NBER WORKING PAPER SERIES

TAX NEUTRALITY AND INTANGIBLE CAPITAL

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Working Paper No. 2430

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 1987

This paper is for the NBER conference on Tax Policy and the Economy held in Washington, DC on November 17, 1987. We would like to thank Harry Grubert, Yolanda Henderson, Jon Skinner, and Lawrence Summers for helpful comments. The research reported here is part of the NBER's research program in Taxation. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

Many studies measure capital stocks and effective tax rates for different industries, but they consider only tangible assets such as equipment, structures, inventories, and land. Some of these studies also have estimated that the welfare cost of tax differences among these assets under prior law is about $10 billion per year or 13 percent of all corporate income tax revenue. Since the investment tax credit was available only for equipment, its repeal raises the effective rate of taxation of equipment toward that of other assets and virtually eliminates this welfare cost.

However, firms also own intangible assets such as trademarks, copyrights, patents, a good reputation, or general production expertise. This paper provides alternative measures of the intangible capital stock, and it investigates implications for distortions caused by taxes. The existence of intangible capital markedly alters welfare cost calculations. Investments in advertising and R&D are expensed, so the effective rate of tax on these assets is less than that on equipment under prior law. With large differences between these assets and other tangible assets, we find that the welfare cost measure under prior law increases to $13 billion per year. Repeal of the investment credit taxes equipment more like other tangible assets but <u>less</u> like intangible assets. The welfare cost still falls, to about $7 billion per year, but it is no longer "virtually eliminated." With additional sources of intangible capital, credit repeal could actually increase welfare costs. Finally, however, the Tax Reform Act of 1986 not only repeals the investment tax credit but reduces rates as well. Efficiency always increases in this model because the taxation of tangible assets is reduced toward that of intangible assets.

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Before the Tax Reform Act of 1986, the investment tax credit was viewed as favoring equipment-intensive industries such as those in manufacturing. The standard view was that nonmanufacturing industries were disadvantaged by receiving a relatively low portion of tax credits for equipment. Measured effective tax rates were often high for nonmanufacturing industries, and a major focus of tax reform was an attempt to "level the playing field" by repealing the investment tax credit. Not surprisingly, perhaps, "the legislation was opposed by the Chamber of Commerce of the U.S.A., the National Association of Manufacturers, ... and a long roster of representatives of corporate America" (Birnbaum and Murray, 1987, p. 161).

However, this standard view ignores intangible capital such as trademarks, copyrights, patents, or a good reputation. Firms invest in these assets through advertising, research and development, and other expenses that create future goodwill and know-how essential for profitable future production. These expenses are deducted immediately rather than capitalized and amortized over the life of the intangible asset. Thus firms' accounting for tax and book income may overstate expenses and understate profits. If so, measured effective tax rates would be overstated for firms with a relatively intensive use of intangible capital. Many of these firms had little to lose from repeal of the investment tax credit and would naturally favor rate reduction: their intangible investments were already written-off at the earlier high statutory rate and would generate subsequent income to be taxed at the new low rate. In fact, tax reform was favored by "such powerhouse companies as General Motors, IBM, and Procter and Gamble" (Birnbaum and Murray, 1987, p. 161). Later in this paper we measure intangible capital and find that its ratio to total capital is highest in transportation equipment and ordnance, second in motor vehicles (including General Motors), third in finance and insurance, fourth in chemicals and rubber (including Procter and Gamble), and fifth in machinery (including IBM).

Mismeasurement extends beyond the "average effective tax rate," or ratio of taxes paid to capital income. It also affects the "marginal effective tax rate" which expresses the future tax on a marginal investment as a fraction of the expected future income. Many studies have calculated these rates for tangible assets such as equipment, structures, land, and inventories, but they often omit intangible capital. If the statutory rate is constant, the marginal effective tax rate is zero on intangible capital because an immediate deduction for the outlay is equivalent in present value to exempting from tax all future income generated by the asset.

These marginal effective tax rates are often used to measure the economic cost of tax distortions and misallocations. In this paper, we calculate the "welfare cost", or the dollar cost of production inefficiency, attributable to tax differences among corporate assets. With only tangible assets such as equipment, structures, inventories, and land in the corporate sector, tax differences under the old law create welfare costs of about $10 billion per year, or 13 percent of federal and state corporate tax revenue. These results accord with existing estimates, where the major distortion is the low tax on equipment due to investment credits. This welfare cost is virtually eliminated by a reform that includes repeal of the investment tax credit.

The existence of intangible capital markedly alters welfare cost calculations because the effective rate of tax on these assets is even less than that on equipment under prior law. We provide alternative measures of the intangible capital stock. With large tax differences between intangible assets and other assets, using our basic measure of intangible capital, we find that the welfare cost measure increases from $10 billion to $13 billion per year. As pointed out by Summers (1987), repeal of the investment credit taxes equipment more like other tangible assets but <u>less</u> like intangible assets. The welfare cost still falls, to about $7 billion per year, but it is no longer "virtually eliminated." Our basic estimate of intangible capital is constructed by considering only advertising and R&D expenditures. With additional sources of intangible capital, credit repeal could actually increase welfare costs.

Finally, we note that the Tax Reform Act of 1986 also reduced the statutory corporate rate that applies to tangible assets. That is, it does not just raise the tax on equipment (away from intangibles), it also reduces the tax on other tangibles (towards intangibles). With our basic measure of intangible capital, the efficiency cost falls from $13 billion per year under the old law to $4 billion per year under the new law. No amount of increase in the stock of intangible capital in this model reverses the finding that the Tax Reform Act reduces interasset distortions.

This finding does not mean that the new law is perfectly efficient. There remain tax advantages to investment in advertising, research and development, and other intangible capital. The subsidy to R&D might be justified by the existence of "external spillover benefits": the firm may not receive all of the returns to its discoveries and therefore may not have sufficient incentive to undertake research. Calculations below show the efficiency-improving nature of the subsidy in the presence of such an externality. It is more difficult to justify the advantage to advertising, however. Calculations with a reduction of this benefit show the greatest efficiency gain of all.

The rest of this paper proceeds as follows. The first section shows how average and marginal effective tax rates are affected by the existence of intangible capital. The second section discusses the nature of intangible capital and the procedures we use to measure it. Tables show the relative use of each type of tangible and intangible capital in each industry. The third section further discusses the tax treatment of tangible and intangible capital, while specifics of our tax and efficiency cost calculations are relegated to an appendix. The fourth section reports results of our efficiency cost calculations, and a final section summarizes our findings with concluding remarks.

1. Effective Tax Rates and Intangible Capital

Much of the discussion about tax differences revolves around measures of effective tax rates that take the ratio of taxes paid to capital income in each industry. This "average" effective tax rate has been used by many to identify high-taxed and low-taxed sectors of the economy. For other applications, such as measuring the effect of taxes on investment incentives, this measure suffers from a number of problems. First, as an aggregate measure, it cannot distinguish the taxation of income earned from the various types of assets in which firms invest. Second, it looks backward at the taxes paid in a given year, rather than forward at the taxes that would be paid on the future income generated by a new investment under consideration in that year. Fullerton (1984) describes many reasons that the two concepts would differ.

For these reasons, many choose to characterize tax differences by the cost of capital or "marginal" effective tax rate. This rate can be calculated for each asset, and it compares the present value of taxes expected to be paid over the life of a given investment with the gross income expected to be generated. It is a "marginal" effective tax rate because it is calculated for an investment that is expected to yield a return just equal to the cost of funds.

Here, however, we would like to emphasize that past measures of <u>both</u> average and marginal effective tax rates often do not account for intangible capital and thus mischaracterize tax differences across industries. An industry that makes extensive use of intangible capital may pay a tax that is relatively low, even though past reported measures of average or marginal effective tax rates have been characterized as relatively high.

The key feature of intangible capital is that firms can expense it. In accordance with generally accepted accounting practices, advertising and R&D expenses are deducted immediately, for both book and tax purposes. If the firm is growing, the deduction for current investments in advertising and R&D is larger than a deduction for economic depreciation of existing intangible assets. Thus expenses are overstated, profits are understated,[1] and the ratio of taxes to profits is overstated. This is the mismeasurement mentioned above: average effective tax rates may not have been so high in industries receiving the tax advantages of expensing intangible investments.

Because an immediate deduction for the initial expenditure on intangible capital is equivalent to exempting the entire income stream from the investment, the marginal effective tax rate of intangible capital is zero. If industries differ in their relative use of intangible capital, comparisons of marginal effective tax rates that excluded the taxation of intangible capital may be misleading.

An example using actual tax data may help demonstrate the tax advantage of expensing intangible capital and the mismeasurement of tax rates. In 1983, corporations in the chemical and rubber industry had taxable income after deductions of $15.9 million.[2] The tax liability of this industry after the use of tax credits was $3.15 million. The ratio of taxes paid to taxable income is 19.8 percent.

Using data described later in this paper, we calculate that firms in this industry spent $15.5 million in advertising and R&D in 1983. Taxable income before the expensing of these intangible investments is therefore $31.4 million ($15.9 million plus $15.5 million). To measure economic income, however, firms should be allowed a deduction for the depreciation of

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[1] While the amount of profit is understated, profit rates are likely to be overstated if capital in the denominator excludes intangible capital.

[2] All tax and income data are from the Internal Revenue Service, Statistics of Income - 1983, Corporate Income Tax Returns. The construction of our data on intangible capital expenditures is described in section 2.

the existing stock of intangible capital. We calculate that total economic depreciation of advertising and R&D capital in this industry is $13.4 million. Subtracting this amount from the $31.4 million yields taxable income equal to $18.0 million. Actual taxes paid as a fraction of this income is 17.5 percent, about 10 percent less than without this correction. Thus previously reported effective tax rates were overstated.

Finally, if firms in this industry were required to deduct only economic depreciation of advertising and R&D capital, tax payments at a 46 percent statutory tax rate would have been nearly $1.0 million higher, or 22.9 percent of the restated taxable income. As shown in this example, some industries may receive a significant tax advantage from the expensing of these intangible investments.

2. The Measurement of Intangible Capital

Conceptually, the firm's stock of intangible capital includes its patents, trademarks, copyrights, customer lists, reputation, and any firm-specific knowledge about technology, marketing, or production. These assets may be specific to the firm and difficult to sell in the market, but they are assets nonetheless. They wear out or become obsolete just like other assets, requiring reinvestment to maintain their stock. While the return to any particular investment may be uncertain, in the aggregate these investments must be expected to generate a viable rate of return since they utilize funds that could have been profitably invested elsewhere.

For many assets, value can be measured using data from market transactions, but intangible assets are rarely bought and sold. For total tangible assets in the national accounts, the Commerce Department and others measure capital by the "perpetual inventory" method. Starting with a time series on investment in equipment, for example, and using assumptions about economic depreciation, this procedure simply starts with the earliest available year, adds investment, subtracts depreciation, accounts for inflation, and repeats for successive years up through the most recently available year.

The same procedure can be followed for intangible capital, once the proper investment series and rate of depreciation are established. Time series data are available for advertising and R&D, but not all of these expenditures generate future income. Much advertising information is used by customers immediately, and much research may never pay off. In fact, for a given firm, expenditures on R&D may bear little relation to intangible capital: small R&D in one firm may lead to dramatic scientific discoveries, while much R&D in another firm may not. Firms likely invest in R&D until the expense is matched by the <u>expected</u> future value of the intangible asset, however, so the aggregation of many firms in the economy or even within one industry may provide a good correspondence between R&D expenditures and subsequent intangible capital.

Some previous research has been directed toward measuring intangible capital. Much of this literature relates to prior claims that industries with high rates of return must have entry barriers and monopoly profits. When measures of intangible capital were added to the denominator of each industry's rate of return, there was much less variation. Clarkson (1977), for example, uses time series on advertising and R&D expenses from a sample of 69 firms representing 11 manufacturing industries. For depreciation, he cites various studies that "indicate that the economic life of advertising capital ranges from less than one year in one industry to more than ten years in some ..." (p. 41), whereas "estimates of the average life cycle of a pharmaceutical product, including research and development time, range from twenty to thirty years" (p. 43). He chooses to assume three-year straight line depreciation for advertising; basic research expenditures are assumed to last for periods of 18 to 21 years, and development expenditures last for 13 to 16 years. Sensitivity analyses on alternative assumptions do not substantially affect his major conclusion, namely, that proper measurement reduces the variation of rates of return among industries. Grabowski and Mueller (1978) use a questionaire study concerning mean R&D project durations and R&D output lifespans. They assign each of the 86 firms in their sample to one of 9 manufacturing industries and find that "a depreciation rate of 10 percent would be a plausible starting point for all of our industries except pharmaceuticals" (p. 334). They cite other studies showing faster depreciation of advertising, so they use a 30 percent rate of depreciation for that type of capital.

Our own procedure is as follows. First, we want comprehensive measures of advertising and R&D, not just for some firms or just for manufacturing industries. We take advertising data from annual issues of the Statistics of Income <u>Corporate Income Tax Returns</u>, published by the Internal Revenue Service of the Treasury Department. This source provides corporate advertising deductions taken by disaggregated manufacturing and nonmanufacturing industries. From this source, we construct a time series on corporate advertising investment in each industry for the period 1977-1983.[3]

Second, for R&D expenditures, we use annual issues of Research and Development in Industry, published by the National Science Foundation. We separate the R&D expenditures in each industry into corporate and noncorporate components, which we assume to be allocated in proportion to the tangible capital stock in each sector for each industry. Although the data are provided with sufficient breakdown among manufacturing industries, we are forced to allocate a single relatively small figure for the nonmanufacturing sector among several nonmanufacturing industries using IRS data on the distribution of R&D credits. At this point, we construct a time series on corporate R&D in each industry for the period 1963-1983.

Third, to account for each type of intangible capital at the beginning of the time series, we (a) measure the rate of growth of investment in the asset in each industry during the time period, (b) assume that prior investment grew at the same rate, and (c) construct an infinite series for prior investment.

Finally, we construct a measure of the stock of each intangible asset as of the end of 1983 in a manner similar to the perpetual inventory method used by the Commerce Department for tangible capital. Thus the stock for year-end 1983 includes investment in 1983 with a half year's depreciation and inflation, 1982 investment with 1.5 years of depreciation and inflation,

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[3] Because of high rates of depreciation assumed for advertising, it is not necessary to collect more years of data. We include constructed estimates for investment in advertising before 1977, as discussed below, but these depreciated investments comprise a very small fraction of the 1983 stocks.

and similarly for earlier years. We undertake considerable sensitivity analysis on annual rates of depreciation. For advertising, we use rates of one-sixth, one-third, and one-half. For R&D, the rates are .10, .15, and .20. Our central estimates are one-third for advertising and .15 for R&D.

Measured stocks of intangible capital are shown in Table 1, where the central depreciation choices imply $165 billion of advertising capital, $305 billion of R&D capital, and $470 billion of total intangible capital. This total could be as low as $330 billion with the high depreciation assumptions or as high as $775 billion with the low depreciation assumptions. Under any assumptions, the largest amount of advertising capital is in wholesale and retail trade, followed by food and tobacco, metals and machinery, chemicals and rubber, and finance and insurance. The most R&D is in our large metals and machinery industry, followed by transportation equipment (including ordnance), chemicals and rubber (including drugs), and motor vehicles.

More important to each industry, however, is the relative use of different capital types. Thus we need measures of tangible capital types used in each industry, and we need to combine several data sources. The Commerce Department's Survey of Current Business provides equipment and structures by industry, but not land and inventories. The Federal Reserve Board's Balance Sheets of the U.S. Economy provides inventories and land, but only in total. Unpublished data of Jorgenson and Sullivan (1981) provide each asset by industry, but only for 1977. We therefore adjusted the 1977 matrix until it matched appropriate totals for 1983. These data are very similar to the tangible capital data used in earlier efficiency cost calculations by Gravelle (1982), Auerbach (1983), and Fullerton and Henderson (1986).

In Table 2, we show the ratio of each type of capital to total capital in each industry. The most advertising-intensive industry is finance and insurance, followed by food and tobacco. The trade industry falls in this relative ranking because it uses large amounts of other assets, particularly inventories; finance and insurance rises in this ranking because it uses small amounts of other tangible assets. The most R&D-intensive industry by far is transportation equipment, followed by motor vehicles. Metals and machinery had the highest absolute amount of R&D capital, but is third in this ranking of relative intensity. It is followed by chemicals and rubber.

This measure of intangible capital constitutes about 11 percent of the total capital stock. With extreme assumptions about depreciation rates, this figure could almost double. The problem of setting depreciation rates is modest, however, compared to the problem that advertising (as reported to the IRS) and R&D expenditures may only account for a small part of total investment in intangible capital. First, much of what one considers advertising may be deductible as another allowable business expense. For example, a company that hires a consultant to mount an advertising campaign could properly deduct this expense as a consultant fee rather than as advertising. The costs of consumer relations divisions and sales personnel are deductible largely as wages. Second, firms may take less direct methods to create intangible capital. While advertising is one way to create a reputation, a new firm may sell at lower margins or take greater care in production or customer service as an alternative way to create intangible capital.[4] Here, foregone profits is the mechanism by which the firm invests in future reputation. Firms also invest in the future productivity of their labor force through recruiting and training. Our basic measure of intangible capital is probably an understatement of the total intangible capital stock.

There are no appropriate time series data for the amounts of all such investment, so the perpetual inventory method can never be comprehensive. In related research, we are investigating alternative methods of measuring intangible capital. One method would reverse the logic of above-mentioned attempts to measure variations in the return to properly measured capital: assume instead an equilibrium where all types of capital must earn the same net rate of return. For each industry, we can then divide total net income by the assumed net rate of return to derive the total capital stock, and subtract estimates of tangible capital to get the implied intangible capital stock. Problems include measuring capital income, choosing a rate of return, and accounting for risk differentials.

A second possible method would take the total valuation of capital in the stock market and subtract tangible capital. Problems here include transitory influences and correction for taxes. In fact, the market value of the capital stock divided by its replacement cost is "q", a ratio that is expected to depend on taxes and to influence investment. It is typically measured by market value over tangible capital stock, however, a ratio that

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[4] If consumers have full information about the quality of the product, then extra production costs may not create intangible capital. It may take time, however, for consumers to recognize quality and recommend the product.

might exceed one if shareholders value intangible capital. Lindenberg and Ross (1981) found that average q was 1.5 over the period 1960-1977 for a large sample of firms. If the entire difference between the firms' market value and the replacement value of their tangible capital stock is attributable to intangible capital, then intangible capital could be as large as one-third of the total capital stock. Further, time series estimates of the effects of taxation on investment using q, such as those in Summers (1981), could be misleading if intangible investments are not just a constant fraction of tangible investments used in the estimation. Even more likely is that intangible capital is not a constant fraction of tangible capital across industries. Thus estimated q would be expected to differ among industries for more than tax reasons.

This other work is not complete, but a simple calculation reveals the possible importance of intangible capital. Feldstein, Dicks-Mireaux, and Poterba (1983) indicate that net capital income divided by tangible capital varies between about 3 and 4 percent. If the properly measured net rate of return were only 2 percent, for example, then the stock of intangibles would be one-third to one-half of the total capital stock. This is four to eight times the estimate of intangible capital from the perpetual inventory method.

As a rough approximation, suppose that this total intangible capital appears in different industries in proportion to the advertising and R&D capital estimated above. We can then represent the possibility of greater intangible capital by simply multiplying the basic estimates by integers from one to eight, or more. We show how efficiency cost estimates depend on the quantity of intangible capital.

3. Tax Distortions and Efficiency Costs

To measure the efficiency cost of tax distortions, we use the cost of capital or marginal effective tax rate in this paper. First, we assume certain conditions about the future environment for marginal investments currently under consideration. In particular, we assume that all investments will earn a risk-free nominal after-tax return of 8.5 percent, that inflation will run at 4 percent, and that firms face a set of tax rules including Federal and state statutory corporate tax rates, investment tax credit rates, depreciation allowances, and local property tax rates that may vary by asset. (See King and Fullerton (1984) for derivation of these parameters under prior law.) Second, we assume that firms will undertake all investments for which the present value of all net returns exceeds the outlay for the asset. They stop investing when the present value of net returns just equals the outlay. Third, this equality can be used to solve for the real pretax return on the marginal investment that just allows the firm to earn the assumed 8.5 percent net return (4.5 percent after inflation). The equation is shown in the Appendix. This required pretax return is the "cost of capital" net of depreciation, because it includes tax costs and financing costs (the required net return). Finally, the marginal effective tax rate is the difference between this real pretax return and the 4.5 percent real posttax return, as a fraction of the real pretax return.

Only the cost of capital is used in subsequent calculations, and it does not depend upon actual choices for financing the marginal investment. With arbitrage by the firm among various real and financial assets in this risk-free world, all assets would have to earn the same net return. For example, arbitrage between debt and real capital assures that any asset must earn the after-tax interest rate. All investments thus have the same assumed 4.5 percent real cost of funds, regardless of actual financing.[5] The effective tax rate, calculated only to help interpretations, is the fraction of the cost of capital that would be attributable to business taxes if the investment were financed by equity.

An advantage of this approach is that we do not have to deal with personal tax changes. Although increases in personal exemptions and reductions in personal rates were crucial components of tax reform, they do not relate in this model to the firm's choice among capital assets. Similarly, we abstract from other detailed aspects of tax law that are not directly related to this allocation decision, including passive loss rules, minimum tax, accounting provisions,[6] at-risk rules, bad-debt reserves,

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[5] In a different model, it is possible that financing proportions could affect the cost of capital. Bosworth (1985) and others have pointed out that structures might use relatively more debt finance and take greater advantage of interest deductions. Also, churning might have provided greater tax advantages to real estate, as discussed in Gordon, Hines, and Summers (1987). Other problems are discussed in Summers (1987).

[6] Fullerton, Gillette, and Mackie (1987) consider accounting rule changes and argue that (a) much of the revenue is from existing investment and does not apply to new investment, (b) some of the changes are best modelled as reduced output subsidies rather than reduced investment incentives, and (c) remaining changes have a small effect on marginal effective tax rates.

foreign tax provisions, and loss carryforwards.[7] To simplify further, we do not model the intricate R&D credit.[8] The model captures the important conceptual distinction that advertising and R&D are capital assets substantially favored under both old and new laws. These investments are still expensed, while other assets lose their investment tax credits or accelerated depreciation allowances.

The effective tax rate includes all business level taxes on the corporation. It would just equal the statutory rate (34 percent under present law) if there were no state taxes or property taxes and if cost recovery were based on economic depreciation at replacement cost. State and local taxes raise the effective rate, while the investment tax credit (a maximum 10 percent under prior law) and accelerated depreciation allowances lower it. With no local property tax on intangible capital, the effective rate is zero because an immediate deduction for the initial outlay is equivalent in present value to exempting the entire income stream. For other assets, we summarize complicated depreciation allowances in a single parameter for the exponential rate of tax depreciation. We report for all equipment and for all structures the annual rate of depreciation on

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[7] Any of these aspects may have some effect on our results. For example, Hulten and Robertson (1984) point out that start-up firms may invest relatively heavily in advertising or R&D but may be least able to expense these investments. Early losses mean that deductions must be carried forward and might be lost altogether.

[8] Incentive effects of the incremental R&D credit can be small, or even negative, depending on the circumstances of the firm. See Eisner, Albert, and Sullivan (1984). Details of the effects of tax reform on R&D are provided in Cordes, Watson, and Hauger (1987).

historical cost that would provide the same present value of allowances as the actual law.[9]

These tax parameters for present law, as provided by the Tax Reform Act of 1986 (TRA), are shown in Table 3 for our six assets. The exponential rate of economic depreciation for equipment is .13, derived by averaging over estimates in Hulten and Wykoff (1981) for twenty kinds of equipment. Comparison with the .38 exponential rate for tax depreciation indicates the degree of acceleration for equipment, but inflation erodes the real value of these allowances since they are based on historical cost. For structures, the average exponential rate of economic depreciation is .03, and the rate for tax depreciation on historical cost is .076. Inventories and land effectively receive economic depreciation allowances, since they do not depreciate and do not get deductions. Effective tax rates for these two assets would match the .383 combined Federal and state statutory rate, except that local property taxes push them up to 44 and 47 percent, respectively. The effective rate for structures is 44 percent. The effective tax rate for equipment is 38 percent, which indicates that tax depreciation is a little more generous than economic depreciation at an inflation rate of 4 percent.

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[9] Fullerton and Henderson (1986) provide present value calculations for depreciation under the old law where many diverse types of equipment receive 150 percent of declining balance, and structures receive 175 percent of declining balance, both switching to straight line. They set a lifetime for each asset, incorporate the half-year convention, and adjust the basis for half the investment tax credit. Similar calculations apply to the new law with double declining balance for equipment of different lives, and straight line for nonresidential structures with a 31.5 year life.

These differences are all reflected in the cost of capital in column (4) of Table 3. The cost of capital under TRA for equipment is 7.3 percent and the cost of capital for other tangible assets is between 8.1 percent and 8.4 percent. Intangible assets have a significantly lower cost of capital, at 4.5 percent.

Because the pretax return on tangible assets is higher than that on intangible assets, total output could be increased by shifting capital out of intangible assets and into tangible assets. For example, replacement of one dollar of intangible capital by one dollar of structures would increase output by 3.6 cents, the difference in their pretax returns (8.1 minus 4.5). To analyze more than marginal changes in the allocation of capital we need to know the marginal product schedule of each type of capital. We assume that asset demands are Cobb-Douglas: a one percent increase in the cost of capital will reduce asset demand by one percent.[10] Since we assume that firms demand capital as long as the marginal product exceeds its cost, this assumption effectively provides all marginal product schedules as well. We use these marginal product schedules to show how much more output would be produced by shifting capital toward the locations with a high cost of capital (and high marginal product) and away from locations with a low cost of capital (and low marginal product). That is, we calculate the additional real value of output that could be produced with a given total stock of

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[10]The loss in production efficiency is dependent on the responsiveness of investment demand to the change in the pretax return of each type of asset. The greater the responsiveness of demand to changes in this rate of return, the greater is the efficiency cost of tax distortions. Fullerton and Henderson (1986) provide some evidence on the sensitivity of the efficiency cost to this parameter.

capital, if it were simply reallocated to more productive locations and used more efficiently.

These calculations are similar to those of Gravelle (1982) and Auerbach (1983) for different types of equipment and structures under the old law. They represent interasset distortions only and do not include additional misallocations between the corporate sector and noncorporate sector or distortions of saving decisions, risk-bearing, financial choices, housing, and labor markets.[11] Fullerton, Lyon, and Rosen (1984) perform similar calculations including equipment, structures, inventories, and land. Fullerton and Henderson (1986) include intersectoral distortions and housing, but none of these studies considers intangible assets. In the previous section we calculated large amounts of intangible capital, and in the next section we calculate revised costs of interasset distortions.

4. Welfare Results under Alternative Tax Regimes

The cost of capital for different assets under the Tax Reform Act are first compared with prior law and a modification of prior law that merely repeals the investment tax credit (Repeal ITC). Under prior law, firms faced a combined Federal and state statutory corporate tax rate of .495 and were eligible for an investment tax credit of 10 percent on most equipment and certain structures (as classified in the National Income and Product Accounts). Tax depreciation for equipment is represented by an exponential

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[11] These calculations also assume that all corporate assets are separable in production. Feldstein (1985) and others have pointed out that particular substitutability relationships among assets could make nonuniform taxation more efficient.

rate of .34, a figure which is less generous than the .38 rate under TRA because the basis is reduced by half the investment tax credit. The present value of depreciation allowances for equipment at an 8.5 percent nominal after-tax discount rate under prior law is 2 percent less than under TRA, indicating that in the absence of the half-basis adjustment of prior law (a 5 percent reduction in the value of depreciation allowances), depreciation allowances would have been more accelerated under prior law than under TRA. Tax depreciation of structures is represented by an exponential rate of .135, providing depreciation allowances that are 30 percent greater in present value than under TRA. Other tax parameters are the same as in Table 3. Repeal of the credit is modeled identically to prior law, except the investment tax credit rate is zero for all assets.

The cost of capital for each type of capital under each of the three tax regimes is shown in Table 4.[12] Because of the investment tax credit, the cost of capital is lower under prior law than under TRA for equipment, while because of the higher statutory tax rate, the cost of capital is higher under prior law for structures, inventories, and land. Because of expensing, however, the cost of capital always equals the real net return for intangible assets. Repeal of the investment tax credit raises the cost of capital for equipment by two-thirds but leaves other assets unaffected.

Average measures of the cost of capital also are shown in Table 4 for all tangible capital and for all capital, including advertising and R&D

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[12] Not shown separately in the table, but included in the overall averages, is the cost of capital under prior law for structures eligible for the investment tax credit. This cost of capital is estimated to be 6.98 percent.

intangible capital. Under TRA and "Repeal ITC", all tangible assets have similar costs of capital, indicating that there is likely to be little loss in productive efficiency due to misallocation of capital across the different types of tangible capital. Major differences in the cost of capital between tangible and intangible capital in all three tax regimes, however, may be a significant source of production inefficiency.

4.1 The Inclusion of Intangible Capital

Previous studies have calculated the cost of the loss in production efficiency of differential taxation among tangible assets. Because we wish to show how this welfare loss changes with the introduction of intangible capital, we first calculate the welfare loss for the three tax regimes assuming no intangible capital.

Our findings under the assumption of no intangible capital are similar to those of previous research. Under prior law, the annual welfare loss from differential taxation is $9.8 billion per year. This cost is 13 percent of corporate tax revenue in 1983, or .3 percent of GNP. With repeal of the investment tax credit, distortions among tangible assets are greatly reduced, and the welfare loss falls to $0.7 billion. The Tax Reform Act of 1986, by reducing the statutory corporate tax rate, provides some further reduction in interasset distortions, and the welfare loss falls to $0.4 billion. In the absence of intangible capital, TRA or repeal of the credit appears quite successful in creating a level playing field.

Next, we repeat these calculations for the three tax regimes using our central estimate of the intangible capital stock attributable to advertising and R&D. Under all three tax regimes, the addition of these untaxed assets increases the interasset distortions and the welfare loss measures. (The addition of any capital with a cost of capital different from the average will increase our measure of the welfare loss.) The cost of interasset distortions under prior law increases to $12.8 billion; under repeal of the ITC it increases to $6.7 billion; and under TRA it increases to $4.1 billion. These welfare losses are compared in Table 5 with the previous estimates under the assumption of no intangible capital.

An important result is that the consideration of intangible capital does not increase the welfare loss by the same amount in each tax regime. Comparing the welfare losses across tax regimes, we find that the absolute welfare gain from repeal of the credit is reduced by one-third when we include intangible capital, from $9.1 billion ($9.8 billion minus $0.7 billion with no intangible capital) to $6.1 billion ($12.8 billion minus $6.7 million with intangible capital). The investment tax credit can be viewed as less distorting in the presence of intangible capital, because the average cost of capital for all assets is lower.

Under the Tax Reform Act, the inclusion of advertising and R&D intangible capital reduces the absolute welfare improvement over prior law only slightly, from $9.5 billion ($9.8 billion minus $0.4 billion) to $8.7 billion ($12.8 billion minus $4.1 billion). As under repeal of the ITC, intangible capital adds more of a distortion under TRA than under prior law, but the reduction in the statutory corporate tax rate mitigates this effect. The statutory rate reduction lowers the cost of capital for all positively taxed assets, while the cost of capital remains unchanged for intangible capital with a zero effective tax rate. Therefore, TRA still provides significant efficiency gains relative to prior law.

As mentioned in Section 2, changes in assumed rates of depreciation for advertising and R&D could nearly double or reduce by one-half our measure of the stock of these assets. More importantly, this study omits many other forms of intangible capital. Because the actual level of intangible capital may be much greater than we have measured here, we also calculate the welfare loss under the three tax regimes for variations in the level of intangible capital between zero and 12 times our measured intangible capital stock. Our results show that inclusion of greater amounts of intangible capital increases the welfare loss from distortionary taxation under each tax regime. Under prior law, if the actual intangible capital stock is four times larger than our measured intangible capital stock, the welfare loss is nearly double the measure in studies that omit intangible capital ($19.2 billion). Figure 1 shows how increases in the level of intangible capital increase the welfare loss measure under each tax regime.

Further, we find that if the actual level of intangible capital is between four and five times our measured level, repeal of the investment tax credit results in a <u>loss</u> of welfare. For these magnitudes of intangible capital, the average cost of capital is low enough that repeal raises the cost of equipment away from the average instead of toward the average.

Repeal of the credit in combination with the corporate rate reduction of TRA, however, results in efficiency gains relative to prior law for all levels of intangible capital modeled. The absolute improvement in productive efficiency declines from $8.7 billion at our measured level of advertising and R&D intangible capital to $5.6 billion when intangible capital is assumed to be 12 times our measured level.

4.2 Further Sensitivity Analysis

The favorable tax treatment for R&D is often justified as a proper correction for postive externalities generated by R&D. In this view, firms are unable to appropriate all of the returns from the research they undertake. Competitors or the world at large may benefit from the R&D performed by a firm. Part or all of this effect might be offset by the fact that we ignore the incremental R&D credit. Under TRA, firms can receive a 20 percent credit for qualifying R&D expenditures exceeding a base period amount. Because R&D expenditures increase the base for calculating future credits, however, the marginal incentive of this credit is very difficult to model. We abstract from it here, but this omission is equivalent to the assumption that the marginal incentive of the R&D credit exactly offsets any positive externalities from R&D.

Suppose, however, that these spillover benefits are even greater than the marginal incentive of the R&D credit. To be specific, assume the marginal return to society from R&D is 50 percent greater than the private after-tax return of 4.50 percent, i.e., 6.75 percent. For all other assets we continue to assume no externalities. Under this assumption, the pretax return to R&D including the externality is closer to that of all tangible capital, causing welfare losses to be lower than shown in Table 5 or Figure 1. At our measured level of intangible capital, the welfare loss under TRA and prior law is about $2.0 billion lower than in Table 5, and under repeal of the ITC it is $3.0 billion lower than in Table 5. The absolute welfare gain of TRA relative to prior law is therefore the same as shown in Table 5, while it is slightly greater for repeal of ITC relative to prior law. At higher assumed levels of intangible capital (but holding the level of R&D fixed), the welfare losses are only slightly lower than those shown in Figure 1.

Next, we consider a modification to the tax treatment of advertising expenditures. One proposal considered during tax reform and again during this year's budget reconciliation is a partial disallowance of the deduction for advertising expenditures. Here, we consider a modification of TRA that provides a deduction for only 80 percent of advertising expenditures. This disallowance is equivalent in present value to capitalizing all advertising expenditures and allowing them to be depreciated at a 34 percent exponential rate, comparable to that for equipment under TRA. To calculate the new cost of capital for advertising, we assume advertising capital has an economic exponential depreciation rate of 33 percent. The partial disallowance of advertising expenditures results in a cost of capital of 9.2 percent, or an effective tax rate of 51 percent. This tax cost is higher than that of other assets because the 80 percent deduction (or equivalently 34 percent rate of depreciation on historical cost) is not enough to cover economic depreciation at 4 percent inflation.

At our measured level of intangible capital (and assuming no externalities for R&D), welfare losses under TRA with a partial deduction for advertising decrease from $4.1 billion to $3.0 billion. At greater levels of intangible capital (while holding constant the level of advertising capital), these welfare gains are smaller.[13]

Finally, some believe that advertising may generate negative externalities, that is, yield a social rate of return below its private rate of return. Some advertising may simply redistribute sales between competing brands but provide no net increase in total sales. Under the assumption that advertising generates negative externalities, welfare losses under all three tax regimes would be greater. A tax on advertising would raise the social rate of return on advertising toward that of other assets, and result in welfare gains.

5. Conclusion

Intangible capital has escaped the attention of many tax researchers and tax policymakers. As a consequence, discussions of a "level playing field" have concentrated on the relative taxation of equipment, structures, and other tangible assets. They have ignored the significant tax advantages of expensing investments in advertising, R&D, and other intangible assets. We show in this paper that the consideration of intangible capital renders invalid many of the standard views about what constitutes an efficiency increasing reform. For sufficiently large levels of intangible capital,

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[13] In fact, if the total stock of intangible capital is at least eight times greater than our measured stock of advertising and R&D intangible capital, the partial deduction for advertising actually decreases welfare. This result occurs because the cost of capital for advertising is greater than the cost of capital for all other assets. With sufficiently large amounts of untaxed intangible capital, it is more distorting to tax advertising at greater than average rates than to leave it untaxed. At any level of intangible capital, however, a less restrictive partial deduction for advertising would always generate efficiency gains.

repeal of the investment tax credit can actually increase the cost of distorting firms' choices among assets. Importantly, however, we find that the Tax Reform Act of 1986 still reduces the cost of these distortions relative to prior law.

The point of this paper is not to provide refined estimates of the welfare costs of taxes on income from capital. Indeed, other studies calculate detailed effects of specific tax provisions on distortions among assets, between the corporate and noncorporate sectors, between business capital and housing, among sources of finance, or between present and future consumption. They might use more sophisticated formulas that account for estimated asset demands or particular relationships among assets in production. Other studies do not consider intangible capital, however. This paper uses very simple calculations to show that this omission has a major effect on measures of distortions among assets that were a major concern in discussions of tax reform.

These results do not imply that concerns about the level playing field were misplaced, however. Perhaps they were only too limited by considering only tangible capital. The model in this paper starts with the presumption that corporate capital is allocated most efficiently when all types of capital have the same pretax return (or, in the presence of externalities, the same social return). With unequal effective tax rates, efficiency can be increased by any reform that raises the lowest effective rates and uses the revenue to reduce the highest effective rates. Repeal of the investment tax credit may have raised the low effective tax rate for equipment and provided revenue for rate reduction, but it did not deal with the asset having the lowest effective tax rate. Further efficiency gains are possible in this model. If advertising and R&D do create assets that depreciate over time, then expensing provides a zero effective tax rate for that asset. Any cut-back from expensing, such as a partial disallowance or delay in deductions, would raise the lowest effective tax rate, remove further distortions, and provide revenue that could be used to reduce or maintain lower rates.

Technical Appendix

In the framework of Hall and Jorgenson (1967), we consider a corporation facing a certain nominal after-tax discount rate r and inflation rate π. The firm makes a one-dollar marginal investment in asset j that depreciates exponentially at rate δ_j and earns a net marginal product ρ_j. Income from the asset is taxed at the statutory corporate rate u. The firm receives an immediate investment tax credit at rate k_j and delayed depreciation allowances on the original purchase price. The present value of these allowances per dollar of investment is z_j, where the firm discounts future nominal allowances by the nominal after-tax discount rate. For further discussion of these assumptions, see Bradford and Fullerton (1981).

The profit-maximizing firm continues to make such investments until, in competitive equilibrium, the cost of the asset is just equal to the present discounted value of after-tax returns and tax savings from the asset. This equilibrium condition is used to solve for the net marginal product or pretax return ρ_j, as a function of other parameters:

$$\rho_j = \frac{r - \pi + \delta_j}{1 - u}(1 - k_j - uz_j) - \delta_j. \tag{1}$$

This cost is gross of taxes but net of depreciation. This pretax return can easily vary among assets with different credit rates k_j, depreciation rates δ_j, and/or allowances z_j. With no investment tax credit, however, depreciation could be set so that the firm receives economic allowances at replacement cost for every asset. The firm then discounts by the real net return $s = r - \pi$. In this case, z_j equals $\delta_j/(s + \delta_j)$, and ρ_j reduces to $s/(1 - u)$ for all assets. Alternatively, equation (1) shows that expensing all assets ($k_j = 0$ and $z_j = 1$)

provides ρ_j equal to s for all assets. If the total corporate capital stock is fixed, the tax system does not distort its allocation in either of these two special cases. Other tax rules also can provide the same ρ for all assets, as shown in Bradford (1980) and Brown (1981).

In general, taxes do distort the allocation of capital among assets. In this paper, we follow Hendershott and Hu (1980) and Gravelle (1982) in measuring the associated welfare cost by a more recent version of the formula used by Harberger (1966):

$$W = \sum_{j=1}^{N} \left| \int_{K_J^*}^{\bar{K}_j} [\rho_j(K_j) - \bar{\rho}] dK_j \right|, \tag{2}$$

where K_j^* is the stock of asset j in the distorted equilibrium, $\bar{K}_j$ is the stock in the undistorted equilibrium, $\rho_j(K_j)$ is the net marginal product given the level K_j, $\bar{\rho}$ is the cost of capital in the undistorted equilibrium, and N is the number of assets. To measure W, therefore, we need to know how the use of K_j depends upon its cost ρ_j. Econometric studies reviewed in Jorgenson (1974) suggest that firms' total use of capital changes by approximately one percent for each one percent change in its cost. This cost could conceivably be gross or net of depreciation, and gross costs are often used in empirical work finding that gross output is a Cobb-Douglas function of capital and labor. However, the use of net costs ρ_j in equation (2) guarantees a fixed total stock of capital under all reallocations. No empirical work has measured price elasticities separately for each of the capital assets used in this study, but we assume that the demand for each K_j has unitary elasticity with respect to its price ρ_j.

Expenditure on each type of capital is a constant under our assumptions, so $\rho_j K_j = \rho_j^* K_j^*$ for any K_j. Thus, we can substitute $\rho_j^* K_j^* / K_j$ for $\rho_j(K_j)$ in equation (2). Further algebra then provides:

$$W = \sum_{j=1}^{N} \left| \rho_j^* K_j^* [\ln(\rho_j^* / \bar{\rho}) - 1 + \bar{\rho}/\rho_j^*] \right| . \tag{3}$$

For the distorted equilibrium under old law, capital costs ρ_j^* are given by equation (1) using parameters for old law derived in King and Fullerton (1984). We obtain the distorted capital allocation K_j^* for 1983 from data in Jorgenson & Sullivan (1981), more recent issues of the <u>Survey of Current Business</u>, the Federal Reserve Board's <u>Balance Sheets for the U.S. Economy</u>, and our constructed stocks of intangible capital. We estimate the long-run distorted allocation for the other tax plans using the same Cobb-Douglas reactions to changes in the cost of capital. Under the Tax Reform Act of 1986 (TRA), for example, K_j^* is given by capital expenditures $(K_j \rho_j)$ under 1983 law divided by the cost of capital (ρ_j^*) under TRA.

For the undistorted or counterfactual equilibrium, capital costs should be the same for all assets. Our particular choice for $\bar{\rho}$ is the capital-weighted average of ρ_j^* from the distorted equilibrium, such that both equilibria have the same aggregate pretax return, the same aggregate after-tax return, and the same total tax revenue.

Once we specify r, π, and tax parameters for each law, equations (1) and (3) together provide the cost of capital for each asset and the efficiency cost of distortions, as reported in the text.

Table 1

Stocks of Intangible Capital from Advertising and R & D in Millions of 1983 Dollars

	Industry	Advertising Capital, for Depreciation Rates of: (1) .167	(2) .333	(3) .500	R & D Capital, for Depreciation Rates of: (4) .10	(5) .15	(6) .20	Central Case Totals (7) =(2)+(5)
(1)	Agriculture, Forestry and Fisheries	1101	496	286	45	32	24	527
(2)	Mining	236	101	57	67	48	37	149
(3)	Crude Petroleum and Natural Gas	461	268	164	227	162	124	430
(4)	Construction	4088	2032	1211	52	37	28	2069
(5)	Food and Tobacco	52306	26944	16483	6374	4540	3485	31484
(6)	Textile, Apparel and Leather	5638	2698	1609	1213	893	690	3591
(7)	Paper and Printing	7815	4290	2664	6529	4751	3674	9041
(8)	Petroleum Refining	7873	3361	1872	4146	2986	2320	6348
(9)	Chemicals and Rubber	34560	17077	10245	55859	39299	30054	56376
(10)	Lumber, Furniture, Stone, Clay & Glass	4455	2098	1232	4971	3524	2683	5621
(11)	Metals and Machinery, Including Electronics	38097	18522	10985	191541	135407	103725	153929
(12)	Transportation Equipment	1880	841	483	121158	76803	56006	77644
(13)	Motor Vehicles	7731	3866	2311	45745	31560	23658	35426
(14)	Transportation, Communication & Utilities	11893	6457	4055	2393	1709	1308	8166
(15)	Trade	103642	51547	30792	446	318	244	51865
(16)	Finance and Insurance	27112	13417	7964	524	374	286	13791
(17)	Services	21135	11431	7089	3555	2538	1943	13969
	Total	330023	165447	99500	444843	304979	230289	470426

Table 2

Intangible and Tangible Assets as Percentages of Capital Stock in Each Industry

	Industry	Advertising	R & D	Total Intangible	Equipment	Structures	Inventories	Land
(1)	Agriculture, Forestry and Fisheries	1	0	1	23	5	4	67
(2)	Mining	0	0	0	51	41	5	2
(3)	Crude Petroleum and Natural Gas	0	0	0	3	51	1	45
(4)	Construction	2	0	2	37	3	31	28
(5)	Food and Tobacco	18	3	20	28	21	20	11
(6)	Textile, Apparel and Leather	5	2	7	37	20	23	12
(7)	Paper and Printing	4	4	8	46	22	11	13
(8)	Petroleum Refining	4	3	7	23	40	12	18
(9)	Chemicals and Rubber	8	17	25	42	14	12	7
(10)	Lumber, Furniture, Stone, Clay & Glass	3	5	8	39	24	17	12
(11)	Metals and Machinery, Including Electronics	3	20	23	30	17	23	8
(12)	Transportation Equipment	1	56	57	10	11	16	5
(13)	Motor Vehicles	4	30	33	35	12	14	5
(14)	Transportation, Communication & Utilities	1	0	1	43	50	2	4
(15)	Trade	6	0	6	19	13	43	19
(16)	Finance and Insurance	28	1	28	1	15	0	55
(17)	Services	7	1	8	54	30	2	6
	Total	4	7	11	31	28	17	14

Table 3

Tax Parameters and the Cost of Capital under 1986 Law for Each Asset

Asset	(1) Exponential Economic Depreciation Rate	(2) Exponential Rate for Tax Depreciation	(3) Property Tax Rate	(4) Cost of Capital	(5) Real Net Return	(6) Effective Tax Rate (4-5)/(4)
Equipment	.130	.380	.008	.073	.045	.380
Structures	.030	.076	.011	.081	.045	.443
Inventories	.000	.000	.008	.081	.045	.442
Land	.000	.000	.011	.084	.045	.466
Advertising	.333	∞	.000	.045	.045	.000
R&D Capital	.150	∞	.000	.045	.045	.000

Note: The cost of capital is defined here to be gross of tax but net of depreciation. It is based on equation (1) of the Appendix, using a corporate rate of .383 including state corporate taxes, a discount rate of .085, an inflation rate of .04, and therefore a real net return of .045 as shown in the table.

Table 4

The Cost of Capital under Alternative Tax Regimes (percent)

Asset	(1) Prior Law	(2) Repeal ITC	(3) Tax Reform Act
Equipment	5.23	8.70	7.25
Structures	8.47	8.47	8.08
Inventories	9.68	9.68	8.06
Land	10.04	10.04	8.42
Average for All Tangible Assets	7.52	9.09	7.92
Advertising	4.50	4.50	4.50
R&D Capital	4.50	4.50	4.50
Average for All Capital	7.19	8.49	7.53

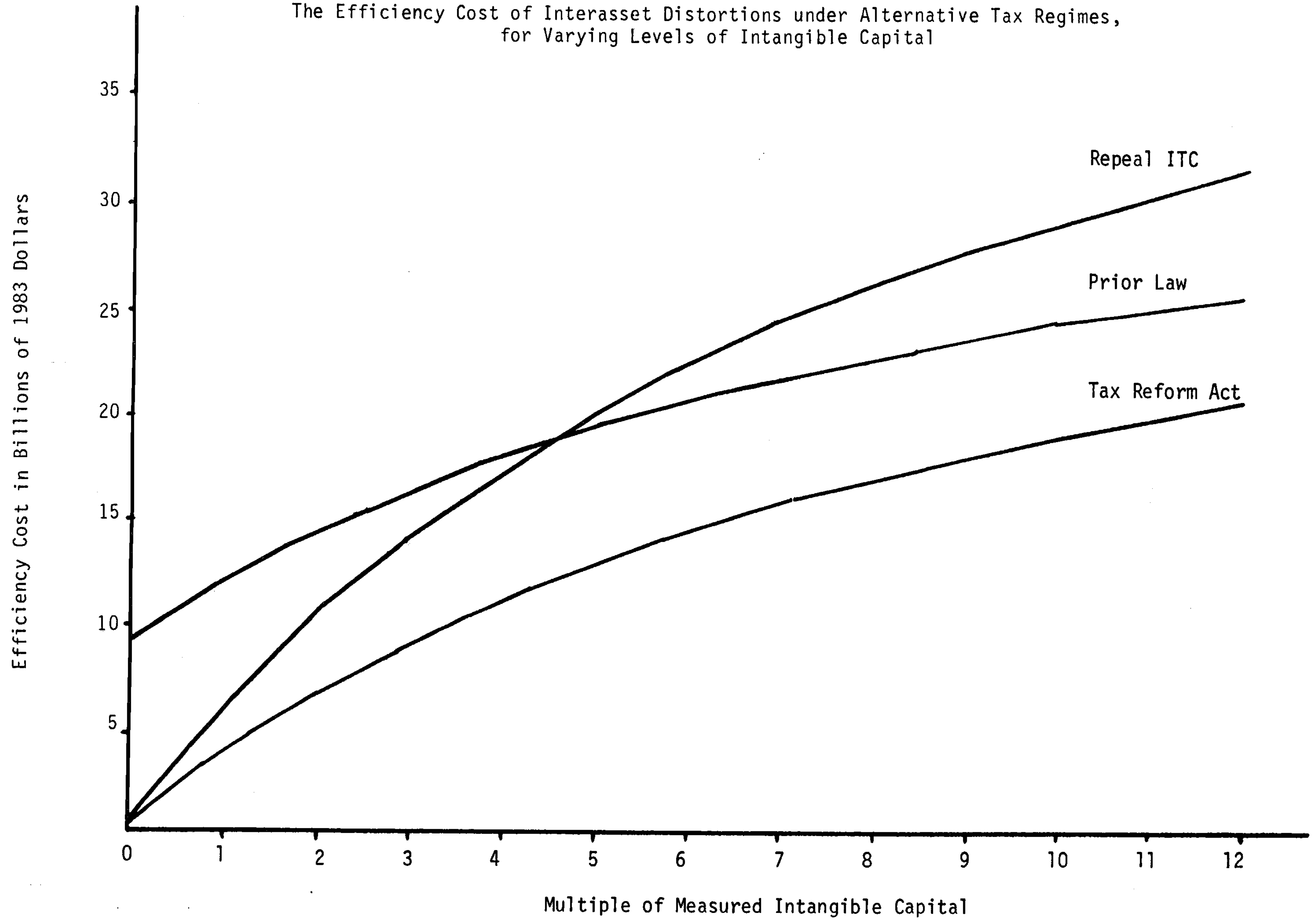
Table 5

The Efficiency Cost of Interasset Distortions under Alternative Tax Regimes

	No Intangible Capital		With Advertising and R&D Intangible Capital	
	Billions of 1983 Dollars	Percent of GNP	Billions of 1983 Dollars	Percent of GNP
Prior Law	9.8	.29	12.8	.38
Repeal ITC	0.7	.02	6.7	.20
Tax Reform Act	0.4	.01	4.1	.12

Figure 1

The Efficiency Cost of Interasset Distortions under Alternative Tax Regimes, for Varying Levels of Intangible Capital



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