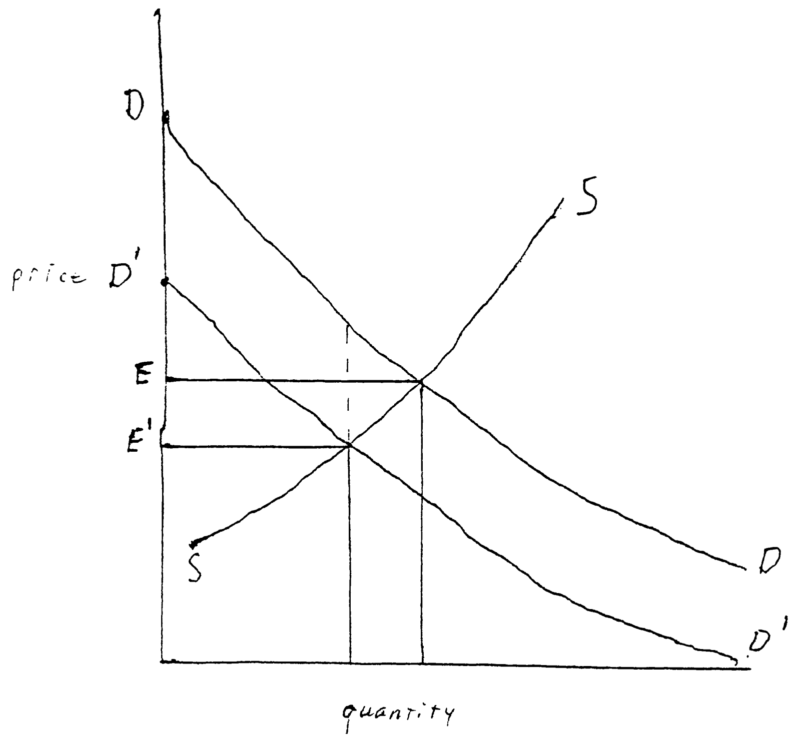

Figure 2

on the use of land, then the demand curve for land as a function of the price received by producers shifts vertically downward by the amount of the tax from DD to D'D' and the equilibrium price received by producers falls by exactly the amount of the tax, from E to E'. The price paid by users of land and the quantity of land used remain unchanged. If, on the other hand, the supply of a taxed commodity is responsive to its price, an equilibrium with a tax on the use of that commodity would have a higher price and a smaller quantity of that commodity than there would be without a tax. This is illustrated in Figure 2. Since with a tax, the equilibrium price paid by users differs from the price received by producers, the tax introduces an inefficiency which is not present in the case of lump sum taxes or taxes on goods in fixed supply. This inefficiency is seen to be present when one notices that the equilibrium price paid by users represents their valuation of a marginal unit while the equilibrium price received by producers represents their marginal cost of producing an extra unit. Since these two prices differ by the amount of the tax, it is clear that the tax prevents a mutually advantageous trade in which some consumer pays some producer to supply him with a marginal unit at a price between the marginal cost and his marginal valuation. In the case of "land", this inefficiency is not present because it is assumed to be impossible to alter the quantity supplied.

It is common, though slightly old-fashioned, to speak of the tax illustrated in Figure 1 as "neutral" in contrast to the "non-neutral" commodity tax depicted in Figure 2. In the partial equilibrium discussion above, we ignored income effects, so that it may have seemed natural to say that the tax was "neutral" in the sense of having no secondary effects on economic activity other than the direct effect on the distribution of wealth between the "government" and the owners of land. General equilibrium economists would be apt to point out that the introduction of a new tax or the substitution of one tax for another will redistribute income from some consumers to others or between consumers and government. These income effects will in general shift the demand curve in Figure 1 so that it can not be expected that introducing the tax will leave the price paid by users unchanged. The modern general equilibrium approach to tax incidence also recognizes that, if there are distortions in other markets, it is possible that increasing some taxes may enhance rather than reduce economic efficiency. Furthermore the possibility is admitted that it might not be possible to meet all of the government's demands for revenue with nondistortionary taxes. Therefore an optimal system of taxes might have to include some "nonneutral" taxes. Nevertheless, it is true in general equilibrium, as it is in partial equilibrium, that unless a commodity is available in fixed supply, a tax on its use introduces a difference between marginal costs and marginal valuations and that this difference typically will reduce economic efficiency. It is therefore interesting to examine taxes which introduce little or no inefficiency in this way. Whether it is appropriate to call this a discussion of tax "neutrality", I will leave to the tastes of the reader.

Rent Taxation over Time in a World of Certainty

In a world where economic activities take place over time and where there is uncertainty about outcomes, it is far less easy to identify rents or to devise a workable method to tax them. E. Cary Brown (1948) proposed a simply implemented method of taxing "rents" in a changing and uncertain environment. Brown proposed that a firm be taxed at a constant rate on its net revenues in every time period. This means that in years when net receipts are negative a firm would receive a payment from the government and in years when its receipts exceeded its expenditures it would pay a tax. Brown argued that, if appropriately designed, such a tax would fall upon "rents" and would not distort marginal incentives in the economy. In Brown's original paper and in the adaptations by Swan and by Garnaut and Clunies-Ross, interest payments are specifically excluded from those expenditures which count for purposes of the Brown tax. This is correct so long as we follow the implicit procedure of these authors of not counting the proceeds of loans as revenues. Alternatively, we could observe that in the case of certainty, the present value of a loan transaction including the proceeds of the loan, the interest paid, and the repayment of principal is zero. Therefore if the Brown tax is applied at a uniform rate to all of these cash flows no revenue will be collected and there will be no distortionary effects from this source.

In a world of certainty, the present value of taxes collected by a Brown tax is just the tax rate multiplied by the difference between the present value of receipts and the present value of expenses. If there are constant returns to scale, then in competitive equilibrium, the present value of profits must be zero. Therefore if firms were allowed to count all of their factor costs as expenses, the Brown tax would collect no revenue. It follows that in a competitive economy, a Brown tax will collect revenue only if either some factor payments can not charged as costs for the purpose of computing the tax or if there are decreasing returns to scale. Where there are decreasing returns, it is always possible to define additional factors of production so that production displays constant returns to scale in the augmented list of factors. Therefore the effect of a Brown tax when there are decreasing returns to scale is the same as that of a Brown tax when the costs of some residual factor are not included when computing the tax.

In principle, any factor, whether or not it is in fixed supply. could be excluded from the list of factors whose costs are counted in computing the Brown tax. The difference between the present value of revenues and the present value of Brown tax "costs" for a profit maximizing firm will be just the present value of inputs of the factors whose costs are not counted. The present value of Brown taxes paid is therefore proportional to the present value of payments to these factors. It follows that the Brown tax is nothing more nor less than an excise tax on inputs of those factors for which payments are not counted as Brown tax "costs". Just as in the static case, a tax on the use of a factor creates a "wedge" between the marginal cost of the factor to a user and revenue received by the supplier of a marginal unit. If the supply of the factor is not perfectly inelastic, this wedge will typically result in less of the taxed factor being used than would be efficient. If the supply of the taxed factor is invariant to price changes, then a wedge between the prices paid by users and received by suppliers can have no effect on the supply of that factor. In fact, if there are no other distortions and if the tax revenues are not "wasted", a competitive equilibrium with a Brown tax imposed on a factor in fixed supply will be Pareto optimal.

If prices and quantities of all factors of production were public information, there would be little point in taxing fixed factors with such a roundabout instrument as the Brown tax. Instead of calculating the returns to the fixed factors by subtracting the costs of variable factors from the value of output, the government could simply impose a tax on recorded expenditures for the fixed factors. The case for a Brown tax rather than a direct tax on the use of fixed factors is best if markets for the fixed factors are not publically observable while prices and quantities of all variable factors are public knowledge. If the prices of variable factors are difficult to observe or to vary, taxing fixed factors by the Brown method will be only partially successful.

In order to see this point clearly, let us consider the effect of a Brown tax on agricultural land. Suppose that a farmer is taxed on his output and allowed to expense his purchases of machinery, fertilizer, and other inputs but not land. Unless he is also allowed to charge a wage for his own labor in computation of the tax, the incidence of the tax will be both on the farmer's labor and land inputs. But the value of the farmer's labor input depends on how hard he works and how skilled he is. This will differ from farmer to farmer and will not be observable from in market place. The Brown tax method could never disentangle differences in agricultural rents from differences in the efforts and abilities of farmers. Therefore an attempt to tax inelastically supplied land by this method would result in a reduction in the farmer's incentive to work. In fact, in this example, it seems likely that market values of land could be better estimated from observations of recent sales prices of similar plots of land than as a residual. If a tax on agricultural land is desired, it would probably be more efficient to tax it directly. Much the same argument applies to any sole proprietorship. To the extent that the residual claimants of a firm's profits also work for the firm, any attempt to tax fixed factors used in the firm will lead to taxation of a variable factor, the owners' labor.

There may be industries for which a Brown tax is better suited than it is to agriculture and small business. The case of large-scale mining comes to mind. In mining as in agriculture, the revenue derived from a particular plot of land will depend not only on the "quality" of the land and the amount of capital used to develop it, but also on the skill and diligence of the laborers employed. The difference from a small business is that most of the skilled workers for the firm will not be residual claimants. Instead, they will be paid wages and salaries which are readily observable. A particularly hard-working or skilled geologist or mining executive may do much to enhance productivity of a mining property, but this will be reflected in his wage since he must be paid approximately his opportunity cost. So long as his wage can be included in costs for purposes of the Brown tax, the tax does not fall on his services.

In order to properly understand the issues involved in efficient taxation of mining, it is essential to think clearly about which of the resources used in this industry are available in fixed supply. Surely the number or size of mines is not fixed, since mines must be developed using capital and labor. Nor is the number of proven deposits of a given quality since resources must be spent on geological exploration and exploratory drilling to gather the information that results in a proven deposit. What is in fixed supply, is property rights to the exploitation of potential mineral deposits on any given site. A change in the price of the mineral rights to a particular piece of land, whatever the current state of knowledge about the minerals that may be located on it, will not change the supply of these rights. On the other hand, a change in the price of land with proven deposits of a specified mineral may well induce a change in the supply of land of that type as the amount of exploratory effort is altered. Therefore in order that a Brown tax fall only on factors in fixed supply, it should allow a firm to expense its exploratory efforts as well as its investments of capital and labor but not the price that it pays for the minerals rights that it holds.

Even in the case of large-scale mining, the question arises "Why tax mineral rights indirectly through a Brown tax rather than simply tax the market value of mineral rights. In Australia, there appears to be an at least superficially appealing answer. Private property in mineral rights is not well established. Mineral and exploration rights belong to the Crown and are only leased to private developers Furthermore, these leases are not obtained at market prices, but awarded according to a complicated scheme of "work project bidding". Leases, once obtained, can not be bought and sold among private parties. Therefore we have no market signals by which to judge the value of minerals rights and if we are to tax them, must compute these values indirectly. While this argument is correct as far as it goes, one is left with the question of whether Australia might not be better off to create a system of private property in minerals rights and either to sell the Crown's holdings at market prices or tax the input of mineral rights directly.

Rent Taxation and Randomness

Where there is uncertainty, "rents" are even more difficult to identify. Because profits are a random variable, observed profits are not always the same as expected profits. A simple "windfall profits tax" which taxes some fraction of profits above a "normal" rate of return would have distortionary effects on investment because an investor would be taxed if he is "lucky" but would not be subsidized if he is "unlucky". The tax would reduce the expected rate of return that an investor would realize from high variance projects relative to safer projects and hence lead to too little investment in high variance projects. A Brown tax, on the other hand, compensates losses at exactly the same rate that it taxes winnings so that there is no *prima facie* case that it would discourage risky investment. In fact as it turns out, much as in case of certainty, if all inputs can be expensed, the market value (in a sense to be defined) of revenues from a Brown tax will be zero. If some factor inputs are not allowed to be expensed then, under reasonable assumptions, Brown tax will be nondistortionary if the factors which are not expensed are in fixed supply and will in general be distortionary if these factors are not in fixed supply.

In order to establish these claims it is necessary to introduce a bit of the modern theory of risk bearing and portfolio selection. Early efforts to deal with the theory of the firm in the presence of uncertainty tended to treat the firm as a "risk averse" agent with a "utility function" that depends positively on the expectation and negatively on the variance of the rate of return on its capital investment.[1] The weakness of this approach is that it fails to recognize that profits can be shared among many stockholders each of whom holds his shares as part of a diversified portfolio.[2] The market value of a share in the returns from an investment project with a given expected return does not depend on the variance of its own return but on its contribution to the variance of the "market portfolio" of investments. The risk from projects which have a high variance of return but for which the returns are uncorrelated with the returns from other investments can be almost entirely diversified away. Projects that have risky returns which are negatively correlated with the returns on other investments will actually reduce the variance of the market portfolio and therefore be more rather than less valuable than a project which returned the same expected value with certainty.

Consideration of incentives and asymmetries of information may sometimes make it inefficient to separate the role of residual claimant from that of worker. If this is the case, firms may be owner-operated and it will be impossible for the owner to diversify his portfolio without weakening his incentives. As we have argued before, a Brown tax will not be an efficient

1. A more sophisticated version of this theory would have firms maximizing some concave expected utility function over time. Our objections apply equally to this version.
2. Even small investors can hold highly diversified portfolios through the expedient of a mutual fund.

method of taxing such firms since it would amount to a tax on the variable input which is the owner's effort. Therefore we will concentrate our attention on the analysis of a Brown tax for firms whose residual claimants are stockholders who can diversify their portfolios.

A powerful source of insight into the workings of the market when there is uncertainty is to think of an investment project as producing dated contingent commodities, each of which has a market price. To fix our ideas, it may be useful to treat a concrete example. Suppose that an investor contemplates drilling an oil well. When the project is begun, he is not certain either about the amount of oil that he will find or about what the price of oil will be during the productive life of the well. The contingent commodity approach models this situation as follows. Define a set of "events", where a typical event takes the form "x barrels of oil are found in this well, the price of oil when the well becomes productive turns out to be p, and the state of the world in other respects is described by z"[1]. A perfect market for risk bearing assets would generate a "price" for a dollar of income delivered at any specified time and contingent on any of the events so defined. The market value of the lottery that is inherent in the drilling project is the sum over all dates and all events of the net cash-flow generated by the project at each date in the future, contingent on each event. This market value will differ from the expected value of cash flow discounted at the risk free interest rate if the events in which the project has high returns tend also to be events for which the price of contingent income is high or low compared to income with certainty.

A single drilling project will be small relative to the relevant capital market and its yield small relative to the market for oil. Furthermore, the amount of oil to be found is a random variable which is unlikely to have much correlation with other economic events that might affect the value of contingent income. If the only source of random variation in the cash flow from the project were the amount of oil discovered, we could therefore expect that there would be no particular correlation, positive or negative, between the amount of cash flow that the project generates under a given event and the price of income contingent on that event. It would then follow that the market value of the random income produced by the project

1. For expository simplicity, it is well to think of there being a finite number of events, but this assumption is not at all essential to the argument.

would be little different from the expected cash flow that it generates. Some of the randomness from the project, however depends on the price of oil which in turn may depend on political events in other countries. This source of variation can not be so easily diversified away. It would not be surprising that income contingent on high oil prices has a different price per unit of probability than income contingent on low oil prices. For example, it might be that individual investors are risk averse and that the events which lead to high oil prices tend to be events that lead to a less prosperous world economy and lower total wealth. Risk averters would be willing to pay more to have income in circumstances where they are relatively badly off. Since the cash flow from an oil project will be larger in the event of high oil prices than of low oil prices, it would then be the case that the market value of the project would exceed the expected present value of the cash flows that it generates.

It should be apparent when one looks at matters from the point of view of contingent commodities that there is no necessary logical connection between the rate at which a project should make intertemporal tradeoffs between cash flows and the appropriate "risk premium" due to the variability of returns. To illustrate this point, consider two oil drilling projects. One is quite certain to yield a moderate amount of oil. The second is a riskier project which may yield an extremely productive well or may yield nothing. For either well, the quality of the deposit will be known shortly after drilling . Decisions on how quickly to extract whatever oil there is in either well will depend on the rate of discount that is applied to future cash flows. Clearly if the risks from the two wells can be fully diversified in the stock market, it would be inappropriate to use different discount rates for the two wells. But even if the risks from the two projects could not be entirely "diversified away", there would be no reason to use different intertemporal prices for the two wells when deciding how fast to pump. The general lesson to be learned from this example is that the overall "riskiness" of a project is, in general, independent of the market evaluation of intertemporal choices within the project. The single instrument of time discount rates is inadequate to capture the differences in market valuation or in efficiency prices of projects which have differing profiles of returns over time and across events.

A source of confusion that is closely related to using temporal rates of discount to allow for risk is the implicit view that for any project, every marginal activity associated with the project has the same structure of associated risk. Clearly this is inappropriate. For example, suppose that a manufacturer who produces a good with a highly variable price should find a way to reduce his fixed costs with certainty at some fixed time in the future in return for some current investment. The effect of this investment is a simple exchange of current payments for future benefits to be realized with certainty. It would be inappropriate to discount the returns from this investment by some "risk premium" related to the pattern of contingent returns from the firm's other activities.

If there are constant returns to scale, then in competitive equilibrium it must be that the market value of the random flow of net revenues from any project that is undertaken is just zero.[1]. Regardless of the pattern of prices over time and over contingencies, a Brown tax would always collect the same fraction of net cash flows. The market value of the random cash flow from a project is the sum over all dates and contingencies of the price of dollars in each date and contingency times the cash flow generated in that date and contingency. Therefore, the market value of the random flow of revenue and expenditures generated from any project by a Brown tax is precisely the Brown tax rate times the market value of the net cash flow from the project. It follows that if all inputs can be expensed at their opportunity cost, the market value of the random stream of revenue and costs flowing to the government from any project that was undertaken in the absence of the tax is zero. Those projects which would have generated a random cash flow of negative cash value in the absence of a Brown tax would remain unprofitable. Therefore a Brown tax that allows all inputs to be expensed has no distortionary effects. On the other hand, the market value of the random stream of expenditures and revenues which is generated for the government by such a Brown tax is zero. Just as in the case of certainty, if a Brown tax is to raise a revenue stream with positive market value, it must be that some inputs are not permitted to be expensed. As before, the Brown tax is equivalent to a tax on those inputs which can not be expensed and will be nondistortionary if and only if these inputs are in fixed supply.

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1. If the market value of random revenues exceeded the market value of random costs when all factors are accounted for, then because there are constant returns to scale a firm could arbitrarily increase its market value by expanding all of its dated contingent inputs and outputs in exact proportion. If the market value of random costs exceeded that of revenues from the project, the firm would increase its market value by not undertaking the project.

The Swan Proposal

Swan (1976), (1979), proposed a variant of the Brown tax for Australian minerals which has the feature that net cash outflows are not immediately reimbursed at the Brown tax rate. Instead, cash outflows are carried forward with interest to be offset against future losses. A possible motive for modifying the Brown procedure as Swan does might be to make the tax politically more palatable. It also turns out that analysis of Swan's proposal is very useful in helping us to understand the more elaborate system proposed by Garnaut and Clunies-Ross. In the case of certainty, it is clear that the Swan proposal is equivalent to a Brown tax plus a requirement that firms incurring net cash outflows lend the government an amount of money equal to the Brown tax times the amount of the cash outflows to be repaid at the time when these firms have cash inflows whose present value equals that of the earlier outflows. If the interest rate that the firm is paid on this "loan" to the government is the[1] market rate of interest, then requiring this loan introduces no distortions and the economic effect of Swan's proposal is precisely the same as that of the Brown tax.

Analysis of the Swan proposal in a world of uncertainty is more difficult. The first question that might be asked is "What interest rate should the government permit firms to charge on negative cash flows that are waiting to be offset against future net revenues?" Garnaut and Clunies-Ross have suggested that in order for the tax to be "neutral" among projects of varying riskiness, this rate should be higher for projects with a relatively high variance in their internal rate of return. As it turns out, under some variants of the Swan proposal, it would be appropriate to use the same "risk-free" interest rate for all projects while under other variants, different rates would be appropriate.

If under Swan's variant of the Brown tax, negative cash flows were certain to be fully offset at some time against future positive cash flows, then the Swan variant would be equivalent to a Brown tax plus a forced loan from the firms to the government which would be repaid with certainty. If the government allowed credit for negative cash flows to accumulate at the risk-free rate of interest, then these forced loans would have no real economic

1. Since we are, for the moment, assuming certainty there is no ambiguity about "the" rate of interest.

effects since the market valuation of the cash flow involved would be zero. Therefore the Swan variant, using the risk-free rate of interest would be equivalent to the Brown tax and hence nondistortionary if the resources which cannot be expensed are available in fixed supply.

Whether it is reasonable to suppose that investors will be certain to be able to recover the full present value of the the Brown tax rate applied to cash outflows depends on further details of the particular plan of deferred offsets. In a world of uncertainty, new information may lead a rational investor to discontinue an investment project at a time even though the present value of all cash flows generated by the project to date is negative. If this happens, the project will not have generated enough positive cash flows to be able to offset the full accumulated value of credits against the Brown tax. This presents no difficulty if the tax is assessed on a "company basis" rather than a "project basis" and if offsets can be "sold". Diversified firms could offset the losses from unsuccessful projects against gains from successful projects. Less diversified firms could sell projects which appear unlikely to recover the present value of investment to firms which have successful projects against which they can offset the cash outflows on the unsuccessful projects which they have purchased. If the tax is run on a project basis, there remains the question of how to treat unused credits for negative cash flows on unsuccessful projects. One possibility would be to allow these credits to be "sold" from one firm to another which has positive cash flows against which to offset them. Another possibility would be that on termination of a project, the government would reimburse the investor for his unclaimed Brown tax credits against cash outflows. If either of these policies is adopted, then again the deferred credit is a safe loan to the government and accordingly the risk-free rate should be used.

If the Brown tax were assessed on a project basis[1] and if unused credits for cash outflows could neither be sold nor reimbursed by the

1. While the idea of a "project-based" Brown tax is interesting in principle, it is likely that such a tax would be extremely difficult to enforce. If the tax system treats income or expenses from one kind of an activity differently from another, then firms which perform both activities will find it in their interest to arrange their accounting system so as to attribute income and expenses where they are least heavily taxed. Thus we would expect project-based taxation to encourage larger integrated firms at the expense of smaller specialized firms. Furthermore, because of the possibilities for shifting income and expenses by transfer pricing schemes, the incentive effects within firms may be very different from those one would expect if a project-based tax could be perfectly enforced.

government, then the difference between the Swan variant and a straightforward Brown tax would be a forced loan to the government that investors could not be certain to recoup. Other things being equal, projects with a higher variance of returns are more likely to be terminated after a cash flow of negative present value than safer projects. It follows that a Brown tax administered in this way discriminates against high variance investments. One method of compensating for this effect would be to allow projects to accumulate their credits against the Brown tax at higher rates of interest, the higher the variance on their returns. This, however can at best be only a partial corrective, since as we have discussed above, using different temporal discount rates is not an adequate set of instruments to deal with distortions in the treatment of risk.

It is also a serious disadvantage of this variant of the Brown tax that in order to achieve even approximate neutrality among projects of different riskiness, different projects have to be taxed differentially on criteria which are not readily observed or publically agreed upon. The arbitrariness in a scheme of "project-specific" tax rates might appeal to politicians who wish to have favors to bestow but is not likely to be conducive to efficient economic decision making. This argument seems particularly compelling since several variants of the Brown tax can be found which are nondistortionary and which entail uniform treatment.

The "Resource Rent Tax"

Garnaut and Clunies-Ross (1975) have proposed a variant of the Brown tax which differs from the Swan scheme in taxing cash flows "progressively". Their proposal, which they call the "Resource Rent Tax" would specify two "threshold" rates of return and two tax rates. Each year in the life of a project, the internal rate of return on the cash flow generated by the project is calculated. So long as this internal rate of return is below the lower threshold, the project incurs no tax obligations, positive or negative. If the internal rate of return rises above the lower threshold but below the higher threshold, annual tax payments are set so that at any date the total amount of taxes paid to the government will have been the smaller tax rate

1. This, however, can at best be only a partial corrective, since as we have discussed, using different temporal rates of discount is not an adequate set of instruments to deal with differences in risk structures.

times the present value of cash flows computed using the lower threshhold as the discount rate. If the internal rate of return rises above the higher threshold, annual tax payments are set so that at each time period, the total tax payment to date will be computed at the lower tax rate on returns between the two threshold rates and at the higher rate on returns above the higher threshold.

The special case of the Resource Rent Tax in which the two thresholds are set equal to each other is seen to be equivalent to the Swan variant of the Brown tax. We have argued that the Swan variant is equivalent to the Brown tax if the "threshold rate" equals the risk-free interest rate and if the rules of the tax are such that owners of projects which are terminated with negative present value can obtain an amount equal to the Brown tax rate times the present value of their losses. If a Brown tax is efficient (as it would be if the factors that cannot be expensed are in fixed supply), a single threshold without progressivity would also be efficient. To add a second threshold would to be to introduce new distortions. Introducing progressivity would unduly discourage high variance projects since high variance projects with the same expected return would more often achieve internal rates of return above the higher threshold and would be taxed more heavily. If the "two-threshold resource rent tax" did not allow the owners of unsuccessful projects to recover the full value of potential offsets on projects which are terminated with negative present value, there would be a further distortion against high variance projects since high variance projects would also tend more often to be unsuccessful. Garnaut and Clunies-Ross propose to counteract this distortionary impact by having higher thresholds in riskier industries than in others. Although doing so may help to eliminate some of the grosser distortions from the tax, adjusting the discount rate is an insufficiently subtle instrument to correct all the distortions introduced. In fact, as we have argued above, additional inefficiencies are introduced by introducing distortions in intertemporal prices to correct for distortions in incentives to take risks. Here too, the lack of clearly observable criteria for determining appropriate differences in threshold rates for different projects is likely to make the system difficult to administer and susceptible to political manipulation.

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*Subject, of course, to the proviso that the factors that cannot be expensed are in fixed supply.

It might be argued that these weaknesses of the Garnaut, Clunies-Ross scheme are "purely theoretical" and of little practical importance. Such an argument would deserve serious consideration if there were not simple practical alternatives to the two-threshold resource rent tax which appear to have all of its advantages and none of the disadvantages which we have pointed out. In fact, the reasons advanced by Garnaut and Clunies-Ross for adding the complications of progressivity and of different rates for different projects to the simple Brown tax or the Swan variant are based on the purely theoretical but misguided view that these complications increase rather than reduce efficiency.

The notion that a progressive Brown tax would be fairer or more efficient than the simpler uniform proportional Brown tax seems to arise from a misunderstanding of the theory of market allocation under uncertainty. According to modern economic theory, private securities markets and the possibility for portfolio diversification work to allocate risk taking efficiently, at least where these securities are traded on the open market. The market puts risks in the hands of those willing to bear them most cheaply. Considerations of efficiency or fairness leave no role for the government to play in reallocating risks from stockholders to taxpayers.

Summary

We have argued that a cash flow tax is equivalent to a tax on those factors whose opportunity costs are not counted as costs for purposes of the tax computation. Such a tax will be nondistortionary if and only if the factors thus excluded are in fact available in fixed supply. In some instances this roundabout method of computing the rents to factors in fixed supply is less effective than direct taxation of the market value of these fixed factors. This seems especially clear in the case of sole proprietorships in agriculture or retail trade where land values can be estimated from recent sales of adjacent properties while calculation of rents from residual cash flows inevitably confounds the returns to the fixed factor land, with the returns to the variable supply of effort on the part of the proprietor.

Residual methods may be more appropriate in the case of large-scale minerals extraction if it is thought that the market value of established sites is difficult to observe because of small numbers of sales of similar properties. In the case of large scale mining, unlike sole proprietorships, workers are, for the most part, not the residual claimants of company income. Therefore a tax on residual cash flows is to a lesser degree a tax on the efforts of the owners. Whether the imperfections of a practical implementation of a Brown tax scheme exceed those from taxation based on direct estimates of market value of factors in fixed supply remains an open question.

Taxes on the "profits" from successful projects undertaken by risk-taking enterprises are often not taxes on rents to factors in fixed supply but rather taxes which distort incentives in such a way as to reduce risk taking below efficient levels. The version of a cash flow tax suggested by E. Cary Brown (1948), however, turns out to be nondistortionary in this regard. Brown's proposal has firms paying a tax a fixed proportion of any positive cash flow and the government paying firms the same proportion of any negative cash flow they may incur. Swan proposed a variant of the Brown tax in which the government does not pay firms for their negative cash flows when they occur but rather lets the firms carry these flows forward with interest to be offset against future positive cash flows. If the Swan variant is designed so that firms always can eventually recover the present value of tax credits against negative cash flows, then it is equivalent to the Brown tax and hence nondistortionary so long as the residual factors are indeed in fixed supply. Garnaut and Clunies-Ross propose an elaboration of the Swan variant which includes a "progressive" tax on the returns from projects and has different tax rates for different industries. These elaborations appear to complicate the administration of the tax and to add distortions rather than eliminate them from the simpler Brown tax or the Swan variant.

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