This work is distributed as a Discussion Paper by the

STANFORD INSTITUTE FOR ECONOMIC POLICY RESEARCH

SIEPR Discussion Paper No. 02-01

Reforming the Taxation of Human Capital: A Modest Proposal for Promoting Economic Growth

By
Paul A. David
Stanford University
And
University of Oxford
November 2002

Stanford Institute for Economic Policy Research
Stanford University
Stanford, CA 94305
(650) 725-1874

Reforming the Taxation of Human Capital: A Modest Proposal for Promoting Economic Growth

By

Paul A. David
Stanford University & University of Oxford

First draft: 15 November, 2000
Second draft: 25 June 2001
This version: 30 October 2002

Forthcoming in ***Economics for An Imperfect World: Essays in Honor of Joseph Stiglitz***, eds. R. Arnott, B. Greenwald, R. Kanbur, and B. Nalebuff, Cambridge MA: MIT Press, 2003.

Contact Author: Department of Economics,
Stanford University
Stanford, CA 94305-6072, USA
Fax: +001+650+725-5702; Tele: +001+650+723-3710;

Oxford Internet Institute,
1 St. Giles, Oxford OX1 3BW, U.K.

E-Mail: **pad@stanford.edu** or **pdavid@herald.ox.ac.uk**

ABSTRACT

This paper proposes a new scheme of personal income taxation that would eliminate inefficiencies arising from differences in the tax treatment of investments in intangible human capital and other types of capital formation. It also would offset the exacerbation of those distortions due to progressive income taxation, without requiring the latter's abandonment. The tax regime proposed here would permit full deductibility of private costs of education and training, but defer the exercise of the deduction credits. A novel instrument for achieving these objectives is an individually held, non-transferable asset: an ***u***ntaxed, ***i***nterest-***b***earing ***e***ducational (expense) ***d***eduction ***a***ccount -- christened the "UIBEDA. The UIBEDA scheme facilitates shifting from direct educational subsidies to the use of publicly subsidized student loans, and also can be readily extended to promote selective immigration of workers who have incurred indebtedness for human capital investments abroad.

Keywords: tax neutrality, human capital investment, education and training subsidies, international labor mobility, economic growth.

JEL Classification: H21, H24, J24

Reforming the Taxation of Human Capital: A Modest Proposal for Promoting Economic Growth

This essay presents a new proposal to modify existing income tax regimes in a way that would render them more supportive of human capital formation, and hence more encouraging to long-term economic growth.

A bias against human capital formation expenditures presently exists in many national tax codes, which tend to favor investments in tangible capital formation and intangible business expenditures for R&D and in-house production of computer software. Differentials in the tax treatment of different classes of assets are "inefficient" in the static welfare-analytic sense, and the inefficiencies become magnified where the various assets are strong complements in production, or in consumption. Due to the complementarities between human capital formation and the accumulation of other classes of productive assets, and the role of human capital in generating technological and organizational innovations,[1] this particular aspect of "non-neutrality" in the workings of the tax system may well have significant perverse consequences for economic growth.

The progressive taxation of personal income, moreover, tends to exacerbate the distortions in the allocation of investment that arise from the failure of most modern tax regimes to treat human and non-human capital formation in a neutral fashion. Because it proves more feasible under most tax regimes to shelter personal property income streams from the effects of rising marginal tax rates than is the case for wage and salary income, educational and training investments that yield incremental earned income are particularly punished.

To significantly reduce or eliminate progressive taxation of incomes will, at best, offer only partial amelioration of the tax-induced distortions of investment, and that approach to reform is an unattractive as a solution on other counts. There are important non-instrumental, ethical reasons for redistributing income to poorer members of society in the high income countries, as well as reinforcing considerations that turn on the consequences of such redistributive policies for productivity improvement and growth in developing countries. Taken together, these constitute a cogent rationale against general proposals for tax regime reforms that would have the effect of eliminating progressive taxation.

What then can be done? Rather than continuing the debates over radical fiscal reforms – in which the elimination of income taxation and its replacement by taxes levied only on consumption expenditures, or various "flat tax" proposals, have figured prominently – a less ambitious, more pragmatic approach is advocated here. Economists are more likely to be effective in this area if their meliorative energies are directed to more modest, piece-meal proposals that do not entail a disruptive overhaul of the entire tax regime.

The reform proposed here would make the private costs of education and training fully deductible expenditures for purposes of calculating individuals' taxable income. But, instead of allowing the tax deduction to be claimed immediately, or to be claimed by a third party, it would be credited to an account in the name of the person receiving the qualified form of education and/or training. Under the scheme envisaged, the value of this "deduction account" would then grow at a rate equal to the real yield on long-term government debt, up until the point at which it was exercised to reduce the personal income tax liabilities of the individual account holder. The period within which this could be done would be confined to a comparatively short time interval.

In effect, a novel financial instrument is proposed to achieve the objectives of a tax regime that was "neutral" in its treatment of "intangible human capital" and other productivity assets, without sacrificing the principle of progressive taxation. It is an individually held, non-transferable financial asset: an ***u***ntaxed, ***i***nterest-***b***earing ***e***ducational (expense) ***d***eduction ***a***ccount. This novel device is conveniently described by its acronym: UIBEDA" – which sounds like "we-bedda."

The strong rationale that can be found in the economics literature for undertaking to reform the tax treatment of human capital formation is reviewed briefly in section 1. This provides a background for the specific features of the proposal that are set out in section 2. A concrete (numerical) illustration of the operation of the scheme is supplied in Section 3. The conditions under which the UIBEDA scheme could satisfy an inter-temporal balanced budget constraint are examined in Section 4, which broaches the important empirical question of how potent this form of subsidy would be in inducing incremental human capital investments that yielded larger earned income streams, and hence enlarged future tax revenues. Section 5 calls attention to two further, and distinctive virtues of the proposed scheme. One is that there is no reason to prevent the recipients of this form of educational subsidy from finding employment for their acquired skills outside their "home" labor markets. The second is that the governments of skill-deficient regions need not restrict the scope of the UIBEDA scheme to their respective native born populations or domestic residents. UIBEDA accounts thus lend themselves readily to use in implementing liberal policies of selective immigration and emigration.

The essay concludes in section 6 with some remarks on the importance of setting in place provisions that establish "credible commitment" to this scheme on the part of the State, and related issues concerning the appropriate time-horizon for such commitments.

1. The Fiscal Bias against Human Capital Formation: Diagnosis and Previously Proposed Remedies

Although the process of developing human capabilities through education and other kinds of training may yield consumption satisfactions for the recipients, today the process is regarded widely as an investment activity from which will flow an incremental stream of future human productive services (and corresponding earnings). Systems of taxation that treat workers as agents of production (analogous to machines) distort the allocation of resources in a direction that militates against human capital formation. The personal income tax is the prime exemplar of such systems.

Contrary to common opinion, examination of modern tax codes in the US, UK and some other advanced economies reveals that some portion of human capital investments actually may be taxed more heavily than the financial investment and tangible physical investments made by households.[2] This state of affairs has emerged clearly where (for the ostensible purpose of raising the national conventional personal savings rate) special tax provisions have permitted the sheltering of income in pension funds, individual retirement accounts, and other savings vehicles. The use of the latter class of instruments for shifting income from the present into the future has thus been favored in comparison with others that can accomplish the same purpose – human capital investment being prominent among them.

On the other hand, it can be pointed out that under conventional systems of income taxation (which are based upon current earnings rather than the accrual accounting method that typically apply in the cases of physical capital-goods) human capital investments are a favored vehicle for young households to use in transferring income (and consumption) into the future.[3] But, as will be seen shortly, the thrust of this observation is considerably blunted when one considers the structure of marginal income tax rates.

General formulations of optimal tax theory, such as the classic papers of Diamond and Mirrilees (1971), consequently have argued that there should be no taxes levied on intermediate goods. Plainly, human capital investments fall under the heading of intermediate goods, as they are an instrumentality for shifting resources from the present to the future. But, the practical implications for policy design that can be derived from optimal taxation principles remain less than immediately clear. This is so because in practice human capital may be a mixture of labor supply, capital investment and a final good, and because it may be necessary to consider general equilibrium effects, as well as the first-order impacts upon the behavior of individual agents.[4]

To make headway towards specific policy recommendations in this area it is helpful to reduce the tension between the principle that human capital (being "an intermediate good") should not be taxed at all, and the practical difficultiy of attempting to tax income from labor services in a way that would not distort

human capital investments. Thus, Judd (1998) suggests continuing to tax workers' incomes but immediately expensing all human capital expenditures: the proposal is to extend the (automatic) deductibility of foregone earnings costs to all direct education and training outlays. Were a significant portion of educational (and/or training) expenditures to represent "consumption" goods (or bads) it would be appropriate to tax the portion of educational expenditures that generated these. But, the obvious problems of strictly implementing such a tax policy suggest that reasonably generous caps, instead, might be imposed on the deductibility of direct education and training related expenditures.[5]

Nevertheless, the elimination of taxation of all investment in human capital has been recommended repeatedly by economists and tax analysts (e.g., Boskin 1977, and Kaplow 1996). This partial tax reform proposal, although quite sweeping, nevertheless falls rather short of a "second-best" policy, because it is not likely to result in a tax regime that is "neutral" with respect to the formation of different types of capital.[6]

Those who view the persistence of differential tax treatment of different types of capital as a potential source of serious allocational inefficiencies cite this among the arguments favoring still more radical reforms, such as the adoption of taxes on *consumption* expenditures alone. But the consumption tax proposal -- to which public finance economists widely subscribe -- compounds two distinct departures from most existing tax regimes' treatment of human capital. First, it removes the tax disadvantage of human capital investments due to the difference between the non-deductibility of the direct cost component of human capital investment and the deductibility of depreciation charges on tangible non-human capital. Second, by eliminating the taxation of labor income, it does away with the effects of progressive marginal taxation on the amount of human capital invested privately by individuals (both foregone earnings and direct educational and training costs).[7]

Although the abandonment of progressive taxation is from some viewpoints the really radical aspect of "consumption tax" (and related "flat tax") schemes, that aspect of the reformers' proposal is not a logical requirement of shifting from labor incomes to consumption expenditures as the basis for taxation. Furthermore, eliminating the inefficiencies in resource allocation created by differential "tax wedges" (gaps between pre-tax and after-tax rates of return that vary according to the type of asset) is not an obviously compelling goal for tax policies to pursue. One should bear in mind here the trade-off between static efficiency and dynamic efficiency. Thus, a consistent growth-promoting logic may be read in the tax treatment of investment so as to favor both shorter-lived tangible assets (and intangible non-human assets such as patents and software), and comparatively long-lived, intangible human capital on the other hand.[8]

As has been noted, the implications for human capital formation of differences among tax regimes in the methods of income accounting are quite separable from those that derive from the structure of marginal personal income

tax rates. The typical progressive structure of the personal income tax schedules exerts an unambiguously discouraging influence upon the use of investments in human capital as vehicles for income- shifting. This effect is due entirely to the temporal positioning of this particular mode of saving within the household's life cycle. The expensing of foregone earnings costs, as well as any deductions that are allowed for direct education and training costs, comes during the early phase of workers' lives, when incomes and marginal tax rates are low in any case. But, these investments, especially when supplemented by taking advantage of on-the-job options, generate a rising stream of labor earnings that are exposed to higher marginal rates under progressive tax regimes.[9]

Is the adverse impact upon human capital investment really a serious drawback of the progressive taxation of labor incomes? Good "natural" experimental data might permit the matter to be resolved empirically, but in its absence economists have turned to simulation models. The latter combine theoretical specifications and parameters estimated from microeconomic data, in order to create quantitative models of household behavior that can be used to evaluate effects of hypothetical alternations in the regime of taxation.[10] According to the results obtained recently with such an approach by Dupor et al. (1996), the substituting a flat tax schedule for progressive rates such as exist in the US 1990 tax code would have a substantial impact: the simulation results indicate that a 10 percent rise of the marginal tax rate over the increasing portion of the individual earnings profile has the effect of reducing investment in human capital by 15 percent.[11]

Quite obviously it is important to consider the general equilibrium repercussions of any significant tax policy changes. It is possible that the immediate positive impact upon the level of human capital investments of setting lower tax rates on labor income – vis-à-vis taxes levied on the returns to physical capital – may well be substantially mitigated over the long run. Indeed, it might be completely nullified by the induced change in the economy's asset portfolio.[12] In the absence of countervailing skill-deepening biases in technological change, the induced increase of the pace of accumulation of human capital (in relationship to the supply of raw labor-power through population growth) should operate to depress the marginal productivity of additional educational training.

Furthermore, to the extent that the contemplated tax reforms induce agents to substitute human capital for physical capital investments, the long-run effect on the level of physical capital per worker in the economy would depress the marginal productivity of labor and drag down before-tax rates of return to human capital.[13]

Dynamic general equilibrium considerations of this kind are particularly relevant when analyzing fiscal policy proposals for large, substantially closed economies. In the situation of small and highly open economies, however, the conclusions of the foregoing partial equilibrium analyses previously reviewed remain more applicable, because when international financial flows and labor

migration are unobstructed they tend to operate in the long-run to peg the before-tax rates of return on human capital and physical capital investments. A small open economy would thus be comparatively free of the counter-forces that which otherwise might work to curtail the rise in the rate of human capital formation among the indigenous population.

An economy that is open to the movements of workers from abroad, as well as to commodity trade and capital flows, also presents an environment in which reforms that positively affect the level of private after-tax returns on human capital may gain added potency, by inducing selective immigration. These are circumstances that characterize many among the smaller developed and developing economies, for which the modest tax reform proposal presented the following sections may well be particularly relevant.

As long as the effect of the reform is to push a substantial portion of the distribution of after-tax private marginal yields on human capital above those elsewhere, it is likely to draw in people with greater potential earnings capacities. The pull would be stronger for individuals who also are more strongly disposed to utilize their inherent and acquired capabilities to gain further education and training, and ultimately to exploit that asset by entering the more highly remunerated occupations.[14] The possibilities of exploiting such effects will therefore be considered more closely (in Section 5) after the basic features of the UIBEDA scheme have been detailed.

2. A New Proposal: Principal Features of UIBEDAs

The main task here is to set out the features of the proposed reform instrument in detail sufficient to indicate the empirical information that would be required to establish its general feasibility. Although this is best tackled by offering concrete specifications of a hypothetical system, the particulars supplied here are those which lend themselves well to purposes of exposition, rather than engaging with the realities of existing administrative institutions and tax codes. The goal in what follows is to stimulate further discussion of the basic idea, and engage the expertise of those most acquainted with the institutional arrangements that would render its implementation practical.

Let us start by considering the simplest practical circumstances, in which direct costs of educational investment are met out of current income flows, as would be the case either where the young adult student had independent means, or was receiving *inter vivo* income transfers for the purpose from family members. Under the proposed scheme, neither the recipient nor the household that had borne these current direct costs would be allowed immediately to enjoy such tax savings as would be generated by taking them as deductions from taxable income. Instead, the nominal value of the tax savings would be recorded in the current year's tax return filed by the student, and would be credited to an untaxed

interest-bearing deduction account (UIBEDA) established in the name of that individual – and identified by a taxpayer number.

Comprehensiveness is desirable in defining "direct costs" for these purposes. Thus, this category should be taken to include expenditures for tuition and educational fees, for textbooks, equipment and supplies purchased in connection with enrollment in formal training programs, as well as additional expenses for living away from one's place of residence whilst engaged in educational and training. It should be understood that the phrase "formal training programs" is meant to include instruction at accredited educational and training institutions, and programs of on-the-job training whose reported costs to the employer or other entity are accepted by the tax authority as an appropriately deductible business expenditure.[15]

The maximum life of these UIBEDAs would be set uniformly, with consideration given to the possibility that post-university professional education, and post-graduate training that occasioned direct costs should likewise generate additional "credits" in the individual's account. The actual life of an account, however, would be a matter for the account-holder's discretion within specified limits. Thus, after some stipulated initial waiting period from the date at which it was established, the account either could be liquidated, or that action could be further deferred until some specified maximum age (of the account) was reached. The aggregate nominal value of an UIBEDA – that is, of the portfolio consisting of a bundle variously dated "certified deposits" (direct cost expenditures) each of which would be growing exponentially at their respective government bond rates – could be "cashed in" for the sole purpose of claiming deductions from the account-holder's domestic wage earnings.

Ideally, the UIBEDA should resemble a tax-free "retirement savings bond" in at least one respect: its value grows at a fixed rate of interest (set at, say, the Treasury's long-term borrowing rate in the year that the credit was established) through automatic reinvestment of yields, up to some maximum attainable surrender value. But, unlike bonds, UIBEDAs would not be transferable; nor would they throw off any "coupon" yields prior to being "cashed in"; and they would have a variable surrender value even when held as long as was possible.

Once the UIBEDA had been thus broached, the stream of annual tax deductions would then resemble a term annuity, in that it would have to be taken in equal amounts (or according to some other pre-specified formula) in each consecutive year during a period of pre-defined length. But unlike annuities, their monetary value would be the resulting annual tax-savings, and therefore would depend upon the account holder's current income, given the prevailing tax rate schedule(s) that would apply to the UIBEDA account.

The benefits offered under this scheme in the form future personal tax-savings are intended to induce the account holders to make use of such

capabilities as they gain through human capital investment, by working at the higher-income occupations that their education qualifies them to enter. The restrictions that have been imposed upon the way in which these benefits can be realized are meant to prevent taxpayers in high-income brackets from abusing the system to escape taxation. Otherwise, they might seek to benefit by claiming a deduction for education-related expenditures in the name of other individuals, especially those who do not intend, or are unlikely ever to utilize that "investment" by working in their home country at subsequent dates.[16]

A further problematic issue which the foregoing provisions are designed to address is that an individual account holder might be myopically opportunistic, and so seek to "cash in" the deduction immediately upon completing her studies, after which she would permanently exit the domestic labor force. The imposed minimum waiting period should serve to diminish the attractiveness of the scheme to such individuals. In addition, because it seems desirable to provide the Treasury with greater predictability in the reduction of taxable incomes due to the liquidation of UIBEDAs, their conversion into an annuity-like stream of deductions should be restricted to take place within a pre-specified number of consecutive tax-years.[17]

More generally, although it is desirable not to impose any limitations on individuals' freedom of action by virtue of their having opened an UIBEDA, that principle is not violated by setting the provisions and parameters in a way that would curtail abuse of the entitlement under the scheme.[18] For example, tighter restrictions could be introduced to curtail opportunistic behavior by requiring that to be eligible to exercise the liquidation option, the surrender date, T,[19] be preceded by a minimum number M years during which the account-holder had filed national income tax returns showing positive tax payments.

The effective after-tax yield on UIBEDAs would thus be determined by three sets of conditions: the intervening history of the Treasury's borrowing rate(s), the progressiveness of the prevailing income tax schedule at the time of the account's liquidation, and the steepness of the individual's earnings profile during the period following their education and training investments. The first two of these being under the government's control, it is important that the rates in effect at the time the particular individual's "credit" was deposited in the UIBEDA remained fixed throughout its life, whether or not the Treasury's borrowing rate actually changed. Keeping track of the implicit fiscal obligations of the Treasury in respect to the credits in these accounts will not pose any real burden for modern financial information systems.

It will be apparent that the novel instruments (UIBEDAs) created under such a scheme not only would work to offset the taxation of the interest component in the returns on investment in human capital, but, because their value is increased by utilizing that asset in employment at higher earnings rates within the domestic economy, they add to agents' incentives to use their acquired skills in that manner. UIBEDAs, therefore, have the expected effect of raising future tax

revenues derived from whatever public subsidies had been given to the individuals during their education in their country of origin.

3. A Numerical Illustration

To illustrate the magnitudes of the incentives that might be created under a scheme of this kind, we can assume the following investment cost, earnings profile and tax parameters:

(a) total private costs of university education amount to 60K;

(b) 0.33 of total private costs are direct costs, the remainder being foregone earnings;

(c) the 15K of total private direct costs are pre-paid by the individual's family and an UIBEDA in her name is established at the end of the tax year in which she matriculated, at age 17;

(d) 0.06 per annum is the government's nominal borrowing, set for the account at that date;

(e) the graduate's earnings profile starts at 15K and rises by 7 percent per annum from graduation at age 20 until age 30, and grows thereafter at 3.5 percent per annum until age 45 after which it remains flat (at 50.7K) until retirement at age 60;

(f) non-educational deductions amounting to 5.0 percent are allowed on gross earnings above 10K;

(g) the marginal rate of tax on taxable wage earning is rising between broad earnings bands, as follows: 0.10 in 8K-14.99K, 0.15 in the 15K-24.99K, 0.25 in the 25K-44.99K, and 0.30 for 45K and above;

(h) the UIBEDA account value is liquidated in equal annual deduction claims over (M =) 5 years;

(i) The maximum allowed life of an UIBEDA is T_2 = 25 years; and the minimum permissive age before an account can be realized is T_1 = 3 years, i.e., given assumption (c), upon graduation at age 20.

An array of alternative outcomes can be generated, by varying the date at which the account-holder exercises her option to begin taking the (five years worth of) UIBEDA deductions:

Table 1

Calculation of the UIBEDA's Scheme's Tax Impact for Individual Beneficiaries

Graduate's age at start of liquidation:	***20***	***25***	***30***	***35***	***40***	***45***
Nominal Value of UIBEDA (000's)	24.0	32.4	43.6	49.0	80.0	107.0
Gross wage income (000's)	15.0	21.3	30.0	35.7	42.6	50.7
Annual value of realized UIBEDA (000's)	4.8	6.5	8.7	9.8	16.0	21.4
Taxable income after UIBEDA (000's)	9.6	14.2	19.1	24.1	25.0	27.3
Annual tax savings from UIBEDA (000's)	**0.5**	**0.8**	**1.3**	**1.5**	**4.0**	**5.3**

Note: See text discussion for underlying assumptions.

It should be noticed that under the schedules assumed in this illustration, the nominal value of the UIBEDA's yield of tax-savings becomes substantial if these are deferred until after age 40, thereby creating an incentive to defer exercising the deduction and, instead, using it as a vehicle for (educational earnings-contingent) savings. This may be seen by comparing the present value at age 20 of 4K worth of annual tax-savings realized at ages 40-44, which is 1.2K, or well more than twice the value of exercising the deduction entitlement at age 20, immediately upon post graduation employment.[20]

Looking at the scheme from a different angle, and assuming constancy of these parameters, the 20K (or 25K) in nominal tax savings received between at ages 40-44 (or ages 45-49, respectively), would be sufficient to meet the direct educational investment costs of one of the graduate's children, assuming that child had been born when the graduate herself was age 25-26 (or age 30-31).

By the same token, had the new graduate's *mother* achieved the same earned income level by the time she was age 40-44, under this scheme she would be in a position to receive 20K-25K worth of tax-savings. Conveniently, under the assumptions, this amount would be available to be applied towards meeting the current direct educational costs of a college-bound child of her own. From the standpoint of the overlapping generations envisaged in these examples, the UIBEDA thus would function as an individual tax-sheltered, government guaranteed educational endowment fund.

4. Can UIBEAs pay for themselves? Public financial intermediation under an inter-temporal "balanced budget" restriction

An important issue for consideration now is whether the proposed scheme can or cannot satisfy an "inter-temporal balanced budget constraint" – a condition that a prudent Treasurer might well be disposed to impose on any such fiscal innovation that involved the surrender of tax revenues.

It is easiest to see what is involved in answering this question by starting from the conditions most favorable to the UIBEDA proposal, namely, where the individual completing university has been induced to do so by the existence of the prospective income tax deductions. It is then straightforward to show -- under plausible specifications regarding the effects on the typical individual's expected earnings profile of having undertaken the educational investment described in Section 3: Table 1 -- that the Treasury can do better than "break even" in present value terms. By engaging in this form of financial intermediation, the public sector can emerge with a tax revenue surplus.

To demonstrate this, the foregoing set of assumptions --(a) through (i) in Section 3 – can be augmented by another:

(j) Instead of attending and completing university, the representative agent's alternative opportunity is to enter the labor market with a high school completion certificate, and receive a stream of earnings that yield taxable wage income of 12K at age 17, rising to 14K at 20, 17K at 25, and 20K by age 30, but remaining constant thereafter.

Given that empirically plausible specification, the average "college differential" in earnings streams and the corresponding expected incremental income tax revenues recovered on those differences can be calculated, and discounted to find their present value at the date at which the UIBEDA deduction credit was initially granted. For simplicity the latter will be taken to be the individual's 20^{th} birthday.

A rough approximation, using the tax rates and other parameters in the previous illustrative example, and therefore discounting at the 6 percent long-term government borrowing rate, puts the present value at age 20 of the incremental education-associated tax revenues generated up though age 44 in the neighborhood of 24K. As all but 3K of the latter is generated during the ages between 29 and 44, it is plain that the Treasury can recover the (present value) of the educational cost deduction credits awarded at age 20 without worrying about the early labor market behavior of recent university graduates. In other words, complete recoupment will be achieved even were the young worker to take her training abroad after graduating, so long as she returned ten years later to recommence working in her home country – and was able to command at least the same, stipulated earnings profile for an university graduate with the equivalent of 10 years post-graduation work experience.

Now consider what happens when the UIBEDA account is "cashed in" by a worker at age 45 who had been in continuous employment up to that point. A total of 26.5K in current tax savings enjoyed by her during that year and the following 4 years has an initial (age 20) present value of 5.1K. But, to find the present value (at that date) of the Treasury's *net* incremental revenue burden, one must consider that even with the UIBEDA deductions, the university graduate's taxable income is higher than that of the high school graduate. It therefore yields as much as an extra 6.8K worth of nominally valued tax revenue *per year* when she is in the age range from 45 through 49. The cumulated amount has a present value of 6.5K at age 20, which means that there actually would be a small net gain for the Treasury, amounting to (6.5-5.1 =) 1.4K – even during the years when the UIBEDA deductions were being realized.

Quite obviously, there are further earnings differentials and corresponding incremental tax revenues to be enjoyed, if our representative worker does not withdraw from the domestic labor force after exercising her deduction credit entitlements. Suppose she continues in employment between age 50 and 60: in the scenario envisaged, the present value (at age 20) of the cumulated incremental income tax receipts flowing to the Treasury from this educated agent's earnings in the decade preceding retirement would approach 9K.

There are several ways in which to interpret the availability of the aggregated (4K + 1.4K + 9K = 14.4K) worth of "present value tax revenue surplus" that emerges from the foregoing calculations.

(1) Under the assumption that the representative worker in each case would be employed continuously up until age 60, the inter-temporal balance budget constraint would be satisfied even if much smaller differentials existed between the expected earnings profiles of high school and university graduates.

(2) The same would hold were an allowance to be made for less than full-time employment by the average college graduate: an expected rate of unemployment from all causes that averaged out at 9 percent per year (in every year from age 20 through age 60), combined with a proportionate one-third lowering of the graduate's full-time earnings profile would leave the inter-temporal balanced budget constraint satisfied, i.e., (.09 + .33)(24K +1.4K +9K) = 20K.

(3) Alternatively, the figures imply that the direct costs of university training these additional college attendees could be publicly subsidized at a cost of 14.4K, so that a total (public and private) educational investment outlay amounting to 34.4K per student could be justified under this proposal as being consistent with maintenance by the Treasury of its inter-temporal balanced constraint.

(4) One also may conclude from the foregoing that the growing risks of disability and death, or of retirement and emigration after age 50, would not

pose a considerable threat to the Treasury's ability to satisfy the inter-temporal balanced budget constraint.

But now it is necessary to re-consider the premise for the preceding calculation, namely, that the gains and costs to the Treasury are solely those arising from the behavior of agents who the UIBEDA scheme induced to attend and complete a university education. Obviously, that is not realistic. The UIBEDA benefits (which produce losses of tax revenue for the Treasury) also would be enjoyed by some people who in any case would have completed their university education (and gained the associated differential earnings). The Treasury gains no incremental tax revenues by granting such persons a UIBEDA deduction.

So, the question of interest can be framed this way: In the context of our illustrative example, what fraction (**p**) of each cohort of college graduates would have to be induced by the UIBEDA scheme to obtain their degree, in order for the Treasury to cover the lost revenues on the other (1-**p**) portion, and thus "break even"? The answer can be obtained almost immediately from the estimates produced in the foregoing calculations. Since the 1-**p** of the cohort cost the Treasury a present value tax revenue loss of 5.1K per capita, and **p** generate a present value tax revenue surplus of 34.K per capita, the magnitude that perfectly balance the one against the other in this case is **p** = 0.12. In other word, an increase in the pre-UIBEDA number of high-school graduates who go on to graduate from college of only 13.6 percent ([0.12/0.88] x 100) would suffice for the UIBEDA scheme to pay for itself –- in present value terms.

On its face, this seems a rather modest required impact on college participation (and completion) rates. Even allowing for a 10 percent average probability of yearly earnings losses (due to unemployment and disabilities) among the induced increment of college degree holders, still the inducement effect required for the UIBEDA scheme to "break-even" at only 16 percent. But, for a country such as US, where the faction of the high school graduates who go on to complete college is already as large as 0.7-0.8, moving up to the 0.81- 0.93 range is not likely to be so readily accomplished simply by means of financial subsidies.[21] On the other hand, in a country where the faction of secondary school-leavers that complete university is closer to 0.4 (as it is in contemporary Britain, the 16 percent gain entailed in reaching the 0.46 level does not appear unachievable by means of incentives such as those which the UIBEDA scheme would provide.

Unfortunately, there is not very much quantitative evidence that allows one to carry this exploratory discussion much farther. A notable exception to the paucity of direct evidence is the body of econometric findings recently provided by James Heckman and his collaborators. It has led them to conclude that in the U.S. the financing of post-secondary school education does not constitute a significant obstacle to university attendance by males, save for a quite small segment of the population.[22] The observation of a marked positive correlation

between parental family income and college participation rates, however, is on this view attributable to structural factors of a more long-run nature: motivational and environmental factors that result in the disadvantages of poor educational preparation and self-image that burden children in many low income households environments, reducing their ability to meet university admission requirements and lowering confidence in being able complete a degree program leading to credentials that will prove valuable in the labor market.

If short-term financing constraints were indeed the serious obstacle to human capital formation in countries other than the US, tax reforms of the sort considered here probably would not be the best policy instrument with which to tackle that problem. Yet, there is another source of difficulty relating to the private financing of higher education that may be successfully addressed by the introduction of the UIBEDA scheme. It appears that in some high-income societies young adults and their parents in lower income households are reluctant to accumulate substantial personal indebtedness – especially without there being any corresponding tangible asset (such as a house, or a car) that could serve eventually to repay the debt.[23] Even in the U.S. it has been noticed that the take-up rates on subsidized college loans under government programs targeted towards students from low income families remains low: more people are eligible to claim this form of support that do so.[24]

Such behavior is not so difficult to understand: coming from family settings where as a rule there is no prior history of successful educational-based economic advancement, these youngsters would be reasonable in attaching a high risk discount to the economic returns that they are told can be anticipated on this form of investment. It is true that the loan default penalties as a rule are not exacting. But the tenets of "financial responsibility" with which aspirant middle-class parents of modest means are likely to implant in their offspring prospect do not encourage a relaxed attitude toward the prospects of carrying an unpaid debt of significant size in relation to post-graduate earnings. They are thus wary of the risks of beginning adult life and having to seeking responsible positions of employment while burdened by a bad credit rating, should they become unable to maintain the scheduled educational loan repayments.

This line of explanation is at least consistent with the observation that rates of continuation to university among secondary school-leavers vary positively with family context factors that are correlated with persistent parental income levels, with parental (especially mother's) educational attainments, and with indicators of the individual's academic ability.[25]

Thus, by giving individuals a deferred yield, work-contingent asset coupled to their educational debts, the UIBEDA scheme conceivably could contribute to counter-acting such inhibitions about borrowing for one's university education, and encourage planning for that of one's children.

It may be remarked, further, that the conceptually and empirically useful distinction which may be drawn between short-run credit constraints and long-run (family background) factors constraining participation in higher education should not obscure the point that expectations matter, so that it is only the *unanticipated* short-run constraints that are clearly distinguishable. The point frequently is made that human capital formation is an extended dynamic process, in which each stage builds upon foundations created at a prior stage.[26] The logic of this justifies the view that providing higher education subsidies for youths whose families did not expect them to be able to attend university is not likely to be effective in fostering higher rates of college enrollment among those groups in the population. Hence, the very same considerations which argue that there will be only rather weak short-run effects of educational subsidies targeted to students from low-income families, suggests that that institutionalized credible expectations of the future availability of loans and tax subsidies for scholastically qualified young people would have much bigger positive effects in eliciting higher university enrollment rates. Their effects would work through the alteration of the family environment during childhood and adolescence, and hence would exceed those identified simply with the removal of short-run credit constraints during the period of university attendance.

5. *Extending UIBEDA Eligibility to International Migrants*

An extensive economic literature has been devoted to the subject of international migration and its effects upon income in the sending countries. The portions of it that are generally thought to be most immediately germane to policies affecting a region's human capital endowments usually focus upon the effects of so-called "brain drains."[27] Emigration of the more able, and more highly educated and skilled members of the population provides a form of windfall capital transfer to immigration regions. The prospect of an uncontrolled redistribution from developing economies where human capital is relatively scarce, toward the economically advanced, high income economies where complementary resources are available to employ such assets at much higher private marginal rates of return, is indeed a source for serious concern.[28]

This is so especially in development contexts where there are critical scarcities of educated personnel required to maintain the minimal functions of a modern government, to effect the transfer of superior technologies, and to facilitate economic and political interactions with other more economically advanced societies. On the other hand, in countries that enjoy substantial supply-side capabilities for expanding the numbers who can be trained, and where the problem is one of insufficient private demand for investment in human capital, efforts to curtail out-migration of the highly trained may well be counter-productive. Their effect may be to further weaken private incentives to invest in education.

Conversely, investment in human capital might be increased in some situations by allowing nationals (whose expected earnings potentials would thereby be raised) to choose to work abroad in order to realize those benefits gains. This effect could alter the investment behavior of a much larger portion of the population than that which actually would emigrate, and therefore might well increase the net positive impact of public subsidies upon the domestic rate of human capital formation.[29]

Where a liberal policy stance on the "brain drain" question is thus warranted, the implications for the implementation of the UIBEDA scheme are quite clear. All who had borne some of the direct and indirect costs of investing in their education and training should be eligible to accumulate and hold deduction credits in a UIBEDA, whether or not they subsequently take their human capital abroad. Transparently, the UIBEDA would be of value to those who emigrated only if they returned to take employment at home at a later point in their careers, hopefully with their productivity having been enhanced by the intervening foreign work experience.

Establishing automatic deductibility would result in emigrating nationals receiving claims to UIBEDA benefits whose rising future value would constitute an inducement for them to return to their country of origin after gaining further training and work experience abroad. This aspect of the proposal thus may be viewed as a means of encouraging voluntary repatriation among more highly educated nationals whose knowledge, skills and overseas connections that are likely to be of considerable value in their country of origin.[30]

Although it is likely that such individuals would have made further, indirect investments in human capital whilst working outside their country of origin, such expenditures need not eligible for further deduction credits in their UIBEDA accounts. Closing that option will eliminate a source of considerable administrative costs

Turning now from the question of the eligibility of emigrating nationals for UIBEDA-benefits, it should be observed that the application of the scheme in the case of immigrants is likely to be even more potent for a small open economy. Encouraging a substantial inflow of individual who have special, high skill qualifications would tend to lower the costs and raise the profitability of the domestic industries that made intensive use of such workers. Under competitive conditions the benefits would be shared indirectly by others, as purchasers of their goods and services. If the effects in the employing industries were to increase investment for additional plant and equipment capacity, the accompanying increases in labor input demands could be sufficient to counteract the downward relative price effect of immigration on the level of remuneration offered to new, domestically trained workers. Consequently, the moderating effects of an inflow of trained workers from abroad upon the incipiently rising local wage premia paid to workers with particular occupational skills need not result in a weakening of the long-run incentives for the domestic population to invest in such training.

The general point that ought to have become apparent in the foregoing discussion is that programs promoting selective immigration, on the one hand, and tax policies promoting human capital formation in the domestic population, on the other, can be designed in ways that render them dynamic complements. When their effects are considered over a suitably extended but nonetheless finite time horizon, it seems quite natural to make short-run use of the features of the UIBEDA scheme as an instrument to promote selective immigration by non-nationals who have made education and training investments in other parts of the world. The mechanism of selection available to the government in this case is the determination of the list of eligible overseas training institutions, and the date of receipt of specified degrees and competence certifications that would qualify immigrants to set up UIBEDA accounts when they first entered employment. Evidence would need to be submitted also to establish the direct expenditures incurred overseas in connection with obtaining those credentials. For administrative simplicity, however, no deduction credits would be allowed for indirect investments in the form of foregone earnings.

Where a foreign government has made provision for the extinguishing of such educational debts as a condition for permitting the trainees to emigrate, or to remain abroad in employment, the government of a skill-deficit region might manage to recruit such workers by extending the UIBEDA scheme's benefits to them. Loan guarantees from the government in the region of immigration can facilitate re-financing of external student indebtedness, and the expenditures represented by the new, domestic loan can then be made eligible for treatment within the UIBEDA scheme on the same basis as newly contracted educational investments.[31]

Immigration offers the most direct and flexible means for a small economy to transform its domestic labor supply conditions in order to facilitate particular lines of economic expansion. The evident intention of the foregoing proposals is to place in the hands of the government another (fiscal) tool that could encourage a rapid inflow of migrants, thereby not only raising the average human capital endowment of the working age population, but doing so in a controlled and selectively targeted manner.

What of the drawbacks? It is likely that a country which extended its UIBEDA scheme to encourage selective immigration and repatriation would be accused of engaging in a "beggar thy neighbor" tax policy. If successful, it would be seen as inducing "brain drains" from other regions. Nevertheless, it is important to distinguish the present idea from the broad class of "industrial policies" and "commercial policies" that are more properly labeled "protectionist" and detrimental to global economic welfare. Tariffs and subsidies for domestic producers are instruments of national economic policy that give rise to both local and global inefficiencies. But, by contrast the removal of differential taxation that is discouraging to individual investment in human capital works to improve the allocation of resources in the economy that implements the reform.

As is the case with protective tariffs and strategic trade policies more generally, extension of the UIBEDA scheme's benefits to cover immigrants could provoke retaliation from other countries – especially those who perceived themselves to be losing the services of their highly trained and uncommonly productive workers.[32] Retaliation in kind would seek to neutralize the effects of the external reform by removing the disability that their own tax regime placed upon human capital investments and possibly including coverage for immigrants. Unlike retaliatory protectionism, however, the result of generalized reaction of this sort would make capital markets function more inefficiently in the long run -- both intra- and internationally. It is true that the benefits to the initiating reformer(s) eventually would be dissipated as a result of the global response. That, however, is not an argument against implementing the proposed reform in the first place; indeed, if the threat of retaliation carries any implications for policy, it would seem to argue for moving quickly to introduce the UIBEDA and thereby realize the "first mover" advantages that a small, open economy would obtain under the scheme.

6. Concluding observations on issues of implementation

For such a program to be effective it is essential that its statutory provisions should clearly prevent subsequent alterations (whether by executive or legislative action) in the obligations of the government as those are defined by the terms of established UIBEDA holdings.

Apart from the necessarily variable current government nominal borrowing rate that sets the yield on deduction credits, the terms of individual UIBEDAs ought to remain fixed throughout the life of these accounts. Of course, establishing a reasonable measure of "credible commitment" on this issue would not require binding future governments to leave tax rates unaltered, or rule out changes in expenditure eligibility provisions that applied in the cases of new entrants to the system.

Conceptually, what is appropriate is to render the assets formed within each UIBEDA as secure from the risk of default as are the government's debt instruments. Domestic inflation is a form of "constructive default" on the part of the state, the risk of which would (or should) be a concern for those being encouraged to acquire the new species of public obligation represented by the UIBEDA. In view of the fact that the great bulk of these obligations will held by tax-paying residents, this issue can readily be addressed by fixing the *real* yield on deductions credited to these accounts, and linking the nominal value of the latter to the domestic consumer price index. There would be no need to provide separate protection against the risk of depreciation in the country's currency *vis-à-vis* other currencies.

The problem of establishing the credibility of the government's commitment to the proposed program of tax reform can be approached from another direction, by taking note of a feature of the UIBEDA scheme that would have the effect of rendering its adoption less readily reversible. Once in place, it would complement policies of replacing direct subsidies for higher education expenditures with regime of financing based on a mixture of (publicly guaranteed) loans and (means tested) grants to needy students. That is a transition which many high-income countries will find themselves having to undertake as they seek to raise the proportion of secondary school-leavers who go on to university.[33] Once "all but free tuition" and maintenance allowances for all but university students from low-income families had been withdrawn, and replaced by government guaranteed education loans, the benefits promised under of the UIBEDA scheme would become quite difficult for a representative government to abrogate or significantly curtail without inciting middle-class outrage and retaliation at the polls.

Plainly, one intention underlying the proposal to introduce UIBEDA-like reforms in the context of developing economies is to create a future material "opportunity" that would not only transform popular attitudes about the value of undertaking investment in the further education of secondary school-leavers and university graduates, but would tend to promote a more general attitudinal change. Governmental commitment to these modest fiscal reforms could go some way towards fostering a greater awareness of the palpable benefits that individuals and their families could anticipate deriving by embracing the more general cultural and psychological orientation that is associated commonly with deferral of gratification and personal commitments to forward planning touching many aspects of human life.

References

Auerbach, Alan-J. and Laurence J. Kotlikoff (1987), *Dynamic Fiscal Policy*, Cambridge: Cambridge University Press.

Bassanini, Andrea and Stefano Scarpetta (2001), "Does human capital matter for growth in OECD countries?: Evidence from pooled mean-group estimates," OECD Economics Department Working Paper No.282. ECO/WKP(2001)8, 31January.

Bassanini, Andrea Stefano Scarpetta and Phillip Hemmings (2001), "Economic Growth: The role of Policies and Institutions," OECD Economics Department Working Paper, (ECO/WKP(2001) 9 31 January.

Bhagwati, Jagdish and John D. Wilson (1989), *Income Taxation and International Mobility*, Cambridge, Mass.: MIT Press.

Boskin, Michael J. (1977), "Notes on the Tax Treatment of Human Capital," in U.S. Department of Treasury Office of Tax Analysis, *Conference on Tax Research, 1975*. Washington D.C.: U.S. GPO, pages 185-95.

Cameron, Steven. and James J. Heckman (1998), "Life Cycle Schooling and Dynamic Selection Bias: Models and Evidence for Five Cohorts of American Males," Journal of Political Economy, 106(2), 262-333.

Carneiro, Pedro and James J. Heckman (2002), "The Evidence on Credit Constraints in Post-Secondary Schooling," The Economic Journal, 112 (October), 1-29.

Carniero, J. J. Heckman and D. Manoli (2002), "Human Capital Policy," Department of Economics Working Paper, University of Chicago, July.

David**,** Paul A., with John Gabriel Goddard **[**Lopez**]** (2001), **"**Knowledge, Capabilities and Human Capital Formation in Economic Growth," *New Zealand Treasury Working Paper, no. 13* (June), 2001, 143pp. Available in pdf format at: www.treasury.govt.nz/workingpapers/2001.

Davies, James and John Whalley (1991), "Taxes and Capital Formation: How Important Is Human Capital?," in B. Douglas Bernheim and John B. Shoven (eds.), *National Saving and Economic Performance*, Chicago: University of Chicago Press (for NBER), pages 163-200.

Diamond, Peter and James A. Mirrlees (1971), "Optimal Taxation and Public Production: I, and II," *American Economic Review*, vol. 61 (1 and 3, respectively), pages 8-27, 261-278.

Dupor, Bill, Lance Lochner, Christopher Taber and Mary Beth Witteking (1996), "Some Effects of Taxes on Schooling and Training," *American Economic Review*, vol. 86 (1), pages 340-46.

Dupor, Bill, Lance Lochner, Christopher Taber and Mary Beth Witteking (1996), "Some Effects of Taxes on Schooling and Training," *American Economic Review*, vol. 86 (1), pages 340-46.

Eaton, Jonathan and Harvey S. Rosen (1980), "Taxation, Human Capital and Uncertainty," *American Economic Review*, vol. 70 (4), pages 705-15.

Goddard, J. Gabriel (2000), "The Conditions of Entrepreneurship: Non-verifiable Human Capital, Endogenous Technological Opportunities, and Financial Institutions," University of Oxford, mimeo.

Heckman, James J. (1976), "Estimates of a Human Capital Production Function Embedded in a Life-Cycle Model of Labor Supply," in Nestor E. Terleckyj (ed.), *Household Production and Consumption*, New York: Columbia University Press (for NBER), pages 227-264.

Heckman, James J., Lance Lochner, and Christopher Taber (1998), "Explaining Rising Wage Inequality: Explorations with a Dynamic General Equilibrium Model of Labor Earnings with Heterogeneous Agents," *Review of Economic Dynamics*, vol. 1 (1), pages 1-58.

Heckman, James J., Jeffrey A. Smith and Rebecca R. Roselius (1994), "U.S. Education and Training Policy: A Re-evaluation of the Underlying Assumptions Behind the 'New Consensus'," in Lewis C. Solomon and Alec R. Levenson (eds.), *Labor Markets, Employment Policy, and Job Creation*, Boulder, CO: Westview, pages 83-121.

Judd, Kenneth L. (1998), "Taxes, Uncertainty and Human Capital," *American Economic Review*, vol. 88 (2), pages 289-92.

Kaplow, Louis (1996), "On the Divergence between "Ideal" and Conventional Income-Tax Treatment of Human Capital," *American Economic Review*, vol. 86 (2), pages 347-52.

Orfield, G. (1992), "Money, Equity and College Access," Harvard Educational Review, 2(3), 337-372.

Steuerle, C. Eugene (1996), "How Should Government Allocate Subsidies for Human Capital?," *American Economic Review*, vol. 86 (1), pages 353-57.

Stark, Oded, Christian Helmenstein, Alexia Prskawetz (1997), "A Brain Gain with a Brain Drain," *Economics Letters*, vol. 55 (2), pages 227-34.

Stark, Oded and Yong Wang (2000), "Inducing Human Capital Formation: Migration as a Substitute for Subsidies," University of Oslo, Economics Department Working Paper. November.

Trostel, Philip A. (1993), "The Effects of Taxation on Human Capital," *Journal of Political Economy*, vol. 101 (2), pages 327-50.

World Bank (1995), *World Development Report 1995*, New York: Oxford University Press.

ACKNOWLEDGEMENTS

My initial thinking about this subject was clarified in conversations about it with Kenneth Judd, Ronald McKinnon and James Poterba, at Stanford during the Fall of 2000. I am grateful to have had the benefit of Murray Shadbolt's penetrating comments on an earlier draft (circulated under the title "*UIBEDA* -- A Modest Proposal for Reforming the Tax Treatment of Intangible Human Capital Investments.") Peter Temin also made very useful suggestions for improving the exposition, and James Heckman's comments drew my attention to important recent econometric evidence bearing upon human capital policy. The final draft has benefited from the editorial advice of Ravi Kanbur and comments by an anonymous reviewer. None of the people who I have the pleasure of thanking here necessarily subscribe to the tax reform proposal advanced in this essay, nor should they be held responsible for failing to correct such deficiencies as it may be found to contain.

ENDNOTES

[1] David and Goddard, (2001: sect. II (2)), provides an extensive review of the theoretical and empirical economics literature relating to these propositions, including material from historical studies. See Bassanini and Scarpetta (2001) for a recent study of the OECD countries that finds recent econometric support for the asserted impact of human capital formation on economic growth during the second half of the 20th century. For a related discussion of the links between policy settings, institutions and economic growth in 21 OECD countries over the period 1971-1998, based on a survey of recent economics journal publications, descriptive quantitative material and cross-country time-series regression analyses, see Bassanini, Scarpetta and Hemmings (2001).

[2] See, e.g., Judd 1998; Steuerle 1996.

[3] See Kaplow (1996). Under accrual accounting the returns from investment are included in current income; the costs of the asset are capitalized (not immediately expensed) and depreciated at a rate reflecting its "economic service life", i.e., the temporal change in the present value of the remaining stream of returns; current depreciation charges are set against current income. Were accrual income taxes to be applied to human capital, the effect would be less favorable to investment in education and training than the conventional income tax regime. The reason is that such investments tilt the time-profile of earnings upwards, and conventional income taxes do not impose additional taxes on the implicit interest component of higher later returns – whereas an accrual income system would do so.

[4] See, e.g., Boskin 1977, Davies and Whalley 1991, Trostel 1993, Dupor et al., 1996, Heckman, Lochner and Taber 1998, Judd 1998.

[5] Furthermore, for the sake of consistency and completeness, the central tax authority should allow individuals to deduct from taxable income any mandatory community tax payments that were devoted to local public education and training

activities. The latter step would preserve neutrality in the tax treatment of privately vs. publicly provided educational services.

[6] Physical capital goods purchased by businesses cannot be fully "expensed", i.e., set off against earnings by firms that pay corporate income taxes; instead, most national and local tax codes allow depreciation charges on these durables to be deducted from gross earnings.

[7] Both features of the proposed reform are mimicked by the less sweeping proposal to shift to a "flat tax" on wage income, with full deductibility of human capital costs.

[8] In the first case the tax bias tends to promote rapid turnover of elements of the tangible capital stock that embody recent technological innovations; in the second case the tax bias works to compensate for the greater systematic obsolescence risks to which owners of human capital are exposed by policies that promote more rapid rates of advance of fundamental knowledge and technological progress.

[9] By comparison, the option of sheltering pension contributions (with equal pre-taxes rates of return) is a more attractive vehicle for personal savings, pension proceeds -- unlike the returns from educational investments -- typically are realized (during retirement) when earned income levels and marginal rates of income taxation are expected to be lower.

[10] The paradigmatic approach to the problem (following Heckman 1976) postulates that individuals make educational investment decisions within the framework of a model of inter-temporal expected utility maximization, subject to the constraints of a human capital production function and private borrowing in perfect (financial) capital markets. Dupor et al. 1996, for example, econometrically estimate the parameters of a life-cycle human capital investment model of US white males (based upon synthetic cohort data for various educational attainment groups in the 1970 Census), and use these to simulate the effects of various tax regimes.

[11] In other words, the (arc-) elasticity of education and training investment with respect to the marginal tax rate is roughly – 1.5.

[12] This proposition is brought out in the work of Auerbach and Kotlikoff 1987, Davies and Whaley 1991, Heckman, Lochner and Taber 1998, and Trostel 1993.

[13] Consequently, as Trostel (1993) shows, the after-tax interest rate in the economy's steady-state equilibrium need not be raised by removing taxes on human capital investment.

[14] Although this may achieve the purpose of augmenting the stock of human capital in the receiving country, it would do so without stimulating additional investment in education and training among the pre-existing population – except indirectly, under some special conditions. Indeed, if immigrants who have been educated abroad bring capabilities that render them substitutes rather than complements for domestically trained members of the workforce, it is conceivable that an unrestricted inflow from overseas will so alter domestic labor supply conditions as to depress the demand for "in-country" training. See Section 6 below for further discussion.

[15] Further, it may be noted that where local tax authorities subsidize educational and vocational training programs and use local excise and property taxes for that purpose, and where all such taxes are not already treated as deductible under the national tax code,

that fraction of local tax rates attributable to the subsidies (as announced by local authorities) could be used by households to calculate an allowable deduction.

[16] If the tax-benefits derived were to be significantly separated from the size of the incremental earnings power created by the "deductible expenses," a serious problem of moral hazard would arise: there would be little incentive for "educational investors" seeking to tax-shelter future (other) income to care about the efficacy of the educational/training services they purchased.

[17] As described thus far these deductions would start no sooner than year T_1, and end no later than T_2 after the account was first established; the entire value of the account would have to be liquidated by exercising deduction claims (in equal amounts) spread over the N consecutive years, where $N = T_2 - T_1$. Individuals would be free to privately insure against the risks of disability or other sources of taxable personal income losses during the N years when their UIBEDA was being liquidated.

[18] Or enable it to satisfy an inter-temporal balanced budget constraint, a requirement that is considered in Section 4.

[19] Following the notation in footnote 9, the surrender date must satisfy the restrictions: $T_1 \leq T \leq (T + M) \leq T_2$.

[20] As will be seen in Section 4 (below), the viability of the scheme from the Treasury's standpoint will depend upon the gross pre-tax rate of incremental earnings growth from educational investments being expected to maintain a long-term yield rate that exceeds the yield on long-term government borrowing. Otherwise, the scheme becomes a (low) minimum yield guarantee for private investments in human capital formation.

[21] More will be said on this matter, below.

[22] This view has emerged from the findings reported by Cameron and Heckman (1998), Carneiro and Heckman (2002), Carneiro, Heckman and Manoli (2002). They report that short-run credit constraints are binding in the case of only 4 percent of the male population.

[23] Or, in the case of appreciating assets, provide collateral for additional borrowing in future emergency circumstances. Systematic evidence on "the willingness to borrow" is lacking. Britain, however, the fear among low income students and their families of having accumulated substantial debt upon graduation is widely accepted as a constraint on the restructuring higher education finances. This reluctance to make use of existing student loan programs is cited in connection with the observation that the Labour government's withdrawal of student maintenance grants and the introduction of modest fees in 2000 was followed by a decline in the proportion of university enrolments comprised of students from low-income families. As a consequence, favorable consideration presently is being given by the Treasury to provide "higher education maintenance allowances" (HEMA's) on a means-tested basis to students in the 16-18 age range who remained in full time (secondary) education, and to university student in the 18 plus age range. For many students whose parental family incomes fall in the range below £30,000, the contemplated MEMA would cover the present university fees. See, e.g., "Grants may be restored for poorer students," *The Guardian*, 9 August 2002, p.2

[24] Carneiro and Heckman (2002) cite Orfield's (1992) findings that students who are eligible for Pell Grants and Perkins Loans do not claim support from those sources.

Various explanations have been suggested, ranging from the complexity of the applications process to the view that students from low-income families anticipate low (risk adjusted) rates of return that simply do not justify the investment of the opportunity costs of college attendance. See Carneiro, Heckman and Manoli (2002) for further discussion.

[25] See Cameron and Heckman 1998, and Carniero, Heckman and Manoli (2002).

[26] See, e.g., David and Goddard (2001) for a synthetic review of the literature on this theme; Carneiro, Heckman and Manoli (2002: p. 69) sum up the same point succinctly: "Learning begets learning because of dynamic complementarities."

[27] See, e.g., Bhagwati and Wilson 1989; World Bank 1995.

[28] Thus, the *World Development Report* (World Bank, 1995, p. 64) asks: "Can something be done to stop the exodus of trained workers from poorer countries?"

[29] See, e.g., Stark, Helmenstein, and Prskawetz (1997) ; Stark and Wang (2000).

[30] Given the parameters of the calculations in Sections 3 and 4, it can be seen that for individuals in the age range between 35 and 45, the relocation costs of repatriation otherwise would become a disincentive which firms in the home region would have to overcome in order to repatriate them.

[31] In effect, immigrants with "approved" educational credentials could be made eligible (upon entering domestic employment) to receive educational loans in the amount of their pre-existing indebtedness on the same terms as are available to residents, provided those funds are applied to extinguish their previously incurred debts. Upon doing so, the full amount of such outlays could be made the basis on which UIBEDA credits would be accumulated. A more cautious approach might be adopted, in order to increase the probability that the re-financing loans would be repaid: UIBEDA credits would be granted only upon production of evidence of actual domestic loan repayments. In principle, such a scheme could be implemented using private lenders for the re-financing activity, with some government guarantees to keep interest rates at the same level as those being offered to domestic students.

[32] Other nations might chose an alternative strategic response to an externally induced "brain drain": curtailing the freedom of its population to work abroad. This, however, is completely analogous to blocking the outward movement of financial capital, and, *as a long-run policy* it, too, would be injurious to the economic interests of the population.

[33] This issue currently confronts the UK, where the university continuation rate among secondary school leavers has risen to a bit over 42 percent and the Labour government has announced 50 percent as the target rate to be reached by 2010. The latter will still fall well below current US levels. Indeed, the US the college participation rate fluctuated in the 40-52 percent range over the course of the whole 1970-98 period even for male high school completers (ages 18-24) whose parental families occupied the *bottom quartile* of the family income distribution. The corresponding participation rates for the top half of the family income distribution ranged from 61 to 81 percent. (See Caniero and Heckman 2002: Figure 1). At present the Labour government in Britain finds itself trying to cope with the legacy of the fiscally reckless but politically adroit Conservative Party initiatives begun in the 1980s, which set in motion the rise in university enrolment rates without providing proportionate incremental funding for

higher education from general tax revenues. As a consequence, public funding for higher education per student per university student declined by roughly 40 percent since the late 1970's. See, e.g., "Higher education for all: the missing ingredient is a graduate tax," *The Guardian*, 9 August, 2002: p. 19.