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GUNNAR ELIASSON, JAN SÖDERSTEN, EDITORS

Business Taxation, Finance and Firm Behavior

Proceedings of a Symposium at IUI, Stockholm, August 28-29, 1978

THE INDUSTRIAL INSTITUTE FOR ECONOMIC AND SOCIAL RESEARCH, STOCKHOLM.

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FOREWORD

Over the years IUI has devoted considerable resources to research under the heading Taxes, Finance and Firm Behavior. Several such projects are currently in progress. In the summer of 1978 when the Institute was about to engage in an international project comparing capital income in various countries a small seminar was arranged at the IUI on a similar theme. The papers given at the seminar are presented in this volume. They cover the research frontier concerning corporate taxation and firm behavior—and to some extent also finance.

After considerable updating, extension and revision these papers are now ready for publication. We are happy to include this volume in the Institute's conference series. We hope and believe it will catch considerable attention and interest.

Stockholm, August 1981

Gunnar Eliasson

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Business Taxation, Rates of Return and the Allocation Process

Gunnar Eliasson and Jan Södersten

1 Introduction

The topic of business taxation and firm behavior has been covered extensively in literature over the years. The problems have been explored in many directions. The diversity of the subject matter is mirrored in this volume. The term business taxation is understood here in a broad sense to include the taxation of capital income by way of the corporation income tax, the taxation of shareholders' dividends and capital gains, as well as the taxation or subsidization of the firms' wage costs.

An important aim of this conference was to frame a set of relevant problems from the point of view of important policy issues. Paramount among those discussed was the allocation and efficiency effects of traditional schemes of business taxation. Several approaches to this problem appear in this volume. Four papers, ranging from the Feldstein, Green and Sheshinski general equilibrium analysis on a high level of abstraction to Rolf Rundfelt's down to earth calculations of effective rates of return on the Swedish stock market, represent the time-honored approach of analyzing the rate of return effects of existing (and possible) tax structures. Contributions by McLure, Lodin, and Carlson and Hufbauer explore efficiency aspects from the point of view of different institutional arrangements.

A novel "experimental" third approach is outlined in the paper by Eliasson and Lindberg. Here tax induced effects on allocation, stability and economic growth are studied in an explicit micro market context. Quantification is made possible through the use of the IUI micro-to-macro simulation model of a Swedish-like economy. These problems link directly to those of Ysander, who brings up important and so far largely overlooked questions of how various taxation regimes affect the stability properties of an economic system.

Policy issues of different kinds are raised in the papers by Bishop and Haveman, and Holmlund. These contributions provide theoretical and empirical appraisals of recent schemes to stabilize and promote employment by subsidizing the firms' wage costs.

The rapid growth of international trade during the post-war period and the emerging importance of the multinational corporation and an international credit market in linking the industrialized economies together have made the international side of business taxation important both as a real economic factor and as a matter of economic and political debate. This development is indeed reflected in the papers presented in this conference volume. Our brief review in the following sections of this introduction makes it quite clear that an international theme runs through most of the papers. As a consequence we have chosen to pay special attention to a particular aspect of the international side of business taxation, namely the importance of international markets in determining the rate of return requirement for domestic investments.

2 Taxation and the rate of return

Basic in received theory is the notion that private investment decisions are taken so as to equate the marginal rates of return for alternative uses of capital and that the supply of savings to the economy may depend on the rate of return received by savers. Hence, a large part of the literature on capital income taxation has been devoted to the rate of return effects of taxation. Four papers directly address this issue—how do tax wedges affect the cost of capital and how is this effect transmitted through the investment and financing decisions to the owners of equity and debt?

Feldstein, Green and Sheshinski (III:4) restrict their general equilibrium analysis to an economy that grows at an exogenously given fixed rate and with a fixed savings rate—implying a constant marginal productivity of capital. All business activity is assumed to take on a corporate form, using debt and equity as financial instruments. Assuming the costs to firms of debt and equity financing to be increasing functions of the debt-equity ratio, there is in this model world a unique debt-equity ratio minimizing the cost of capital. They introduce a corporation income tax, a personal income tax and a preferential tax treatment of capital gains. The corporate income tax of course reduces the net yield on equity. Less obviously, however, is that the net rate of interest received by bondholders falls.

The implication is that the burden of the corporation income tax will be borne by both debt and equity investors. This tax structure, furthermore, is shown to substantially distort the financial behavior of firms, inducing them to substitute debt for equity and to reduce the dividend payout rate.

The F, G & S (III:4) study, albeit based on several restrictive assumptions, provides a good starting point for further analysis. The authors touch upon the possibility of introducing a variable (interest elastic) savings rate and a non-corporate sector. The corporation tax within such a framework is expected to reduce net yields on both equity and debt and to distort intersectoral as well as intertemporal resource allocation.

Bergström and Södersten (III:5) start from a somewhat different end. They assume market yields on equity and debt to be determined exogenously in world capital markets open to firms—but not to individual investors. For a small, open economy with the particular, regulatory set up of Sweden this assumption is appropriate.

Changes in the corporation tax rate, therefore, do not affect these exogenous market returns. After tax returns to owners of equity and debt, however, are reduced by the personal income tax. Individual investors by assumption have no alternatives, national or international, to avoid a general personal income tax that applies to all sources of household income.

Some effects of double taxation of corporate source income on the capital cost and the tax differentials between the corporate and non-corporate sectors of the economy implied are analyzed by Bergström and Södersten (III:5). They choose to derive the tax burden on corporate source income directly from the cost of capital of the firm, defined as the lowest pre-tax rate of return on new investment that maximizes stockholders' wealth. The total effective marginal tax rate on capital income from the corporate sector is determined simply by comparing stockholders' after tax yield on equity investment with the firm's cost of capital.

The Bergström and Södersten analysis provides a framwork for appreciating the allocation effects of the classical system of double taxation. Firstly, the tax differential between the corporate and non-corporate sectors of the economy turns out to be a somewhat ambiguous concept, varying in sign and size according to the income levels of the "representative" shareholder. Secondly, it is clear that the present preferential tax treatment of capital gains makes it considerably more expensive—on the average—to use new share capital rather than retained earnings as a source of finance.

A common feature of earlier attempts to determine the differential tax burden on corporate income, is the *ad hoc* assumption that retention of corporate profits gives rise to capital gains on a one-for-one basis. By this assumption—appearing, i.e. in the F, G & S (III:4) paper in this volume—the tax burden on retained earnings has been identified with the tax on capital gains.

B & S (III:5), however, demonstrate that this one-to-one assumption is not tenable in view of the preferential tax treatment of capital gains. In fact, it may be quite rational for a management to undertake investments that produce less than a dollar's worth of capital gains for the marginal dollar of retention.

These theoretical conclusions by B & S are supported by the empirical findings in Rundfelt's paper (IV:10). Rundfelt shows that the market value of equity for major Swedish engineering companies quoted on the Swedish stock exchange corresponds to roughly one half of its replacement value in the mid 1970's. This figure may be compared to the "marginal rate of substitution of dividends for capital gains" as derived by B & S (III:5). Given a marginal individual income tax rate of 60% and a capital gains tax rate of 20%—not unreasonable for Sweden—plow back would be worth-while from the point of view of the owners of equity even if the marginal dollar of retention produced as little as 50 cents worth of capital gains. This is one way of demonstrating the static misallocation effects inherent in the business taxation systems of most industrialized countries. The dynamic side of this allocation effect including as well the total growth effect of keeping labor locked up in inefficient low profit plants as long as current costs are covered will be discussed below in the context of Eliasson's and Lindberg's (IV:11) paper.

Market and replacement values in Rundfelt's calculations appear to have developed in Sweden along roughly parallel paths from the beginning of the 1950's till the mid 1960's. From this time, however, replacement values have grown at a considerably faster rate than market values. Whether changes in the tax rates on dividend income and capital gains—which are the crucial parameters in the B & S (III:5) analysis—over this period have contributed to this development remains an open question. Rundfelt rather emphasizes the combined effect of inflation and the predominantly nominal individual and corporate tax systems when explaining the poor performance of the stock market in Sweden during the 1970's. We will return to this issue below.

Inflation and capital cost is also the theme of the second paper by Bergström and Södersten (III:7). They assume, as before, exogenously given market yields on equity and debt but add the assumption that market yields in real terms are invariant of inflation. The conclusion is that inflation affects the real cost of capital through several counteracting factors. Capital cost is (1) raised because depreciation allowances are based on historical costs and because shareholders are taxed on nominal gains on corporate stock, and (2) lowered when the firm is allowed to deduct the nominal cost of debt and when shareholders are fully taxed for the nominal rate of return on alternative financial investments. The net outcome is an empirical question. For reasonable assumptions, total real capital cost will fall as a result of inflation.

It is interesting to note that Rundfelt (IV:10) comes to the opposite conclusion, namely that capital cost will rise as a result of inflation. Rundfelt's discussion is, for one thing, limited to the cost of financing through equity capital. Secondly, he introduces the crucial assumption that the *after tax* real rate of return required by the shareholders remains unaffected by inflation (and taxation). Bergström and Södersten, on the other hand, assume the *market* yield on equity to be constant in real terms. The combined effect of inflation and the nominal system of individual income taxation is then to lower real after tax returns to equity. Which of these alternative assumptions—producing different results as to the effects of inflation on capital cost—is the most reasonable one is of course an empirical question. In section 4 of this introduction, we shall deal explicitly with this critical issue.

Several of the papers appearing in this volume present ways of eliminating the distorting effects on resource allocation brought about by inflation—via the tax system—and by the double taxation of corporate source income. Bergström and Södersten (III:7) point out that different norms can be used to eliminate such effects. Governments in many countries, e.g. Sweden, consciously intervene in the market resource allocation process to promote industrial investment in particular by various schemes of accelerating depreciation allowances. B & S begin their analysis from a capital cost norm calculated at zero inflation. If investment incentives are to be unaffected at the zero inflation standard both the corporate and the personal tax systems would have to be changed. On the corporate taxation side, the book value on which depreciation charges are calculated must be adjusted for price changes and the deductability of interest costs restricted to the real rate of interest. For personal taxation, stockholders must be taxed only for the real rate of return on alternative investments and for real capital gains on corporate stock. In short, all the stock and flow accounts on the corporate and the personal side would have to be adjusted for inflation. In return, capital costs and investments would still be a function of the tax system, but it would be independent of the rate of inflation.

The efficiency problems raised by Feldstein et al (III:4) and B & S (III:5) with regard to the double taxation of corporate source income provide the starting point for the paper by McLure (II:2) on tax integration. Writing against the background of current US debate McLure presents the case for integrating the personal and corporate income taxes to obtain equity and economic neutrality of taxation. He warns, though, that there is little direct evidence on just how integration will affect vital issues like capital accumulation, the financial policies of firms and the behavior of financial investors of various kinds.

Full integration, under which corporate source income would be taxed only to the shareholders, is pointed out to suffer from severe practical difficulties. Some of its advantages could be realized through dividend relief, McLure argues. At the firm level, dividend relief can be accomplished by granting a deduction for dividends paid or through the use of a lower corporate tax rate on distributed earnings. At the shareholder level, there is the alternative possibility of allowing a dividend-received credit for corporate taxes imputed to have been paid on shareholders' behalf.

In his appraisal of the feasibility of integration McLure pays particular interest to the problems posed by tax preferences, i.e. provisions reducing the effective rate of tax on the economic income of firms below the statutory rate. At the heart of the matter is the question whether tax preferences should be passed through to the shareholders or be nullified when preference income is distributed. The logic of full integration according to McLure, would seem to require that corporate shareholders receive the same benefit from the preferences as they could realize on the same income obtained through e.g. a partnership. It appears, however, that the countries that currently provide dividend relief, largely for administrative reasons, rather have chosen to nullify tax preferences for distributed earnings.

3 Tax discrimination and differentiation—international aspects

Most industrialized countries have adopted very similar taxation schemes for business income. This is an important notation when we are interested in the overall functioning of the industrialized economies. There is, however, enough country to country variations between the taxation schemes, to allow observation of differential effects between countries. From this we can both learn how to improve the systems and gather more empirical knowledge about the overall tax effects. e.g. on investment. Not least important are the political and equity issues raised by different tax schemes in a world economy that is now very integrated in the investment, production and financial dimensions.

As noted by Lodin (II:3) it is very important to spell out one's concern before starting the investigation. One important question is whether we are worried about the real (investment, trade, production) effects of the tax regimes or whether the "fairness" problem is the one discussed. The equitable distribution of profits within, say a multinational corporation, is by definition an arbitrary thing. One may observe the actual distribution via open rearrangements in financial structure and in cash flows. The distribution is, however, also affected by the actual internal price system used. What is fair here and what is rational from a management point of view is quite arbitrary and it depends on the situation of the firm. Hence these systems often differ between firms (Eliasson, 1976a) and there is no objective way to assess the effects on the distribution of profits.

On the whole, and leaving aside that particular and odd tax rules in some countries are often mirrored in the company accounts, Lodin finds little cause for concern. Tax planning seems to have influenced the pattern of financial flows with international companies to a limited extent only.

Even though common sense argument coupled with reported experience suggest that more important real effects on investment and production should be even smaller, the problem is still there to be investigated. Heavy and/or discriminatory taxation may affect the investment decision. However, and this would be one argument, the investment decision will not be altered to secure an uncertain, a minor and perhaps temporary tax advantage. This is at least the results often reported from studies on the effects of regional investment incentives.

The effects of taxation upon international resource allocation are discussed also in McLure's (II:2) paper on tax integration. McLure argues that in an international setting, tax integration, for instance dividend relief, must be based on the rate of tax in the country of residence of the corporation paying dividends across national borders. This is so in order not to distort the international allocation of capital. This result is achieved automatically when dividend relief is accomplished at the corporation level. Using the imputation credit system, i.e. placing the reduction of the tax burden on dividends at the shareholder level, is more complicated internationally. In order not to affect investors' decisions on where to invest, gross up and credit must then be based on the source country's tax rate. If it is not, relief would be given for taxes not paid or be less than taxes paid; hence recource allocation would be affected. This is actually one theme of Carlson and Hufbauer (II:1).

Carlson and Hufbauer (II:1) commence their paper by explaining how nations have come to adopt border adjustment rules to address both the threat of international double taxation and of fiscal avoidance. They begin by bringing the problems associated with the border adjustment rules currently in use to the surface. They then proceed to discuss the formula apportionment principle by which a portion of a multinational corporation's total taxable income is assigned to a particular jurisdiction (nation, etc.) based on some measure of the corporation's activity in that particular jurisdiction. On balance they come out strongly critical of the formula apportionment method both on grounds of fairness and the real effects. Formula apportionment may erode the tax revenues of a nonformula tax credit country, Carlson and Hufbauer argue, and may force other countries to retaliate by adopting the formula scheme.

The real effects of formula taxation may be substantial. Competing firms in the same industry may be subject to quite different rates of taxation on their income, depending e.g. on the position of their sister firms located in other jurisdictions. Carlson and Hufbauer also note that formula appointment interferes with the disciplinary mechanism inherent in Tiebout's (1956) famous principle, i. e. firms and individuals can vote with their feet vis-à-vis public bodies and leave the jurisdictions if they are better structured to their preferences elsewhere. A corporation established in a formula jurisdiction may find, e.g., as it acquires affiliates in other jurisdictions, that its tax liability in the formula jurisdiction increases, although income earned there is unchanged.

From an equitability point of view the effects of formula apportionment are not in conformance with principles of fairness generally applied in the context of taxation. One can argue, however, (Eliasson, 1972) along traditional, theoretical lines that the formula apportionment principle, albeit unfair, may be an efficient and beneficial device for both the national economy and the global economy, since it helps to drive inefficient firms out of business. Furthermore, the idea of formula taxation in fact implies that tax assessment and taxation of the entire multinational corporation is the task of an international institution, authorized by the national tax bodies, leaving the problem of dividing up the total tax cake to the participating countries and the multinational company alone.

4 The rate of return requirement—an international pivot variable?

The choice of discount rate for the investment decision is crucial to the theoretical and empirical results on business behavior in general and responses to taxation in particular. Where and how is this rate of return requirement determined? To what extent does the discount rate represent an internationally determined reference criterion interfering with national ambitions to redistribute income, through the dependence of investment decisions on the after tax rate of return?

The papers which we reviewed in section 2, differ in their assumptions on this issue. The framework of a closed, all corporate economy with a fixed supply of savings, set up by Feldstein-Green-Sheshinski (III:4), precludes any adjustments in the volume and composition of real investment on the part of the owners of capital in response to lowered after tax rates of return. In our terminology, this may be phrased as an assumption that the owners of capital—for lack of alternatives—react to taxation by reducing their (after tax) rate of return requirements enough to keep the rate of real investment unchanged.

In Bergström and Södersten (III:5), on the other hand, market rates of return on equity and debt are exogenous and independent of the domestic corporate tax rate. The effect of corporate taxation, hence, is to raise before tax rate of return requirements—the cost of capital—on equity financed real investment. B & S, furthermore, assume that household investors (as in Sweden) have no alternatives, national or international, to avoid the individual income tax. Though reducing the net return on corporate shareholdings, the individual income tax reduces the after tax returns on alternative investments as well, and therefore the after tax required rate of return. With unchanged tax differentials between dividends and capital gains, changes in the individual income tax then have no effect upon the firm's before tax cost of capital.

A third set of assumptions on the determinants of the rate of return requirements appears in Rundfelt's paper (IV:10). He emphasizes that households invest in a wide range of assets including as well real estate, consumer durables, art and antiques. It is thus reasonable, Rundfelt argues, to assume a given after tax rate of return requirement. The firm's before tax cost of capital is then inflated by corporate as well as personal income taxation.

How to choose between these last two alternative assumptions on the relationship between taxation and rate of return requirements is of course an empirical question.

For a small open economy, like Sweden, much may be said for the assumption that after tax rate of return requirements are largely unrelated to changes in the corporation income tax. There are several reasons for this. Even though capital flows across Swedish borders are subject to formal controls, current practice of the currency authorities is such that foreign direct investments by Swedish firms may be carried out practically unhindered. Firms, furthermore, are allowed to repatriate profits in foreign operations with ownership shares exceeding 25%, without being taxed. Hence, it is reasonable to assume that firms do compare the rate of return after corporation income tax on new investment in Sweden with the rate of return on the same investment if carried out abroad.

Admittedly, the real and financial flows that are affected by international direct investment are quite small relative to the total Swedish economy. The point is, however, that Swedish firms operating under international competition must require approximately the same rate of return on their investment as their competitors in order to be able to keep on investing and growing on par with their competitors in the long run.

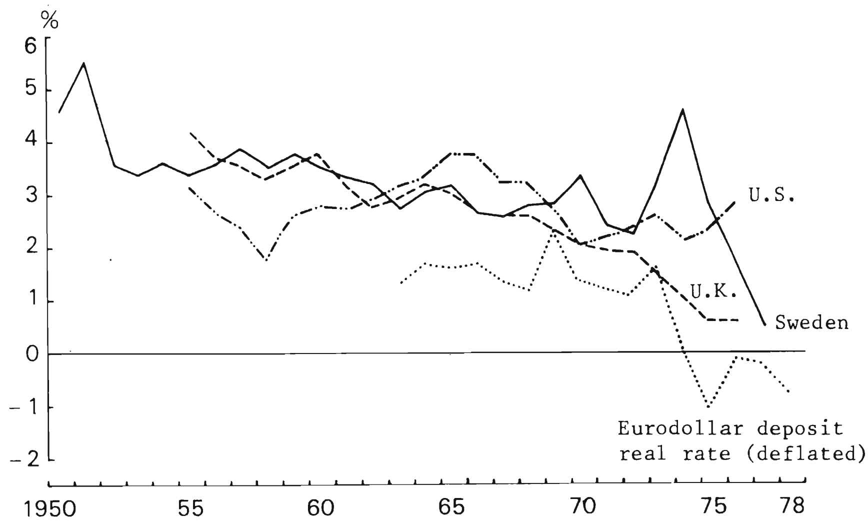
A second important factor, forcing an international rate of return standard on Swedish firms has to do with the increased financial integration of the Swedish economy with the rest of the world. Reliance upon long term foreign borrowing has increased. Interest sensitive short term credit transactions (largely associated with the financing of trade) have grown rapidly throughout the postwar period. Through the postwar development of an international credit system, the handling of credit transactions in massive volumes have been made extremely efficient. This makes the credit markets of most industrialized countries part of the international credit system, rather than individual, isolated markets, as many policy authorities would like them to be.

The combined effect of adjusting the domestic interest rate to internationally determined costs of finance in general and of the possibility to choose alternative—foreign or domestic—locations for real investment in particular, provides strong arguments for the view that after tax rate of return requirements of Swedish firms are largely unrelated to variations in the Swedish corporation tax.

Empirical verification of the notion of an internationally determined rate of return reference obviously is difficult. The usual approach to this issue has been to compare *ex post* profitability between industries and between individual firms in different countries, though there are several problems involved in this. For one thing, an *ex ante* rate of return concept is needed, while actual data on profitability refer to the outcome of past performance. Secondly, there is the problem of measurement. Valuation standards and tax motivated accounting practices vary between countries in a way that complicates comparison.

Figure 1 presents some results of recent comparative work on profitability performance in the US, UK and Sweden. With due reservations for the difficulties of principle and measurement involved, there is a clear indication of a common trend in the development of profitability. If the rate of return on capital has in fact followed a downward trend for the last 20 years, it has been a common feature

Figure 1. Real rates of return on total assets before tax in US, UK and Swedish manufacturing



Source: Eliasson (1972 and 1976 b) and Hill (1979), and later updatings within IUI.

among the industrialized nations.[1]

As pointed out, Rundfelt (IV:10) bases his work on the strong assumption that the household's after tax yield on corporate equities is given independently of the tax system. The before tax cost of equity capital in his analysis is then inflated to allow for both corporate and personal income taxation.

Rundfelt's assumption would seem to require the existence of a sector of the economy where the return on capital accrues to the investors untouched by taxation and where investment opportunities are completely elastic in supply. Alternatively, one might think of the households as responding to lower prospective, after tax yields by increasing consumption.

Actual tax regimes seem to cluster somewhere between Rundfelt's extreme position which actually implies that capital income cannot be taxed at all and the position held by Bergström and Södersten, namely that the (nominal) return on alternative investments is fully taxed as income.

The Swedish tax system provides a good illustration to the difficulties that may be involved when trying to generalize about the tax treatment of the return on alternative investments. When investing in

[1] This downward trend is, however, not empirically established beyond doubt. See for instance Nordhaus (1974), Feldstein and Summers (1978), and Bergström and Södersten (1979).

assets other than corporate equity, households are faced with a wide variety of effective tax rates ranging from full taxation of nominal rates of return to no taxation at all. The spread of effective tax rates, furthermore, has increased dramatically with the surge of inflation during the 1970's reflecting the existing mix of nominal and real rules of taxation.

In summing up, it seems reasonable to conclude that the after tax rate of return requirements face by firms in a small open economy like Sweden are invariant with respect to changes in the domestic corporation income tax. By way of foreign direct investment and the international credit system the international rate of return reference steps right into domestic investment decisions. It moves investments throughout the world economy (not only the small fraction invested by international firms) in accordance with a similarly determined standard and so tends to equalize real rates of return across countries as well (cf Figure 1). It also forces the domestic interest spectrum closer to the international one, and this is probably what has forced many European countries to abandon immediate postwar "low interest policies" during the 60's, parallel to the development of an international credit system.

The role played by household taxation for the before tax cost of capital is harder to appreciate. The broad range of alternatives to investment in corporate equities with varying tax treatment available to the household implies, on the one hand, that the close link between income taxation and the required after tax yield on equities—as assumed by B & S—is relaxed.[2] On the other hand, it would certainly be going too far to overlook completely the existence of such a link by assuming the after tax required yield to be given independently of personal—as well as corporate—income taxation.

5 Taxes on and subsidies of wage costs

Profitability is a critical variable in the growth process of a firm. Capital costs and prospective returns are matched in the investment decision and profits appear again as a flow of financing. However, before that, profits can be broken down into components among which wages play a crucial role. Wages are nor independent of the investment decision in the long term, neither is the investment decision in the short term independent of wages and various taxes that apply to wages.

[2] While constituting a reasonable norm of comparison for the high level of abstraction chosen for their analysis, Bergström and Södersten point out that this assumption obviously may be questioned, bearing in mind, e.g., that capital gains on alternative investments open to households often receive a preferential tax treatment.

With the rising ambitions of economic policy during the 1970's and the demands for financing public setor growth the tools of public policy have been increasingly more diversified. The process of diversification has encompassed, as well, the area of business taxation. Going beyond traditional endeavors to promote capital formation by various schemes of investment incentives different forms of negative payroll tax arrangements by way of subsidizing wage costs have been used to stabilize and promote employment.

Payroll taxes in various shapes have been used extensively and for a long time in many countries to curtail private demand to "finance" growth of the public sector. Relying upon the notion of an inelastic supply of labor, taxes on the wage bill are believed—at least in the long run—not to affect total labor costs. That total labor costs to the firms remain unaffected, implies, of course, that the burden—or incidence—of the payroll tax is on the wage earners. No effects on employment and profits would then be expected in the long term.

Fairly dramatic increases in unemployment have taken place during the past decade throughout most of the industrialized market economies. These practical experiences, together with persistent and sometimes aggravated inflationary problems have occurred simultaneously with new developments in the theory of inflation and unemployment. The new theoretical results, corroborated by numerous econometric tests, have—*inter alia*—implied a rejection of the naive Phillips curve hypothesis. The mainstream view in the late 70's considers the long run Phillips curve to be vertical—or at least much steeper than the short run relationship.

These developments in theory and practice have produced increased scepticism against traditional demand management programs and caused awakened interest in selective employment policies. The persistence of significant sectoral unemployment differences—among regions or demographic groups—have reinforced this interest. Several Western governments have undertaken various programs of employment subsidization in recent years. Among the schemes considered are *marginal* employment subsidies, where subsidies are paid for increases in employment only. Most of the programs in operation are temporary in nature, introduced as contracyclical devices. There exist, however, also permanent schemes, e.g. the Swedish regional employment premium. They all represent attempts to find means to reduce employment without increasing inflation.

In this volume Bertil Holmlund (III:8) examines the effects of marginal employment subsidies in a partial microeconomic setting. The question is how the recruiting behavior of a profit maximizing firm is affected over time when adjustment costs with respect to labor are assumed. The basic message is that a rising subsidy leads to a higher equilibrium level of employment regardless of whether the firm is on a growing or a contractive path. Some characteristic institutional details of subsidy programs are studied as well, including in particular the effects of subsidy thresholds.

Bishop and Haveman (IV:9) in their study of targeted wage subsidies for the US economy, commence by examining the rationale for such policies. Two aspects are emphasized: The subsidy of production costs may be passed on to consumers in lower prices and this temporary reduction in inflation may lower subsequent rounds of wage increases, thus curtailing long run price development. The second component stressed by Bishop and Haveman is the possibility to concentrate employment stimulus to groups of workers in relatively elastic supply.

The empirical part of the Bishop-Haveman contribution deals with a particular wage subsidy scheme for the US economy, namely the New Jobs Tax Credit (NJTC). By way of time series analysis the authors examine the assumptions that this scheme stimulates employment, decreases hours worked per week and reduces product prices for the construction, retailing and wholesale industries.

By reducing labor costs at the margin, price pressures will be reduced and the temporary reduction in inflation may lower the next round of wage increases. Furthermore, a targeted subsidy confined to particular types of labor might be used to stimulate employment for workers that are in relatively elastic supply. Such targeting would increase the total supply of factors of production and therefore potential GNP.

The US NJTC-scheme from 1977 offered a tax credit of 50% of the first $ 200 of wages per employee for increases in employment of more than 2% over the previous year.

A priori expectations were that such credits should stimulate employment, decrease hours worked per week and reduce product prices of the subsidized industries. The time series analysis of the construction, retailing and wholesailing industries contained in the final section of the paper strongly supports these hypotheses. The results of Bishop and Haveman suggest that the NJTC was responsible for between 150,000–670,000 of the more than one million increase in employment that occurred between mid-1977 and mid-1978 in the construction and retailing industries. Similar analyses indicate that by June 1978, NJTC had produced roughly a 1 percentage point reduction in the margin between retail and wholesale prices of commodities.

6 Economic systems stability and taxation

The built-in stabilizing effects of public budgets have been treated extensively in literature. The possible destabilizing effects of taxes and subsidies in individual markets have received practically no attention. To some extent lack of suitable analytical tools is the reason. The strong tendency towards higher taxing ambitions and fast growing public sectors throughout the industrialized world has made the actual policy problems acute. A new economic situation has accentuated the need for better and more relevant theory.

Ysander (III:6) approaches these problems through a single market analysis. He observes that practically all literature on the effects of taxation hinges on the implicit assumption that rules of taxation are determined once and for all, while many of the important problems associated with taxes occur because the rules are changed frequently or because factors like inflation change the economic content of the tax rules in unpredictable ways.

The starting-point for Ysander's argument is that stability problems have gradually taken on serious proportions in the real world around us. This hurts the predictive power of received theory.

The common approach to systems stability analysis in literature has been in the Walrasian-Arrow-Hahn tradition. A Walrasian economy has a rubber band quality when forced to deviate from its equilibrium (fix) point. The model economy is assumed to be such that it returns to this same equilibrium point without moving the point in the process. Alternatively the analysis consists in ascertaining the conditions under which this same result occurs. Most models of the Walrasian type specify market price movements as functions of excess demand. Stability or convergence back to the equilibrium fix point, requires that agents each point in time accept prevailing disequilibrium prices as if they are equilibrium prices or believe them to be. A second requirement is that the adjustment step size be small enough not to generate excessive overshooting of the equilibrium point.

Third, some links across markets are needed to ensure that the adjustment (convergence) process in one market does not blow other markets out of equilibrium. Obviously the analytical problem can take on formidable proportions and there are various analytical "devices" to enforce stability, like disregarding other markets or across market linkages or assuming no endogenous price adjustment to the policy parameter change. The problem, however, is that one can easily stage a case for tax induced market instability for several relevant problems related to this volume. One such problem, that we return to in the next section has to do with the relative rate of return spectrum in the Swedish economy. Tax wedges between the stock market and the property market and inflation in combination can affect stock prices in an erratic fashion and disturb the investment allocation mechanism.

While Ysander (III:6) deals with the stability issue at grass root levels, Eliasson and Lindberg (IV:11) bring the problem from the micro level all the way up to the macro "systems" level.

With discretely formulated theories and micro agents operating in markets, as in the micro to macro model used by Eliasson and Lindberg, the total macro stability problem, even though more complex, can be quantified and placed in a grid of good quality micro statistical information.

A unique equilibrium point does not exist in this model, but rather a bounded multidimensional region of convergence. What Arrow-Hahn (1971) call stability in Liapunov's sense (or maybe even more adequately what La Salle-Lefschetz (1961) call "practical stability") prevails if the economy stays within a bounded region. Within the domain of the micro to macro model the uniqueness of the equilibrium point is removed allowing for an endogenous relative and absolute price adjustment (due to structural change as well as short term cyclical factors) and having structural change in turn depend endogenously on relative price change. From a pure mathematical point of view systems of such dynamic complexity do not generally have one unique (stable) optimum to move around. Hence, interest focuses on how the system behaves relative to a Liapunov type of stability region. The factors determinating systems behavior relative to that region, however, are the same as those treated in the earlier static equilibrium approaches to disequilibrium analysis; namely the way agents (1) interpret recorded market prices (expectations side) type of (2) across market interdependence, adjustment (3) step size and (in addition) (4) speed of response. Eliasson and Lindberg (IV:11) have found here that certain structural specifications of the economy may be extra sensitive to price shocks of a certain size and type under some market characteristics in the four senses above. This is so, if the Salter structure of one large market, or several markets, is too flat, or if markets are very integrated through a speedy arbitrage mechanism (like the labor market) with a tendency to large and/or fast step adjustments in response to outside price shocks. If biased in favor of one or a couple of industries and negatively to the rest a whole sector can suddenly collapse, with a dramatic change in supply conditions that throws prices into a state of disequilibrium, i.e. out of the Liapunov region, if narrow enough. Return to the same stability region may not occur or take a long time, since erroneous investment and supply reactions on the part of firms in the short term may keep moving the economy in the wrong direction for years.

Under such disequilibrium circumstances it has proved difficult (even in the fairly simple micro to macro modelling world) to design policies to remedy the situation faster and better than simply sitting back and allowing the model economy to adjust on its own. Policy devices to smooth the transition by slowing down structural change may even prolong and worsen the agony of adjustment, especially if the origin of the problems is of the built-in tax wedge kind.

7 Allocation through markets

The efficiency aspect of taxation focuses attention on how current practice of taxing capital income inserts various "tax wedges" between the costs of finance to the investors and the return received by savers, affecting the financial decisions of firms and biasing the rate of return between firms and between different sectors of the economy. Most papers in this volume are directly or indirectly related to these aspects of the allocation process.

Several studies reveal that possibilities of deferring tax payments to some degree characterize corporate tax systems in most industrialized countries. In Sweden at least, this possibility has been used mainly by firms reporting large profits on their existing stocks of capital. Hence, a conservative trait is built into the system. Historically well-performing firms benefit from lower capital costs and greater financing resources. One cannot know for sure that superior *ex post* performance guarantees good future performance, especially in times of great structural economic changes, when current relative prices may be bad predictors of long run future relative prices. Eliasson and Lindberg (IV:11) elaborate this observation by concluding that it may not matter so much from an efficiency point of view if firms invest in the wrong markets. The large misallocation effects stem from the fact that they keep producing in the misallocated investment facilities by tying up labor and maintaining artificially high wage levels, that make it difficult for expanding firms to pull out locked in labor through wage offers.

The extreme and inflationary market situation created under such circumstances by a progressive income taxation system is addressed by Ysander (III:6). One would suspect by analogy that the wage subsidy and maintenance programs discussed by both Bishop and Haveman (IV:9) and Holmlund (III:8) further aggravate this situation and even more so the extreme individual firm subsidization programs now so prevalent in Europe.

Locking-in effects of the corporate income tax are reinforced by the double taxation of corporate source profits discussed by McLure (II:2), and Bergström and Södersten (III:5). Since the total tax burden on corporate source income varies, depending on how profits are used by the firms—for retention or dividends—there is a strong incentive for firms to "withhold" some of their internal resources in the form of retained earnings rather than having them routed 100 percent through a capital market screening process. Putting it differently, the preferential tax treatment of capital gains makes it considerably less expensive to finance investments through retained earnings than through new issues of equity capital.

Capital gains, income and corporate income taxation combined constitute powerful and differentiated tax wedges, that discriminate between household investments in nominal bank deposits, shares and property. These wedges have been further enlarged by inflation and especially so in a country like Sweden where exemptions from full taxation of household interest income on bank accounts, Government bonds etc. are few and minimal, capital gains taxation on shares is not generous and capital gains tax rules on real estate are indexed. The dichotomy in capital gains taxation between shares and real estate (see Rundfelt, IV:10) means that the higher inflation the more profitable for private investors to allocate resources to property investments *even though* relative real, before tax returns to investments do not change. Eliasson and Lindberg (IV:11) demonstrate in addition that the higher inflation the more difficult for firms to maintain normal, before tax rates of return to investments due to disturbances in the market pricing mechanisms. The two effects together may contribute to an overall allocation of resources that is strongly detrimental to economic growth and even destabilizing (see Ysander, III:6).

Few empirical studies have been made but indirect evidence supports a strong tendency of households towards inflationary hedging in property as far as their long term investments go. The large number of summer houses in the Swedish country side and the absence of a working venture market for share capital may be more due to tax wedges that make this type of consumption relatively inexpensive than to particular Swedish consumer preferences. A bias towards property investments reduces both incentives and credit market resources available for investments in industry. The importance of the stock market as an allocator of venture capital is correspondingly reduced.

The tax wedge problem turns acute when very steep progressive income scales on earned income and a sudden and permanent change in the international market situation combine, as during the second half of the seventies for Swedish companies. Attempts to reallocate labor through after tax wage incentives become very costly indeed, when expressed on a before tax basis. Reallocation of capital is hampered by a generous business taxation system that favors indigenous plow back of profits. Tax discrimination against traditional household saving in banks and shares, as argued, both in Ysander (III:6) and in Eliasson and Lindberg (IV:11), indirectly affects the stability of the entire economy. The total tax wedge effect is a flow of investment resources out of the manufacturing sector. This hurts export performance in particular and contributes towards an external balance problem, much as it has already, for instance in Sweden.

Provided that the promotion of economic growth is politically desirable and that it requires an effective allocation of savings within and between different sectors of the economy, there is an obvious need to eliminate "locking-in" effects of the kinds discussed above. There are several possible and simple remedies within the domain of business taxation that could be indicated already at this stage. During the first half of the 1970's the effective corporate tax burden for manufacturing industry in Sweden averaged about 20%. Clearly, the same effective tax burden could be accomplished by combining less favorable rules of fiscal depreciation with a sufficient cut in the statutory corporate tax rate. Such a reform would even out the effective tax burden between different firms, making it less expensive to reallocate profits within the corporate sector and between different sectors of the economy.

The current discussion on integrating the corporate and personal income taxes may be thought of as motivated by the same desire to improve the mobility of savings in the economy. Different schemes of partial integration are thoroughly explained by McLure (II:2) and Bergström and Södersten (III:5). Again, reducing the total tax burden on distributed earnings would make it more attractive to find alternative investments outside the firm—for internally generated profits.

In short, the whole problem centers around how to impose a uniform rate of return requirement on the economy that is compatible with the rate of return standard set in international markets.

That the dynamic allocation mechanisms matter for the entire economy is clearly illustrated in Eliasson and Lindberg (IV:11) where various corporate income taxe wedges are allowed to impede the reallocation process forced on the Swedish economy through a sudden, unpredicted and permanent change in relative export prices. The results indicate that the economy eventually settles down to oscillate around some steady state growth rate in a typical, cyclical fashion. This new growth rate, however, depends significantly on how the reallocation process is policed through the corporate income tax system. For instance, the actual scenario played by Swedish policy makes the years 1972 through 1978 look like one of the worst possible scenarios that were available at the time. The extreme relative price change in favor of heavy base industries and strong overall inflation in 1972–74 was allowed to run through the economy unimpeded. Investment and wage drift soared in the wrong industries, stimulated by generous fiscal rules. Firms met the following recession with dramatically lowered prices compared to expectations, overly inflated wages and an enlarged capacity to produce in very modern facilities that were productive in a technical sense but commercially obsolete.

When the scenario was reenacted with a tighter fiscal policy package and the extreme but temporary raw material boom 1973/74 removed long term economic growth and cyclical stability improved. Reallocation of resources (capital and labor) from declining to expanding sectors was faster and more efficient. The circumstance that a fairly large number of raw material firms had to close down in fact stimulated investment and growth in engineering industries through a favorable effect on factor prices and labor mobility. The effects on unemployment were negligible, at least in the simulations.

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Part II

Corporate Income Taxation in an International Context

Tax Frontiers and National* Frontiers

George N. Carlson and Gary C. Hufbauer

1. INTRODUCTION

Various tax systems have emerged in the industrial world as each country has pursued its own vision of "fiscal sovereignty". Some countries have come to rely on indirect taxes, such as sales or value added taxes, others on direct taxes, such as the corporate income and social security taxes, while others have adopted an amalgam of indirect and direct taxes. In an open world economy, the problem arises of meshing these various tax systems. As goods and services, capital and income have moved across national frontiers in ever larger volume, nations have come to adopt border adjustment rules to address the twin threat of double taxation and fiscal avoidance. For historical reasons, different border adjustment rules have avolved for different kinds of taxes. This paper summarizes the broad rules now applied to indirect and direct taxes, and then focuses on the evolution of formula allocation approaches.

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A. Border Treatment of Indirect Taxes

Under the General Agreement on Tariffs and Trade (GATT), indirect taxes on commodities may be treated under either a destination or an origin principle. A destination principle border tax adjustment consists of an import tax and an export rebate at rates equal to the internal tax; consequently, a commodity is taxed where it is consumed. An origin principle border tax adjustment consists of the exemption of imports and the taxation of exports at a rate equal to the domestic tax; thus a commodity is taxed where it is produced. If country A follows the destination principle while country B follows the origin principle, exports from A to B will avoid all indirect taxation, while exports from B to A will be subjected to double indirect taxation. But as a practical matter, most countries apply the destination principle to the majority of their indirect taxes. The result is that the indirect tax rates of the consuming nation govern the taxation of most commodities.[1]

B. Border Treatment of Direct Taxes

The direct tax situation is not in practice so simple. The two basic jurisdictional standards for

[1] Depending on the particular system, prior stage indirect taxes, and indirect taxes on services may or may not be adjusted on a destination basis. In this sphere, the border rules can lead to double taxation or fiscal avoidance. In addition, hard mineral and oil royalties collected by national governments (and thus barely distinguishable from indirect taxes) are almost always imposed under the origin principle by producing nations, while consuming nations often levy additional indirect taxes on those products.

asserting income tax liability are source and residence.[1] Under the source standard, a country asserts tax jurisdiction over income earned within its geographic area. It makes no difference who receives the income; both residents and nonresidents are taxed on income derived from within the source jurisdiction.[2] France and the Netherlands are examples of countries with a source or "territorial" system of taxation. To the extent nations use source systems, and follow the same rules for determining sources of income, double taxation and fiscal avoidance need not arise.

Under the residence standard, the residence of the taxpayer, rather than the source of income, is the relevant criterion. Residence is usually defined in terms of domicile for individuals and place of incorporation or central management for corporations. World-wide taxation is closely related to the residence principle since a resident may be subject to taxation on income from all, including foreign, sources. Clearly the residence approach raises a danger of double taxation. This danger is often avoided by allowing a credit for taxes paid to a foreign jurisdiction.

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[1] The United States, unlike most other industrial countries, also taxes on the basis of citizenship.

[2] Residents and nonresidents need not necessarily be taxed under the same rules. Sections 871 and 881 of the U.S. Internal Revenue Code, for example, impose a flat-rate tax of 30 percent on U.S.-source dividends, not effectively connected with a U.S. trade or business, received by nonresident alien individuals and foreign corporations. Although popularly known as a "withholding" tax, this 30 percent tax does not represent a prepayment of domestic income tax, but rather a final tax payment that substitutes for taxation at the rates applied to resident individuals and corporations.

Many countries follow a hybrid of source and residence rules. United States citizens and residents, for example, are subject to United States taxation on their world-wide income while non-resident foreign taxpayers are generally subject to United States taxation on only their United States source income.[1]

a. <u>Neutrality principles</u>. The source, residence, and hybrid systems have been developed in light of two alternative principles of international direct taxation. One principle is capital export neutrality, which in its pure form would require an enterprise to pay the same total rate of taxation on its foreign as on its domestic profits. This principle, often followed by residence-basis taxation countries, tends to maximize efficiency by encouraging investment decisions to be made on the basis of the most favorable pre-tax rates of return. Capital-export neutrality is frequently implemented by taxing all income at home rates, but allowing a foreign tax credit, subject to limits, on income earned abroad. The other principle is capital-import neutrality, achieved when both foreign and domestic firms pay the same total rate of tax on operations in a particular country. Capital-import neutrality, often followed by territorial countries, promotes the most efficient use of resources in the host country. It is usually

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[1] Non-resident foreign taxpayers are subject to United States taxation at the normal rates on income "effectively connected" with a United States trade or business and to the basic 30 percent withholding tax on United States source investment income, such as dividends, interest, and royalties. The 30 percent rate frequently is reduced in bilateral tax treaties.

implemented by the simple expedient of not taxing foreign income.

b. Arm's length pricing, nondiscrimination, and equitable principles. Both source and residence systems depend on the arm's length pricing principle for distinguishing between income earned at home and abroad, and for setting limits on the foreign tax credit. Under the arm's length principle, prices for transactions between related entities should equal the prices charged for similar transactions between unrelated parties. Nondiscrimination is another basic principle of international tax policy and requires that non-residents should not be subject to heavier taxation than residents. The foreign branch or subsidiary of a country A corporation, for example, should not be taxed more heavily in country B than a branch or subsidiary of a country B corporation is taxed in that country. Finally, all countries are interested in an "equitable" division of revenue between the source and residence countries. While perceptions of equity differ, there is general agreement, both among source and residence countries, that the source country is entitled to the major share of revenue. There is also agreement that foreign taxes should not reduce home country taxation of domestic source income.

2. FORMULA APPORTIONMENT

As the network of international transactions has grown increasingly dense, it has become more difficult to administer a source rule approach. Opportunities for tax evasion and avoidance seem to expand, both through the manipulation of transaction prices and through the legal recharacterization of income flows. In addition, certain host nations (for example, Brazil, Indonesia, Jamaica, and Mexico) and subfederal units (for example, the Canadian provinces and the American states) feel disadvantaged by the established rules. The response to this discontent, both in the international arena and at the sub-federal level, has been a trend toward formula apportionment.

On the one hand, formula apportionment may be viewed simply as an administratively attractive alternative to the present system for dividing the income of a taxpayer among the jurisdictions in which it operates. On the other hand, formula taxation may be seen as a device for giving national tax systems an extraterritorial reach, thereby threatening the international accomodation which characterizes the existing scheme of rules. The balance of this paper explains why we are more persuaded by the second view.

Under a formula apportionment approach a portion of a corporation's total taxable income is assigned to a particular jurisdiction (state, province, or nation) based on the relationship between the corporation's activities in that jurisdiction and its total activities. Income is apportioned on a basis of a weighted or simple average of the percentages that factors such as payroll, property, and sales within the jurisdiction bear to the total amounts of these factors.

Assume, for example, that a corporation has \$100,000 in total taxable income; payroll, property, and sales in country A of \$75,000, \$100,000, and \$300,000, respectively; and total payroll, property, and sales of \$300,000, \$300,000, and \$600,000, respectively. In addition, assume that country A requires that corporate net income be apportioned under a payroll-property-sales (three-factor) formula, with each factor having a weight of one-third. The corporation's taxable income in country A would then equal:

$$\frac{\frac{75,000}{300,000} + \frac{100,000}{300,000} + \frac{300,000}{600,000}}{3} = \frac{13}{36} = \text{Apportionment factor}$$

$$\frac{13}{36} \times \$100,000 = \$36,111 = \text{Taxable income attributed to country A}$$

Recently, formula apportionment has been carried a step further and applied to the corporate group as well as to single corporations. This application is known as the unitary system of taxation. Assuming a three-factor formula, the taxable income of a particular corporation in country A is determined by relating that corporation's in-country payroll, property, and sales to the total payroll, property, and sales (and the total income) of the unitary corporate group, including affiliated corporations established in other countries.

Formula or unitary apportionment formulae are based on two assumptions: that the factors used in the formula bear a reasonable relationship to the income earned by the corporate family; and that the corporate family is equally profitable, in relation to the formula's factors, in all its geographic and product operations. If these twin assumptions are not correct, a country may be taxing more (or less) than the income actually earned within its borders, as measured by a true arm's length standard.

A. Expansion of Tax Jurisdiction

The critical question raised by formula or unitary apportionment is whether, in addition to serving as a convenient measuring device, it has the side effect of enabling a country to tax income earned outside its jurisdiction. Consider the following example in which country X levies its taxes on the basis of a unitary apportionment formula. Suppose parent corporation A and wholly owned subsidiaries B and C form a unitary business,[1] engaged in the manufacturing and selling of lathes. Coporation A manufactures lathes and does all its business in country X. Corporation B sells lathes in country X and other countries, while corporation C does no business in country X. Since corporations A, B, and C form a unitary group, a separate, but combined, return must be filed for corporation A and corporation B, each of which does business in country X. Although corporation C is not required to file a return in country X, its income and apportionment factors must be included in the combined return of the unitary group. Suppose that

[1] While definitions vary between jurisdictions, generally there are three elements to a unitary business: (1) unity of ownership, presumptively fulfilled if stock ownership of one corporation in another is at least 50 percent; (2) unity of operation as evidenced by centralized purchasing, advertising, and management; and (3) unity of use of a centralized executive force or general system of operation.

the payroll, property, and sales and total taxable income (measured under an arm's length standard) for these corporations are as follows:

Corporation	Payroll Total	Payroll Country X	Property Total	Property Country X
A	120	120	180	180
B	80	40	120	60
C	100	0	150	0
	$300	$160	$450	$240

	Sales Total	Sales Country X	Total Taxable Income (measured at arm's length)
A	240	240	50
B	160	80	50
C	200	0	80
	$600	$320	$180

If country X applies a three-factor, equal weight formula, corporation A's taxable income in country X under the unitary approach would be computed as:

$$\frac{\frac{120}{300} + \frac{180}{450} + \frac{240}{600}}{3} = 0.40 = \text{Unitary apportionment factor}$$

$$0.40 \cdot \$180 = \$72 = \text{Taxable income in country X}$$

Corporation B's taxable income in country X would be computed as:

$$\frac{\frac{40}{300} + \frac{60}{450} + \frac{80}{600}}{3} = 0.133 = \text{Unitary apportionment factor}$$

$$0.133 \cdot \$180 = \$24 = \text{Taxable income in country X}$$

Corporation A would have taxable income in country X of $50 either under a non-unitary apportionment approach (since all its activity is in country X) or under a separate accounting approach (based on arm's length principles) but under the unitary method it has taxable income in country X of $72. In this instance, the inclusion of corporation B (a domestic subsidiary) and corporation C (a foreign subsidiary) in corporation A's combined report serves to increase corporation A's combined tax liability to country X.[1]

Since country X is taxing more than corporation A's total income, it is necessarily taxing income earned outside its borders. In this instance, the unitary method of apportionment clearly enables country X to tax income that would lie beyond its reach under a purely source rule approach. This result arises because a corporation's tax liability under the unitary method of apportionment depends on three elements, in addition to the statutory tax rate: (1) the total income of the multinational enterprise in all jurisdictions; (2) the amount of the particular corporation's apportionment factors located in the formula jurisdiction; and (3) the amount of the entire corporate group's apportionment factors in all jurisdictions. If, as in this case, the ratio of taxable income to payroll, property, and sales for the corporation sub-

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[1] Note that corporation B's taxable income in country X is decreased by the combined report requirement, by comparison with a single corporation formula approach. It would be $25 under a non-unitary apportionment approach, (since one half of its total activity is in country X) while it is $24 under the combined report. The hypothetical facts are not adequate to indicate what corporation B's taxable income in country X taken alone would be under a separate accounting approach based on arm's length principles.

ject to formula apportionment (corporation A) is less than that ratio for the remaining members of the unitary enterprise (corporations B and C), some of the income of corporations B and C will be apportioned to corporation A and taxed by the formula jurisdiction.

B. Interference with the Principle on Non-discrimination

This extraterritorial taxation also has discriminatory implications. Competing firms in the same industry may be subject to quite different rates of taxation on their income, depending on the position of their sister firms located in other jurisdictions. In the preceding example, corporations A and B have the same income, but corporation A pays three times as much tax to country X. This outcome, incidentally, is quite at odds with the concept of capital-import neutrality.

It might be argued that the outcome is appropriate since corporation A has more payroll, property, and sales in country X. So long as we are speaking of an income tax, this contention begs the question, for it assumes that income arising in country X is appropriately measured by payroll, property, and sales. And even if the factors reasonably indicate the origin of income, they presumably work best when applied to a single corporation with a limited range of products, not the entire corporate group.

But of course we can always drop the idea that formula apportionment is consistent with an income tax. As McLure first pointed out, formula apportionment can instead be viewed as a series of excise taxes on the factors represented in the formula.[1] Viewed in this light, income taxation on the basis of formula apportionment can be seen as indirect taxation levied under the origin principle--with a consequent danger of double taxation and potential tax discrimination among firms. To be sure, the discrimination arises covertly from the operation of the formula, rather than overtly from the application of different income tax rates to competing firms. But covert discrimination can have the same economic impact as overt discrimination.

According to standard economic analysis, if competing firms pay differing rates of taxation, the differential amount cannot be shifted in the short run. The firm subject to heavier taxation must simply accept lower earnings than its competitors. In the long run, however, standard analysis holds that the firm bearing the heavier tax burden can escape by leaving the jurisdiction or shifting to a new line of production. But formula apportionment may make it more difficult to escape discriminatory taxation even in the long run.

The particular corporation subject to heavier taxation can of course move to another jurisdiction. But the remaining members of the multinational enterprise present in the formula jurisdiction would still be liable to taxation. They may well

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[1] See Charles E. McLure, Jr., "The Equivalence of State Corporate Income Taxes and State Taxes on Corporate Sales, Payroll, and Property," 1976, unpublished.

be taxed on what, in effect, is income earned by other members of the corporate family, including the corporation which has just vacated the jurisdiction. Unless a unitary corporate group is willing to sever all ties with the taxing jurisdiction, the use of formula apportionment may make it difficult to escape discriminatory taxation. This difficulty may in turn encourage countries to pursue discriminatory formula taxation in the belief that they will not so quickly suffer the adverse consequences of lost employment and sales normally associated with the relocation of firms.

C. Interference with Capital Export Neutrality

Capital export neutrality requires that an enterprise pay the same rate of total taxation on its foreign as on its domestic profits. If, for example, a foreign subsidiary is taxed in the host country at 40 percent, and if the tax rate in the home country is 50 percent, capital export neutrality would require a current home country tax of 10 percent on the subsidiary's profits. Formula apportionment is inconsistent with this principle. Since it purports to tax on a source basis, the formula approach does not recognize foreign taxes. The tax levied by the formula jurisdiction *qua* home jurisdiction therefore will not vary with respect to any foreign taxes assessed on the same income. This same criticism can be made about the territorial tax systems of the world. Those systems, however, attempt to measure income earned within the jurisdiction through the application of internationally recognized source rules and arm's length pricing requirements.

Moreover, a formula jurisdiction qua host jurisdiction may effectively tax corporate income at a rate well in excess both of its own nominal rate and the home country's nominal rate. To be sure, similar results can occur under existing corporate tax systems. In particular, host countries can tax at rates well in excess of home country rates. Depending on the workings of particular foreign tax credit systems, excess host country taxation might or might not be allowed as an offset against home country tax liability.[1] But formula apportionment decreases the likelihood that the standard of capital export neutrality will be met.

D. Interference with Tiebout-type Efficiency

A classic problem in public finance is whether political mechanisms work to provide an optimal quantity of public goods. A public good is one which is jointly supplied to the community as a whole; no one can be excluded from its benefits. National defense is a popular example. Musgrave and Samuelson have noted that, within a single jurisdiction, no market exists to determine the appropriate level of expenditures on public goods. The core problem is that individuals will not reveal their true preferences, since they can enjoy public goods without paying for their use.

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[1] If the home country limits the foreign tax credit on an overall basis, rather than a per country basis, then an enterprise which earns income in a high-tax jurisdiction may offset part of those taxes against its potential home country liability on income earned in a low-tax jurisdiction.

Tiebout, in his seminal work,[1] noted that the "public goods" problem finds a solution in the local government milieu. Individuals (and firms) are confronted with various bundles of public services and tax rates. They choose the more desirable bundles by moving to those jurisdictions and reject the less desirable bundles by moving away from those jurisdictions. The result is an optimal or market-type amount of public services as taxpayers adapt to the economic system. In Tiebout's words, "spatial mobility provides the local public-goods counterpart to the private market's shopping trip". The power of individuals to "vote with their feet" not only enables a better match between public offerings and private demands; it also provides a salutary discipline on the natural tendency of government bureaucracy to serve up an excessive quantity of public goods.

Tiebout's analysis can be extended to the world economy. A multinational enterprise enjoys some flexibility in deciding where it will open new plants and how it will source output from existing facilities. One element in the enterprise's decision calculus will be the revenue-expenditure patterns of national governments. *Ceteris paribus*, a firm will expand output in the country offering the most attractive revenue-expenditure package.

Formula apportionment interferes with this disciplinary mechanism. Consider a corporation established in the formula jurisdiction. It may discover that, as it acquires affiliates in other jurisdictions, its tax liability in the formula

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[1] Charles M. Tiebout, "A Pure Theory of Local Expenditures", *The Journal of Political Economy*, October 1956, pp. 416-424.

jurisdiction increases, although income earned there is unchanged. Conversely, the newcomer firm to the formula jurisdiction may discover that its tax liability depends not so much on its own performance as the performance of sister corporations. In both cases, formula apportionment will have interfered with the ability of the enterprise to easily evaluate the revenue-expenditure menu offered by the particular jurisdiction.

E. Revenue Erosion for Non-formula Jurisdictions

Formula apportionment may erode the tax revenues of a non-formula jurisdiction by "piggybacking" on its tax credit system. Consider a formula jurisdiction which successfully extends the reach of its taxing powers beyond the members of the corporate family located in its jurisdiction. This was characteristic of country X in the prior example since corporation A was assigned a taxable income in country X substantially in excess of its actual taxable income. Such overreaching by country X will erode the revenues of non-formula jurisdictions which credit the taxes imposed by formula jurisdictions. The extent of erosion may be constrained by limits which tax credit countries, such as the United States, place on the amount of foreign taxes eligible for the credit. But within these limits, a formula jurisdiction can raise its taxes with impunity, since its higher taxes simply transfer revenue from the non-formula jurisdiction, rather than increase the overall tax liability of the enterprise.

Non-formula jurisdictions are unlikely to remain silent as they observe and experience the undesirable effects of formula apportionment. The response to this discontent may be the retaliatory adoption of formula systems. This would not be the type of efficient fiscal competition described by Tiebout. Rather, it would be an overly-aggressive attempt to tax income earned outside the source jurisdiction, with special emphasis on taxing foreign enterprises.

3. CONCLUSION

The desire to avoid double taxation has been the driving force behind the design of border adjustment rules which accommodate the divergent tax systems of the world. Formula apportionment is a relatively recent development in the area of international taxation. While advocated as an administratively attractive alternative to the present methods of determining taxable income, it can easily be diverted to serve as a vehicle for extraterritorial taxation. It thus threatens to destabilize the existing accommodation of national tax systems and to disturb the free flow of goods and capital.

Tax Integration in the United States *

Charles E. McLure, Jr.

1. INTRODUCTION

The past several years have seen a remarkable amount of interest in the United States in what can generally be described as the integration of the corporate and personal income taxes. This interest, seemingly rooted in recent concern that the present tax system retards capital formation and economic growth, has strong theoretical foundations in the academic arguments that an unintegrated or separate corporation income tax reduces both the equity of the tax system and the efficiency of allocation of the nation's resources.

While the Ford Administration was sufficiently convinced of the case for integration to propose dividend relief to the Congress in July 1975, the largely Democratic Congress was unconvinced and the proposal was generally ignored.[1] On the other

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[1] Throughout this paper, except where context makes meaning clear, "integration" is reserved for approaches to the taxation of corporate-source

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hand, the proposal for complete integration contained in Blueprints for Basic Tax Reform, a white paper issued by the U.S. Treasury Department (1976) during the waning days of the Ford Administration, received considerable attention. But it seems to have done so more because it was part of a comprehensive scheme for revamping the U.S. tax system than because anyone really believed integration to be politically viable. Over the next two years, however, there developed a substantial interest in integration--so much so that President Carter's failure to include dividend relief in the tax reform package presented to the Congress in late 1977 surprised some, and in early 1978 Chairman Al Ullman (1978) of the House Ways and Means Committee proposed a scheme for partial dividend relief patterned closely after that reported to have been suggested to the Carter White House by the Treasury Department ("Tax Reform Options Papers...", 1977). Since then interest in integration or dividend relief seems to have diminished somewhat as attention has turned increasingly to rate cuts and reduction of taxes on long-term capital gains as means of stimulating capital formation.

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equity income which involve the taxation of all such income to shareholders at the relevant marginal tax rate of the shareholder, without regard to whether the income is distributed or retained by the corporation. "Dividend relief", on the other hand, is used to refer to approaches which apply only to distributed corporate-source income, that is, two systems which relieve the double taxation of dividends but retain the corporate income tax as a final tax to the extent that income is retained by the corporation.

This paper reviews the advantages of integration, describes some of the significant practical problems of full integration, discusses alternative approaches to dividend relief and the possibility of achieving most of the objectives of full integration by merely providing dividend relief, and emphasizes especially the administrative problems and issues raised by tax preferences and international ownership of capital.[1] It will be seen that the prognosis for full integration is not good and that even dividend relief poses significant problems.

2. THE CASE FOR INTEGRATION[2]

Though much has been made in recent public discussions of the presumed effects integration or dividend relief would have in stimulating capital formation, the fundamental economic arguments for integration are in terms of equity and economic neutrality of taxation. Under a separate unintegrated or "classical" system of taxation, corporate-source income which is paid out as dividends is taxed more heavily than income retained by the corporation and more heavily than other capital income which is fully taxed to the taxpayer as ordinary income. This creates an incentive for firms to finance expansion through the retention

[1] The discussion in this paper draws heavily on McLure (1979).

[2] The case for integration and the counter-arguments against it are described in substantially greater detail in McLure (1979) chapter 2. For a more detailed presentation of the case for integration, see McLure (1975).

of earnings or the issuance of corporate debt rather than through the sale of new equity issures (including reinvestment of dividends by shareholders). That is, it is commonly argued that both dividend payout rates and debt-equity ratios are distorted by the separate corporation income tax.[1] Moreover, since corporate-source equity income is generally thought to be taxed more heavily, on average, than capital income earned in the noncorporate sector, it is usually presumed that the separate corporation income tax results in the misallocation of capital from the corporate to the noncorporate sector. This misallocation has been estimated to result in a loss of welfare of perhaps one-half of one percent of GNP per year.[2]

The equity effects of integration and dividend relief can be appraised from at least two perspectives. On the one hand, it is easily shown that the overtaxation of corporate-source income resulting from the failure to integrate the income taxes or provide relief from double taxation of dividends is greater at the bottom of the income scale

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[1] This argument has been expressed, for example, by Tambini (1969) and Scott (1976), and forms the basis for the analysis in Ballentine and McLure (1980). It has, however recently been questioned by Stiglitz (1973) and Bradford (1977). The relevance of these counterarguments is still being hotly debated.

[2] The standard reference for this argument is Harberger (1962). Important subsequent work on this issue has been done by Rosenberg (1969) and Shoven (1976). But see Stiglitz (1973), Bradford (1977), and King (1977).

than at the top.[1] With a 46 percent corporate rate and marginal personal rates ranging from zero to 70 percent, for example, the overtaxation of distributed corporate-source income, relative to the taxation that would be incurred if only the individual income tax were applied to such income, would be 46 percentage points for the person in the zero marginal rate bracket, but only 13.8 percentage points at the top of the rate structure. Similarly, for retained corporate-source income which subsequently results in preferentially taxed long-term capital gains the results would range from overtaxation of 46 percentage points at the bottom of the marginal rate scale to undertaxation of from 8.9 to as much as 24 percentage points at the top.[2]

The argument just presented does, however, give a somewhat misleading impression of the distributional effects of integration and dividend relief. Because the ownership of corporate shares is highly concentrated in upper-income classes,

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[1] Inherent in the statements which follow is an implicit assumption that the corporate tax cannot be shifted. As Harberger (1962) has argued, the tax is, in fact, quite likely to be borne more or less equally by all owners of capital, rather than merely falling on owners of corporate shares. For arguments that the case for integration is little affected by shifting, see Mieszkowski (1972) and McLure (1975). Moreover, the effects of tax preferences in reducing effective corporate tax rates are ignored at this point.

[2] In calculating the maximum undertaxation of retained corporate-source income resulting in long-term capital gains, it is assumed that realization and taxation of such gains occurs after basis has been stepped up at death. Short-term capital gains are treated like dividends for tax purposes and therefore are not discussed separately here.

relief from double taxation of dividends is of greatest benefit at the top of the income scale and providing dividend relief would greatly reduce the progressivity of the income tax. On the other hand, because the extension of integration to retained corporate-source income is tantamount to taxing long-term capital gains as they accrue at the rates applied to ordinary income, integration would actually increase the progressivity of the tax system.[1]

There can be little doubt that by themselves integration, and especially dividend relief, would spur private capital formation. After all, they would represent tax reduction of some $15 to $30 billion in taxes currently collected on the return to investment in corporate equity securities.[2] But the story is incomplete if it stops there. To be meaningful, analysis of the effects on capital formation should compare effects under dividend relief or integration with those under equally costly alternative ways of reducing taxes. Dividend relief, for example, can be expected to stimu-

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[1] Among the efforts to determine the distributional consequences of integration and dividend relief are Break and Pechman (1975), Feldstein and Frisch (1977a and 1977b), and U.S. Treasury Department (1976). All these studies reach qualitatively similar results. The exact distributional effects of integration or dividend relief would, however, depend crucially on (a) how tax preferences are treated and (b) tax-induced changes in dividend policy. This has been recognized and incorporated all too seldom in estimates of the distributional effects of this type of tax reform.

[2] For evidence that saving is substantially more responsive to the rate of return than commonly thought, see Boskin (1978). For a critical appraisal of Boskin's work and further discussion, see Howrey and Hymans (1978).

late capital formation somewhat more than an equally expensive across-the-board reduction in personal income taxes, both because the tax cut it involves is concentrated on capital income and because the particular type of capital income on which taxes would be cut is concentrated in the hands of the wealthy. But the stimulus would be substantially less than is indicated by analysis of a plan which would simply provide dividend relief. Moreover, it appears that either integration or dividend relief would have a greater positive impact on capital formation the more unequal it left the distribution of after-tax income. Or, stated differently, if the revenue loss involved in integration or dividend relief were made up through an income tax increase which left the distribution of tax burdens across income classes basically unchanged, it is unlikely that there would be much effect on the rate of capital formation in the United States.[1]

The solution which academic economists propose for the ills of an unintegrated income tax described above is, of course, to integrate the income taxes. In a nutshell, this means that the entire current income of a corporation would be attributed to its shareholders for tax purposes. If the corporation income tax continued to exist it would be only as a withholding device. If integration were deemed to be infeasible, dividend relief might be a reasonable second-best solution. Under it the corporation income tax would continue to be

[1] For more complete statements of this position see Feldstein (1975) and McLure (1976). Effects on capital formation would also depend crucially on the treatment of such tax preferences as the investment tax credit and accelerated depreciation.

a final tax so far as retained corporate-source income is concerned, but it would, at most, be only a withholding tax to the extent that income is distributed. That is, the income taxes would be "integrated" to the extent that income is distributed, but not to the extent that it is retained.

Efforts to gain integration or dividend relief in the United States have been hampered by a lack of hard empirical evidence on the likely effects that would result from such a policy. For example, first-round effects on the incidence of taxation can be estimated easily enough. But they depend crucially on the exact "integration" package enacted, especially where the extremely complicated matter of preferences is concerned. Moreover, by the time adjustments of investors' portfolios and corporations' financial policies and investment plans are complete, the incidence effects may differ markedly from the first-round estimates. Unfortunately there is little direct American evidence on how integration or dividend relief would affect capital accumulation, corporate investment strategies, financial policies, the behavior of individual and institutional investors, share prices, etc. European experience is difficult to interpret because the movements between the classical system and various forms and degrees of dividend relief have been all too recent and they have occurred during a time of such economic turbulence that isolating the effects of dividend relief would be difficult, indeed.[1]

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[1] For a partial review of the recent American debate over integration and dividend relief, including citations and discussion of some empirical evidence, see McLure (1979, Chapter 2).

3. THE FEASIBILITY OF FULL INTEGRATION[1]

Interpreted literally, full integration would involve taxation of the equity income of corporations in the same way that the income of partnerships is taxed. A number of difficulties in implementing such an approach have been identified. First, an enormous amount of data would need to be transmitted to shareholders and utilized by them. Many large corporations would have difficulty providing the information shareholders would require to file their tax returns on a timely basis. This problem, like several others to be described below, is even worse if there are chains of intercorporate ownership. For example, firm A could not inform its shareholders of their proportionate parts of its taxable income until it had been told by firm B, whose shares it owns, what the latter's income was.

Moreover, it would be necessary for shareholders to adjust the basis used in calculating capital gains on shares any time corporate income was retained by the firm. Otherwise such income would be taxed twice, once when retained and again when it resulted in capital gains. (See also footnote 1 p. 00.) Intra-year transactions in stock and the existence of stock held for shareholders by mutual funds or in the name of brokers would aggravate this problem.

Second, strictly speaking, alterations in corporate taxable income resulting from amended returns

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[1] For further elaboration of the points made in this section, see McLure (1979, chapter 5). No effort is made to assess the political forces for and against integration. But see McLure and Surrey (1977).

and audit adjustments would involve re-opening the tax returns for all shareholders who held stock in the corporation during the year for which income was changed. Such an approach is patently unworkable, and a compromise in which results of audit adjustments and amended returns would be reflected in the taxable income for the year in which the adjustments were made seems to be the only feasible alternative. But such an approach, besides violating the basic spirit of integration, could lead to manipulation and abuse.

Third, in the case of intra-year sales of corporate shares, profits and losses of the corporation would be allocated to shareholders on a day-by-day basis under a strict interpretation of the partnership approach. Such an approach would clearly be infeasible, and it would be necessary to allocate income and losses for the year to shareholders of record on a given date. Using the last day of the corporation's fiscal year as the date of record would be unsatisfactory since high income individuals could be expected to purchase shares in firms with known losses near the end of the year in order to benefit from the deduction for the corporate losses that would be passed through to shareholders of record. But the first day of the year is also an unsatisfactory day of record, because the seller's tax credit would depend on the performance of the firm after the sale of the stock.

Fourth, the existence of multiple classes of stock and near-stock would add further to the difficulties of implementing integration. In particular, "...profits retained in one year in excess of accumulated claims of preferred shareholders would presumably be allocated to holders of common stock. Yet in a later year these funds might be used to pay dividends on preferred stock".[1] Problems of this type could be avoided if integration were allowed only for firms with simple capital structures. But integration restricted in this way would probably not be worth the trouble.

Fifth, a purist interpretation of the partnership approach to integration would require that the various components of corporate income which are treated differently at the individual level be segregated and reported separately to individual shareholders. Each type of income would be accorded the treatment in the hands of the shareholder that it would receive if realized through a proprietorship or true partnership and tax preferences would flow through to shareholders. Such an approach, besides creating a substantial compliance and administration burden, could result in abuses similar to those that have recently been under attack in the partnership field.[2]

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[1] This quotation is from Goode (1946, pp. 20-21). This remains one of the best analyses of the problems of integration. For more recent discussions, see Royal Commission on Taxation (1966) and U.S. Department of the Treasury (1976).

[2] Under U.S. law no deduction can be taken for interest paid to finance holding securities of state and local governments, which pay taxexempt interest. This prohibition currently impinges only on some high income taxpayers, but any shareholder in a firm holding these securities could, strictly speaking, be affected under integration. Similar comments could be made about other tax-sheltered activities.

For more on the possibility that corporations might come to be used for tax shelter purposes,

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Finally, a literal interpretation of full integration would require that the foreign tax credit be available to individual shareholders, rather than merely to corporations. The thought that all shareholders in firms paying foreign taxes would claim the foreign tax credit and be concerned with the intricacies of the limitation on the foreign tax credit, carry-backs, and carry-forwards staggers the imagination.

In short, it is unlikely that total integration could be implemented in its pure form. At most an approach such as those recommended by the Canadian Royal Commission on Tax Reform (1966) and the authors of Blueprints for Basic Tax Reform (U.S. Department of Treasury, 1976) is feasible. Under it no attempt would be made to differentiate between types of income, changes in taxable income resulting from audit adjustments and amended returns would be attributed to those owning shares in the year of the change, the first day of the year would be the day of record, and the foreign tax credit would be applied at the corporate level. Under the Blueprints approach shareholders would be taxed on the entire income of the corporation in the year in which it is earned. Basis would be adjusted for income taxed in this way, and dividends would be treated as a tax-free return of capital, rather than as a taxable

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much as partnerships have, see Warren (1978 p. 353). The argument in the text could, however, be turned around to say that the reason we have so much trouble with integration is that we have departed so far from a Haig-Simons definition of income. With more accurate measurement of economic income integration would be easier.

event.[1] Tax would continue to be collected at the corporate level, but it would be only a withholding device, the tax being creditable by the individual against his liability for personal income tax.

Though some of these solutions seem satisfactory, the proper treatment of losses remains troublesome, and no satisfactory solution has been found for the problems posed by multiple classes of stock. Moreover, even this less ambitious scheme for integrating the income taxes would create substantial demands for data processing and record keeping. Though full integration should not be dismissed without further study, it is clearly something into which no country can afford to rush.[2]

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1 The recommendations of the Royal Commission on Taxation and those in _Blueprints for Basic Tax Reform_ differ in that the former would separately tax dividends (on a grossed-up basis, to be defined below) and (at the option of the corporation) allocated retained earnings (again on a grossed-up basis), making basis adjustments only in the latter case. While the two are algebraically equivalent, the _Blueprints_ scheme outlined in the text seems administratively preferable. For further discussion of this point, see McLure (1979, chapter 5). In addition, retention of the corporate income tax as a withholding device was inherent in the proposals of the Royal Commission on Taxation, whereas in _Blueprints_ it was not seen to be necessary.

2 This was the decision reached in Germany. For a description of European deliberations on integration and dividend relief, see Gourevitch (1977).

4. TECHNIQUES OF DIVIDEND RELIEF

Given the difficulties of full integration described above, there is a natural tendency for its advocates to retreat to dividend relief. Limiting relief to the double taxation of dividends would avoid the most troublesome problems of full integration, which result primarily from the attempt to include retained corporate-source income in the personal taxable income of shareholders. Since dividend relief is currently being provided under the tax laws of a number of countries, there is little question that it is administratively feasible.[1] Moreover, under certain circumstances most of the advantages of full integration would be achieved if relief were offered only for double taxation of dividends; this is explained further in Section 6.

Basically two methods of providing dividend relief have been proposed and implemented. The most commonly used method goes under such names as the withholding method, the imputation approach, and the gross-up and credit.[2] Under it the shareholder

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[1] For descriptions of the systems of dividend relief found in various developed countries, see Ault (1976 and 1977), Hammer (1975), OECD (1973), Sato and Bird (1975), and Snoy (1975). Skeptics may, however, argue that full integration is no less feasible than is dividend relief if one is willing to make the pragmatic sacrifices to administrative feasibility that other countries have made in implementing dividend relief. See also Section 5.

[2] For further descriptions of these approaches see McLure (1975). There are, of course, other ways to relieve the "double taxation of dividends". For

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does not merely include cash dividends in his personal income for tax purposes, as under a classical income tax. Rather, he "grosses-up" such dividends by the amount of corporate tax which would have been paid on the gross income from which the dividends are paid. (For example, if the corporation income tax rate is 46 percent, as in the United States, a shareholder receiving a dividend of $54 would know that $100 had to be earned by the corporation in order for it to be able to pay the $54 dividend after paying the 46 percent tax.) After including grossed-up dividends in his taxable income the shareholder is allowed to take a credit against personal tax liability for the amount by which cash dividends have been grossed-up--($46 in the above example). The net result is that distributed corporate-source income is taxed at exactly the marginal tax rate of the individual shareholder. In that sense, the corporate and personal income taxes are "integrated", but only for the distributed portion of corporate-source income.

The alternative approach to providing dividend relief is even easier to understand than is the imputation method. Under it the corporation would be allowed a deduction for dividends paid or,

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example, the corporation income tax could be abolished, dividends could be excluded from personal income, a credit could be given on personal tax returns for some portion of dividends received, without the dividends being grossed-up, or corporations could be given a deduction equal to some percentage of its capital. Because these schemes have such adverse allocational and distributional effects, they are not considered further. For a description of their defects, see McLure (1975).

alternatively, a zero tax rate would be applied to that portion of corporate-source income which is distributed. In either event the corporation tax would be a final tax so far as corporate income is retained, but there would be no corporate tax on distributed earnings. Because dividends are included in the personal taxable income of shareholders they are taxed at the shareholder's marginal personal rate and dividend relief is exactly achieved.

The description to this point pertains only to total relief from double taxation of dividends. Under either approach relief could be provided for only some portion of the double taxation. In order to simplify exposition, suppose that the corporate income tax rate is 50 percent. Complete dividend relief would require either a) a gross-up and credit equal to the amount of net cash dividends received (50 percent of gross dividends), b) complete deduction of dividends paid, or c) a zero tax rate applied to distributed corporate income. Half the double taxation of dividends could be avoided through either a) gross-up and credit equal to only half of net cash dividends received (one third of gross dividends), b) deduction for only half of dividends paid, or c) application of a rate of 25 percent to corporate-source income resulting in dividends. While Germany provides complete relief from double taxation of dividends, in France and the United Kingdom the extent of relief is limited to 50 percent and 33/67, respectively.

It is readily seen from the above description that the various alternative approaches to dividend relief would be equivalent if all shareholders were resident individuals and no stockholders held shares in foreign firms. If tax-exempt organizations or foreigners owned shares in domestic firms the two basic approaches need not be equivalent.[1] Whereas all shareholders would benefit equally from dividend relief provided through a dividend-paid deduction or a split-rate system, the benefits of the imputation credit could be denied either tax-exempt organizations or foreign shareholders under the withholding approach.

The effect of denying the shareholder credit under the imputation approach could be replicated by levying a special tax on distributions to tax-exempt organizations or to foreigners (or to both). Such a special tax might be controversial if levied on tax-exempt organizations, but in reality it would be little different from denying such organizations the benefit of the imputation credit. It seems, however, that using a separate tax to replicate denial of benefit to foreigners would be more difficult. This is true because such a separate tax could be interpreted as a withholding tax (in the sense that the term is used in international tax conventions dealing with the taxation of dividends). Such taxes are generally constrained by reciprocity provisions of double

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[1] If, in addition, domestic shareholders owned shares in foreign firms they could be treated differently under the two approaches. That is, if relief from double taxation of dividends paid by domestic firms were provided through the dividend-paid deduction or split rate, its benefits would not extend to domestic shareholders in foreign firms. If, however, gross-up and credit were allowed on all dividends, including those from foreign sources, domestic shareholders in foreign firms would benefit from dividend relief. In no country is the latter practice followed; nor is it likely to be. It is therefore ignored in the remainder of this section.

tax treaties to be "mirror images". That is, most treaty countries mutually agree that they will levy the same rate of withholding tax on dividends paid by domestic firms to shareholders resident in the other country. Since the United States objected to Germany's imposition of nonreciprocal withholding taxes as an accompaniment of its split-rate system, and threatened to object if the United Kingdom adopted a split rate and nonreciprocal withholding rates, but seems not to have objected to the denial of relief to American shareholders under the imputation system, both Germany and the U.K. have opted for imputation systems (combined with a split rate in the case of Germany). Thus it appears that this largely cosmetic difference in alternative approaches to dividend relief may have real consequence in the international sphere. We return to this issue in section 7.

5. THE ROLE OF TAX PREFERENCES[1]

Most elementary expositions of the case for integration and the techniques of integration and dividend relief assume, if only implicitly, that the marginal tax rate commonly applied to corporate-source equity income is the statutory rate, 48 percent in the United States until recently. Some authors have noted that because of tax preferences effective rates have tended to average closer to 36-38 percent than to 48 percent, but rarely have the implications of tax preferences been discussed thoroughly. Indeed, it seems that

[1] For a more detailed discussion of the issues covered in this section, see McLure (1979), chapter 4) and Warren (1978).

only recently has it been realized that the treatment of tax preferences is a crucial component of any comprehensive scheme for integration or dividend relief. This section is an attempt to indicate the nature of the problem, its importance, and its likely practical solution.

Generally speaking, tax preferences can be defined as any provision which reduces the effective rate of tax applied to economic income to below what it would be if the normal statutory rate were applied to economic income. In a classical system these can be roughly divided into three categories: <u>deductible preferences</u>, which reduce taxable income to less than economic income, <u>preferential rates</u>, and <u>creditable preferences</u>, which further reduce the effective rate of tax once tax liability has been calculated using taxable income and tax rates as reduced by special provisions. The exclusion of interest on state and local securities and the excess of percentage depletion over cost depletion are among the best examples of deductible preferences in the U.S. tax law. Accelerated depreciation allowances that initially exceed the real loss of value of depreciable assets are also deductible preferences. But because they reverse over time, they are more complicated than provisions that simply artificially reduce taxable income to below economic income.

Preferential rates are applied to corporate capital gains and to selected other types of income that are generally unimportant to most corporations. The investment tax credit is the primary creditable preference in the U.S. tax code. The foreign tax credit, which some observers consider a preference, is discussed in Section 7.

Preferences, as defined here, are essentially identical to the concept of tax expenditures first popularized by Surrey and now incorporated in annual budget figures for the United States.[1] There may be a tendency to think that the problem of tax preferences is relatively unimportant in Europe, where taxable income corresponds more closely to "book" income than in the United States. But this misses the point; deviations of taxable income from economic income sanctioned by accounting practices are none-the-less tax preferences. That tax preferences are indeed a potentially important problem in Europe is indicated by the discovery by some businessmen that they have liabilities for précompte, after having initially been sanguine about the prospect.

Generally speaking the first and third of the kinds of preferences indentified above can be defined in an analogous way in an integrated system. That is, deductible preferences, rather than being allowed at the corporate level, could be passed through to shareholders. Similarly, tax credits could be used to reduce the tax liability of the shareholder, rather than that of the corporation. Preferential rates at the corporate level really have no place in an integrated system, since the corporate tax, if it continued to exist, would be only a withholding device. Any preferential rates would need to be allowed at the individual level, rather than the corporate level.

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[1] See Surrey (1973) for a complete discussion of tax expenditures. Effective corporate tax rates have been estimated in Kaplan (1975) and U.S. Treasury (1978).

The logic of full integration would seem to demand that corporate shareholders receive the same benefit from tax preferences that they could realize on the same income realized through a proprietorship or a partnership; that is, in the terminology to be employed below, "pass-through" seems to be inherent in the conceptual case for full integration.[1] This is not to say that all existing tax preferences make sense and should be continued. Indeed, many do not. (But it has been argued that many preferences exist only as an offset to the overtaxation that capital invested in the corporate sector would otherwise experience.) But equity and neutrality seem to demand that whatever preferences are available in the noncorporate sector should also be available in the corporate sector if integration or dividend relief is provided. Thus specially taxed items should be reported separately to the shareholder so that he can benefit from the special tax treatment. Even so, some might argue that certain tax preferences should not be passed through or that they should be passed through only if corporate-source income is

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[1] It may help to clarify this term if we note that a deduction of 10 is worthless to a taxpayer in the zero marginal tax bracket but is worth 7 to one in the 70 percent marginal rate bracket. By comparison, a credit of 5 is worth that amount to all taxpayers, regardless of their marginal tax bracket. If corporate preferences were passed through to individual shareholders they would be worth the amounts just indicated to shareholders in the various marginal tax brackets. If, on the other hand, preferences were "washed-out", they would be worth nothing to all shareholders.

not distributed.[1] This line of reasoning is not pursued further here for several reasons. First, it is not persuasive. Second, full integration appears to be so unlikely for the foreseeable future that it seems preferable to concentrate on the analogous problems under dividend relief. Third, the issues under full integration and dividend relief are sufficiently similar that substantial progress can be made by focusing on the latter.

Dividend relief is, in a sense, a hybrid solution to the problems posed by a separate and unintegrated corporate income tax on the one hand and those of full integration on the other. Relief is provided for double taxation of dividends, but no effort is made to integrate the corporate and personal taxes so far as the retained portion of corporate-source income is concerned. For this reason the definition of tax preferences is somewhat more complicated than under either a classical or an integrated system and one must face squarely several issues which are less obvious if full integration is at stake.

We noted above that even though pass-through of preferences seems to be inherent in the case for full integration, some might argue that the bene-

[1] Contention that a given tax preference should not be passed through seems generally to reflect a belief that the preference should not exist in the first place. The view that preferences should be available only if corporate-source income is not distributed appears to be relevant primarily for such preferences as the investment tax credit and accelerated depreciation, both of which can be argued to be intended to increase saving and investment.

fits of tax preferences should be available only to the extent that income is not distributed. A similar policy decision must be faced under dividend relief: should tax preferences be passed through on distributed corporate-source income or should they be available only to the extent that earnings are retained? While a strong case can be made that preferences should be passed through on distributions, the countries that currently provide dividend relief generally do not follow this path; rather, the benefits of tax preferences tend to be nullified when preference income is deemed to be distributed.[1]

But note the use of the word "deemed" in the last sentence of the previous paragraph. When dividends are paid they do not automatically carry tags saying whether they are paid out of preference income or fully taxed income. Thus it is necessary to have arbitrary rules for the determination of

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[1] In fact, tax preferences are not fully nullified on income that is distributed, except in Germany, where dividend relief is complete. In countries such as France and the United Kingdom, where dividend relief is only partial, the précompte or advance corporation tax (to be explained further immediately below) equals only the rate at which the shareholder's gross-up and credit is calculated, rather than the higher corporate income tax. Thus, distributed corporate-source preference income is taxed at exactly the marginal tax rate applicable to ordinary income of the shareholder, whereas the availability of only partial dividend relief implies that distributed income which is fully taxable is taxed at aggregate (corporate and personal) rates which exceed the shareholder's marginal tax rate. Thus in one sense the preference is nullified; in another it is not. For more on this point see McLure (1979, chapter 4). For a more detailed description of the treatment of tax preferences in the British, French, and German systems, see McLure (1979, chapter 3).

the split of a given amount of dividends between tax-preferred and fully taxed income. Three such rules suggest themselves. Under the first it would be assumed that dividends are paid first from fully taxable income; such a rule we will define to involve "stacking preferences last". By analogy, if preferences are "stacked first", it would be assumed that the first dollar of dividends is paid from preference income. A more natural presumption might be that dividends are paid in proportionate amounts from fully taxed and preference income.[1] Combining these alternative stacking rules with the alternative treatments of distributed preference income described above (pass-through and wash-out), we have the six cases of potential interest indicated in Table 1. (Ignore

Table 1. Alternative Approaches to the Treatment of Tax Preferences

Treatment of Distributed Preference Income:	Passed Through	Washed Out	
Gross-up and Credit:	Variable	Variable	Fixed
1. Preferences Stacked First (against dividends):	1a	1bV	1bF
2. Preferences Prorated:	2a	2bV	2bF
3. Preferences Stacked Last (against retentions)	3a	3bV	3bF

[1] Among the many additional complications which will not be considered further here is the need to decide, for example, whether dividends are assumed to come in proportionate amounts from taxed and preference income of the current year or from accumulated taxed and preference income.

for now the "variable credit" and "fixed credit" subdivisions of the "wash-out" column.) Thus in case 2a preferences are prorated between dividends and retentions and are passed through on distributions. On the other hand, in case 3b preferences are stacked last, but are washed out to the extent that they are distributed. This last treatment is characteristic of European tax systems.

Given the pervasive importance of the treatment of tax preferences, it may be worthwhile to describe briefly how preferences are commonly washed out upon distribution. Though the mechanics of the three systems differ somewhat, the British, French, and German systems employ advance or supplementary corporate taxes to prevent the pass-through of tax preferences when preference income is deemed to be distributed. That is, suppose that a German firm with 100 of tax-exempt income and 100 of taxable income wishes to make a complete distribution of both the exempt and taxed earnings. Though the firm would initially pay corporate tax at a rate of 36 percent on only the 100 of taxable income, it can distribute only 128 because a supplementary tax (called a précompte in the French and German systems) equal to the 36 percent tax on taxable income must be paid on the 100 of exempt income when the exempt income is distributed.[1] The shareholder then includes the

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[1] Germany actually employs a hybrid system which involves both a split rate (56 percent on retained income and 36 percent on distributed earnings) and an imputation approach. This complication is of no relevance for the present discussion. The shareholder is allowed a gross-up and credit based on the 36 percent corporate tax levied on distributed earnings. The British advance corporation tax serves much the same purpose as the précompte.

200 (cash dividend of 128 plus shareholder credit of 72) in his income for tax purposes and takes the imputation credit of 72. The ultimate result is that the 100 of income that would have been exempt if retained is taxed at the shareholder's marginal tax rate when distributed; that is, the preference is nullified if the preference income is distributed.

Under the approach just described the shareholder completing his tax return would be unconcerned with whether or not he is receiving taxable or preference income; in either event he uses a fixed fraction (36/64 = 9/16 in this case) to gross-up his cash dividends.[1] Under an alternative approach a gross-up rate based on the corporation's effective tax rate could, in theory, be used instead of a précompte to achieve wash-out of distributed preferences. In the example of the previous paragraph, in the absence of the précompte the firm would pay only the tax of 36 on its taxable income and distribute the rest. Shareholders would then gross-up net dividends (164) by only 36 and take a credit for 36 of tax. While the ultimate results would be identical, the gross-up rate for this firm would be 36/164 = 9/41, instead of the standard 9/16 in the system employing a précompte. Because the gross-up rate depends on the effective tax rate it would vary across firms and from year to year. The relevance of this point is discussed further below.

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[1] The shareholder would, of course, generally care about whether or not the firm distributed preference income. The point here is that in completing his tax return the shareholder would treat a given amount of dividends identically, regardless of whether it was paid from taxed or preference income.

Among the most complicated provisions of U.S. tax law are those governing the calculation of "earnings and profits". Earnings and profits, commonly referred to as "E and P", is utilized in determining whether or not a given distribution is taxed to shareholders as a dividend (ordinary income) or as a tax-free return of capital. Distributions are treated as dividends and fully taxed to shareholders, up to the full amount of E and P. Additional distributions are treated as return of capital and reduce basis for calculating capital gains (but not to less than zero). Since earnings and profits include many items which could properly be characterized as tax preferences, once a firm goes beyond distributing fully taxed income the shareholder must include the corporate preference income in his ordinary income for tax purposes. This implies that the preferences are valuable to the extent they are retained, are washed out to the extent they are distributed, but are "stacked last".

The complicated calculation of earnings and profits is, as a practical matter, largely unnecessary for the bulk of American corporations. Because of the "stack last" provision, only firms which distribute amounts in excess of both current and accumulated earnings and profits need to inform shareholders that they have done so and for most firms the "cushion" of accumulated E and P is sufficiently large that the calculation need not even be made. A similar comment might be made about the arrangements in Table 1 above which involve stacking preferences last. For most firms it would not be necessary to calculate economic income or preference income, and under certain proposals for the treatment of tax preferences under dividend relief it would not even be necessary to have a concept analogous to earnings and profits.[1]

By comparison, if preferences were prorated between dividends and retentions it would be necessary for every firm with preference income to calculate preference income in order to make the arbitrary allocation. But recall that preferences were defined relative to taxation of economic income. The existence of relatively clear-cut cases such as tax-exempt interest on municipal bonds creates a false impression of simplicity. It is easy to construct examples in which it would be virtually impossible to implement the critical definition of preference income. Similar problems would arise if preferences were stacked first (against dividends). Any rule which involves stacking preferences first or prorating preferences has generally been agreed to be administratively infeasible.[2]

Although integration and dividend relief are fairly complicated, it should generally be possible to isolate the compliance burdens at the corporate level, so that the individual shareholder would be little affected by the fact that dividend relief is being provided. Under a dividend-paid deduction or split-rate system (application of different corporate rates to retained and distributed earnings) the personal return need be hardly any

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[1] This would be true, for example, under the scheme proposed by Ullman (1978) outlined below.

[2] For further arguments along these lines, see McLure (1979, chapter 7) and Warren (1978).

more complicated than under a classical system; the shareholder would simply include cash dividends in income for tax purposes. Under the imputation approach to dividend relief the tax return need be only marginally more complicated than under a classical system. Ideally the shareholder would be provided three pieces of information: his net dividends, his gross taxable dividends, and the shareholder credit. Under some of the alternative approaches to the treatment of tax preferences complications could not, however, be isolated at the corporate level.

Suppose, for example, that it were desired to nullify preferences on dividends. Suppose in addition that a corporation with a fiscal year ending in November made a distribution of dividends in December of 1978. A calendar year shareholder would include such dividends in his 1978 income tax return. Moreover, this dividend should be recorded on a grossed-up basis. But this is generally impossible under a system which utilizes a variable-rate gross-up and credit, because if it has any tax preferences a corporation cannot calculate its effective tax rate and the appropriate gross-up and credit until after the end of its fiscal year. Based on current experience it would not be unreasonable to believe that corporate income and its division between taxable and preference income would be known only 9 or 10 months after the close of the corporate fiscal year, or as much as 6 months after the individual shareholder had filed his return for the year <u>following</u>

that in which the dividend was originally paid.[1]

The situation is quite different if a précompte were employed to nullify preferences and a fixed gross-up and credit could be allowed at the shareholder level. Under this approach, typified by the German approach described above, the corporation would simply report to the shareholder dividends grossed-up using the statutory rate. To the extent that tax had not in fact been paid on income deemed to be distributed, the firm would pay the supplementary tax. Any problems resulting from delay in calculating corporate income, audit adjustments, and amended returns would be isolated at the corporate level. It is thus clear that a fixed gross-up and credit would be vastly preferable to using a variable gross-up and credit to achieve the same result.

The discussion above suggests that viable options in the treatment of tax preferences under dividend relief are restricted to cases 3a and 3bF in Table 1. Attempting to pass preferences through to the extent distributed (case 3a) would also be doomed if it required the use of a variable gross-up and credit.[2] But it has been argued that the firm could report taxable income and preference income to the shareholder separately and a fixed gross-up

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[1] This discussion is based upon McLure (1979, chapter 4). Note that a literal interpretation of the variable gross-up and credit approach would require reopening tax returns of individual shareholders any time an amended return or audit adjustment altered the firm's preference income for an earlier year.

[2] This argument is presented, for example, in McLure, 1979, chapter 4).

and credit could be applied to the taxable income. Dividends paid from preference income would simply be exempt, and therefore not grossed-up at all.[1] It appears, however, that this approach, while ingenious, would not overcome the problems created when the corporation does not know until after the shareholder has filed his return whether its claim for a given preference will be allowed. Moreover, it would open the entire Pandora's box of calculating preference income.

In summary then, the form of integration most likely to be adopted is dividend relief which stacks preferences last and washes them out on distributions. This approach, which is followed in Europe, is not the most attractive from a policy point of view. As argued above, it would seem more reasonable to allocate preferences between dividends and retained earnings on a prorata basis and pass them through on dividends. But this choice is likely to be made on grounds of administrative feasibility, rather than on the basis of policy objectives.

That this is true is indicated by the way tax preferences would be treated under the scheme for dividend relief proposed by Chairman Al Ullman of the House Ways and Means Committee (1978). A shareholder credit account (SCA) would be established at the corporate level in order to limit the amount of credit allowed shareholders to a fraction of the taxes actually paid by the corporation. The firm's SCA would be increased by a given

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[1] This argument has been stated eloquently in Hickman (1978). It is summarized in somewhat greater detail than here in McLure (1979, chapter 7).

percentage of net corporate tax liability and reduced by the amount of any credits allowed shareholders; once the firm's SCA was exhausted no further credits could be taken. When fully implemented, the Ullman plan would allow a shareholder credit equal to 20 percent of net dividends (thereby eliminating 21.67 percent of the corporate tax at the then-current rate of 48 percent).[1] In order to produce increases in the SCA which would exactly offset the credits taken by the shareholders it would be necessary to allow corporations to add 21.67 percent of corporate tax liability to the SCA.[2]

An assumption that dividends are paid first from taxable income is implicit in the mechanics of this proposal. But it would not be necessary to calculate preference income under the Ullman proposal. Additional tax would automatically be collected any time tax-preferred income was distributed, without it being necessary to define tax preferences explicitly. As noted above, this would facilitate administration considerably.

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[1] Assuming a 48 percent corporate tax, 100 of corporate-source income could result in 52 of dividends. 20 percent of 52 is 10.4 or 21.67 percent of the corporate tax of 48. In its use of the shareholder credit account, this proposal, which is said to resemble closely that proposed to the White House by the Treasury Department, is more like the British system with its advance corporation tax than the French or German systems.

[2] Though additions to the SCA of only 21.67 percent of tax liability would prevent shareholders from taking credit for taxes not paid, the Ullman proposal would allow contributions to the SCA equal to 30 percent of tax liability. It would therefore be substantially more liberal than exact washout of preferences under even the more generous definition of washout given in footnote 1 on p.73.

6. EQUIVALENCE OF INTEGRATION AND DIVIDEND RELIEF

If all corporate-source income were distributed and tax preferences were treated identically under the two systems, integration and dividend relief would be identical. This is of considerable interest, because under at least one possible tax reform package that includes complete dividend relief, it could be expected that virtually all corporate income would, indeed, be distributed. To see this, ignore for the moment the existence of tax preferences and suppose that dividend relief were accompanied by the reduction of the top personal income tax rate to the level of the corporate rate.[1] In such a case individual shareholders in the top marginal rate bracket would have no tax incentive to prefer retained earnings to dividends, and anyone in lower brackets would have a positive tax incentive to prefer dividends.[2]

With these strong fiscal pressures for distribution it can be assumed that a substantial proportion of income would be distributed. To the extent that income was distributed, shareholders would be

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[1] The tax reform package allegedly recommended to President Carter by the Treasury Department in September 1977 ("Tax Reform Option Papers...", 1977) reportedly included such a proposal. Taxation of long-term capital gains as ordinary income, also included in that tax reform package, would strengthen the argument made in the text, but is not necessary for it.

[2] This argument would be stronger if tax-exempt organizations were to benefit from dividend relief. If they did not, these organizations would be indifferent between receipt of dividends and accumulation of retained earnings, so far as tax considerations are concerned.

taxed on corporate-source income at the rate applicable to ordinary income.[1] Since this is the objective and result under full integration it would appear that even if integration is technically infeasible, it could, in effect, be achieved "by the back door" by simply allowing dividend relief.

While there is much truth in this argument, it suffers from several flaws. First, one hallmark of integration is its total neutrality, toward corporate financial policy as well as toward resource allocation. But the results of dividend relief resemble those for full integration under the assumptions stated above precisely because dividend relief would distort dividend payout policy.

Second, and perhaps more important, if preferences were to exist and be stacked last and nullified, it is quite unlikely that dividend payout rates would increase to the extent just posited. This is true because this treatment of tax preferences would imply that taxpayers in marginal rate brackets substantially below the corporate rate would find that aggregate (corporate and personal) taxation would be minimized by the retention of an amount equal to preference income. Even for taxpayers in higher marginal rate brackets it would become very expensive to pay dividends, in terms of forgone retained earnings, once all taxable income

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[1] Any increase in dividend payout ratios induced by dividend relief would, of course, be constrained by provisions of corporate indebtedness.

has been paid out.[1] This is shown in Table 2. This being the case, we could expect less than complete distribution of corporate income, even if dividend relief were complete. If only partial relief were allowed, then there would be even less reason to expect a shift to nearly complete dividend payout.

Table 2. Aggregate Corporate and Personal Tax on $100 of Corporate-source Income, for Alternative Marginal Personal Tax Rates and Dividend-payout Rates[a]
(Based on deductible preferences of $20)

	Aggregate Tax			Tax Cost
Marginal Personal Tax Rate	100 Percent Retention (a)	Retentions Equal 20 (b)	100 Percent Distribution (c)	of Distributing Preference Incom (d)
0	40	0	0	0
20	40	16	20	4
40	40	32	40	8
60	40	48	60	12

[a] Based on corporate income ax of 50 percent. Ignores capaital gains tax on gains resulting from corporate retentions.

[1] This argument is substantially stronger if the top personal rate is not reduced to the level of the corporate rate. If, for example, the top marginal rate is 70 percent and the corporate rate is 50 percent, it becomes extremely expensive to pay dividends out of preference income to taxpayers subject to the top personal rate. For a further discussion on this issue, see McLure (1979, chapter 4).

7. INTERNATIONAL ASPECTS OF DIVIDEND RELIEF

That dividends are sometimes paid by U.S. corporations to shareholders resident in foreign countries or by foreign firms to U.S. residents considerably complicates dividend relief. An exhaustive discussion of these complications would go well beyond the scope of this paper.[1] Yet it seems worthwhile to discuss several aspects of this problem.

First, dividend relief should be based on the rate of tax in the country of residence of the corporation which is paying dividends across national borders. If it is not, relief would be given for taxes not paid or be less than taxes paid, and the international allocation of capital would be distorted. The desired result would occur automatically if the dividend-paid deduction were employed by the country of source of dividends; if the imputation method were used, the gross-up and credit must be based on the source country's tax rate. Because it would be very difficult for the country of residence of individual shareholders and corporate portfolio investors to provide imputation credits using taxes paid in the source country, it seems almost inevitable that dividend relief should be provided in the first instance by the

[1] See, however, Ault (1977), Sato and Bird (1975), McLure (1978), and McLure (1979, chapter 6). In what follows we ignore for the most part the extreme complications which result from the interaction of tax preferences and international streams of dividends. Moreover, we limit the discussion to international aspects of dividend relief, though allowance for full integration in this context does not considerably complicate matters.

source country. It might, however, be that arrangements for the sharing of the overall fiscal costs of dividend relief would be necessary if international dividend flows were sufficiently out of balance that the sharing of costs in the absence of such arrangements would be deemed unsatisfactory.

While the above conclusions seem reasonable enough in the case of individual shareholders and corporate portfolio investors, it seems likely that alternative rules might be necessary where dividends paid to parent corporations by foreign subsidiaries are concerned. For one thing, there would be substantial opportunity for abuse if relief was provided by source countries, for firms incorporated in tax-haven countries could be employed to escape all tax liability on income earned through foreign subsidiaries. It would therefore appear proper that in the case of dividends paid to parent firms by subsidiary corporations relief should be provided by source countries only on the basis of tax treaties; otherwise relief should be provided by the country of residence of the parent firm.

It seems that in large part the practices outlined in the previous two paragraphs are becoming standard. That is, both France and the United Kingdom extend the benefits of dividend relief to foreign individuals and corporate portfolio investors but do not grant it to resident shareholders on dividends received from abroad. Germany does not currently provide relief to foreign shareholders, but seems likely to do so, and it already withholds dividend relief from domestic owners of shares in foreign corporations. Thus far source countries have shown little inclination to provide relief from double taxation of dividends where subsidiary-parent relations are involved. (But the United Kingdom has agreed in treaty negotiations with the United States and the Netherlands to provide dividend relief on direct investment at half the rate available to foreign portfolio investors.) Finally, where dividends received from foreign subsidiaries but retained by parent corporations are concerned, relief from double taxation is generally provided by the resident country of the parent, through either a foreign tax credit or exemption. But where foreign-source income is distributed by the parent, taxes paid abroad are not recognized for purpose of application of the imputation approach. Rather, such income is treated like preference income and subjected to précompte.

It is useful to appraise this developing practice in the light of commonly accepted normative goals in the international tax sphere. Perhaps the overriding objective of foreign tax treaties, in the eyes of economists, should be capital export neutrality. This form of neutrality has the advantage that if it is achieved investors' decisions on where to invest are not distorted by tax considerations and under certain circumstances world-wide efficiency is realized. If précompte were not applied to distributed foreign-source income which has benefited from exemption or foreign tax credit, the practices outlined above would be consistent with capital export neutrality, so far as distributed corporate-source income is concerned.[1]

A somewhat different basis has been used for judging the propriety of withholding taxes collected on dividends paid to foreign shareholders by domestic firms. Reciprocity of withholding rates has tended to govern provisions of double taxation treaties dealing with dividends; it has generally been agreed that the taxes levied on dividends by two countries should be "mirror images" if they are to be reciprocal. Strong adherence to this principle has caused the United States to object to Germany's use of withholding rates in excess of those charged by the United States on dividends paid to German shareholders by American firms. Being unable to convince the United States that higher withholding rates than would be allowed by a strict interpretation of reciprocity are justifiable, given its use of a split-rate system, Germany has changed to a hybrid system incorporating an imputation credit as well as a preferential rate for distributed earnings. Similarly, the United Kingdom, learning from the German experience, chose to adopt an imputation approach despite a preference for a split-rate system.[2] Hav-

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[1] For a further elaboration of this and other concepts of neutrality, see Musgrave (1969, chapter 7). Most other commonly discussed criteria of neutrality are generally agreed by economists not to be relevant for policy in this area. So long as corporate parents are not taxed on the retained earnings of their subsidiaries on an accrual basis, capital export neutrality will not be fully realized. This important qualification is not considered further in this paper.

[2] For more on this see Ault (1977), Gourevitch (1977), McLure (1978) and (1979, chapter 6), and Sato and Bird (1975).

ing forced its treaty partners into systems of dividend relief which they judged to be inferior when appraised on the basis of domestic considerations, the United States may have a difficult time choosing any form of dividend relief other than the imputation approach.

Whether denial of benefits of dividend relief to foreign shareholders will eventually be deemed to be equivalent to levying a special withholding tax on dividends paid to foreign shareholders under a split-rate system, and therefore subject to the rules of reciprocity, remains to be seen. But it should be noted that it has been argued that strict adherence to the principle of reciprocity, while appropriate in a world of classical tax systems, is not proper when various countries have differing degrees of dividend relief.[1] According to this view "effective reciprocity" would require considering the entire (corporate and withholding) tax burden on dividend income attributed to foreigners in the negotiation of double tax conventions.

8. SUMMARY AND CONCLUSIONS

Integration and dividend relief are not novel topics in the United States. Provisions for integration and dividend relief, having been incorporated in the income taxes used to finance the Civil War, predate the existing corporate and personal income taxes. Moreover, the tax on undistributed profits levied during the late 1930's was economically equivalent to a deduction for dividends paid.

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[1] See Sato and Bird (1975).

Of course, the provisions of the tax law need bear no close relationship to our understanding of their effects. But integration and dividend relief were studied thoroughly in the first half of the twentieth century. From 1950 to 1975 there was relatively little public interest in integration and dividend relief in the United States, and hardly greater academic interest. (This is in marked contrast to the ferment generated in Canada by the Royal Commission on Taxation during the 1960's.) Even so, the analysis of the 1940's had been thorough and our understanding of the case for integration and the administrative difficulties of integration and dividend relief would have probably been judged in 1975 to have been substantial. What is therefore amazing is how little we really did know about several vital aspects of integration. In 1975 so little was known about the problems posed by tax preferences that the Secretary of the Treasury could propose to the Congress that the statutory rate be employed in the calculating gross-up and credit under the imputation approach.[1] Similarly, except for a few experts hardly anyone knew very much about how dividend relief fit into international fiscal relations.[2] It would appear that similar statements could be made about the state of knowledge in European countries.

The considerable attention integration and dividend relief have received in the past 5 years in

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[1] See Simon (1975). For the defects of employing the statutory rate to calculate the imputation credit, see McLure (1976 and 1979, chapter 4).

[2] For an excellent exposition of this subject, see Sato and Bird (1975).

both Europe and the United States has substantially increased our understanding of this type of tax reform. Especially important are our increased understanding of the role played by tax preferences and appreciation of the importance of the international aspects of integration and dividend relief. Work on administrative details done by European experts and by the U.S. Treasury Department has contributed significantly to the understanding of integration and dividend relief. But because President Carter chose to exclude dividend relief from the tax reform package he proposed in late 1977, the knowledge generated at the Treasury Department has, unfortunately, been given all too little circulation. One can only hope that dividend relief will be subjected to more wide-spread analysis and that the Treasury studies of integration and dividend relief will be extended and made public. Only then will we really be able to appraise integration and dividend relief adequately. Integration is clearly a good idea, if it is feasible, and dividend relief is probably a good idea. But, whether either is "good enough" depends in part on whether or not they can be effectively administered in a way that makes good public policy.

Finally, it should be noted that this paper has focused very largely on theoretical and conceptual discussions of integration and dividend relief and their difficulties. It contains no hard evidence about the effects of integration or dividend relief on such things as the rate of capital accumulation and economic growth, the allocation of resources between the corporate and non-corporate sectors, corporate financial policy, including debt-equity ratios and dividend payout policies, the distribution of income, tax exempt organizations, international capital flows, etc. This lack is explained in part by the necessity of limiting the scope of the study. But in larger part it reflects a gap in available knowledge. In appraising the case for integration and dividend relief it is essential to know not only whether such a policy is administratively feasible but more about its economic effects.

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International Enterprises and Taxation

– Some Preliminary Results of an Empirical Study Concerning International Enterprises

Sven-Olof Lodin

1. BACKGROUND

Much attention has been paid to taxation of international enterprises in recent years. Among the questions which have been asked are:

(a) are these enterprises able to secure special tax advantages due to their international structure, and

(b) do they in fact make use of this structure to secure such advantages.

It has been claimed in public discussion that international enterprises are able to avoid reporting a certain proportion of their profits in high-tax countries, by way of reporting these profits in subsidiaries in low-tax countries or "tax-havens". It has also been claimed that the high-tax countries are thus deprived of their "proper" share of tax revenue. International enterprises, on the other hand, maintain that their international status in fact renders them liable to an increased tax burden owing to international double taxation and the difficulties involved in achieving consistency in profit and loss allocation across national boundaries.

Despite the interest that has been shown in the taxation of international enterprises, and the importance attached to this issue --and not only in the Nordic countries-- our knowledge of the behavior of these enterprises is very limited. There is virtually no observation material available on their financing and the nature of their payments-- what charges are for, the amounts involved, and where they go. Nor do we know in what measure these transactions conform to the international tax system; also insufficiently known are those organizational features of international enterprises that are of special relevance to their taxation. The impact on taxation of intra-group transfer pricing has been discussed rather widely, but without systematic knowledge of the framework of countries and tax systems within which such intercompany transactions take place.

In a number of studies concerning taxation and international enterprises attention has been called to the fact that empirical data concerning the tax-related behavior of international firms are lacking or are insufficient.[1] Also relatively few attempts have yet been made to undertake a broad survey of transaction flows, or of the organization of international enterprises for tax purposes. Yet such surveys are of obvious importance in any attempt to evaluate the tax issues related to these international enterprises. This shortage

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[1] See _inter alia_: Eliasson, G. (1972), _Capital Transfers, Taxes and International Corporate Operations_, _Economic Research Reports B2_, The Federation of Swedish Industries; Chown, J. (1974), _Taxation and Multinational Enterprises_; and Kopits, G.F. (1976), _Taxation of Multinational Firm Behavior: A Critical Survey_.

of knowledge is unfortunate, especially considering that political decisions may be made on the basis of insufficient information.

In an attempt to map out on a broader basis the behavior of international enterprises with regard to taxation and to shed light on some of the basic issues relevant to their behavior the Nordic Council for Tax Research in 1975 initiated a research project concerning the intra-group financial flows between Nordic subsidiaries of international enterprises and their related foreign companies. The study is now near completion and some preliminary results are available. The study covers subsidiaries of international enterprises operating in the Nordic countries and relates to transactions during the year of 1975. Its main purpose is to clarify the pattern of financial flows to and from the Nordic countries within various types of international firms --i.e., what kinds of transactions occur within them; their frequency and amount; and between which types of companies within the enterprises and between which countries such transactions are carried on-- and to clarify the tax consequences of these transactions. The degree to which the international enterprises have adapted their organization to the tax situation is also highlighted.

2. WHY ARE WE INTERESTED IN TAX IMPACT ON BUSINESS BEHAVIOR?

Before we proceed to measure we have to define our questions operationally, that is to say, why and in what sense we are interested in studying tax-related behavior of the multinational firms and to what extent it contains arrangements avoiding taxes. Following Eliasson (1972, p. 67), it is useful to distinguish between three different dimensions of the problem.

(1) Do internal tax arrangements affect the real side of global business operations (investment, production, trade, etc)?
(2) Do tax motivated arrangements change the form of remittance policies without or with effect on the global distribution of wealth of the corporation (the cash flow aspect)?
(3) Given a fixed real structure in (1), do they affect the global distribution and pooling of profits as recorded (book-keeping aspect)?

Each item is associated with a different sort of worries and concerns. Tax motivated effects of a real nature[1] if not intended by the law maker is probably the most serious problem. Such real effects can, however, seldom be ascertained at the international level. The second type of arrangement operates via open cash flows and organizational structures. The worries of national authorities this time are the revenue and the external financial and exchange side.

The third item has to do with the valuation of real transactions in the books of the multinational corporation, the transfer pricing problem in a broad sense. This is where problems of fairness and equity appear and much of the discussion of

[1] That is the concern of many papers in this conference volume.

multinationals has been about their presumed capacity to change their transfer prices at will with the purpose of avoiding taxation. The problem to draw any conclusions here has to do with the problem of finding the "true" or the "fair" price. From our point of view such effects are outside the scope of measurement.[1] This is so also when it comes to studying how adjustments in real operations (say investment) save on taxes. We will concentrate attention on the second item, looking at the open cash flow arrangements (dividends, interest, royalties) where measurement is in fact possible, (if one is willing to devote time and effort) and indirect conclusions can be suggested.

The following reasons can be given, in brief, for the approach which has been chosen. In order to assess the importance of the issue of the taxation of international enterprises and the extent to which the international status of these groups leads to a reduced or increased tax burden, it is necessary to know the nature and magnitude of transactions and their routings within the international groups, and what is the nature of the internal financial flows. This is of importance quite apart from the question of whether the international firms can obtain tax advantages by way of intra-firm pricing arrangements. Moreover, the significance of transfer pricing for the tax burden of international enterprises depends on what types of transactions occur and on whether the transactions are undertaken with related corporations in high or low-tax countries. The aims of the study

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[1] See for instance the preliminary discussion in Eliasson (1972), op.cit. (especially chapter IV).

iffer to some extent from other studies in the ame field in the sense that we are investigating ne significance, relative to total financial lows, of different types of intra-firm transac- ions and of different transactions routes. The im is also to find out whether the behavior dif- ers significantly between enterprises depending n nationality, size, industry and degree of inter- ationalization. The inclusion of several home ountries and four host countries in the study akes it possible to study whether differences in ax legislation have their counterparts in differ- nt transaction patterns, irrespective of what ne cause behind the differences might be.

. DESCRIPTION OF THE PROJECT

ne main objective of the study is to measure the ize and direction of the financial flows within nternational groups of companies and to explore ne organization and financing of these groups in espect of importance for taxation. The study con- ists mainly of a survey by questionnaire, the aim eing the inclusion of all foreign-owned subsi- iaries of a certain size in the Nordic countries. ne main emphasis of the inquiry is laid on the easurement of transaction flows. Concerning nese, the amounts are requested of the following ost and revenue items as accounted for in 1975: a) dividends, (b) interest, (c) royalties and ther disbursements for intangibles, (d) manage- ent and service fees, (e) purchase and sale of oods.

ne following questions are asked in respect of ach item:

(1) The proportion of the amount involved pertaining to transactions with related companies abroad.
(2) The country of each related transaction partner.
(3) The line of business of the partner in question.
(4) The amount related to each partner.

The study includes all majority-owned (more than 50 percent) subsidiaries of foreign companies in Denmark, Finland, Norway, and Sweden, having a turnover exceeding Skr 1 million, or the equivalent in other currencies (approximately $230,000). The relevant population includes close to 2,000 companies. Complete answers (adaptable to data processing and analysis), have been received from 1,000 companies. In Sweden 239 out of 485 have answered. However, the coverage of significant companies and value of turnover is more encouraging. Approximately 80 percent of the turnover of foreign-owned manufacturing Swedish companies are covered by the answers received.

Represented in the material are 274 Swedish-owned subsidiaries, 180 U.S. subsidiaries and 84 U.K. subsidiaries. These three countries account for almost two thirds of the companies. There are relatively few German companies (56 answers). Only a few companies report a turnover of less than Skr 5 million. Very few companies of this size have answered and those answering cannot be assumed to be representative for this size group. The whole group thus has been omitted from the analysis in Denmark and Sweden.

In general the firms participating in the investigation have a very high degree of internationalization. They are established in many countries and have many subsidiaries. Except for Nordic enterprises the general conclusion is that the Nordic markets seem to be penetrated at a rather late stage in the internationalization of an enterprise. Most of the companies studied are selling almost exclusively in the Nordic market (market orientated). Only 10 percent of their gross revenue are derived from related companies, whereas 57 percent of their transactions have reference to group transactions.

4. PRESENTATION OF PRELIMINARY RESULTS FROM THE STUDY

Table 1 shows the distribution of gross revenue and costs related to different kinds of transactions:

a) The value of intra-firm cost transactions is several times larger than the value of income transactions (in Sweden 6:1). The effects of cost transactions are not in any way balanced by income transactions.
b) The value of intra-firm cost transactions account for more than half of the value of total cost transactions (including external transactions). Internal income transactions count for less than 10 percent of the total income value.
c) Cost transactions with goods count for more than 90 percent of the value of cost transactions (in Sweden 94 percent).

Table 1. Categories of revenue and costs, totally and intra-firm

Per cent

	Interests	Royalty fees	Leasing fees	Management and service fees	Purchase or sale of goods	Dividends	Total value (millions of Skr)
Total revenue							
Share of value	1.0	0.1	3.2	0.4	94.9	0.4	40,135
Intra-firm revenue							
Share of value	1.1	0.5	0.1	3.0	93.9	1.4	5,041
Number of transactions	158	21	6	118	576	31	910
Total costs							
Share of value	2.3	1.5	0.5	1.0	92.6	2.1	27,011
Intra-firm costs							
Share of value	1.2	2.5	0.2	1.7	91.0	3.5	15,443
Number of transactions	389	148	25	332	1,185	281	2,360

Table 2 shows the distribution of the different categories of intra-firm cost transactions, number and amount (including dividends, although this is not a cost item) by nationality of the group. The overwhelming importance of the purchase and sale of goods has already been mentioned. Table 3 shows the transaction pattern related to industry. Table 4 shows the distribution of different costs related to destination countries (transaction partner). Considering the overall importance of price elaborations, a 2 percent change of prices on goods outweights any conceivable price change of any other kind of cost. Of course, the pattern differs between individual companies and industries, but in view of the attention given to the different types of transactions in the public discussion, the aggregated comparison is relevant. It is interesting to note the frequency and relative amount of management and service fees (more frequent than interest and of the same amount). With regard to royalties the amount of internal costs is SKr 386 million compared to the amount of external royalties of only SKr 19 million. Thus, internal royalties account for 95 percent of the total amount of royalties. The dominant role of intra-firm royalties compared with external royalties makes it hard to find comparable arm's length prices for this kind of transactions.

With regard to the transaction pattern of groups of different nationalities important differences can be seen. American subsidiaries account for 26.2 percent of the total amount of intra-firm cost transactions, but have 69.1 percent of all royalties, 62.3 percent of all management and service fees and 60.6 percent of all dividends. In

Table 2. Intra-firm costs by group nationality

Group nationality (Home country)	Inter- ests	Royalty fees	Manage- ment and service fees	Pur- chase of goods	Divi- dends	Total in lions of and per of intra- costs
	Kind of transaction					
	per cent					
USA						
1. of line →	1.0	6.5	4.1	80.3	8.0	4,052
2. of kind of transaction (column) ↓	22.4	69.1	62.3	23.2	60.6	26.2
West-Germany						
1.	0.8	0.2	0.6	97.4	0.9	2,276
2.	10.0	0.9	5.5	15.8	4.0	14.7
Holland						
1.	0.6	2.2	1.3	93.8	2.0	2,130
2.	7.3	12.3	10.8	14.2	8.0	13.8
Switzerland						
1.	1.4	2.2	1.1	93.9	1.4	997
2.	7.2	5.8	4.3	6.7	2.5	6.5
United Kingdom						
1.	1.1	0.5	0.7	90.9	4.3	694
2.	3.9	0.9	1.8	4.4	5.5	4.4
Sweden						
1.	1.8	0.6	0.6	94.7	2.2	4,100
2.	39.2	6.5	9.6	27.6	16.9	26,6
Others						
1.	1.6	1.4	1.3	94.5	1.1	1,204
2.	10.0	4.5	5.7	8.1	2.5	7.8

able 3. Intra-firm costs by industry of the subsidiary

ndustry of ubsidiary	Kind of transaction					
	Inter- ests	Royalty fees	Manage- ment and service fees	Pur- chase of goods	Divi- dends	Total in mil- lions of Skr and per cent of intra-firm costs
	per cent					
anufacturing						
. of line →	2.0	4.1	2.7	86.1	5.0	4,603
. of kind of transaction ↓ (column)	49.9	50.0	46.0	28.2	42.8	29.8
rade						
.	0.9	0.7	0.7	95.9	1.9	9,300
.	43.5	16.5	25.1	63.5	32.3	60.2
inancing and ervice						
.	0.9	12.3	7.8	63.2	13.7	861
.	3.9	28.0	25.3	3.9	22.1	5.6
thers						
.	0.8	3.1	1.4	92.5	2.2	679
.	2.7	5.5	3.6	4.4	2.8	4.4

Table 4. Intra-firm costs by country of destination

Country of destination (transaction partner)	Interests	Royalty fees	Management and service fees	Purchase of goods	Dividends	Total in Millions of Skr and per cent of intra-firm costs
	Kind of transaction					
	----------------		per cent	----------------		
USA						
1. of line →	2.0	22.6	14.3	39.2	18.2	983
2. of kind of transact. (column) ↓	8.8	58.5	36.2	3.3	40.7	7.5
West-Germany						
1.	0.5	0.1	0.5	98.6	0.3	2,626
2.	5.8	0.8	3.4	22.4	1.7	20.1
Holland						
1.	0.5	4.9	2.1	88.9	3.4	1,205
2.	2.7	16.0	6.5	9.3	9.4	9.2
Switzerland						
1.	2.2	2.8	1.7	89.7	3.6	810
2.	8.3	5.8	3.4	6.3	6.6	6.2
United Kingdom						
1.	1.1	0.3	2.5	87.6	5.9	1,050
2.	5.0	0.8	6.9	8.2	14.3	8.3
Sweden						
1.	1.6	0.6	0.7	95.3	1.8	3,914
2.	28.6	6.1	6.6	32.3	15.7	29.9
Denmark						
1.	2.5	2.2	3.6	83.4	7.9	402
2.	4.1	2.3	3.7	2.9	7.2	3.1
Others						
1.	3.9	1.8	6.2	87.1	1.0	
2.	36.7	9.7	32.3	15.3	4.4	15.7

ontrast, German-owned subsidiaries account for 4.7 percent of the cost value, but of interest nly 10 percent, of royalties 0.9 percent, and of ividends 4 percent. 97 percent of the cost transctions within German groups relate to goods.

ritish groups, having a total share of 4.4 perent of the costs, report 3.9 percent of the interst costs, large costs for goods but very small mounts of royalties. The dividends amount to 5.5 ercent.

witzerland plays a smaller role in the context han is often assumed. Swiss-owned subsidiaries ccount for 6.5 percent of the cost transactions nd 93.9 percent of these are purchases of goods. he picture does not change much if we also take nto consideration intra-firm payments destinated o Switzerland in non-Swiss groups (see Table 4). he average payment to Switzerland seems to be ather small.

ransactions with tax havens exist but they are nsignificant. In the Swedish group payments of ahamas, Luxembourg, and Panama are reported mounting to 0.5 percent of total internal costs. he tendency is the same in the other countries.

. FINANCING AND DIVIDENDS

ith regard to financing and dividends the pattern iffers considerably between the host countries ut also between different group nationalities as an be seen from Table 5, but less between different lines of business and different sizes of roups.

The results from Finland are of special interest in this context as they seem to suggest that tax laws affect corporate behavior substantially. In Finland tax legislation authorizes tax authorities to refuse foreign-owned subsidiaries a deduction for interest payments on internal long-term debts. Furthermore, Finland in 1969 amended the tax code in order to stimulate equity financing of Finnish industry, granting companies a deduction for dividends related to newly issued share capital.

Dividends going to other Finnish companies, which enjoy the exemption for intercorporate dividends, do not entitle to any deduction. Dividends transferred abroad are deductible without limitation. The effects can be seen in Figure 1. See also Tables 5 and 6.

Table 6 shows the growth of paid-up share capital in Finland and of dividend payments. Especially the Swedish and American companies have increased both their paid-up share capital and their dividends, probably in order to take advantage of the tax treatment. The changed relationship from 1968 to 1975 between stock dividends, not entitling to dividend deduction, and cash issues, entitling to dividend deduction, is remarkable.

In Norway the rate of borrowing is higher than in the other countries. Both total debts and the internal part of long-term debts are great. This is also reflected by a higher proportion of interest costs than in the other countries.

In Denmark one can notice the high share of interest costs combined with the lowest ratio of divi-

Table 5. Financing structure and dividends in national currency

Country	Long-Term Debts 1968	1971	1975	Share Capital 1968	1971	1975	Total Debts 1975	Dividends 1968	1971	1975
Sweden[a]										
Total, millions of Skr	1,530	1,209	1,757	480	735	1,203	4,994	48	95	209
Share borrowed from the group, %	21	31	23							
United States[b]	1,054	307	648	196	272	508	1,727	24	70	147
	7.5(?)	31	31							
Holland[b]	197	279	219	106	111	168	723	14	12.5	24
	41	47	26							
Switzerland[b]	86	109	120	19	39	81	317	1	1.8	4
	85	57	69							
United Kingdom[b]	109	132	94	59	68	83	381	5	6	15
	78	50	18							
Norway[a]										
Total, millions of Nkr	929	1,246	1,825	529	650	1,063	6,441	32	92	107
Share borrowed from the group, %	45	42	44							
Finland[a]										
Total, millions of Fmk	221	364	809	194	309	662	3,015	14	49	88
Share borrowed from the group, %	13	14	16							
Denmark[a]										
Total, millions of Dkr	433	772	1,047	630	790	1,423	4,653	63	100	124
Share borrowed from the group, %	43	43	39							

[a] Host country. [b] Group nationality.

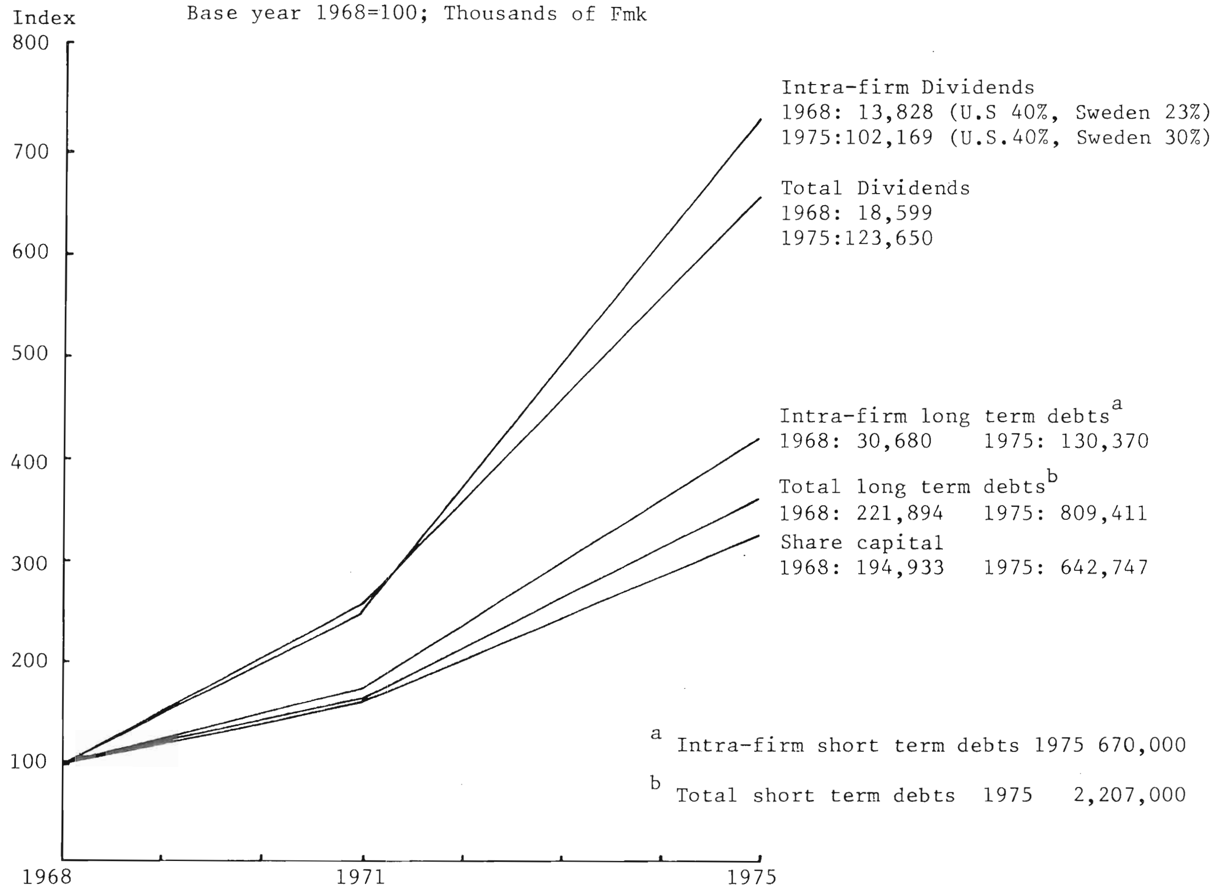
Table 6. Share capital and dividends
Finland 1968 and 1975
Thousands of Fmk

Nationality of parent company	Paid in share capital		Dividends	
	1968	1975	1968	1975
Holland	42,766	73,240	4,252	12,486
United States	57,355	202,079	5,593	39,084
United Kingdom	23,283	62,386	480	12,484
Sweden	32,438	189,926	3,237	30,572

Issues of share capital
Finland
Thousands of Fmk

	1968	1975
Stock dividends issues	1,370	6,580
Paid-up (cash) issues	650	83,006

Figur 1. Finland



dends in relation to share capital. The Danish corporation law on dividend limitation, in force in 1975, coincides with the fact that the internal interest rates as reported in the questionnaires were more than twice as high in Denmark than in other countries. This goes also for U.S.-owned companies, which in the other countries report lower interest rates than subsidiaries of other nationalities. It should be noted, however, that the general interest level is considerably higher in Denmark than in the other Nordic countries, which has probably had an influence on the interest level with regard to intra-firm debts. The general tendency seems to suggest that international enterprises act in a more differentiated fashion and adapt their policy to local conditions more with regard to financing and dividend payment, than they do in other respects.

6. SUMMARY OF TAX RELATED EXPLANATIONS OF RESULTS

With a few exceptions the results reached are not surprising. In general it appears that tax planning has influenced the pattern of financial flows within the international enterprises to a limited extent only. The transactions are almost entirely taking place with companies in countries belonging to the most important trading partners of the Nordic countries. The relations between different kinds of transactions and the transaction values correspond in general to what could be expected.

Insofar as tax rules could be expected to marginally affect the behavior of enterprises such influences could be traced in a number of cases. However, there are also some respects in which the tax rules do not seem to have influenced the transaction pattern. The great dominance of goods transactions demonstrate the importance of the internal pricing system of goods within the enterprises for the reported distribution of profits. Changes in profit allocation within the studied firms that might have been achieved through other kinds of transactions than goods transactions are as a whole of minor importance. The situation might differ between individual firms, however. The differences in profit and dividend level between subsidiaries of different nationalities suggest that internal pricing policies are potentially important. The level of interest on internal borrowing seems on average to be somewhat below the market level.

Royalty fees do not appear to be a generally used instrument for tax minimization for subsidiaries located in the Nordic countries. U.S.- and Dutch-owned companies account for over 80 percent of internal royalty costs.

Interesting to note is that the royalty-remitting companies also account for 80% of all dividend remittances. If we look at the data the other way around we also find that the dividend-remitting companies account for close to 80 percent of all royalties. Thus, no support can be found for the theory that companies having possibilities to pay royalties use that possibility instead of paying dividends. Furthermore the royalty fees are directed to the home countries of the enterprises.

Flows of royalty fees to tax havens are insignificant. The results indicate that intangibles have been transferred to subsidiaries in low tax countries only to a very limited extent. It is a common feature that intangibles are owned by the group parent or by a company in the home country of the enterprise.

Management and service fees are more common and of greater importance than might have been expected. To some extent this can be influenced by taxation as in several countries the tax laws and the tax autorities--however not in the Nordic countries--are very restrictive with regard to royalties transferred abroad. Management and service fees can often be of similar nature; however, they are often not subject to the same restrictive treatment. This is a possible explanation of the value and frequency of this kind of transactions. The transaction pattern and the tax planning strategy seem in general to be dependent primarily on the nationality of the enterprise. Clear national differences seem to exist. Differences related to industry are less significant than expected with the exception of the oil companies.

Concerning the U.S.-owned enterprises, their significant propensity to distribute dividends compared with those of other nationalities, can at a first glance seem to be unfavorable from a tax point of view. However, distribution can be quite rational from the standpoint of American tax legislation. The American system for foreign (direct and indirect) tax credit on earnings from abroad, including the rules--voluntary until 1975-- for an overall limitation on the foreign tax credit, makes it often profitable to take some dividends from high-tax countries to balance dividends from subsidiaries with lower taxes. The ultimate American tax burden will be the same as long as the average foreign tax paid does not exceed the American corporation tax on the income. Moreover, the American Subpart-F tax legislation often makes it unprofitable to have intermediate holding companies in certain low-tax countries and tax havens, as the legislation may imply a liability of the U.S.-parent company with respect to the income of the foreign holding company, regardless of whether such income is distributed to the parent company or not. Thus, it is not surprising that U.S.-owned companies account for a very small share of the transactions with Switzerland. A few cases of transactions with companies in Bermuda and Panama are found.

German companies generally have very low dividend pay outs. However, most of the dividends reported by companies in German groups are, moreover transferred to holding companies in Switzerland. The dividend flow back to West-Germany is minimal. The German split-rate system for corporate taxation in force in 1975 made it rather expensive to retain profits or dividends in Germany. There were strong tax reasons to direct dividends to Switzerland when the dividends were to be retained for future use within the international enterprise.

The Danish corporate tax legislation contains some features--the option to consolidate the income of Danish parents and their foreign subsidiaries in combination with the reduced tax rate on foreign income--that sometimes make it profitable to form a Danish sub-parent company. The data also indicate that this is done by some firms. Thus non-Danish enterprises account for more than half of all dividends going to Denmark from the other Nordic countries.

As already pointed out the Finnish financial pattern--high ratio of share capital, high dividend level, high level of new share issues, small long-term internal borrowing, and low share of interest --is probably affected by the tax laws.

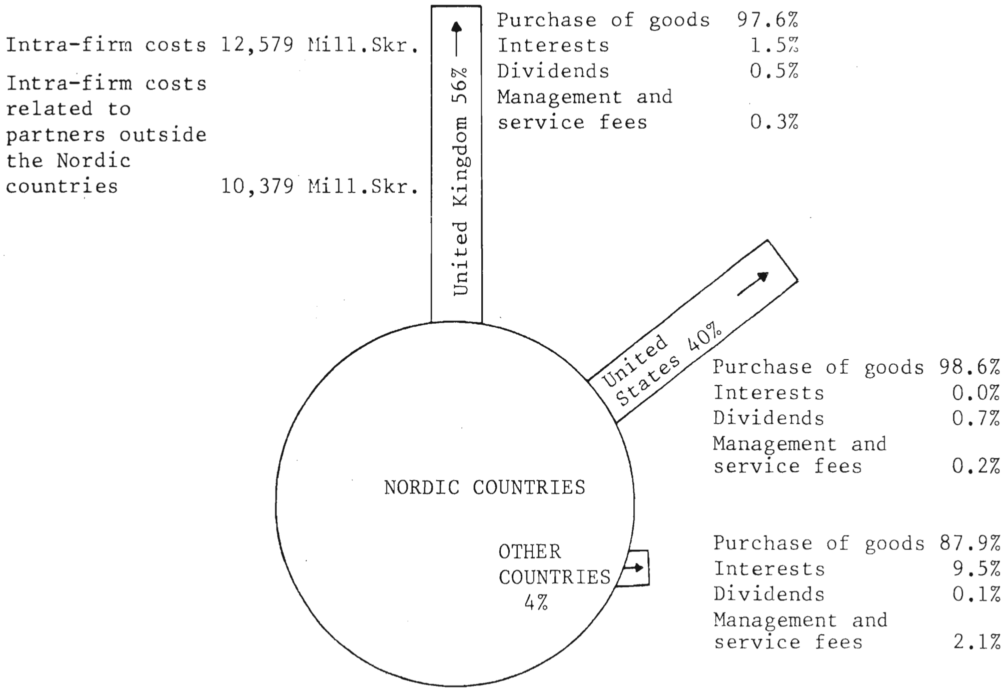
In a few cases it has been observed that Swedish subsidiaries--Sweden has an extensive network of double taxation treaties also with developing countries--have been used as intermediaries in transactions with countries having no tax treaty with the country of the parent company. By this arrangement high with-holding taxes of the other country with regard to payments to non-treaty countries have been avoided.

There is a general tendency in the reported answers, also when tax planning seems to have influenced the transaction, that transactions with tax havens are rarely used. Considering the problems of intra-firm transfer pricing policy it is important to note that intra-firm goods transactions essentially take place among countries with approximately the same corporate tax rates. To the extent that pricing manipulations may occur, they will not, from a general point of view, result in any substantial gains in tax rates. Other reasons are more likely to direct the pricing policy in these cases. Transactions with Switzerland do not play any significant role. With the exception for German firms big international enterprises do not often use Switzerland or tax havens as a base for holding or service companies in connection with transactions with the Nordic countries. The number of transactions with countries, not having tax treaties with the Nordic countries, is insignificant. This does not mean that international firms abstain from using tax havens, but it indicates that they do not use tax havens in transactions with their manufacturing or selling subsidiaries--at least not in the Nordic countries. Interviews with some US-parent companies in 1979 confirm this picture. Tax havens are used by the companies but for other purposes than shifting profits from their operating subsidiaries.

The oil companies (having a very high answering frequency) account for more than half of the transaction value of all firms. For that reason their answers have been analyzed separately. Their transaction pattern is extremely homogeneous as can be seen fom Figure 2. It gives a very poor base for conclusions concerning tax effects. The oil companies report very small, if any, profits in the Nordic countries and the reported dividends are very small. A contributing factor is probably to be found in their financial structure showing a very high ratio of internal borrowing. No conclusions concerning tax-related behavior can be drawn by the strongly centralized financial flows to the United Kingdom and the United States.

It is important to note that this study is focused on financial flows and transaction patterns at an

Figure 2. <u>Oil companies: distribution of intra-firm costs, credit transaction; partners outside the Nordic countries</u>



aggregated level, leaving aside the individual differences among the companies. The results are valid only for the companies that participate in the investigation and for their share of the total financial streams.

7. CONCLUSIONS

The results reported on here relate directly to the discussion on fairness in international tax rules in Carlsson and Hufbauer (II:1 in this volume) and the international assessment method suggested in Eliasson, G. (1972; op.cit. pp. 55-60). We have found in this study that the U.S. credit system affects remittance behavior. C.&H. (II:1) conclude that a credit country, being alone would loose tax revenues and sooner or later would be forced onto some more nationalistic system, less generous to other countries. C.&H. (II:1) find the formula apportionment method as arbitrary and impracticable as other methods like armslength pricing etc for a number of reasons. What, for instance, would be the best or the fair apportionment criterion? Countries would each make the choice that suits them best. Eliasson starts from another end and concludes that any practical or theoretical principle to distribute tax revenues fairly between countries will be arbitrary by definition. Different transfer pricing methods between firms is one reason, and these methods may differ for reasons that have nothing to do with taxes.[1] It is possible to look at the problem as a

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[1] Cf also Eliasson, G. (1976), Business Economic Planning, John Wiley & Sons (pp. 122 f, 178 ff, and p. 246).

conflict between the tax interest of different states in which the companies only are the object. According to this approach dividing up the tax-take among jurisdictions is a problem for the nations not for the firms and should be settled at that level alone with the least possible trouble and influence for the firms. The straight forward principle would be to leave the assessment and taxation of any company that operates on an equity basis in more than one jurisdiction to an international authority that operates under an international tax law and that taxes the entire multinational company as a whole. This would leave the problem of splitting up the tax among the national bodies to where it belongs - to the national bodies. The company would have no tax interest to allocate resources to particular tax regimes and the device would have very attractive economic efficiency properties from a global point of view (Eliasson, G., 1972, op.cit. p.60). The practical difficulties, however, are very large. The difficulties lie in having national legislative bodies agree on the formula--but that is a problem that for many reasons should not be left to the discretion of the companies--as it is now. However, the political will among the states seems to be lacking. Therefore the problem will remain unsolved within the scope of a foreseeable future.

Part III
Theory

Corporate Financial Policy and Taxation in a Growing Economy *

Martin Feldstein, Jerry Green and Eytan Sheshinski

This paper presents a model of corporate financial policy in a growing economy and then uses this model to study the effects of changes in corporate and personal taxes. Our picture of the firm includes a flexible debt-equity ratio and a flexible dividend payout rate. The costs to the firm of both debt and equity capital are increasing functions of the firm's debt-equity ratio. We use a realistic description of the tax system that includes a corporate income tax with deductible interest expenses, a personal income tax, and a favorable tax treatment of retained earnings.

Our work builds on earlier research[1] on both corporate finance and taxation but provides a more general and realistic model. This new model implies a unique optimal debt-equity ratio instead

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[1] See in particular Harberger (1962), Modigliani and Miller (1958), Miller (1976) and its useful bibliography, Lintner (1964), Solow (1971), Stiglitz (1973, 1976), and Jakobsson (1976), as well as our own previous research reported in Feldstein, Green, and Sheshinski (1978).

of the indeterminacy associated with the Modigliani-Miller tradition. The model also implies that firms will choose a positive equilibrium payout rate in spite of the favorable taxation of retained earnings. We know of no other model that explains why firms simultaneously borrow and pay dividends in an economy with corporate and personal taxation.

The model is presented and explained in Section 1. The second and third sections then examine the effects of changes in the corporate tax rate and in the differential between the taxation of dividends and of retained earnings. The nonneutrality of the corporation tax is discussed more generally in Section 4.

The framework for our analysis is an economy in steady-state growth with a fixed saving rate. To avoid the usual complexities and ambiguities of corporate tax shifting in a two-sector model, we assume that all business activity takes a corporate form. These simplifying assumptions allow us to focus on the effects of the tax system on financial behavior (the debt-equity ratio and the dividend payout rate) and on the after-tax yields on stocks and bonds. The implications of recognizing a noncorporate business sector and of allowing the saving rate to vary with asset yields are discussed briefly in Section 4.

1. A MODEL OF FINANCIAL EQUILIBRIUM

In order to study these questions, we extend the simple one-sector, nonmonetary growth model to include a specification of the financial behavior of firms and households. By virtue of the assumptions that aggregate savings are insensitive to the rate of return and that population grows exogenously at a fixed rate n, the economy's capital-labor ratio will be constant in the long-run equilibria that we analyze. Under the usual neoclassical conditions, this means that the gross rate of return per unit of capital f' is also a constant.

In the following subsections we discuss the behavior of firms and investors in the context of a simple tax structure that is designed to capture the basic features of the U.S. tax system.

1.1 Firms' Decisions and the Post- and Pre-Tax Returns

The decision variables on which we focus are concerned with the way in which investment is financed. There are two financial instruments, debt and equity; the proportion of capital financed by debt is denoted b. Firms must also choose their payout rate p, which is the fraction of the total return to equity holders (before any personal taxes are paid) that they receive in the form of dividends.

As a first step in the analysis, it is necessary to relate the net-of-tax yields of investors to the corresponding costs of finance to firms. Debt costs the firm i per unit of capital raised, and this return is taxed at the personal interest income rate θ. Thus, the net rate return to bond holders is

$$i_N = i(1-\theta). \tag{1:1}$$

The return to equity is e and consists of pe paid in the form of dividends and (1-p)e retained for capital accumulation by the firm.[1] We assume that dividends are taxed at the same rate as interest but that retained earnings are in effect taxed at a lower rate ($\mu\theta$), where μ is between zero and one. The reason for the effectively preferential treatment of retained earnings is that no personal taxes are levied on corporate income held within the firm. Taxes are paid upon realization of the resulting gains, but they are below the ordinary income tax rate both because of the differential treatment of capital gains and because of the delay that is typically entailed in taxing only realized capital gains. Overall, the net return to equity is, therefore,

$$e_N = pe(1-\theta) + (1-p)e(1-\mu\theta). \tag{1:2}$$

It will be convenient to have a special symbol for the effective rate of taxation on equity income, which depends on the firm's control variable p as

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[1] This assumes that the increase in the market value of the firm resulting from acquiring a dollar's worth of capital goods is one dollar; i.e. that Tobin's parameter q equals one (Tobin, 1969). This is a crucial difference between our analysis and that of Auerbach (1979) and Bradford (1978).

well as the tax rate; let

$$x = p(1-\theta) + (1-p)(1-\mu\theta) \tag{1:3}$$

so that

$$e_N = ex. \tag{1:4}$$

Before the decisions of the firm can be studied, we must describe the economic environment in which it is embedded. Its securities must compete with those of other firms that are substitutes, but not perfect substitutes because their risk characteristics differ. From the household investors' point of view, the relevant variables are assumed to be the expected returns net of tax offered on the two types of securities issued, and the risk characteristics of these assets as determined by the debt-equity ratio the firm has chosen.

We shall use carets to denote the variables relating to all other firms collectively considered; the offered returns are $\hat{e}_N$ and $\hat{i}_N$ for equity and debt, respectively. The debt per unit of capital held by all other firms is $\hat{b}$.

In an equilibrium the firm's sources and uses of funds must be in balance. Its gross income per unit of capital is f'. Interest costs of bi per unit of capital are deductible for tax purposes. The residual is taxed at the rate τ. The return to equity holders per unit of equity before personal taxation is thus defined as

$$(1-\tau)(f'-bi)/(1-b) = e. \tag{1:5}$$

We assume that a firm, in marketing its securities, perceives rising supply prices for both debt and equity capital as its debt-equity ratio rises.[1] This assumption is clearly contradictory to the extreme form of Modigliani-Miller view that the debt-equity ratio has no effect on the costs of either debt or equity. As we note below, this Modigliani-Miller view is not compatible with an interior solution for corporate debt policy. We also share the view of Myers (1977) and others that a high debt-equity ratio restricts a firm's real investment options, thereby reducing the value of its shares. In addition, we reject the extreme view that "home-made leverage" and corporate leverage are perfect substitutes.

It will be most convenient to express these schedules as giving the net required return to investors. They also depend upon the debt-equity ratio of all other firms $\hat{b}$, and their promised returns to the two types of securities, net of personal taxes $\hat{i}_N$ and $\hat{e}_N$:

$$\begin{aligned} i_N &= \phi(b,\hat{b},\hat{e}_N,\hat{i}_N) \\ e_N &= \psi(b,\hat{b},\hat{e}_N,\hat{i}_N) \end{aligned} \qquad (1{:}6)$$

Higher returns available elsewhere, $\hat{e}_N$ and $\hat{i}_N$, shift these schedules up. More riskiness in the "market" portfolio $\hat{b}$ will have the opposite effect. We shall assume that the cross-partials of the ϕ and

[1] We assume that both prices rise, although our analysis requires only that at least one rises.

ψ schedules are zero.[1]

We are now ready to discuss the way in which firms operate. Firms choose b and p so as to minimize the net cost of capital N, defined as

$$N = b(1-\tau)i + (1-b)e. \tag{1:7}$$

It is important to remember that i and e in this formula are interpreted as the supply prices to the firm. The economic actions of other firms enter into this decision problem as parameters of the ϕ and ψ functions. Note that minimizing the cost of capital is equivalent to maximizing the present value of the equity in the company with our assumption that a dollar of retained earnings adds one dollar to the market value of the firm.[2]

Although it is clear that the risk considerations that make the firm's costs of debt and equity an increasing function of b cause the firm to find an optimal mixture of debt and equity, it is natural to ask why such a firm would ever pay dividends. By retaining everything possible (p=0), the firm can apparently lower the effective tax rate on equity earnings (x) and thus lower the cost of equity finance associated with any fixed level of

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[1] Perhaps a more natural assumption would be that the elasticities with respect to b are independent of the levels of the other variables, but this would complicate the comparative statics significantly, without adding much of interest. The results do not depend in any way on the assumed effects of $\hat{e}_N$, $\hat{i}_N$, and $\hat{b}$ on the individual firm's cost of funds schedules.

[2] This equivalence is discussed by Auerbach (1979).

the net return to equity holders. Since p is not an argument of ϕ or ψ, the policy $p = 0$ would seem always to be the best.

The answer to this line of argument is that if all earnings were retained, the equity of the firm would grow at a rate equal to the rate of return on equity gross of personal income tax. In order to maintain[1] a constant debt-equity ratio, debt finance must also increase at the same rate. Hence the policy $p = 0$ may force the firm's total capital stock to grow at a rate that exceeds the rate of growth of the economy. In this event the risk class represented by this firm's securities would become very large relative to the market, and it would not be able to raise enough capital in the long run. Since we are restricting firms to choose steady policies only, such a program would be infeasible. The firm could sustain a rate of growth higher than the economy as a whole in the short run only, but the ensuing shifts in the ϕ and ψ schedules would eventually cause the zero profit condition to be violated.

The rate of growth of the effective labor force is denoted by n. The firm operates under the constraint, $n > (1-p)e$. Growing at a faster rate would cause the firm to become too large a risk relative to the remainder of the economy and would thus raise its cost of capital. The firm's problem is therefore

$$\min N = b(1-\tau)i + (1-b)e \qquad (1:8)$$

[1] We consider only steady policies--that is, choices of p and b that could be pursued indefinitely--throughout this paper.

subject to

$$n > (1-p)e. \tag{1:8a}$$

Writing the cost of capital as

$$N = b(1-\tau)\phi/(1-\theta) + (1-b)\psi/x, \tag{1:9}$$

we see that the Lagrangean for this problem is

$$L = b(1-\tau)\,\frac{\phi}{1-\theta} + (1-b)\,\frac{\psi}{x} + \rho\left(n-(1-p)\frac{\psi}{x}\right), \tag{1:10}$$

where ρ is the Lagrange multiplier of the growth-rate constraint. Differentiating with respect to b, p, and ρ, we obtain the firm's optimality conditions:

$$0 = \frac{1-\tau}{1-\theta}\,(i_N+b\phi') - \frac{e_N}{x} + \frac{(1-b)}{x}\,\psi' - \rho\frac{(1-p)\psi'}{x} \tag{1:11}$$

$$0 = (1-b)e_N(\mu\theta-\theta)/x^2+\rho e_N\left(-x+(1-p)\theta(1-\mu)\right)/x^2 \tag{1:12}$$

$$0 = n - (1-p)e_N/x, \tag{1:13}$$

where ϕ' and ψ' are the derivatives with respect to b. Solving (1:12) for ρ, we have

$$\rho = -\,(1-b)\theta(1-\mu)/(1-\theta). \tag{1:14}$$

Note that ρ is negative as might have been anticipated. A higher growth rate would make feasible a financial policy in which retentions increase sheltering equity income to a greater extent, thus lowering the gross return equivalent to the required net return.

Substituting the solution for ρ into (1:11) and simplifying, we obtain

$$0 = \frac{1-\tau}{1-\theta}\,(i_N+b\phi') - \frac{e_N}{x} + \frac{(1-b)\psi'}{1-\theta}\,. \qquad (1:15)$$

Equations (1:13) and (1:15) describe the first-order conditions for the firm's problem of selecting a debt proportion b and a payout ratio p that minimizes the cost of capital subject to the firm's equity growth constraint.[1]

1.2 Aggregate Portfolio Balance Conditions

The analysis above is a complete specification of the suppliers of corporate securities. To close the system, some description of investors' risk preferences and their resulting market behavior must be given. The simplest method is to write the market's desired, or acceptable, level of debt per unit of capital as

$$\hat{b} = \eta(\hat{i}_N-\hat{e}_N). \qquad (1:16)$$

[1] For a given economic environment, as specified by $\hat{b}$, $\hat{e}_N$, $\hat{i}_N$, n and the functions ϕ and ψ, the firm's choice of b and p that minimizes the cost of capital may not also satisfy the equilibrium cash flow condition (1:5). If these choices were actually affected, there would be a surplus or deficit in the firm of $z=(f'-bi)(1-\psi)-e(1-b)$, which it is natural to assume, would accrue to equity as they are the residual claimants. Thus, the true disequilibrium return to equity would be $z/(1-b)+e$. Investors would be off their ψ schedules, and an adjustment would be necessary. In this paper we do not give any specification of the process of achieving equilibrium. It would be necessary to do so if one were to use the assumed stability of such a mechanism to derive comparative static results.

The sign of η' can be either positive or negative. We shall deal primarily with the case of $\eta' = 0$ to isolate risk changes from other effects, but we shall also discuss other cases.

Because of the symmetry of firms, in equilibrium the market (careted) variables will equal the corresponding firm-specific variables $\hat{b}=b$, $\hat{i}_N=i_N$, $\hat{e}_N=e_N$.

This reduces the system to a determination of b, i_N, e_N, and p. Of course, in this determination each individual firm treats the market variables $(\hat{b}, \hat{i}_N, \hat{e}_N)$ as given parameters of its own problem.

1.3 The Complete System

Using equations (1:3) and (1:8a) to write p in terms of x and the rate of growth, we see that in the long run, the system can be specified by the four relations,

$$0 = b-\eta(i_N-e_N) \tag{1:17}$$

$$0 = f' - \frac{bi_N}{1-\theta} - \frac{1-b}{1-\tau}\frac{e_N}{x} \tag{1:18}$$

$$0 = (1-\mu)\theta xn - (x+\theta-1)e_N \tag{1:19}$$

$$0 = \frac{1-\tau}{1-\theta}(i_N+b\phi') - \frac{e_N}{x} + \frac{(1-b)\phi'}{1-\theta}, \tag{1:20}$$

which are, respectively, the portfolio balance condition, the financial balance condition, and the two first-order conditions for the firm's optimization.

Notation

For the reader's convenience, before proceeding, our notation is recapitulated below in tabular form:

Tax rates

θ = personal income tax rate, applicable to interest and dividend income.

$\mu\theta$ = personal tax rate on retained earnings (through eventual capital gains).

τ = corporate tax rate on profits; interest is deductible.

Financial variables for the firm

e = cost of equity finance.

i = cost of debt finance.

b = debt as a proportion of capital.

p = payout rate, the proportion of post-corporate tax earnings paid in the form of dividends.

e_N = the supply price for net rate of return on equity of the firm.

i_N = the supply price for net rate of return on debt of the firm.

Macroeconomic variables

f' = gross return per unit of capital.

n = rate of growth.

$\hat{b}$ = market debt as a proportion of capital stock.

$\hat{e}_N$ = market rate of return on equity.

$\hat{i}_N$ = market rate of return of debt.

2. EFFECTS OF CHANGES IN THE PROFIT TAX RATE

In this section we examine how an increase in the rate of profits tax affects the decisions of the representative firm and the net returns to debt and equity investors. The differential taxation of dividends and retained earnings (i.e., the value of μ) is assumed to remain unchanged.[1]

Our analysis will focus primarily on the case in which $\eta' = 0$; i.e., in which the debt-to-capital ratio (b) remains fixed because the market's demand for relative quantities of debt and equity is not sensitive to differences in their yields. We focus on this case because only when b is constant can the predicted changes in e_N and i_N be interpreted unambiguously. With a fixed debt-capital ratio, the values of e_N and i_N are good reflections of the welfare of the owners of debt and equity capital. In contrast, when b changes in response to a change in the tax law, parts of the observed changes in e_N and i_N reflect compensation for the new level of risk associated with the new value of b.[2]

Totally differentiating equations (1:17)-(1:20) in the general case of $\eta' \neq 0$ with respect to b, e_N, i_N, x, and the predetermined τ yields[3]

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[1] Section 3 considers changes in μ as well as compensated increases in τ and decreases in μ that keep total tax revenue unchanged. In contrast, the increase in τ in the current section increases tax revenues.

[2] A more complete analysis of risk and risk aversion would be required to provide a precise welfare measure.

[3] Recall that we have assumed that the cross-derivatives of ϕ and ψ are zero.

$$\begin{bmatrix} 1 & \eta' & -\eta' & 0 \\ \frac{1-\tau}{1-\theta}i_N - \frac{e_N}{x} & \frac{1-b}{x} & \frac{1-\tau}{1-\theta} & b - \frac{(1-b)e_N}{x^2} \\ 0 & 1-x-\theta & 0 & (1-\mu)\theta n - e_N \\ Z & -\frac{1}{x} & \frac{1-\tau}{1-\theta} & \frac{e_N}{x^2} \end{bmatrix} \begin{bmatrix} db \\ de_N \\ di_N \\ dx \end{bmatrix}$$

$$= \begin{bmatrix} 0 \\ \frac{bi_N}{1-\theta} - f' \\ 0 \\ \frac{i_N + b\phi'}{1-\theta} \end{bmatrix} d\tau, \qquad (2:1)$$

where $Z=\partial^2N/\partial b^2$. The second-order condition for choosing b to minimize the cost of capital implies that $Z>0$.

2.1 The Debt-Capital Ratio

Although we shall concentrate on the case in which inelastic market demand ($\eta'=0$) keeps the debt-capital ratio (b) fixed, it is useful to examine first the effect of the corporation tax on the debt ratio in the more general case in which $\eta'\neq 0$. Solving (2:1) implies that

$$\frac{db}{d\tau} = \Delta^{-1}\eta' \left\{ \frac{e_N}{x}\left(\frac{i_N}{1-\theta} - \tau f'\right) - b\phi' \left[\frac{1-\tau}{1-\theta}b\big((1-\mu)\theta n - e_N\big) + \frac{1-b}{x}\big((1-\mu)\theta n - e_N\big) + \frac{(1-b)e_N}{x^2}(1-x-\theta)\right]\right\} \qquad (2:2)$$

where Δ, the determinant of the matrix in (2:1), is

$$\Delta = \frac{1-\tau}{1-\theta}\frac{e_N}{x} + \eta' Z - \eta'\tau\left[\frac{1-\tau}{1-\theta} b\phi' + \frac{1-b}{1-\theta}\psi' + Zb\right]. \quad (2:3)$$

Consider first the case in which $\eta'>0$. Equations (2:2) and (2:3) show unambiguosly that the introduction of a corporate income tax induces a substitution of debt for equity finance when $\tau=0$. Equations (2:2) and (2:3) then yield

$$\frac{db}{d\tau} = \eta'\left[i_N e_N - b\phi'\left[\left(\frac{b}{1-\theta} + \frac{1-b}{x}\right)\left((1-\mu)\theta n - e_N\right) + \frac{(1-b)e_N}{x^2}(1-x-\theta)\right]\right] > 0, \quad (2:4)$$

since $(1-\mu)\theta n = \left((\theta-1)e_N\right)/x < 0$ and $(1-x-\theta) = -(1-p)(1-\mu)\theta < 0$. It is easy to understand the reason for this. The corporation tax permits the deduction of interest payments in the calculation of taxable income. It thus raises the cost to the firm of providing a dollar of net equity income relative to the cost of providing net interest income. The firm's cost of capital is therefore minimized by substituting debt for equity. The extent of this substitution is limited by the market's reaction to the increased riskiness implied by an increasing ratio of debt to equity.

If $\eta'<0$, the numerator is negative, and $db/d\tau>0$ only if the denominator is also negative. The sign of the denominator can be negative if $\eta'<0$, but without quantitative information on the magnitudes of η' and Z, it is not possible to be certain of the sign. Stability considerations do not provide a definite answer unless arbitrary restrictions are imposed on the adjustment process.

2.2 The Net Rate of Interest

Previous studies of the corporation tax have not provided a satisfactory analysis of the effect of the tax on the net rate of interest received by bondholders. Harberger's (1962) discussion of corporate tax incidence ignored debt completely and assumed that all investment is equity financed. Stiglitz (1973) considered the opposite extreme case in which all marginal investment is financed by debt and therefore in which a change in the corporate tax rate does not alter the net rate of interest; i.e., $di_N/d\tau=0$.

We now show that when firms combine debt and equity finance, the introduction of a corporation tax (or the increase in a pre-existing tax rate) with full interest deductibility reduces the net yield to bondholders. To abstract from changes in i_N that just compensate for the increased debt-equity ratio, we consider the case in which $\eta'=0$ and therefore b is constant. Equations (2:1) and (2:3) then imply that

$$\frac{di_N}{d\tau} = \frac{-(1-\theta)}{1-\tau}\ \{f'-i-b\phi'(1-b)\left(x-1+\theta+\frac{1-\theta}{x}\right)\} \tag{2:5}$$

Using (1:18) and (1:20), we see that a lower bound on the bracketed expression in (2:5) can be obtained under the condition $\psi'=0$, as

$$(1-b)b\phi'\left(\frac{1}{1-\theta}\ -x+1-\theta-\ \frac{(1-\theta)}{x}\right).$$

This expression can be seen to be positive. Therefore, $di_N/d\tau$ is always negative. (Typically, ψ'

will be positive even when ϕ' is very small because equity risk is more sensitive to corporate leverage than is the default risk on debt.)

It may first seem paradoxical that a higher rate of corporation tax changes the yield on debt even though interest payments are fully deductible in calculating the corporation's taxable income. Looked at in this way, it would seem that the interest rate should be unaffected by a corporation tax and that all of the tax should be absorbed by a reduction in equity income.[1] Such an outcome is not compatible with the firms' financing and cost minimization conditions (equations (1:18), (1:19), and (1:20)). If the interest rate remained unchanged, firms would try to reduce their supply of bonds; since $\eta'=0$ implies that b cannot change, equilibrium must be re-established by a fall in i_N.

To obtain an indication of the order of magnitude of the effect of changes in the corporate tax rate, we can evaluate equation (2:5) for plausible values of the relevant parameters under the further assumption that $\phi'=0$.[2] We shall set the effective rate of corporate income tax at $\tau=0.40$ and the personal tax rate on bond interest and divi-

[1] Recall that we are dealing with the case of $\eta'=0$ in which individual investors wish to hold the same portfolio regardless of the relative values of i_N and e_N. With $\eta'>0$, a fall in e_N would increase the households demand for bonds and this in turn would be a further reason for i_N to fall.

[2] The magnitude of ϕ cannot be ascertained in general, since it depends on the substitutability among debt issues in investors' portfolios. Close substitutability implies that ϕ is small.

dend income at $\theta=0.30$, values that are roughly appropriate for the United States. The marginal product of capital of U.S. nonfinancial corporations has been about $f'=0.11$ in the past twenty-five years (Feldstein and Summers, 1977). The real rate of interest on medium grade corporate bonds has been approximately $i=0.03$.[1] Substituting these figures into (2:5) implies that $di_N/d\tau= -0.093$. An increase in the effective corporate tax rate by 0.1 (i.e. from 0.40 to 0.50) would lower i_N by 0.93 percentage points. Since $i=0.03$ and $\theta=0.3$ imply $i_N=0.021$, this would cut the net yield nearly in half. Note also that a fall of 0.93 in i_N implies a fall of $0.93/(1-\theta)=1.3$ percentage points in the real rate of interest, from 3.0 to 1.7 percent.[2]

2.3 The Net Yield on Equity

The fall in the net rate of interest that we have just calculated shows that the burden of the corporation tax is borne by both debt and equity investors. To assess the share borne by each, we must complement the calculation of the previous section by calculating the effect on e_N of an increase in the corporate tax rate.

It follows directly from equations (2:1) and (2:3), that, with $\eta'=0$,

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[1] During a decade of relative price stability (1954-1964), the yield on Moody's Baa bonds averaged 4.6 percent a year.

[2] The issue is more complex where there is a positive rate of inflation. See Feldstein, Green, and Sheshinski (1978).

$$\frac{de_N}{d\tau} = \frac{[(1-\mu)\theta n - e_N](f' + (b^2\phi/1-\theta)]}{e_N/x} \tag{2:6}$$

Since equation (1:19) implies that $(1-\mu)\theta n - e_N = (\theta-1)e_N/x$, we have that when $\phi'=0$, (2:6) simplifies to

$$\frac{de_N}{d\tau} = -(1-\theta f'). \tag{2:7}$$

This is a striking result. It implies that the reduction in the equilibrium equity yield in response to an increase in the corporate tax rate is independent of the debt-equity ratio, the dividend payout rate, and the preferential treatment of retained earnings[1] when corporations' borrowing rates are perfectly elastic.

The numerical values suggested above imply that $de_N/d\tau = -0.077$. An increase in the corporate tax rate from 0.40 to 0.50 would thus lower e_N by 0.77 percentage points, less than the reduction in the net interest rate.

Total income of equity investors per dollar of capital is $E_N = (1-b)e_N$ and the corresponding income of bondholders is $I_N = bi_N$. The relative income changes can therefore be written directly from equation (2:1) as

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[1] Note that equations (2:5) and (2:7) together imply that introducing a new corporate income tax reduces the earnings on the average portfolio of debt and equity by $d[bi_N+(1-b)e_N]d\tau=-(1-\theta)(f'-bi)$. This is of course just the revenue raised by taxing the return to equity, $f'-bi$, when the net income is otherwise subject to personal tax at rate θ.

0

$$\frac{dE_N/d\tau}{dI_N/d\tau} = \frac{1-b}{b}\,\frac{de_N/d\tau}{dI_N/d\tau}$$

$$= \frac{1-b}{b} \cdot \frac{(\theta-1)(e_N/x)(1-\tau)/(1-\theta)f'}{(-e_N/x)(f'-i_N/(1-\theta))}$$

$$= \left(\frac{1-b}{b}\right)(1-\tau)\left[\frac{f'}{f'-i}\right]. \qquad (2{:}8)$$

With our values of $\tau=0.40$, $f'=0.11$, and $i=0.03$, and $b=0.3$, $dE_N/d\tau=1.925(dI_N/d\tau)$. Equity owners bear only about 66 percent of the tax, even though they account for 92 percent of the pretax corporate income and 89 percent of the after-tax income.[1]

2.4 The Dividend Payout Ratio

We turn finally to the effect of the corporation tax on the dividend payout ratio p. Recall that the balanced growth of the corporation at the common growth rate of the economy (n) requires that the corporation's equity also grows at this rate. Equation (1.8a) noted that this balanced growth condition could be written as

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[1] On a pretax basis, bondholders receive only $bi=0.009$ per dollar of capital while equity receives (before tax) $(1-b)e=f'-bi=0.101$ per dollar of capital. Net of tax, bondholders receive $(1-\theta)bi=0.0063$ per dollar of capital. To calculate the net income of equity investors, $(1-b)e_N=x(1-b)e$, note that $x=p(1-\theta)+(1-p)(1-\mu\theta)$. Values of $p=0.5$ for the dividend payout ratio and $\mu=0.2$ for the relative rate of tax on retained earnings (allowing for the effect of postponement and the lower capital gains tax rate) are reasonable for the United States; these imply that $x=0.82$. From $(1-b)e=(1-\tau)(f'-bi)$, we obtain $(1-b)e_N=x(1-\tau)(f'-bi)=0.497$. Total after-tax income per dollar of capital is therefore 0.0560 of which equity investors receive 89 percent.

$$n = (1-p)e. \tag{2:9}$$

If we substitute e_N for e, this becomes

$$n = \frac{1 - p}{p(1-\theta)+(1-p)(1-\mu\theta)} e_N. \tag{2:10}$$

When an increase in the corporate tax rate lowers e_N, the balanced growth condition requires an offsetting increase in the remaining part of the right-hand side of (2:10). Since this expression varies inversely with p for any feasible values of θ and μ, an increase in the corporate tax rate requires a reduction in the dividend payout rate.[1]

We calculated that, with b constant, increasing τ from 0.40 to 0.50 would reduce e_N by 0.0077. Since $e_N = 0.071$ at the initial numeral values,[2] this is a reduction of 10.8 percent. To continue to satisfy the balanced growth equation, the dividend payout ratio must fall from 0.50 to 0.43.[3]

3. EFFECTS OF CHANGES IN THE TAXATION OF RETAINED EARNINGS

A central feature of the corporate-type tax is that retained earnings are taxed at a lower effective rate than dividends. Under current U.S. law,

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[1] More formally, it can be shown that $1/(1-p)d(1-p)/d\tau = -f'/e$.

[2] Note 1 on p.146 showed that $(1-b)e_N=0.497$. Since $b=0.3$, $e_N=0.071$.

[3] More generally, equation (2:1) can be used to calculate $dx/d\tau$ and then $dp/d\tau$ derived by using the definition that $x=(1-\mu\theta)-(1-\mu)\theta p$.

retained earnings are not subject to any personal income tax as such. The resulting capital gains are taxed at a rate less than the rate on dividend income, and the tax is assessed only when the asset is sold. We have parameterized the extent to which retained earnings are sheltered by μ: $\mu=1$ representing no advantage to retained earnings over dividend income, and $\mu=0$ representing a zero effective tax on retained earnings. Thus, differentiating with respect to μ corresponds to studying decreased levels of sheltering.

The effects of changing μ run through two channels. Directly, μ alters the effective tax rate on equity income x. Thus, μ influences the cost of capital for fixed values of e_N and i_N. Indirectly, the induced change in e, after firms have adjusted to the new cost of capital, will influence the payout rate p necessary to satisfy the steady-state equation. This feeds back onto the effective tax rate because it alters the part of equity income that is sheltered.

Intuitively, we would expect to find that reducing the extent of sheltering lowers the after-tax total return to equity e_N. This is true in this model. Moreover, we shall show that changes in the retained earnings provisions are otherwise neutral (provided that $\eta'=0$), leaving the gross returns, the net interest rate, and the dividend payout rate unaffected.

3.1 Uncompensated Shifts in μ

Recall that our basic equation system, (1:17)-(1:20), and its total differentiation (2:1) are written in terms of the endogenous variables, b, e_N, i_N and x, with μ as a fixed parameter. This form is inconvenient for the purpose of studying the effects of varying μ because μ enters into the definition of x. By rewriting the system with p, instead of x, as the fourth endogenous variable, we can see the effects of μ more simply. To do so, note that p, μ, and x are related by the definition,

$$x \equiv p(1-\theta) + (1-p)(1-\mu\theta). \tag{3:1}$$

Thus, in differentiating (1:20)-(1:23) totally with respect to b, e_N, i_N, p, and μ, it is only necessary to use

$$\begin{aligned} \frac{\partial x}{\partial \mu} &= -\theta(1-p) \\ \frac{\partial x}{\partial p} &= -\theta(1-\mu) \end{aligned} \tag{3:2}$$

to convert (2:1) into an equivalent system in these variables. This gives

$$\begin{bmatrix} 1 & \eta' & -\eta' & 0 \\ \frac{1-\tau}{1-\theta}\, i_N & -\frac{e_N}{x}\,\frac{1-b}{x} & \frac{1-\tau}{1-\theta}\, b & \frac{(1-b)e_N\theta(1-\mu)}{x^2} \\ 0 & 1-\theta-x & 0 & -[(1-\mu)\theta n-e_N]\theta(1-\mu) \\ z & \frac{-1}{x} & \frac{1-\tau}{1-\theta} & \frac{-e_N}{x^2}\,\theta(1-\mu) \end{bmatrix} \begin{bmatrix} db \\ de_N \\ di_N \\ dp \end{bmatrix} = \begin{bmatrix} 0 \\ -(1-b)\,\frac{e_N\theta(1-p)}{x^2} \\ [(1-\mu)\theta n-e_N]\theta(1-p)+\theta nx \\ \frac{e_N\theta(1-p)}{x^2} \end{bmatrix} d\mu \tag{3:3}$$

The matrix on the left-hand side of (3:3) is just the same as that in (2:1) with the last column multiplied by $dx/dp = -\theta(1-\mu)$. Thus assuming that $\eta'=0$,[1] we see that its determinant is

$$-\Delta\theta(1-\mu) = -\frac{1-\tau}{1-\theta}\,\frac{e_N\theta(1-\mu)}{x}. \tag{3:4}$$

We obtain the following comparative static results:

$$\frac{de_N}{d\mu} = -\theta n < 0 \tag{3:5}$$

$$\frac{di_N}{d\mu} = 0. \tag{3:6}$$

The particularly simple form of these expressions is worthy of note. The decrease in e_N in response to a higher effective tax on equity is no surprise. Its dependence on n, the growth rate, results from the fact that retentions are constrained in equilibrium by the growth rate. Therefore, in a faster growing economy with a higher retention rate, the nature of the taxation of retained earnings and capital gains will be more important to equity owners.

The result that i_N is unaffected is somewhat more surprising and is an important conclusion that

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[1] Throughout this section we shall maintain this condition. Little in the way of precise analytic results can be obtained if the aggregate debt-equity ratio is flexible and can respond to shifts in the composition of the cost of capital. Of course, on the firm level in our model, the cost of capital can be affected by financing changes of this type.

follows from the behavioral equations of the model. When μ increases, the initial impact is felt on all the equations of the system (except $b=\eta(i_N-e_N)$, which does not matter when $\eta'=0$). The firm has a cash flow deficit, as can be seen from equations (1:18) and (3:2). The retention ratio is no longer compatible with a steady state (from (1:19)); and bond finance becomes underutilized, since the value of e necessary to provide the original net return e_N is higher. It is important to note that if e_N and p were to change so as to restore cash-flow balance, they would also re-equilibrate the cost of capital at its original level. This can be seen simply by noting that e_N and p enter both of these equations in the form e_N/x only. Since i_N does not enter the steady-state equation at all, it is clear that the new equilibrium is achieved only by changing e_N and x, and leaving i_N at its original level.[1]

To summarize in economic terms the constancy of i_N results from the fact that the cost-of-capital equation and the cash flow equation both embody e_N, x, and μ in precisely the same functional form. Viewed in this way the result is no surprise at all. These equilibrium relations are concerned with firms' behavior and as such depend only on the returns to capital gross of personal taxation; in particular, the tax on retained earnings enters only through e, which is fixed in steady-state equilibrium.

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[1] This follows formally from the singularity of the matrix in (3:3), when the coefficients of $d\mu$ are substituted for the third column.

Note that since i_N and θ are unchanged, so is i. Therefore, the cost of capital minimization can be compatible with a fixed b only if e is also unchanged.

From the steady-state condition, $n=(1-p)e$, it is clear that p must also be constant. An uncompensated for change in the sheltering provision for retained earnings affects only the net return to equity through a shift in the effective tax on equity income. There are no further repercussions through the general equilibrium of the system. In this sense the differential taxation of retained earnings, unlike the corporate profits tax itself, is neutral.[1]

3.2 Compensated Shifts in μ

In concluding this section, it is interesting to ask what happens when μ and τ are changed simultaneously in a way that keeps the net burden of the tax unchanged while increasing the degree of sheltering of retained earnings. In our notation this involves lowering μ and raising τ in a way that keeps $bi_N+(1-b)e_N$ unchanged.[2] This can also be interpreted as making the tax more like a corporation tax. In the extreme case of complete integration of the personal and corporate taxes, $\mu=1$, and

[1] It should be emphasized again that this neutrality holds only in the special case of $\eta'=0$ that we are examining in this section.

[2] Recall that we are assuming that $\eta'=0$ and therefore that b is fixed. Fixing the net portfolio yield $bi_N+(1-b)e_N$ is equivalent to fixing the net burden of the tax.

$\tau=0$; there is then no difference in the taxation of dividends, retained earnings, and interest; as μ falls and τ rises, we move toward the current type of corporation tax.

Since an increase in τ lowers i_N, while a change in μ does not alter i_N, the combined change in τ and μ also lowers i_N. The requirement that the net portfolio yield $(bi_N+(1-b)e_N)$ remains unchanged implies that e_N must rise. As the equal yield tax changes in the direction of a corporate-style tax, the net equity yield increases, while the net return on debt falls. Moreover, since $dp/d\tau<0$ and $dp/d\mu=0$, the compensated change of increased sheltering has the effect of increasing the fraction of income that is retained.

4. THE NONNEUTRALITY OF THE CORPORATE INCOME TAX

Our analysis has shown that the current structure of corporate and personal taxes can substantially distort the financial behavior of firms. This occurs, even though we have assumed that the stock of capaital at each instant of time is fixed and that all business activity occurs in a corporate form. If we drop either of these assumptions, there is a further source of distortion in either the intertemporal or intersectoral allocation of resources. Before discussing the possibility of such additional distortions, we shall examine the nature of the nonneutrality of the corporation tax in a one-sector economy with a fixed growth rate.

Consider first the nonneutrality of the tax law with respect to the debt-equity ratio. Our analysis showed that the current tax system induces firms to increase their debt-equity ratio. The essential reason for this substitution is that interest payments are deductible in calculating taxable income, while the returns to equity are not. The extent of the substitution is limited because every rise in the firm's debt-equity ratio increases the perceived uncertainty of the firm's interest and equity payments, and this perceived risk raises the cost to the firm of both debt and equity capital. A new equilibrium debt-equity ratio is established at the point where the tax advantage of deductibility just balances the cost induced by the increased riskiness of heavier leverage.

This analysis stands in sharp contrast to two models recently developed by Stiglitz that imply that the corporation tax does not affect the debt-equity ratio. In the first model Stiglitz (1973) postulated that firms retain all of their earnings (i.e. pay no dividends) and can borrow at a fixed interest rate to finance investment in excess of these retained earnings. Since all marginal investments are financed wholly by debt in that model, the introduction of a corporate income tax has no effect. The important contribution of that paper is the reminder that previous studies of the corporation tax have been deficient in assuming that all corporate investment is financed wholly by equity. Stiglitz's own assumption that firms can borrow as much as they want at a fixed interest rate is crucial to his conclusion. Stiglitz explicitly recognizes that his assumption would only be tenable in an economy in which there is no uncertainty and would then imply that the marginal product of capital equals the rate of interest (f'=i). The inability of this model to explain why any dividends are paid is a further warning against accepting its other conclusions.[1]

In a subsequent analysis Stiglitz (1976, Section 5) developed a quite different model in which the interest rate paid by the firm is an increasing function of the firm's debt-equity ratio. In the context of this model Stiglitz again concluded that a corporate income tax would not change the firm's optimal debt-equity ratio. More specifically, Stiglitz posited an individual investor who divides his wealth between investment in a corporation (which he controls and which also borrows from others at a rate of interest that is an increasing function of the firm's debt-equity ratio) and investment in an unspecified alternative asset with a fixed return. In Stiglitz's formulation of the problem, the introduction of a corporate income tax does not alter the investor's optimal investment or borrowing decisions. This conclusion rests on the unwarrented assumption that the introduction of a corporation tax at rate τ reduces the net yield on the "alternative asset" by the same factor of $1-\tau$ that is applied to net corporate income.[2] No reason is offered for this critical assumption. Moreover, the assumption is

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[1] These remarks should not be regarded as a criticism of Stiglitz's model (which we believe makes an important analytic contribution) but as an explanation of why its implications should not be regarded as directly relevant for any actual economy.

[2] The crucial character of this assumption is clear, since Stiglitz's argument rests on the tax simply multiplying all terms in the first-order condition by $1-\tau$.

clearly false if the "alternative asset" is assumed to be the market portfolio of debt and equity or the debt issued by other corporations. The yield on the alternative asset will fall by the corporate tax rate only if this alternative asset consists exclusively of equity in other firms. However, this implies that any individual who owns corporate equity invests only in corporate equity regardless of the tax, while corporate bonds are held by a wholly separate group. It thus appears that Stiglitz's result that the debt-equity ratio remains unaffected by the tax follows from an implicit assumption that there are two classes of investors, one of which invests only in equity while the other invests only in debt. We therefore reject the "neutrality" conclusion of Stiglitz's second model.

In their justifiably famous article Modigliani and Miller (1958) showed that under certain conditions a firm's debt-equity ratio is indeterminate. One of these crucial conditions is the absence of any taxes. The introduction of the corporation tax in the simplest Modigliani-Miller framework implies that firms will finance their investment by debt only. In his recent Presidential address to the Americal Finance Association, Miller (1976) surveys the attempts to extend the model to include taxes without reaching this extreme and unrealistic implication. Miller concluded correctly that previous analyses have ignored the tax features that favor equity finance, i.e., the absence of any personal tax on retained earnings and the relatively low rate of tax on capital gains. He then argues that this favorable treatment of equity could re-establish the indeterminacy of debt-equity ratio and could therefore explain (without introducing considerations of risk related to the debt-equity ratio) why firms have not relied more on debt finance. More specifically, Miller points out that the debt-equity ratio is indeterminate if (in our notation) $(1-\Theta) = (1-\tau) \cdot \left[p(1-\theta) + (1-p)(1-\mu\theta)\right]$; i.e., if the after-tax yields on debt and equity are equal. However, since $\theta<\tau$ and $p(1-\theta)+(1-p)(1-\mu\theta) < 1$, this required "indifference condition" is definitely not satisfied in practice. Although Miller is right to stress the full structure of tax incentives, we believe the observed mix of debt and equity can be explained only by incorporating the risk-premium effects of changes in the debt-equity ratio (i.e., $\Theta'>0$ and $\psi'>0$).[1]

In addition to noting the potential effect of the corporation tax on the debt-equity ratio, our own analysis pointed out that the corporate tax lowers the net rate of interest[2] (as well as the yield on equity capital) and reduces the dividend payout rate. Thus, even in the case of an all-corporate economy with a fixed capital stock, the corporate income tax affects every margin of choice.

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[1] Miller appears to accept this at certain places in his address but generally stresses the "indifference condition" and minimizes the importance of uncertainty. Since Miller does not present an explicit complete model, we are uncertain of his final judgment.

[2] Stiglitz (1973) concluded that the net rate of interest would be unchanged by the corporation tax, but this rests on the assumption that marginal investments are financed wholly by debt and thus indirectly on the assumption of a riskless economy.

It is useful to consider the implications of extending our analysis to the type of two-sector economy studied by Harberger (1962, 1966). In this economy, fixed total supplies of capital and labor are divided between corporate and noncorporate production. All capital is equity capital. The introduction of a tax on capital income in the corporate sector involves an excess burden because the allocation of capital and labor between the two sectors is distorted. The introduction of debt finance along the lines developed in our model does not eliminate this excess burden. It is clear from Section 2 that i_N and e_N are both decreased by the introduction of a corporate income tax; this would induce a shift of capital from the corporate to the noncorporate sector until the net rates of return were again in equilibrium.[1] Note that this change in the allocation of capital and labor might also change the marginal product of labor.

If the savings rate is not fixed, but depends on the net yield to savers, the corporate income tax will also distort the intertemporal allocation of resources. In the all-corporate economy, the corporate tax reduces i_N and e_N and therefore the return on the market portfolio. This raises the price of future consumption relative to the price of current consumption and therefore distorts individual consumption and saving decisions. This en-

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[1] The corporation tax reduces the risk as well as the yield of corporate sector investment. The risk effect could in principle outweigh the yield effect and cause capital to flow into the corporate sector (Penner, 1964). The implication would still be that the tax is distortionary and creates an excess burden.

tails an efficiency loss even if there is no net change in private saving (Feldstein, 1977). The distortion is more complex in an economy with noncorporate as well as corporate firms but the conclusion concerning a potentially large intertemporal misallocation of resources remains unchanged.

5. CONCLUSION

In this paper we have examined the long-run effects of a corporate-type profits tax in a growing economy. Our model explicitly includes optimization by individual firms of their debt-equity ratio and dividend payout rate.

The analysis shows that the corporate-style tax is nonneutral in several important ways even though debt finance is available and the interest payments are deductible in the calculation of taxable income. Even if the economy's saving rate is fixed and all business activity occurs in the corporate form, changes in the tax rate would alter the firms' debt-equity ratio and the dividend payout rate as well as the net-of-tax rates of return earned on both equity and debt investments. With a more general specification of saving behavior and the recognition of an untaxed noncorporate sector, it is clear that this reduction in the net equity and debt yields will alter both saving and the allocation of capital between the corporate and noncorporate sectors.

There are several directions in which the current model should be extended. We have ignored inflation here even though we previously found (with a simpler model) that the interaction of inflation and taxation can be of substantial importance.[1] Although we have discussed the general implications of our research for a two-sector economy, an explicit analysis of the effect of a corporation tax when there is debt and equity finance of the type we analyze and an untaxed noncorporate sector remains to be done. Finally, we have dealt exclusively with the long-run, steady-state characteristics of the economy; it would clearly be useful to analyze the transitional behavior of both corporate borrowing and dividend decisions.

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[1] See Feldstein (1976) and Feldstein, Green, and Sheshinski (1978).

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Double Taxation and Corporate Capital Cost*

Villy Bergström and Jan Södersten

1. INTRODUCTION

The corporate income tax has recently received much attention. Its efficiency costs and incidence have been analyzed. Prominent studies in this field include Harberger's pathbreaking article of 1962, creating a framework for a general equilibrium analysis of capital income taxation. The empirical analysis of the corporate income tax following upon Harberger (1962) has dealt with the size and character of the tax differential between capital income from the corporate and non-corporate sectors. Rosenberg (1969), for instance, makes empirical estimates of the tax differential in the U.S. economy, while other economists, including Bailey (1969) and Holland (1958), have developed formal measures for the tax differential against corporate earnings.

Bailey's analysis includes taxes paid directly by the shareholders, i.e. personal income tax on dividends and capital gains, as well as the corporate income tax. He holds that the total effective marginal tax rate on corporate earnings is the sum of the corporate tax rate, stockholders' marginal tax rate on dividends multiplied by the fraction

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of profits paid as dividends and the tax rate on capital gains (on an accruals basis) multiplied by the fraction of profits ploughed back into the firm.

Behind Bailey's method lies the simple assumption, that retained profits give rise to capital gains on a one-for-one basis. By this assumption, the tax burden on retained earnings is identified with the tax on capital gains.

Basically the same assumption--one dollar of capital gain for one dollar of ploughed back profit--has been used by several other economists, including Holland (1958), Slitor (1966), McLure (1975) and Break & Pechman (1975) in their attempts to determine the total tax burden on corporate earnings.

The assumption that the retention of corporate profits produces an equivalent rise of the market value of the firm's shares is not, however, a tenable starting point for an economic analysis of the tax differential between the corporate and the non-corporate sectors. In view of the preferential tax treatment given to capital gains (as demonstrated by i.e. Bailey) it is, in fact, quite rational for a management, attempting to maximize the value of the firm in the portfolios of the stockholders, to undertake investments that produce less than a dollar's worth of capital gains for the marginal dollar of corporate retention.

In this paper, we will introduce an explicit theoretical model of firm behavior. Specifically, we will derive the cost of capital to a firm maximizing stockholders' wealth taking into account (i) the corporation income tax recognizing the existence of accelerated depreciation for tax purposes, (ii) personal income tax on dividends and (iii) capital gains tax.

In section 2 we establish the assertions stated above about the one-to-one relation between corporate retention and capital gains. Section 3 derives the net cost of capital demonstrating i.e. the different costs to the firm of using retained earnings and new issues as sources of finance. The total effective marginal tax rates on capital income from the corporate and non-corporate sectors of the economy may then be determined in section 4 with explicit reference to the firms' costs of capital. We then go further by constructing numerical examples of the tax burden on corporate capital income as compared to non-corporate. In the last section, finally, the analysis is extended to appreciate the effects of recent schemes to mitigate double taxation of corporate source income on capital cost and tax differentials.

2. SHAREHOLDER TAXATION AND STOCK VALUATION[1]

Define a rate of return, k_i, demanded by a stockholder on his financial investments in common

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[1] In this article we disregard risk and uncertainty despite the fact that we deal with expectations of long run future developments.

It should be mentioned that personal taxes and corporate taxes have been introduced into models of stock values before, for instance by Stapleton (1972) and King (1974), mainly to study the effects of financial policies on the firm's stock value or derive criteria for te firm's optimal financial policy.

stocks, net of all taxes. This rate of return can be seen as partially determined by what can be earned on, say, savings accounts or on government bonds after tax. Call such a basic rate of return, $\bar{p}$, exogenously given to the national economy by opportunities on capital markets in the world economy.

The rate of return demanded by the stockholder would then --disregarding risk-- be $k_i = \bar{p}(1-\tau_i)$, where τ_i is the marginal income tax rate of the i:th stockholder. The value of a share in a company to the stockholder is then defined as the capital value of his cash flow from one common stock.

$$V_i(s) = \int_{t=s}^{\infty} \left[\tilde{U}(t)(1-\tau_i) - \gamma_i \tau_i \frac{d\tilde{V}(t)}{dt}\right] e^{-k_i(t-s)} dt. \tag{1}$$

Here $\tilde{U}(t)$ is the expected dividend per share and $d\tilde{V}(t)/dt$ the expected capital gain (or loss) at time t. Further γ_i is a parameter that takes care of the fact that only a fraction of capital gains is taxed as personal income and also that accrued capital gains are taxed only at the time of realization. The deferred capital gains tax, imposed at the time of realization, can always be transformed to a tax on the accrued gain if the holding period of the stock is known. Therefore $\gamma_i \tau_i$ is the annual effective rate (a "shadow rate") of capital gains taxation implied by the nominal rate of deferred capital gains taxation and the holding period.[1]

[1] Cf. Bailey (1969), p. 15 ff.

The value of a share to the stockholder is then, according to (1), the capital value of the payment stream net of taxes generated by the share, when discounting is undertaken by $k_i(\tau_i)$. Now, to continue we will assume that we are dealing with the "representative stockholder" whose valuation of the share, $V_i(s)$ coincides with the market value, $V(s)$. We therefore skip the index referring to individuals below and also let $V(s)$ stand for the value of all shares, i.e. the value of the firm.

It can easily be shown from (1) that ploughing back profits does not require a one-for-one dollar's worth of capital gains. To show this take the derivative of (1) with respect to the lower limit of integration, s, to get:

$$\frac{dV(s)}{ds} = kV(s) - \left[U(s)(1-\tau) - \gamma\tau \frac{dV(s)}{ds}\right]$$

which can be rearranged to:

$$k = \frac{U(s)(1-\tau) + \frac{dV(s)}{ds}(1-\gamma\tau)}{V(s)} \tag{2}$$

Now (2) can be seen as describing market equilibrium: The sum of dividends and capital gains net of taxes must be a fraction of the value of the firm equivalent to the stockholders' required rate of return, k. For $kV(s)$ to stay constant, the following equation must hold:

$$d[U(s)(1-\tau)] + d\left[\frac{dV(s)}{ds}(1-\gamma\tau)\right] = 0$$

implying the marginal rate of substitution of dividends for capital gains as:

$$\frac{d[\frac{dV(s)}{ds}]}{d[U(s)]} = - \frac{1-\tau}{1-\gamma\tau}.$$

Thus it would be worthwhile to reallocate profits from distribution to retention as long as the absolute amount of the marginal rate of substitution is larger than the ratio of the after tax part of a dollar of dividend income to the after tax part of a dollar of capital gain.

Because $\gamma<1$, reflecting the preferential tax treatment of capital gains, this marginal rate of substitution is smaller than one:

$$(1-\tau)/(1-\gamma\tau) < 1.$$

Shareholders would be prepared to give up more than a dollar of dividends for retention to obtain a dollar of capital gain. For the analysis of "marginal total" tax rates on corporate profits, therefore, it is not justified--as done by Bailey et al.--to presuppose equivalence of the amount of retention and capital gains.[1]

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[1] Bailey's empirical analysis (1969) of capital gains compared with retention in Table 1, p. 18 and Appendix A does not--in our opinion--give an unambiguous support of his assumption, and that also goes for other studies (surveyed by Break, 1969) of the same problem. Furthermore, our proposition is not "tested" by Bailey's data because we only discuss a marginal condition, whereas Bailey's data on capital gains and retention concern totalities. Even if our marginal condition is fulfilled, capital gains on intramarginal retentions can drive the ratio of total capital gains to total retention to a figure equal to or greater than one. Nevertheless, it is wrong to assume this ratio to be equal to one for the analysis of effective marginal tax rates.

Now let us introduce issues of new common stocks into the model. The cash flow to stockholders in (1) is thereby altered so that the value of the firm now is:

$$V(s) = \int_{t=s}^{\infty} \{U(t)(1-\tau) - \gamma\tau[\frac{dV(t)}{dt} - N(t)] - N(t)\} e^{-k(t-s)} dt \tag{3}$$

In (3) $N(t)$ is the proceeds of new stock issues. The above model expresses how the firm is valued --in principle-- by rational investors on the market. As seen from (3) marginal personal income taxes on current income and the marginal tax rate on capital gains are very much involved in the pricing of stocks.

To simplify (3) take the derivative with respect to the lower limit of integration, s. By integrating and rearranging terms, the stock value, $V(s)$, can be written as[1]

$$V(s) = \int_{t=s}^{\infty} [\frac{1-\tau}{1-\gamma\tau} U(t) - N(t)] e^{-\frac{k}{1-\gamma\tau}(t-s)} dt. \tag{4}$$

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[1] Taking the derivative of $V(s)$ with respect to s gives

$$\frac{dV(s)}{ds} = kV(s) - (\text{Integrand of } (3)).$$

After rearranging we get

$$\frac{dV(s)}{ds} = \frac{k}{1-\gamma\tau} V(s) - [\frac{1-\tau}{1-\gamma\tau} U(s) - N(s)].$$

From the solution of this differential equation we get expression (4).

In the simplified valuation formula (4) the capital gains taxation is technically taken care of by an adjustment of the dividend stream and the rate by which it is discounted.

3. CORPORATE CAPITAL COST

Our purpose now is to go one step further and ask, given the above principle of valuation, what is the cost of capital to the firm, when not only personal income taxes are considered but also profit taxes. We proceed by defining U(t) and N(t) in (4).

To simplify we will abstract from debt financing. Hereby, we focus on that part of business capital --equity capital--of which yields are treated differently in the corporate and non-corporate sectors of the economy. Including debt finance would not change the character of our results.[1] Furthermore, we assume that the firm finances a constant fraction, n, of its net investments by new issues of common stocks.[2]

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[1] Assuming debt finance would be introduced in such a way that the proportions of new issues and retained earnings in equity capital is not changed.

[2] In this paper, we do not attempt to explain why such a financial pattern is actually chosen. Rather, we pose the question, given the firm's financial behavior, what is capital cost?

To actually explain the firm's choice between retained earnings, new issues and debt, a more elaborate model would be required. Such a model would have to take into account e.g. the existence of positive dividends from firms having unexploited profitable investment opportunities and the often noted coexistence of dividends and issues of new stocks.

Let P_K be the price of capital goods, $K(t)$ the firm's capital stock and $I(t)$ its gross investment. Net investment is then, if a is a constant fraction to take account of capacity depreciation:

$$P_K(t) \frac{dK(t)}{dt} = P_K(t)[I(t) - aK(t)].$$

The amount of new issues, $N(t)$, is then

$$N(t) = nP_K(t) \; [I(t) - aK(t)].$$

By these assumptions the volume of investment will be bounded at certain points in time by the fact that dividends in our formulation cannot be negative. To see the implication of this define dividends in the following way:

$$\begin{aligned} U(t) = {} & P(t)F[K(t), L(t)] - W(t)L(t) - P_K(t)I(t) + \\ & + nP_K(t)[I(t) - aK(t)] - \text{Taxes}, \end{aligned}$$

where $P(t)$ is the output price, $W(t)$ the wage rate and $L(t)$ input of labor.

The bound on (net) investment can be expressed as:

$$\begin{aligned} & (1-n)P_K(t)[I(t) - aK(t)] < P(t)F[K(t), L(t)] - \\ & - W(t)L(t) - aP_K(t)K(t) - \text{Taxes}, \end{aligned} \tag{5}$$

i.e. that portion of the firm's net investments not financed by new issues, must not exceed the firm's profits, net of depreciation and taxes.

To compute the amount of taxes paid we have to introduce the book value, C(t), and depreciation for tax purposes, b, a constant fraction of the book value, C(t). The amount of profit taxes is then:

$$T\{P(t)F[K(t), L(t)] - W(t)L(t) - bC(t)\},$$

where T is the rate of corporate profit tax.

Substituting the above expressions for dividends, new issues, and taxes into (4) and dropping time indices will give the market value of the firm as

$$V(s) = \int_{t=s}^{\infty} [\tfrac{1-\tau}{1-\gamma\tau} \{(1-T)[PF(K,L) - WL] - P_K I + n(P_K I - aP_K K) + TbC\} - n(P_K I - aP_K K)]e^{-\frac{k}{1-\gamma\tau}(t-s)} dt. \tag{6}$$

Assume now that the firm tries to maximize its value in stockholders' portfolios. Given this assumption, there is a lowest rate of return before taxes the firm can accept from a real investment in order not to lower the value of the stocks. This minimum rate of return we shall call the cost of capital. We look, then, for a necessary condition for real investments to be positive.

It should be pointed out again that the assumptions of financial behavior used in our model mean that the investment plan will be bounded from above as seen from (5). We do not take this bound into account but treat the problem as if there were no bounds meaning that we study only <u>free intervals</u>, where bounds are ineffective.[1]

We will simply assume that a solution exists, with a determinate firm size and a limited firm value (which would require the production function to exhibit diminishing returns to scale). Also, initial and transversality conditions can be disregarded.

Our simplified problem can now be handled by the calculus of variation method of maximizing Q in

$$Q = \int_s^\infty [M(t)+\lambda_1(I-\dot{K}-aK)+\lambda_2(P_K I-\dot{C}-bC)]e^{-\frac{k}{1-\gamma\tau}(t-s)}dt$$

$$= \int_s^\infty f(K, \dot{K}, C, \dot{C}, I, L, t)dt.$$

where $M(t)e^{-\frac{k}{1-\gamma\tau}(t-s)}$ is the integrand of (6)--the whole expression under the sign of integration--and where the time derivatives are written by putting a dot above the variables.

To compute capital cost we only need the following Euler necessary conditions for a maximum of (6), where we have set $\dot{\lambda}_1=\dot{\lambda}_2=0$, to simplify from the outset[2]

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[1] Control problems with bounded investment plans have been studied by Appelbaum and Harris (1978) and before them by Arrow (1968).

[2] The economic meaning of these assumptions is that all prices, including the wage rate, and tax rules (τ, γ, T and b) are expected to be constant.

$$\frac{\partial f}{\partial I} = [-\frac{1-\tau}{1-\gamma\tau}(1-n)P_K - nP_K + \lambda_1 + \lambda_2 P_K]e^{-\frac{k}{1-\gamma\tau}(t-s)} = 0$$

$$\frac{\partial f}{\partial K} - \frac{d}{dt}\frac{\partial f}{\partial \dot{K}} = \{\frac{1-\tau}{1-\gamma\tau}[(1-T)PF'_K - naP_K] + naP_K - \lambda_1 a$$

$$- \frac{k}{1-\gamma\tau}\lambda_1\} e^{-\frac{k}{1-\gamma\tau}(t-s)} = 0$$

$$\frac{\partial f}{\partial C} - \frac{d}{dt}\frac{\partial f}{\partial \dot{C}} = [\frac{1-\tau}{1-\gamma\tau}Tb - \lambda_2 b - \frac{k}{1-\gamma\tau}\lambda_2]e^{-\frac{k}{1-\gamma\tau}(t-s)} = 0.$$

Now, solve the second and third Euler equation above for λ_1 and λ_2 respectively and substitute into the first. By rearranging terms we get then, on the left hand side, PF'_K/P_K, the gross rate of return before taxes on real investment on the optimal path. This is the minimum gross rate of return that the firm can afford to earn on new investment while leaving shareholders no worse off, i.e. the gross cost of capital.

By subtracting from the gross cost of capital the rate of capacity depreciation, a, which by our assumption of "exponential decay", coincides with the rate of economic depreciation, we get the net cost of capital, r*:

$$r^* = \frac{kn}{(1-T)(1-\tau)} + \frac{k}{(1-T)(1-\gamma\tau)}[1-n-\frac{T(b-a)}{\frac{k}{1-\gamma\tau}+b}] \quad (7)$$

For the interpretation of (7), let us first assume that b=a, i.e. the rate of tax depreciation equals the rate of capacity depreciation. Since n is the portion of the firm's investments financed by new issues, $(1-n)$ is the portion financed by retained earnings, making the cost of capital a weighted average of the cost of new issues and the cost of retention. Thus, $k/(1-T)(1-\tau)$ can be identified as the cost of new issues, and $k/(1-T)(1-\gamma\tau)$ as the cost of retained earnings. Evidently, retained profits make up a less expensive source of equity capital than new issues, provided that $\gamma < 1$, i.e. capital gains are less heavily taxed than dividends in the hands of the shareholders.

If instead $b > a$, i.e. the firm is allowed to defer taxes through accelerated depreciation, the cost of retained earnings is weighted by

$$1 - n - \frac{T(b-a)}{\frac{k}{1-\gamma\tau} + b}.$$

This weight, in turn, is the portion of the firm's investment financed by ploughed back "true" profits net of tax. Thus, $b > a$ implies that a third part of capital growth, $T(b-a)/[k/(1-\gamma\tau) + b]$, is financed by deferred taxes, adding the weights up to one. However, this last cost of finance is zero and consequently does not show up in (7).

4. TAX AND CAPITAL COST DIFFERENTIALS

Having defined the net cost of capital r^* to a firm maximizing stockholders' wealth, the marginal effective tax rate on corporate profits may be derived in a straightforward way.

By definition, r^* is the rate of return before tax on an investment yielding the required rate of return k --that is $\bar{p}(1-\tau)$-- net of all taxes on stockholders' financial investment. The relation between r^* and k, being determined by the tax system and the firm's financial policy, actually implies the existence of an effective marginal tax rate T_c^* on corporate profits, such that

$$r^*(1-T_c^*) = k.$$

Using the expression for r^* given by (7), this means that

$$T_c^* = 1 - \frac{(1-T)(1-\tau)(1-\gamma\tau)}{n(1-\gamma\tau) + \left[1 - n - \dfrac{T(b-a)}{\dfrac{k}{1-\gamma\tau} + b}\right](1-\tau)} \tag{8}$$

To clarify the meaning of (8), let us consider two special cases. Ruling out the possibility of deferring taxes through accelerated depreciation (i.e. setting b=a), we will first assume that the firm finances its investments entirely through new issues (i.e. n=1). T_c^* then becomes

$$T_c^*(n=1,b=a) = T + \tau(1-T), \tag{9}$$

which means that the effective marginal tax rate would coincide with the total marginal tax rate--corporate and personal--on distributed profits.

Assuming instead that investments are financed exclusively by the retention of "true" profits (i.e. n=0, b=a), would cause (8) to collapse into

$$T_c^*(n=0,b=a) = T + \gamma\tau(1-T), \tag{10}$$

which in turn may be intuitively seen as the marginal tax rate on retained profits, determined by the corporate tax rate T and the tax rate on accrued capital gains, $\gamma\tau$.

Next, looking at the non-corporate sector, we assume that profits are fully taxed with the owners of equity as personal income, i.e. at tax rate τ. Ruling out, by this assumption, plough-back and tax deferral as sources of finance, net capital cost for the non-corporate sector, becomes

$$r^*_{nc} = \frac{k}{1-\tau}$$

i.e. the capital cost is simply the net rate of return demanded by the owner of equity, expanded to allow for the individual income tax. By definition then, r^*_{nc} coincides with $\bar{p}$, the rate of return exogenously given to the economy, as assumed at the outset.

Some numerical comparisons between marginal tax rates, T^*_c and τ --determining the tax differential-- and between the capital costs, r^*_c and r^*_{nc} --indicating a capital cost differential-- are presented in Table 1. Calculations are carried out on the assumption that $\bar{p}$ equals 10% and include several alternatives regarding individual income tax rates. It should be pointed out that this table (as well as Tables 2A and 2B on p.186) must be interpreted with care. Two interpretations are allowed, namely (i) that the household tax system is progressive and all shareholders are taxed at one of the marginal tax rates indicated in column one and (ii) that the household tax system is proportional. In this latter case column one indicates alternative tax rates of the proportional system.

The taxation of capital gains poses a special problem, since γ, expressing that fraction of each dollar of capital gain that must be declared as taxable income, is a rather complex entity, depending e.g. on holding periods. To approximate the effective tax burden on capital gains, prevailing e.g. in the U.S., we have chosen $\gamma=0.15$ throughout Table 1.[1] The assumptions regarding n, T and b appear below.

Table 1. Marginal tax rates and net costs of capital in corporate and non-corporate sectors
Percent

Marginal individual tax rate (τ)	Effective tax rate on corporate profits (T_c^*)	Tax differential (T_c^*)	Net cost of capital: Corporate sector (r_c^*)	Net cost of capital: Non-corporate sector (r_{nc}^*)
0	50	50	20	10
30	53.9	23.9	15.2	10
50	57.4	7.4	11.7	10
60	59.6	-0.4	9.9	10
70	62.6	-7.4	8.0	10
80	67.2	-12.8	6.1	10

Special assumptions: n=10%, T=50%, b=a, $\bar{p}$=10%, γ=15%.

The calculations presented in Table 1 indicate a differential tax burden on corporate source income varying from +50% to some -13% and a capital cost differential ranging from +10.0 to -3.9 percentage points, depending on the income levels of "the representative stockholders". These results largely agree with those presented by Bailey and others.[2]

[1] Cf. Bailey (1969) p.29, and Break and Pechman (1975) p.92.

[2] See Bailey (1969).

Our analysis is different from previous studies, therefore, mainly by being based on an explicit model of neoclassical firm behavior rather than on an untenable assumption regarding the consequences of corporate retention. Furthermore, our approach makes it possible to appreciate the effects on capital cost and tax differentials of various schemes of fiscal policy, such as accelerated depreciation and the investment tax credit. By distinguishing between the rate of tax depreciation, b, and the rate of capacity depreciation, a, we have in fact hinted at how such measures may be handled.

5. EFFICIENCY ASPECTS

The analysis carried out above of the effective marginal tax rate on corporate profits and of the net capital costs in the corporate and non-corporate sectors is of obvious importance to much discussed questions about the efficiency of the investment process in the economy. Two aspects of efficiency are involved here.

First there is the allocation problem between the corporate and non-corporate sectors, at stake in the writings of Harberger and others. Table 1 illustrates marginal tax rates and the net costs of capital relevant to this question, making it clear that present tax regimes provide quite varying sets of inducements for reallocating capital between the sectors. Thus, the differential tax burden on corporate profits turns out to be a somewhat ambiguous concept, varying not only in size but also in sign between different income levels of the "representative shareholder".

Second, there is the question of the relative costs to the firm of using retained earnings, debt or new issues as sources of finance. Baumol et al. (1970) in their empirical study of earnings retention and growth of firm found the rate of return on new equity capital to be very much higher than the rate of return on either ploughback or new debt. These authors ran their explanation to these findings in terms of the transaction costs involved with different sources of finance. Our analysis, however, suggests that the firm's apparent preference for financing investments out of retained earnings may also be explained in terms of the tax <u>differential</u> between capital gains and dividend income.

Referring to p.174 above, the ratio between the cost of new issues and the cost of retention may be written[1]

$$\frac{r^*(n=1)}{r^*(n=0)} = \frac{1-\gamma\tau}{1-\tau}.$$

To appreciate the size of this tax effect, let the marginal individual income tax rate be 70% (τ=0.7) and the effective tax burden on capital gains be 15% of the individual tax rate (γ=0.15). Then $r^*(n=1)/r^*(n=0)=2.98$. Given a 15% cost of new equity capital, it would thus be quite rational for the firm to accept a rate of return on the marginal dollar of retention of as little as 5.0%. In fact, the differences in rates of return found by Baumol <u>et</u> <u>al</u>. are not far outside the range of this example.

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[1] This ratio is equivalent to the marginal rate of substitution of dividends for capital gains, defined on p.168.

6. MITIGATING DOUBLE TAXATION[1]

The efficiency aspects touched upon here are the motivating forces behind the recent discussions in Europe and U.S. about integrating the personal and corporate income taxes. Several proposals have been put forth that tend to reduce the tax differentials between capital gains and dividend income and between corporate source income and non-corporate income. This is accomplished by partially eliminating the "double taxation" of corporate dividends, which characterizes the tax regimes analyzed above.

Two different methods have been discussed in this context. One, referred to as the imputation credit system, places a reduction in the total tax burden on distributed profits at the shareholder level, while the other, called the split rate system, implies the use of a lower corporate tax rate for distributed earnings. The effects of these methods on capital cost and tax differentials between the corporate and non-corporate sectors of the economy will be studied below. Furthermore, in this section, we will demonstrate the workings of the special scheme used in Sweden to reduce the cost of new equity capital.

The split rate system, used e.g. in Japan and West Germany, can be described as follows. Let T^d and T^r be the corporate tax rates on distributed and retained profits, respectively, and $\Pi(t)$ be the firm's total taxable income. Assume as before that the firm distributes $U(t)$ to the shareholders. Since $U(t)$ is defined net of corporation tax, then

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[1] This section is based on Södersten (1977).

$U(t)/(1-T^d)$ represents the firm's distributed profits before tax and $\Pi(t)-U(t)/(1-T^d)$ retained profits, also before tax. The corporation tax liability, due at time t, may then be expressed as

$$S(t) = \frac{T^d U(t)}{1-T^d} + T^r[\Pi(t)- \frac{U(t)}{1-T^d}] = T^r\Pi(t)-(T^r-T^d)\ \frac{U(t)}{1-t^d} \tag{11}$$

which makes it clear that a reallocation of profits from retention to distribution will reduce the firm's tax payments, provided $T^d<T^r$. Then, using the definition of $\Pi(t)$ implied on page 171, the effects of the split rate system on the stockholders' cash flow and the value of the firm may be determined by inserting (11) into (6).

According to the imputation system, used e.g. in France and the United Kingdom, part of the corporation tax paid by the firm on distributed profits is regarded as an advance payment on account of the shareholders' eventual income tax liability. Shareholders therefore receive a credit in their income tax assessments for part of the tax already paid by the corporation.

In order to describe the imputation system in a general way, it is convenient to introduce a parameter, ϕ, representing a "rate of tax credit" given to the shareholders. For the interpretation of ϕ we may note that full compensation to the shareholders for the corporation tax on dividends requires that $\phi=T$, i.e., the rate of tax credit should equal the corporate tax rate. Consequently, $\phi<T$ --as is the case for France and the United Kingdom-- implies that shareholders are given credit only for part of the corporation tax.

According to this system, the dividends received, $U(t)$, would first be "grossed up" to $U(t)/(1-\phi)$, to represent a corporate pretax income behind the dividend. $U(t)/(1-\phi)$ is then interpreted as an imputed shareholder income, implying an income tax liability of $\tau \cdot U(t)/(1-\phi)$. For this amount, however, shareholders would receive a tax credit of $\phi \cdot U(t)/(1-\phi)$, reducing the income tax on the dividends to $(\tau-\phi)U(t)/(1-\phi)$.

After the deduction of $(\tau-\phi)U(t)/(1-\phi)$ from the dividends paid by the firm, there remains $U(t)(1-\tau)/(1-\phi)$ for the shareholders. The firm's objective function with due adjustment to the imputation system therefore becomes

$$V(s) = \int_{t=s}^{\infty} \left[\frac{(1-\tau)U(t)}{(1-\gamma\tau)(1-\phi)} - N(t)\right] e^{-\frac{k}{1-\gamma\tau}(t-s)} dt \qquad (12)$$

Having introduced the split rate system through expression (11) and the imputation system through expression (12), the analysis may be carried out in exactly the manner outlined in section 3. Ruling out --for simplicity-- the possibility to defer corporate taxes through accelerated depreciation, capital cost then becomes

$$r^* = \frac{kn}{\left[1-T^d - \frac{\tau-\phi}{1-\phi}(1-T^d)\right]} + \frac{k(1-n)}{\left[1-T^r-\gamma\tau(1-T^r)\right]} \qquad (13)$$

The interpretation of (13) is the same as that of (7). Measures implemented to mitigate double taxation of dividend income, either through an imputation credit system ($\phi>0$) at the shareholder level, or through a split rate system ($T^d < T^r$) at the corporate level, <u>ceteris paribus</u>, tend to lower the cost of new issues. Neutrality as to the firm's choice between new issues and retained earnings obviously requires that

$$T^d + \frac{\tau-\phi}{1-\phi}(1-T^d) = T^r + \gamma\tau(1-T^r), \tag{14}$$

which means that the total tax burden on distributed profits, the left-hand side of (14), equals what may intuitively be regarded as the total tax burden on retained profits. Clearly, fulfillment of condition (14) may be secured not only through a reduction in the total tax burden on dividends, but also through an increase in the rate of tax on capital gains, or on retained profits.

A third way of mitigating double taxation appears in Sweden. Putting it generally, Swedish firms are allowed to deduct against current profits over a period of ω years a fraction α of the amount raised by issuing new shares. For analytical purposes, we shall assume that the subsequent savings in corporate taxes reduce the need for raising equity capital through new issues. Precisely, we assume that the firm finances a fraction n of its net investment by new share capital <u>and</u> the tax savings due to the special deduction. Our definition of $N(t)$, the amount of new issues (p. 171) then changes into

$$N(t)(1+\beta)=nP_K(t)\left[I(t)-aK(t)\right] \tag{15}$$

where β is the present value of corporate tax savings from a \$1 issue of new share capital:

$$\beta = \int_0^w T\alpha e^{-kt} dt = \frac{T\alpha}{k} \left[1-e^{-wk}\right]$$

(15) means then that the firm's capital growth will be financed by new share capital and subsequent corporate tax savings in proportions $n/(1+\beta)$ and $n\beta/(1+\beta)$.[1]

Using (15) and assuming as before that the rate of tax depreciation equals the rate of capacity depreciation (i.e. b=a), our expression for capital cost [cf. equation (7)] turns out

$$r^* = \frac{kn}{(1-T)(1-\tau)(1+\beta)} + \frac{k(1-n)}{(1-T)(1-\gamma\tau)}. \qquad (16)$$

The weight attached to the cost of new share capital now has changed into $n/(1+\beta)$, as explained above.

Tables 2A and 2B illustrate the effects on capital cost and tax differentials between the corporate and non-corporate sectors of the various schemes to mitigate double taxation outlined above. It should be pointed out, as may be seen from equation (13), that using the imputation credit system with $\phi = 0.33$ (as is approximately the case for France and the United Kingdom) is equivalent to reducing the rate of corporate tax on distributed earnings from 50 to 25% (i.e. $T^r = 50\%$, $T^d = 25\%$). Furthermore, $\phi = 0.50$ has the same effect on capital cost as completely abolishing the corporate tax on distributed profits (i.e. $T^r = 50\%$, $T^d = 0\%$). For the understanding of the tables it

[1] Note that $n/(1+\beta) + n\beta/(1+\beta) = n$.

Table 2A. Capital cost and tax differentials between the corporate and non-corporate sectors when mitigating double taxation

n = 10 %

Marg. individual tax rate (τ)	Rate of tax credit (ϕ)						Swedish system α=0.05 ω=10	
	0		0.33		0.50			
	Δr^*	ΔT^*	Δr^*	ΔT^*	Δr^*	ΔT^*	Δr^*	ΔT^*
0	10.0	50.0	9.3	48.3	9.0	47.4	9.7	49.3
30	5.2	23.9	4.5	21.8	4.2	20.7	4.9	23.0
50	1.7	7.4	1.1	4.8	0.7	3.4	1.4	6.2
60	-0.1	-0.4	-0.8	-3.3	-1.1	-4.9	-0.4	-1.8
70	-2.0	-7.4	-2.6	-10.7	-2.7	-12.7	-2.3	-9.1
80	-3.9	-12.8	-4.6	-16.9	-4.9	-19.3	-4.3	-15.0

Note: Capital cost differentials are indicated by Δr^*, tax differentials by ΔT^*. The first column of the table which comes from Table 1 is included for comparison. Special assumptions: see Table 1.

Table 2B. Capital cost and tax differentials between the corporate and non-corporate sectors when mitigating double taxation

n = 30 %

Marg. individual tax rate (τ)	Rate of tax credit (ϕ)						Swedish system α=0.05 ω=10	
	0		0.33		0.50			
	Δr^*	ΔT^*	Δr^*	ΔT^*	Δr^*	ΔT^*	Δr^*	ΔT^*
0	10.0	50.0	8.0	44.4	7.0	41.2	9.2	47.9
30	6.3	27.0	4.3	20.9	3.3	17.2	5.3	24.4
50	3.6	13.1	1.6	6.8	0.6	2.7	2.6	10.3
60	2.2	7.1	0.2	0.6	-9.8	-3.7	1.1	4.1
70	0.7	1.9	-1.4	-4.5	-2.3	-9.0	-0.4	-1.2
80	-0.8	-1.8	-2.8	-7.8	-3.8	-12.4	-1.9	-4.8

Note: Capital cost differentials are indicated by Δr^*, tax differentials by ΔT^*.

must also be noted that $\phi = 0$ (the first columns) corresponds to the classical system of double taxation discussed above. The Swedish scheme, as represented by the last column, finally, includes a 5% deduction against current profits of the amounts raised by new issues for a period of 10 years. Table 2A assumes n = 10%, Table 2B n = 30%.

Tables 2A and 2B make it clear that the alternatives discussed above to mitigate double taxation do not change the general pattern of tax and capital cost differentials between the corporate and non-corporate sectors of the economy, as already demonstrated by Table 1. $\phi = 0.33$, (cf. France and the United Kingdom), implies a tax differential ranging from +48% to -17%, when 10% of capital growth is financed by new issues, and from +44% to -8% when n = 30%.

Since the imputation credit system--as well as the split rate system--is designed to reduce the total tax burden on distributed earnings and therefore, the cost of new issues, the effect on tax and capital cost differentials will be stronger the larger the share of capital growth financed by new equity capital. Thus, when n = 10% putting $\phi = 0.33$ will eliminate roughly 1/3 of capital cost and tax differentials for "representative" shareholders in the 50% bracket. Assuming instead, as in Table 2B, the share of new equity financing to be 30%, setting $\phi = 0.33$ will halve tax and capital cost differentials in the same brackets.

The stimulus to increased reliance on financing by new share capital brought about though the imputa-

Table 3. Relation between costs of new issues and retained earnings when mitigating double taxation

ϕ	$r^*(n=1)/r^*(n=0)$
0	3
0.33	2
0.50	1.5
Swedish system	2.4

tion credit system and the special Swedish scheme is illustrated in Table 3. Referring to page 180, the table indicates the ratios between the (average) costs of new issues and the (average) costs of retention, on the assumption that the marginal individual income tax rate of the "representative" shareholder is 70%.

As explained on p. 180 a 5% cost of retained earnings would correspond to a 15% cost of new issues with full double taxation of corporate distributions ($\phi = 0$). Putting $\phi = 0.33$ (cf. the French and British systems) the cost of new issues would fall to 10%.

The Swedish system is at present less effective, implying a cost of new share capital of 12%.[1]

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[1] According to a recent proposal, α will be raised from 5 to 6% and ω from 10 to 15 years. This implies $r^*(n=1)/r^*(n=0) = 2.2$, i.e., a cost of equity of 11%.

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Taxes and Market Stability

Bengt-Christer Ysander

Much has been said and written by now about the possible stabilizing effects of public budgets on the effective demand in the total economy. On the following pages we are concerned with a hitherto seldom discussed topic, namely the possible destabilizing effects of taxes and subsidies in individual markets. Particular examples of these possibilities, for example in the labor markets and in the markets for housing, have lately aroused a good deal of public discussion in Sweden, whose world leadership when it comes to taxing ambitions, especially marked in the seventies, makes some of these problems particularly acute. Unfortunately we still lack a well-established analytical framework for dealing with these kinds of stability problems. The modest aim of the following discussion is merely, to point out some dimensions of the problem and to provide some illustrative examples of possible tax-induced instability.

The Changing Role of Taxation

Over the last half-century "taxation"--which in the following I take to include also negative taxes or subsidies--has not only been steeply increased in most market-economies, but has at the same time also changed character. Taxation once used to be dominated by the fiscal aim of financing the provision of certain basic collective goods, mainly the machinery of control--central administration, defense, justice, etc. The means, then, could be kept relatively few and simple--a low income tax with at most a mild form of progression and/or local estate rates. This, as it happens, is still the picture of the public sector often presented in economic equilibrium theory--the provision of collective goods being financed if not by lump-sum taxes then by some proportionate taxation on final goods. There is, then, no need to worry about taxes destabilizing individual markets. Apart from the problems of international adjustment, in a model economy without monetary markets proportionate price increases need not change the stability properties of individual product markets.

The aims and means of taxation today are very different. A drastic illustration of this is provided by Sweden, where the structural change in taxation has probably gone further and faster during postwar years than in any other industrialized market economy.

The provision of collective goods in the narrow definition of the word presented above, plays a steadily decreasing role in the public budgets and is now responsible for less than 15 per cent of total central government expenditure. Apart from social insurance the dominant expenditure items on the public budgets are, now, subsidies of social and private goods. In the national accounts these are classified either as public consumption or transfers depending on how production and distribution are organized.

The ways of financing public expenditure are also becoming more varied and complex. Although taxes on income and wealth, have been sharply increased and made more progressive in the early seventies, they now provide, in Sweden, less than half of central government income and are, to an increasing extent, being complemented by various forms of indirect taxation, including, V.A.T., obligatory social insurance fees and taxes on non-labor factors.

Today's public budgets, therefore, can be best characterized as huge instruments for central price and income regulation. By combining positive and negative taxation with various forms of tax rebates and subsidy rules a highly individualized and differentiated form of taxation can in principle be realized--given the necessary information. With the high general level of taxation--more than 2/3 of private disposable income being channeled through public budgets--the tax effects on individual markets are, in any case, becoming increasingly decisive for price-setting and profitability also in the private production sectors.

The differentiation of means are correlated to--and indeed to a large extent motivatived by--a differentiation of the aims of taxation. The central government's wish to fulfill increasingly differentiated aims concerning industrial and regional policy and income redistribution without undue centralization of market decisions, have put a great strain on the system. In the last few years the shrinking possibility for redistribution in Sweden by way of progressive income taxes has led to an increased use of differentiated price subsidies as a means of redistribution.

There are doubts as to whether we have - or will ever have - sufficiently precise tax instruments, and enough information on how to use them, to match the regulatory ambition of the government. Most tax instruments are still rather blunt in the sense that considerations of fairness and administrative simplicity force us into making tax rules so general that they usually hit rather widely or wildly compared with the aims of tax policy. The complex pattern of taxation and the decentralized handling of various policy areas also make it increasingly more difficult to discern or guess the combined impact of the various horizontal chains of taxation on individual markets and goods.

This raises several important questions concerning efficiency limits to economic control by way of taxation. The one we are going to deal with here is the problem of possible tax-induced market instability. What happens to "normal" price adjustment mechanisms when these are not only transformed by prevailing tax rates but also intercepted by a simultaneous process of tax adjustment with a quite different purpose? How do the "tax links" between different markets affect the stability of interrelated markets? What are the chances of attempted tax adjustments ever converging on the intended allocative or distributional targets?

Market Stability from An Equilibrium Point of View

In looking for an analytical framework for studying tax-induced market instability you are faced with two main alternatives. You can plunge directly into a disequilibrium scenario, which means paying the price of not being able to generalize and of not necessarily ever being in the neighborhood of equilibrium.

The other and more traditional way of studying stability problems is by looking at them from the point of view of an equilibrium position. The question will then roughly be the following: given that the agents behave as if they were constantly in an equilibrium and that the adjustment process follows some simple prescribed rules, what are the conditions for convergence? The results you attain this way are mostly of a rather formal and general nature, but may still provide some leads as to how to structure our approach to the problem of tax-induced instability.

The usual stability analysis aims at determining sufficient conditions under which a system of market price adjustments, each being a monotonic function of excess demand, will converge.[1] The results of these studies are by now well known (cf., for example, Karlin (1959), Lancaster (1968), Arrow-Hahn (1971)). To make sure of convergence three types of conditions are usually needed. One type of condition guarantees that the agents are willing to accept disequilibrium prices as if they stemmed from a final equilibrium (cf., "Walras' law"). A second type of condition--for discrete-time adjustments--is needed to ensure that the rate and/or stepsize of adjustment is not so big that you over-shoot the equilibrium target by too much.

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[1] See Appendix, note I, p. 225.

Finally you need some condition concerning the links between the adjustment in different markets to make sure that solving excess demand problems in one area does not inflate the same problems in other markets by too much.

This last condition can take many technical forms --"gross substitution", "aggregate revealed preference", "diagonal dominance", etc.-- all of which, unfortunately, appear rather restrictive and difficult to make intuitively plausible.

These conditions are suggestive when transplanted to our special problem of tax-induced instability. When agents become conscious of prices being to a large extent determined in government offices, they may be less willing to accept them as given data to which they passively adjust. The varying "tax multiplier" on price in different markets could increase the risk for excessive, destabilizing adjustment steps in some markets.

Taxes and tax adjustments tend to provide direct links between adjustments in different markets. The risk would consequently increase that an adjustment in one market might counteract overall stability by disrupting other markets.

There are other limitations of existing economic stability analysis apart from the restrictive conditions used. It tells us, in fact, little or nothing about those stability properties of the economic system that we are often most interested in when dealing with real-life economies.[1] One

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[1] See Appendix, notes II and III, pp. 226 ff.

such property, for example, is stability in the sense that prices (and volumes) originating from a point within a region will never move outside given boundaries. Another question has to do with the possibility of prices converging to an equilibrium "close" to the original one, after a shift in some coefficient. In as far as taxes tend to change even the behavioral structure of an economic system these stability questions are very pertinent and will be raised again later on in connection with some of the illustrative examples quoted.

The problem with which we are concerned here--simultaneous price and tax adjustment in individual markets--can obviously be treated as an extension of the traditional market stability problem. The stability problem of decentralized policy, without involving simultaneous price adjustment, has been discussed by inter alia Mundell (1962) and Cooper (1967). They were concerned with the risks of instability with a decentralized policy arising from the inability of individual authorities to foresee and take into account the effects of policy instruments on markets or areas outside their own field of responsibility. The question of what happens if you combine the two problems--superimposing a tax adjustment on a market price adjustment--has, however, not been treated in economic literature, as far as we know. We hope the examples presented below will suffice to show that further work in this direction could be worthwhile and relevant to economic policy.

Tax-induced Instability in A Single Market

Let us start by looking at a general and very simple case --price- and tax-adjustment in continuous time in a single market. The "tax coefficient", T, is supposed to be defined in terms of the producer price, P. The product, TP, gives the demand price. The producer price is supposed to adjust in a simple way, changing in proportion to excess demand, while the tax rate is adjusted proportionate to some other function of market conditions. A straightforward tax target--relatively innocuous from a stability point of view--would be the volume of demand. The aim of the tax authorities could then simply be to make demand, d, adjust to a pre-set value d*. The purpose of such a tax target could be, for example, to limit the effect of environmental damage or some other collective externality or to keep down consumtion of some noxious commodity. Denoting the supply function by s(P) we would then have the following system:

$$P = \alpha E = \alpha\big(d(TP) - s(P)\big) \qquad (1)$$

$$P,\ T,\ \alpha,\ \lambda > 0$$

$$\dot{T} = \lambda G = \lambda\big(d(TP) - d^*\big) \qquad (2)$$

If we assume stability in the Liapunov sense, local asymptotic stability or resilience[1] is a necessary condition for global stability. With this assumption we can discover possibilities of

[1] See Appendix, note I, p.225.

global instability by simply looking at local properties.[1]

If we assume E and G to be continuous functions and P^*, T^* to be an equilibrium point, we can use a linear approximation around this equilibrium;

$$E = E_p^* p + E_\tau^* \tau \tag{3}$$

$$G = G_p^* p + G_\tau^* \tau \tag{4}$$

where E_p^*, G_p^*, E_τ^* and G_τ^* denote the first partial derivatives of E and G with respect to P and T at the equilibrium, and p, τ stand for $(P-P^*)$ and $(T-T^*)$.

The linear adjustment system can then be written in vector form as:

$$(\dot{p}, \dot{\tau}) = A(p, \tau)^2 \tag{5}$$

where A is the matrix

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[1] It should perhaps be emphasized that what we are, then, conditionally proving is only that the system will not tend to work back all the way to the equilibrium. To prove unconditionally that the system is unstable in the sense of Liapunov, that it will eventually tend to cross any preset boundary, would require, for example, the use of one of Liapunov's own instability theorems and would in the discussed examples be a difficult --and often impossible-- task.

[2] A tax adjustment similar from a stability point of view is implied by any progressive taxation of the supply price. This can be seen, for example, by writing the progressive rate as $T = \lambda P$ which gives $\dot{\tau} = \lambda \dot{p}$.

$$A = \begin{matrix} \alpha E_p^* & \alpha E_\tau^* \\ \lambda G_p^* & \lambda G_\tau^* \end{matrix} \quad (6)$$

It may facilitate the understanding of the adjustment process if we rewrite (5) in terms of the slope o0 the demand curve, $\partial d^*/\partial(TP)$, and supply curve, $\partial s^*/\partial P$, respectively:

$$\dot{p} = \alpha(pT^*+\tau P^*)(\frac{\partial d}{\partial(TP)})^* - \alpha p(\frac{\partial s}{\partial P})^* = \alpha\Delta^*(d-s) \quad (7)$$

$$\dot{\tau} = \lambda(pT^* + \tau P^*)(\frac{\partial d}{\partial(TP)})^* = \lambda\Delta^* d, \quad (8)$$

where Δ is used to denote the differential. In comparison with a market situation without tax, two changes have occurred in the adjustment. The demand differential is now a function of two kinds of divergences instead of just one--in the producer's price and in the tax coefficient. Secondly, beside the price adjustment we now have the tax adjustment being proportionate to the change in demand as well.

The system (5) is a first order homogeneous linear vector differential equation. It will converge--showing local asymptotic stability--if and only if all roots of A have negative real parts.[1]

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[1] For a survey of the "mathematics of stability" cf. La Salle-Lefschetz (1961) and Murata (1977). See also Appendix, notes I-II, pp.225 ff.

The two roots, x_i, of A are:

$$x_i = \frac{\alpha E_p + \lambda G_\tau}{2} \pm \sqrt{\left(\frac{\alpha E_p + \lambda G_\tau}{2}\right)^2 - \alpha\lambda(E_p G_\tau - G_p E_\tau)} = \tag{9}$$

$$= \frac{\left[(\alpha T^* + \lambda P^*)\frac{\partial d}{\partial(TP)} - \alpha\frac{\partial s}{\partial P}\right]}{2} \pm$$

$$\pm \sqrt{\left[\frac{\left[(\alpha T^* + \lambda P^*)\frac{\partial d}{\partial(TP)} - \alpha\frac{\partial s}{\partial P}\right]}{2}\right]^2 - \alpha\lambda\left(-P^*\frac{\partial d}{\partial(TP)}\frac{\partial s}{\partial P}\right)} = \tag{10}$$

$$= a \pm \sqrt{a^2 - b}. \tag{11}$$

A closer inspection reveals that $a^2 > b$, i.e., the roots are real. No oscillatory price movements will occur owing to the fact that tax adjustment, as defined, follows and reinforces the price adjustment.

Given this, the convergence condition can be written as:

$$a^2 > b \rightarrow \left[\left(a \pm \sqrt{a^2 - b}\right) < 0 \equiv \begin{cases} a < 0 \\ b > 0 \end{cases}\right] \tag{12}$$

Written out in terms of the slopes of the demand and supply curves (12) acquires the following meaning:

$$\frac{\partial d}{\partial(TP)} < 0, \ \frac{\partial s}{\partial P} > 0 \tag{13}$$

This convergence condition should be compared with the condition for stability in the Walrasian sense in a market with only price adjustment:

$$\frac{\partial d}{\partial (TP)} < \frac{\partial s}{\partial P} \tag{14}$$

In the "normal" case with a negatively sloping demand curve and a positive slope of the supply curve, we will have local stability both with and without tax adjustment. However, with supply price decreasing with scale, i.e. the supply curve having a negative slope,--and with the case of demand increasing with price--the risks of instability differ.

Without tax, the price will be instable only if the negative slope of the supply curve is less steep than that of the demand curve. This traditional condition for stability means that the convergent price change via the demand term should in absolute terms dominate an eventual counteracting supply term.

With the tax being determined as in (2), any negatively sloping supply curve will, however, make system (5) instable. This can be intuitively understood from the expressions (7) and (8). We see that divergences in demand price ($pT^* + \tau P^*$) determine the tax change, and also affect the change in the producer's price. The tax in other words, acting as a wedge between supply and demand prices, keeps the demand price from diverging too fast, which in turn makes it possible for the supply price to outrun the demand price.

Without taxes this cannot happen even when supply tends to decrease slightly with price. Suppose supplies are too big, with supply prices being too low. This in itself will tend to lower the price further. Demand, however, will act in the opposite, stabilizing direction. Being more price-sensitive, it will dominate. Introducing a tax wedge means that the demand price can be controlled by way of increased taxation allowing the supply price to slide further without being effectively checked by a demand expansion, etc. The tax has made both prices instable.

Other tax targets may, however, introduce new and potentially larger risks of instability. Local government price subsidies for utilities, housing, etc., in Sweden seem to aim at keeping the household expenditures for these "necessities" constant relative to household income. Let us assume prices to be expressed in some representative numeraire and neglect income changes. This tax target would then mean that current expenditure on the item in question has to be adjusted to some prescribed amount M. In a wider political interpretation this tax rule could be thought of as implying that political decision-makers allocate the subsidies to the big expenditure items so as to maximize appreciation and votes. With this interpretation the rule approximates subsidizing policies within a wide range of state and local areas, from adult education and recreational activities to fringe services on health and old-age care. Keeping the denotations as above, the adjustment system can be written as:

$$\dot{P} = \alpha E = \alpha(d-s) \qquad (15)$$

$$P,\ T,\ \alpha,\ \lambda > 0$$

$$\dot{T} = \lambda G = \lambda(M - PTd). \qquad (16)$$

Using the same reasoning as before, we find that the real parts of the corresponding matrix roots have to be negative for the adjustment system to converge.

The matrix roots are:

$$x_i = \frac{1}{2}\left[\alpha T^*\frac{\partial d}{\partial (TP)} - \alpha\frac{\partial s}{\partial P} - \lambda P^* d(1+e_P)\right] \pm \sqrt{\left(\frac{1}{2}\left[\alpha T^*\frac{\delta d}{\partial (TP)} - \alpha\frac{\partial s}{\delta P} - \lambda P^* d(1+e_P)\right]\right)^2 - \alpha\lambda P^* d(1+e_P)\frac{\partial s}{\delta P}} = \tag{17}$$

$$= a \pm \sqrt{a^2 - b}, \tag{18}$$

where e_P denotes the price elasticity of demand. As before, all derivatives are evaluated in equilibrium.

In this case, complex roots may appear giving rise to oscillatory price movements, which is what we would expect since tax and price adjustment in (15-16) tend to counteract each other.

We thus have the following two possibilities of convergence:

$$\text{I. Dampened oscillation} \quad \begin{cases} a < 0 \\ b > a_2 \end{cases} \tag{19}$$

$$\text{II. Straight convergence} \quad \begin{cases} a < 0 \\ a_2 > b > 0 \end{cases} \tag{20}$$

The common necessary conditions for convergence, $a < 0$, $b > 0$, can be derived directly from (17):

$$T^* \frac{\partial d}{\partial (TP)} - \frac{\partial s}{\partial P} < \frac{\lambda}{\alpha} P^* d(1+e_P); \; \frac{\partial s}{\partial P}(1+e_P) > 0 \qquad (21)$$

Let us finally also have a closer look at the condition that differentiates between dampened oscillation (19) and straight convergence (20). We will get oscillatory convergence if:

$$4\alpha^2 T^* \frac{\partial d}{\partial (TP)} \frac{\partial s}{\partial P} > \left[\alpha\left(T \frac{\partial d}{\partial (TP)} + \frac{\partial s}{\partial P}\right) - \lambda P^* d(1+e_P)\right]^2 > 0 \qquad (22)$$

One simple implication of (22) is that:

$$\frac{\partial d}{\partial (TP)} \frac{\partial s}{\partial P} > 0.$$

In other words we will get oscillatory convergence only if the supply or demand curve behaves "abnormally", when we have, for example, a negatively sloping supply curve. If condition (22) is fulfilled, the movement of both the supply price and the tax coefficient will be described by:

$$[P(t), T(t)] = k_1 \; e^{\rho t}[\cos(\nu t+\Phi)r - \sin(\nu t+\Phi)\upsilon]$$

$$+ k_2 \; e^{\rho t}[\cos(-\nu t+\Phi)r + \sin(-\nu t+\Phi)\upsilon] \qquad (23)$$

where $\rho \pm \nu i$ = the roots, $r \pm \upsilon$ = the characteristic vectors associated with the roots, and where both the conjugate constants k_1 and k_2 and the phase constant, Φ, depend on initial conditions.

From (21) we see that with an elastic demand, ($e_P < -1$), and a positive supply curve, subsidies aimed at stabilizing expenditure will introduce instability of price. This is also easy to understand intuitively. While, in the first example, producer prices and the tax coefficient are adjusted in the same direction, thereby slowing down the adjustment of each other we now have a reversed situation. Suppose the producer's price has been set too low. This gives rise to excess demand, moving the supply price upwards. At the same time, however, with elastic demand, expenditures are too big, which means that the tax coefficient moves down. Hence, subsidies grow, counteracting the effect of the producer's price on demand price. This, obviously, leads to a decreasing demand price followed by an increasing supply price, etc.

Taking a gradual increase of both income and of the expenditure target, M, into account does not change this conclusion. A too low supply price then means an increased potential risk of instability compared to a too high supply price. If the subsidy rule is changed to mean that subsidies vary in a fixed proportion to demand, the conclusion is in fact strengthened --holding for an inelastic demand as well. Political expediency may often seem to require the use of such "explosive" subsidy rules. This is illustrated by the Swedish experience in some areas of health and recreation.

The model exemplified above can be generalized to the multi-market case. Without individual specification of the tax rules involved little more can, however, be learned from such a generalization except the important, but obvious, conclusion that none of the ususal sets of sufficient stability conditions retain any credibility when extended to involve also tax adjustment rules.[1]

The step-size of tax adjustment

Real life adjustment is seldom a continuous process. This is true both for price-setting producers and, perhaps even more, for tax authorities.

If we make the realistic assumption that adjustments take place in discrete steps, the size of these steps or the rate of adjustment becomes important for stability.[2]

Since there is, no longer, an immediate feed-back from market reaction to adjustment, you now run the risk of over-shooting your targets. If your "over-correction" is even bigger than the needed correction, the adjustment will obviously become unstable.

This is true already when there is only a price adjustment to deal with. Formulated as a difference equation with $\Delta p(t) = p(t+1)-p(t)$ and $p(t)$ representing the divergence from equilibrium, the price adjustment can be written:

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[1] Cf. Ysander (1980), where sufficient conditions for the multi-market case are discussed.

[2] In actual life you may, of course, decide independently how often to adjust and how much to adjust. In the analytical example above, however, the time period is taken as given, restricting the possible variation to the rate of adjustment.

$$\Delta p(t) = \alpha E_p^* p(t) \qquad \alpha > 0 \tag{24}$$

By iteration, this can be solved as:

$$p(t+1) = (1 + \alpha E_p^*)^t p(0). \tag{25}$$

The wellknown condition for convergence is:

$$-2<\alpha E_p<0 \text{ (with alternating values for } -2<\alpha E_p<-1) \tag{26}$$

This simply expresses that any "over-correction" must be less than the needed correction. The Walrasian condition for market stability being fulfilled, (26) can be expressed as limits for the rate of adjustment:

$$0 < \alpha < \frac{2}{-\left(\frac{\partial d}{\partial p} - \frac{\partial s}{\partial \bar{p}}\right)} \tag{27}$$

Since any fixed positive tax, T, will increase the step-size of demand-induced adjustment by $(T-1)\alpha$, by definition it follows that even without tax adjustments all proportional market taxes will narrow the safety margins for stable price adjustment.

Let us now take a further step and introduce a tax that is adjusted at the same intervals as price and has the same simple aim as that in our first example above, i.e., to keep demand at a pre-determined value d*. In vector form the adjustment system (neglecting again the asterisks when possible) can be written as:

$$\left(\Delta p(t),\ \Delta\tau(t)\right) = A\left(p(t),\ \tau(t)\right), \tag{28}$$

where, A, stands for the same matrix as in (6) above and $\Delta(t) = \Delta(t+1) - \tau(t)$ with $\tau(t)$ representing the divergence from an equilibrium tax coefficient, T*. A necessary condition for convergence of a simple difference system of this kind is that:

$$\left|1 + x_i\right| < 1; \qquad i=1,\ 2 \tag{29}$$

where x_i is a root of A.

We already know the roots from (9-11) above, and know that they are real. Thus:

$$-2 < a \pm \sqrt{a^2-b} < 0 \tag{30}$$

It was shown in (13) above that the second part of this condition requires that the demand slope be negative and the supply slope positive, i.e., a "normal" market situation. The first part of (30) is the now added restriction on step-size. Given the second part of (30) we can spell out the first part in the following manner:

$$\begin{matrix} a^2 > b \\ a<0,\ b>0 \end{matrix} \rightarrow \left[\left(a \pm \sqrt{a^2-b} > \right) -2 \equiv \begin{matrix} a > -2 \\ b > -4(1+a) \end{matrix} \right] \tag{31}$$

The two inequalities to the right in (31) express constraints on the rates of adjustment, α and λ.

$$(\alpha T^* + \lambda P^*)\ \frac{\partial d}{\partial(TP)} - \alpha\ \frac{\partial s}{\partial P} > -4 \tag{32}$$

$$\alpha\lambda P^*\ \frac{\partial d}{\partial(TP)}\ \frac{\partial s}{\partial P} - 2\left[(\alpha T^*+\lambda P^*)\ \frac{\partial d}{\partial(TP)} - \alpha\ \frac{\partial s}{\partial P}\right] < 4 \tag{33}$$

After some reshuffling (32) and (33) yield the following limits --now expressed in terms of the decision variables p and τ-- for the rate of price adjustment, α:

$$\frac{\frac{\partial d}{\partial \tau}}{\frac{2}{\lambda}\left(\frac{\partial d}{\partial p} - \frac{\partial s}{\partial p}\right) - \frac{\partial d}{\partial \tau}\frac{\partial s}{\partial p} + 4} < \alpha < \frac{4 + \lambda\frac{\partial d}{\partial \tau}}{-\left(\frac{\partial d}{\partial p} - \frac{\partial s}{\partial p}\right)} \qquad (34)$$

Comparing (34) with the restriction on α without taxes in (27) (and remembering that the slope of the original demand curve corresponds to $\partial d/\partial$(TP $= 1/T^*(\partial d/\partial p)$) we see that the introduction of tax means that α is now bounded also from below and that both bounds are functions of the rate of tax adjustment, λ. The right-side inequality shows, for example, that the more price-sensitive demand is, the slower the tax adjustment has to be, given α. Increasing the relative tax adjustment rate, λ/α, will always lead to instability.

Taxes and Structural Stability

Our examples so far have dealt with stability in the usual sense, i.e., we have discussed price developments in a market characterized by given coefficient values.

Of at least equal interest, but more difficult to exemplify formally, is the case where a tax adjustment rule renders the market structurally instable, in the sense that even small changes in the parameters will change the behavior of the system, establishing a quite different set of equilibria or regions of stability.

When we are discussing the stability of an economic system in the face of large quantitative or qualitative changes, say, a big hike in oil prices or drastic changes in the laws governing ownership of firms, the myopic study of local stability properties is seldom of much use. The kind of instability we are then interested in means that we are far from the original equilibrium or the established growth-path. If the initial disturbance concerned the size of an endogenous variable in our model of the economy, we would say that the size of the change had been "out of bounds" for the stability region within which we had, so far, been operating. With the change occurring in an exogenous variable or a behavioral parameter we would, instead, interpret the result as evidence of "structural instability" in the sense that shifts in the parameters can lead to changed stability properties, a new topography for the phase space of the system.[1]

The introduction of taxing procedures on various markets is, in itself, an important change that could modify the structural stability properties of the entire system. Taxes may, moreover, often induce changes in the behavior of the economic actors as well as alter the system's ability to adjust to and absorb other institutional or environmental changes that occur.

The Swedish economy abounds with illustrative examples of tax-adjusted behavior and tax-induced changes in market structure.

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[1] See Appendix, note III, p.228.

High tax rates have, in many cases, led to the establishment of "grey" or "black" markets. Competition from these often modifies behavior in the "official" markets considerably. In the fifties and sixties market structure also tended to change as a result of taxation laws being generally unfavorable to small family businesses. In recent years the combination of complex tax laws, mostly written in nominal terms, and a high rate of inflation have led to huge unintended discrepancies betweeen the tax treatment of various kinds of real and financial investment. Since these discrepancies are quickly discounted in capital values they tend to make the whole economic system increasingly vulnerable to changed expectations of inflation or of tax adjustment.[1]

Any attempt to discuss these structural stability problems in substance would take us far beyond the scope and ambition of this paper. Let us, however, try to clarify the formal stability concepts involved by giving an example from oil price-setting, couched in the same terms of market adjustment as our preceding analysis. The example chosen may fill this function, although it can claim no immediate relevance for policy.

Suppose there are two kinds of oil prices, P_r which is an index of the US producer price of refined oil and, p_o, which stands for an index of the Saudi government's unit charge for crude oil.

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[1] For an assessment and a discussion of these assymetries and discrepancies in the tax treatment of different kinds of investment cf. Johansson (1978).

It is assumed, here, that the U.S. oil companies try to reduce any eventual gap between their domestic price increase and that of the Saudi government. The Saudis on their side are considered to have an idea of what constitutes a "fair" proportion, r, between the price increase they get and that of the U.S. companies. The price adjustments can then be described by the following:

$$\dot{p}_r = \alpha(p_o - p_r) \tag{35}$$

$$\dot{p}_o = rp_r - p_o. \tag{36}$$

The stability properties of this system obviously depend crucially on r, the Saudi's preset idea of a fair proportion. r=1, for example, means that any point with $p_o=p_r$ is a stable equilibrium. With r>1 no equilibria exist and prices will explode.

The U.S. government now interferes in the game, trying to curb the inflationary impulses of the oil parties by taxing away domestic demand whenever oil price hikes increase. The oil tax rate, τ, expressed as a multiple of p_r, is raised in proportion to the product of both oil prices, although at a decreasing rate. The Saudis now have to take the tax into account in calculating the "fair" proportion. The total adjustment can be written as follows:

$$\dot{p}_r = \alpha(p_o - p_r) \tag{37}$$

$$\dot{p}_o = (r - \tau)p_r - p_o \tag{38}$$

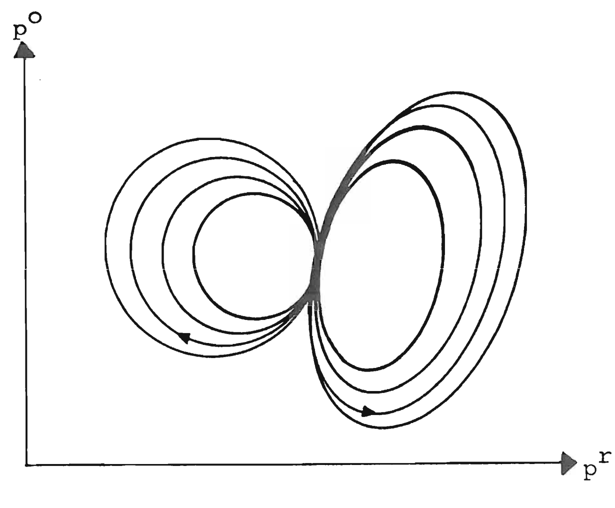
$$\dot{\tau} = p_r p_o - \beta\tau. \tag{39}$$

The behavior of this system is very different. For small values of r the system globally tends to a simple equilibrium. Should the Saudis, unlikely enough, consider it "fair" that the crude price develops much slower than the U.S. domestic price, the effect of the tax may be, in fact, to accelerate the downsliding of both prices towards zero. For a somewhat larger r, there is one stable equilibrium (two, if negative prices are allowed), denoting an equal price increase, with a positive tax to balance off the Saudi's claim for a "fair" price edge.

If r gets even larger--magnifying the Saudi's idea of a fair relation of price--it suddenly leads to a completely new mode of behavior. Wherever the development starts off (excepting some isolated points of equilibrium) it will eventually be drawn into a circular motion of prices and tax. The crude price leads, due to the Saudi's high price ambition, with the U.S. price following. Both are, however, outrun by a fast although decelerating tax change. The high tax then turns the movement downwards, again with the crude price in the lead, followed by tax and U.S. domestic price until the shift in relative oil price is enough to offset the tax and the crude price starts increasing again. The relative oil price will thus vary around 1 while the tax rate moves around (r-1). The development is, however, very sensitive to small differences in the values of the variables. After a certain number of "orbits" (the rotation numbers being a Markov sequence) the system will suddenly branch off into another but similar "orbit", only to return again after a while to the first "orbit", etc. Looking at the system from outside we would observe sudden shifts in the price- and tax-cycles occurring according to a seemingly stochastic schedule. The movement could --projected on the price plane--look like figure A.

This rather "exotic" example[1] illustrates the fact that taxes may not only change the stability properties around equilibria; they can also change the whole nature of equilibria and their structural stability in the face of parameter changes.

Figure A. Alternating price cycles



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[1] The quoted model is an instance of the so-called Lorentz model, originally invented to solve a problem in aerodynamics (Lorentz, 1963). It has later been shown to give a good description also of the reversals of Earth's magnetic field over geological times (Ruelle and Takens, 1971). Continued work with this kind of attractor system has been reported by Grümm(1976a-b).

Tax Uncertainty and Market Stability--the Housing Market

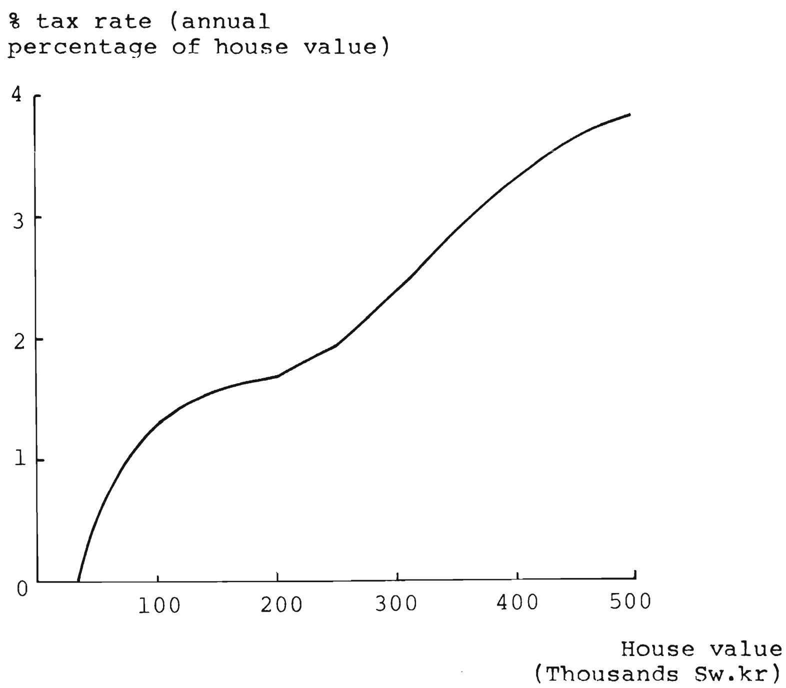
So far we have dealt explicitly only with tax-induced instability under full information. However, if tax adjustment is hard to predict for the parties concerned, the induced uncertainty may give rise to stability problems in the form of highly erratic price movements. A striking example of this is provided by the Swedish market for owner-occupied houses.

Pricing, in this market, is to a large extent determined by the tax authorities. This is done firstly by assessing the taxable value of the property--supposedly at 3/4 of market value--and secondly by applying to this value a progressive scale of imputed taxable income, which is then superimposed on the already steeply progressive income tax. The outcome in many cases is that the owner pays more to the government than to his bank and that what the tax authorities evaluate is in fact the result of previous tax decisions. Especially when tax scales and tax norms are changing rapidly and at an unpredictable rate this can give rise to cyclic price fluctuations and demand instability. In recent years, inflationary gains have dominated houseowners' expectations. Tax instability--which increases with inflation--could soon, however, become a serious problem especially if inflationary expectations also become unstable. A relatively advantageous taxing of capital gains on private houses compares favorably with the level of taxation on more rigidly taxed markets, for example, the stock market and bank deposits. Fluctuating capital gains from private real estate find their way back to other markets and there contribute to intermittent swings in demand.

Let us take a closer look at the way in which unpredictable tax adjustments create instability problems.

The theoretical impact of current property tax rates is shown in Fig. B. We have computed the curve for a recently assessed house whose owner has, on average, a marginal income tax rate of 75 per cent. The curve is "theoretical" in so far as it presupposes that the prescribed assessment norm --3/4 of market value-- is strictly adhered

Figure B. Current Swedish tax rates on owner-occupied houses



to. Actually, this has not been the case in recent years. By systematically lowering the norm for more expensive houses in the most recent assessment (1975), the tax authorities seem to have, to a certain degree, counteracted the effects of progression.

To see what the progressive rates might do to the prices of houses, one can compute and compare price curves for proportionate and progressive tax rates respectively, as shown in Fig. C.

If we use the following notations:

$V(t)$ = market value of house at time t

a_0 = net annual user value (rent value) at time 0

p = rate of growth of user value

s = tax coefficient (tax paid in percentage of market value of house) (40)

r = discount rate

$n-t$ = remaining economic life of house

b = parameter of tax progression, $s(t) = b\,V(t)$

The market value of the house computed as the discounted value of future incomes and tax payments can then, with a constant proportionate tax coefficient, be written as:

$$V(t) = \int_t^n (a_0 e^{pu} - sV(u))e^{-r(u-t)}du \qquad (41)$$

which resolves into:

$$V(t) = \frac{a_0}{p-r-s}\, e^{pt}\left(e^{(p-r-s)(n-t)}-1\right) \qquad (42)$$

We now use the following parameter values:

$$\begin{aligned} a_0 &= 6 \\ p &= 0.08 \\ s &= 0.01 \\ t &= 0.06 \\ n &= 40 \end{aligned} \tag{43}$$

A computation of (42) with these parameter values gives the price curve I, in Fig. C. As expected the elasticity of price to changes in the tax coefficient is relatively low, -0,2, at the start and -0,1 at half-life.

Let us now introduce progression by setting s = 0.00007V(t). Compared to the current formal tax scales these rates are relatively low, both as to level and progression. Thus, they take some account of the effect of intermittent assessment. The market value of the house can now be written as:

$$V(t) = \int_t^n \left(a_0 e^{pu} - bV^2(u)\right) e^{-r(u-t)} du \tag{44}$$

The explicit solution--which the common buyer is supposedly following in his evaluation--turns out to be a rather tortuous and long-winded expression.[1] The numerical result for the chosen parameters is shown as price curve III, in Fig. C.

The elasticity of price to changes in the tax parameter is now very much higher, given a high rate of growth in user value.

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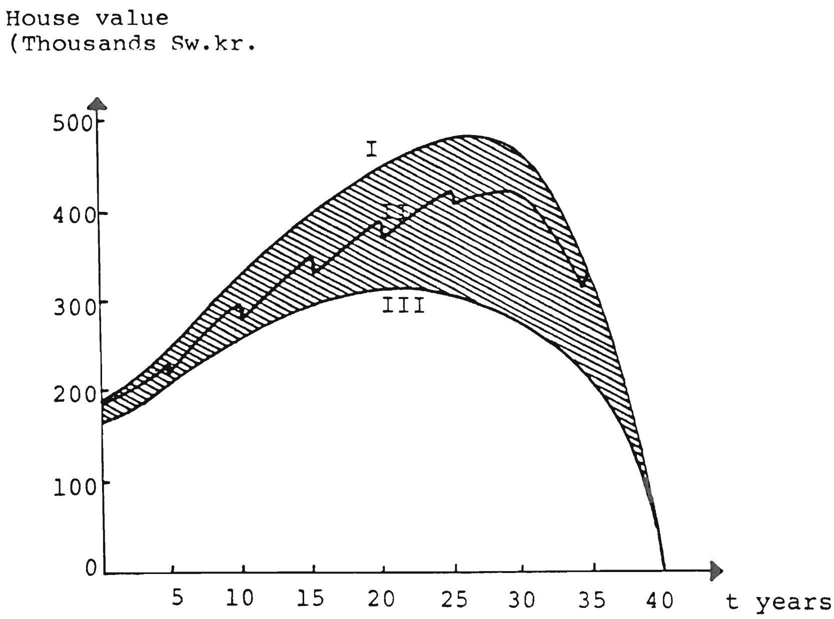
[1] An account and discussion of the complete solution is given in Ysander (1976).

Figure C. Development of house price for different taxing and market behavior



Comparing the curves I and III we see that an increase of the tax yield is not likely to be the main effect of applying a progressive scale. First, and foremost, the price difference between the various categories of houses diminishes. Bigger and/or more comfortable houses become less profitable to build and sell.

Rather than taking full account of future progression, buyers and sellers may expect the current total tax coefficient to remain constant. The result would be a jumpy price development as demonstrated by price curve II in the figure. As shown by the Swedish experience in the seventies it is very difficult to predict when and how far tax rates will be adjusted for inflation or counteracted by assessing practices. The shaded area between curves I and III, in Fig. C, can be interpreted as a margin for the price uncertainty arising from progressive taxation. This margin will, moreover, tend to increase with inflation. The instability normally associated with changing inflation rates will thus be multiplied by this "tax uncertainty".

Taxation and wage inflation

Up to now we have dealt exclusively with isolated adjustments in a single market. However, the most widely observed and best known example of tax-induced instability relates to the adjustment of heavily taxed wage markets to price increases in the product markets, i.e., to inflation. This has been an acute problem in Sweden during most of the seventies.

In contrast to our previous examples we are faced, here, with annual tax adjustments aiming, mainly and explicitly, to compensate for the stability problems created by the tax structure itself.

The rates of income tax in Sweden are highly progressive -- and changing rapidly. Even excluding the various kinds of employers' social insurance fees, etc.--adding up to about 40 per cent of paid out wages--the marginal income tax rate for an average skilled industrial worker in Sweden now approaches 70 per cent, the average rate being some twenty per cent lower--all measured in terms of taxable personal income. The progression is steeper for high-income earners--and for low-income earners receiving subsidies.

If the worker, cited above, should be compensated for say a 10 per cent of inflation--with tax-scales not being automatically adjusted for inflation--he would have to receive a wage increase of some 17 per cent--starting off a run-away wage inflation spiral.

Negotiations are further aggravated by the variance in marginal tax rates between different groups of labor. Since gross wages are what is negotiated any compromise between the unions is likely to add further inflationary pressure.

Continuous tax revisions or an indexing of the tax scales provide the standard answer to the first problem--that of eliminating the "tax multipliers of inflation".

The second part of the problem however does not disappear so easily. Support for a tax redistribution of today's income does not automatically mean acquiescence in the further leveling of tomorrow's income implied by the marginal tax rates necessary to carry through the redistribution. To ward off this cause of wage inflation, annual revisions of relative total tax rates for various income-groups have, in recent years, become an important part of collective wage negotiations in Sweden. The structure of any progressive income tax is unfortunately such that every attempt to use tax revisions to satisfy claims for further leveling of net wages is apt to aggravate the "locking-in" effects and stability problems for the next round of wage negotiations.

There is another side of this instability problem that should be mentioned here, although it falls somewhat outside the model context of the previous discussion. Introducing progressive taxation, applied to gross market price, definitionally means, ceteris paribus, a lowering of the gross price elasticity of supply in the market. In terms of the labor market this means making labor less inclined to move in response to certain given wage inducements.

When this weakened pull effect is compounded, as in Sweden, with an institutionally and legislatively restricted push effect--by restrictions on how and when and why labor can be laid off--the possible consequences on market stability are apparent. The adjustment to shifts in foreign demand and/or to relative price changes will be slowed down and the competition for labor from expanding firms could either result in more inflationary wage increases or a petering out of expansion with inflated wage demand working as a damper.

Instead of Conclusions

Our previous discussion has involved a rather varied collection of examples of possible tax-induced instability. Our focus on individual market adjustment however means, that we have not treated the equally important problems of the impact of taxation on macro-economic stability.

The examples presented earlier do not readily lend themselves to any general interpretation or conclusion. They do however illustrate two important points.

The first one concerns policy. When raising the "technical" ambitions of tax-policy, gradually using it for more differentiated regulatory aims, the risk of disrupting the "normal" market adjustment processes grows.[1]

Stability problems are thus added to the more widely discussed problems of the long-term allocative effects of tax-induced changes in relative prices. The Swedish experience in the seventies seems to suggest that, also from the stability point of view, there are severe limitations to what you can safely hope to accomplish by tax policy.

The second point has to do with research. We have by now a fairly well-developed literature on "optimal taxation" and the welfare effects of a fixed tax structure from an "equilibrium point of view". Our examples demonstrate that there is now good reason to take one further step and investigate the impact of taxes and tax adjustment on market stability as well. Unfortunately, any thorough investigation into these problems will have to work with disequilibrium models, which makes points of departure harder to find. The results will also be less general and theoretically convincing. That may be an explanation for our being late to start but it is hardly an excuse for further delay.

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[1] Alternative ways of pursuing these policy aims may of course be even worse from a stability point of view. The use of more direct intervention or regulation by definition makes the economy more rigid and hence less shock-proof. Having more "fixtures" and less free variability tends to narrow the margins of adjustment in the economy.

APPENDIX

THREE NOTES ON THE CONCEPT OF STABILITY

I Some basic stability concepts

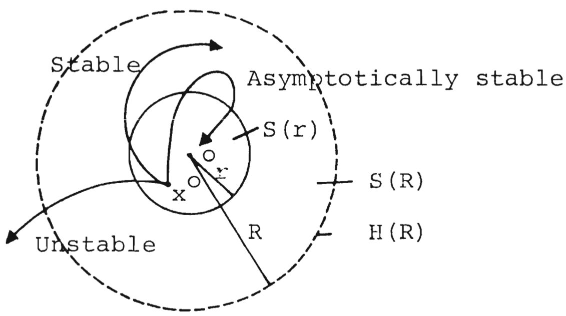
To facilitate reading the paper the reader may want to recall some basic stability concepts.

The concepts can be illustrated as in Fig. 1. We assume that we are dealing with an autonomous system, i.e., a system in which time, t, is not an essential variable but only used as a parametrization variable. We further assume that we are working in some open region of phase space, through each point, x, of which there goes a unique path of the differential system:

$\dot{x} = X(x),\ X(o) = 0;$

where x and $\dot{x}$ denote vectors.

Figure 1. Some basic stability concepts



We shall designate by S(r), S(R) the spherical region $\|x\|<r$ and $\|x\|<R$, respectively, and by H(R) the sphere $\|x\|=R$ itself.

We now say that the origin o is:

1) Stable (or stable in the Liapunov sense) whenever for each R there is an $r \leqslant R$ such that a path initiated in S(r) always remains within S(R).

2) Asymptotically stable or resilient[1] whenever it is stable, and, in addition, every path starting inside some $S(R_o)$, $R_o>0$, tends to the origin as time increases indefinitely.

3) Unstable whenever for some R and r, no matter how small, there is always in S(r) a point x such that the path through x reaches the boundary H(R).

II Boundedness, Practical and Ultimate Stability

The usual basic concepts of stability analysis unfortunately turn out to be of little practical use when applied to price developments in real life economics. There are, in particular, four further problems that must be taken into account in any attempt at measuring stability in actual price movements.

In real economics time is an essential variable, i. e., the systems are non-autonomous. In theory, a generalization of the stability concepts to non-autonomous systems is straightforward although proofs tend to get more laborious. In practice we almost never know enough to analyze explicitly the time-dependence.

Resilience and stability are empirically indeterminate properties as long as we are talking in terms of some neighborhood which may be arbitrarily close to the origin. To acquire an empirical content the concepts must be quantified by measuring the extent of the regions involved in the stability definitions.

In most economic as well as physical systems, stability problems usually arise, not primarily because of initial conditions being far from equilibrium, but because of various kinds of persistent disturbances or perturbations. Any useful stability concept must therefore refer to the movements of such a perturbed system.

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[1] Different authors use "resilience" to cover various shades or aspects of stability. We have chosen, here, to use the word when the system tends to become more narrowly confined within some neighborhood of an equilibrium.

Finally, we are often less interested in ascertaining the return to origin than we are in making sure that the system stays within bounds. Stability in the sense of Lagrange means just this, viz., that all solutions are bounded. Again this definition needs to be quantified to make empirical sense.

In trying to meet these four empirical requirements we could end up with the following two stability definitions that are illustrated by Fig. 2. Our starting-point is a system:

$$\dot{x} = X(x,t)+p(x,t), \quad t>0;\ X(0,t)=0 \text{ for all } t>0$$

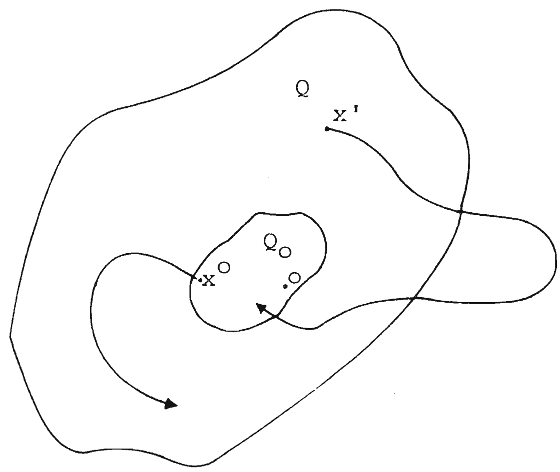
where p denotes perturbations satisfying $p<\delta$. We have, also, in the figure two sets: Q which is a closed and bounded set containing the origin, and Q_o which is a subset of Q. We could then, following LaSalle-Lefschetz (1961) define:

Practical stability of the origin as the property requiring that for given Q, Q_o and δ, any solution starting in Q_o will remain in Q for $T>t>0$ (cf. x' in Fig. 2).

Somewhat analogous to the concept of asymptotic stability or resilience would be:

Practical resilience: requiring that, for given Q, Q_o and δ, any path going through Q will be in Q_o for all $t > T$ (cf. x' in Fig. 2).

Figure 2. Practical stability and practical resilience



III. Structural and Comprehensive Stability

In most economic discussions of stability we deal with a system with fixed parameters where the path of prices, for example, can be completely described as a function of the state variables: $dx = f(x)dt$.

In real economies parameters do change. This is obviously the case with the parameters representing the state of the external world, such as world market prices for a national economy. Even if we simplify by ignoring these exogenously determined parameters we will still be faced with changing parameters.

In a widened or lengthened perspective we must take account of the fact that the behavior or the institutionally determined parameters of an economic system change according to some rule. Denoting the vector of parameters p, such a generalized explanation of change could be written as: $dx = f(x, p)dt$.

To avoid making the analysis too unwieldy economists usually try to discuss time developments in two stages - sometimes identified as a short and a long run. In the short run, parameters can be treated as given and the total change can thus be split into two parts:

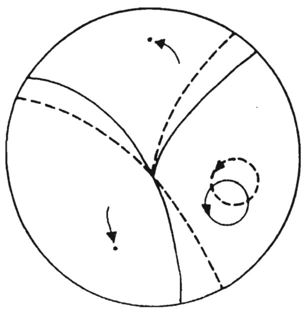
$$dx = f_1(x, p)dt + f_2(x,p)dp.$$

To be able to separate the impact of parameter change, f_2, from the "short-run" developments with given parameters, f_1, it is obviously necessary to assume that parameter changes are measured in time scales quite different from those used to define "short run" changes. This could be done by assuming parameter changes to be extremely "sudden". Usually however, economists go the opposite way, making the "comparative static" assumption that parameter changes occur slowly enough so that the "short run" system always has time to reach its asymptotic equilibria.

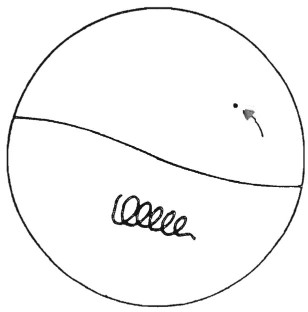
Instead of discussing stability as a property of the "phase-portrait", f_1, of a system with given parameters one may want to treat stability as a question of how big or how continuously the change in "phase-portrait" is, that results from certain parameter changes. This is roughly what is meant to be measured by "structural stability" in the sense of Smale (1967) or of the "catastrophy theory".

Fig. 3 may help to give some intuitive idea of this concept. Drawn with full lines in Fig.3a is the original "phase-portrait", which is supposed to be fairly simple--three basins, each with an attractor.

Figure 3. Change in "phase-portraits" caused by change in parameters



a



b

We now make a slight variation of the parameters and watch for results. The dotted lines in Fig. 3a show what could happen if the structure of the system is relatively stable. The parameter variation does not change the dynamic structure but only causes a continuous shifting of basins and limit-cycles. Fig. 3b illustrates a structurally unstable case where the same variation completely remodels the phase-portrait, reducing the number of basins and changing the character of attractors.

Once you include parameter changes in the framework of analysis there is one further question of stability to be considered. What causes parameters to change and does that kind of "system change" tend to counteract or reinforce instability "within the system"? Do institutions and economic behavior adapt in the long run so as to reduce or to maintain long-term imbalances? These questions concerning comprehensive stability --central to the current discussion of stagflation-- can, however, seldom be usefully analyzed within our economic models. The inability of our models to deal with "structural change" is indeed probably a major explanation for their poor showing during recent years.

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Inflation, Taxation and Capital Cost

Villy Bergström and Jan Södersten

INTRODUCTION

The world inflation of the 1970's has called for a growing literature on the causes as well as the effects of the inflation surge. The literature on the effects of inflation has been partly normative by dealing with indexing the economy to avoid distortions added by inflation--to already existing ones--through the tax system.

A large part of the recent literature on the distorting effects of inflation deals with profit taxation and the cost of capital. Another part deals with inflation and taxation of income in the household sector.

In this paper we deal both with the profit taxation of the business sector and the income taxation of the household sector. The central concept of our analysis is the cost of capital and our intention is to make a detailed analysis of how taxation influences capital cost in times of inflation.

When there is inflation there are distortions produced by the tax system because not all real costs are deductible for taxation and because not all real income is included in taxable profits. Also costs of debt and equity become distorted.

With the tax regimes existing in most countries there are four different distorting factors that operate in times of inflation. Two of these are due to the construction of the system of corporate profit taxation (points 1 and 2 below) and two due to income taxation of households (points 3 and 4 below).

1) When depreciation allowances are based on <u>historical costs</u> under corporate tax laws inflation undermines their real significance. Therefore, part of capital consumption may be included in the tax base (or accelerated depreciations are diminished in real terms). Hereby capital cost increases.

2) When the <u>nominal interest</u> on debt is deductible against corporate profits a real amortization is in fact deductible, when market rates of interest on debt are adjusted to the rate of inflation. Therefore, capital cost is reduced.

3) When <u>nominal capital gains</u> on household holdings of corporate stocks are taxed, capital cost is increased.

4) When the <u>nominal rate of return</u> on the household's alternative financial investments is taxed, capital cost is reduced.

The result of our analysis indicates that for most reasonable assumptions the net outcome of these effects is to lower capital cost, when both profit tax and personal taxes on dividends and capital gains are taken into account.

When the effects of inflation on capital accumulation of private firms are analyzed in the literature, the analysis is often limited to the system of profit taxation.[1]

However, an interesting line of development of the analysis of inflationary effects through the tax system is represented by Feldstein and different co-authors.[2] These authors include also income taxation in the household sector and they use a general equilibrium framework, (as compared to the authors mentioned in note 1 below whose models are more partial) to study how inflation influences i.e. costs of equity and debt and the debt-to-equity ratio. But with the general equilibrium framework the corporate tax system is stylized and does not allow a detailed analysis of how capital cost is influenced by tax laws in times of inflation. For instance, accelerated depreciation is disregarded, which restricts the results.

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[1] See e.g. the paper by Tideman and Tucker (1976, especially appendix A). The authors claim that inflation increases capital cost for all kinds of investment. Their numerical analysis rests upon a model that is not fully presented in their paper. It seems, though, that the objective of their model firm is not to maximize stockholders' required rate of return -- the cost of equity -- but by the average cost of equity and debt (less the rate of inflation). (Cf Nelson, 1976.) Another example is Sumner (1973). Contrary to Tideman and Tucker, Sumner holds (p. 30) that the net result of points 1 and 2 above is inconclusive. At low inflation rates an increased rate of inflation would tend to increase capital cost, wheras capital cost would be decreased at high rates of inflation by further increases.

[2] See Feldstein (1976) and Feldstein, Green and Sheshinski (1978).

Another (implicit) assumption is that one dollar of retained earnings creates a capital gain of one dollar. This would not be the case--due to differential taxation of dividends and capital gains--on an optimal growth path.[1]

When the distortionary effects of inflation on capital cost via the tax system are analyzed, different norms can be used. The inflationary situation can be compared to resource allocation in a world without inflation and free of tax distortions.[2] The other way is to compare capital cost with the inflationary distortions introduced in times of inflation by the construction of the tax system to capital cost with those distortions present that are due to the tax system at zero rate of inflation.[3]

If the tax system represents a deliberate choice on the part of the government to intervene in the allocation of resources but the tax system was constructed without regard to inflation, this

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[1] Feldstein and Summers (1978) in a recent paper discuss the effects of inflation on the maximum nominal interest rate a firm can afford to pay on a "standard" investment. Their analysis is similar to ours in that the complexities of the actual tax system are taken into account. They differ, however, by basing their analysis of capital gains taxation on the ad hoc assumption that a dollar of retained earnings will produce a dollar's worth of capital gains. For a criticism of this assumption, see e.g. Bergström and Södersten (III:5 in this volume) and Auerbach (1979).

[2] This norm is used by Sandmo (1974) in his short comments on inflation.

[3] This norm is inherent in the numerical analysis of Tideman and Tucker (1976).

second norm should be used. The idea that depreciation rules for tax purposes should reflect a real economic loss of value has a very limited scope in Sweden as well as in several other countries. By way of accelerating depreciation allowances governments make effective tax rates lower than statutory tax rates, not primarily to compensate for historical cost depreciation in times of inflation.[1]

Therefore, when we discuss effects of inflation on capital cost our main norm of comparison is capital cost with those distortions present that are due to taxation of profits and household income at zero rate of inflation. We also discuss briefly the over all norm of capital cost with no tax distortions (and a zero rate of inflation).

The model used for this paper and which is presented in the next section is in the Jorgenson[2] tradition of a firm aiming at maximizing the value of its shares in the portfolios of stockholders. The <u>gross</u> cost of capital of this firm, financed by equity and debt in a given proportion, is derived. The cost of equity and debt are then taken at their nominal values as the firm is assumed to observe them on the capital market.

We then analyze the <u>net real</u> cost of capital, where market rates of return are adjusted for in-

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[1] See Bergström (1977) and Södersten (1978).

[2] Jorgenson himself early introduced inflation into his model, but because he used depreciations for tax purposes on replacement values and did not have explicit debt financing the essence of the problem with inflation was concealed. See Jorgenson (1965) and (1968).

flation. This allows us to determine the net effects of inflation on capital cost. The analysis is first performed for corporate taxation only. Thereafter personal taxes are introduced. In the concluding section, different ways of indexing taxation to insulate the cost of capital from inflationary distortions are discussed.

1. BUSINESS TAXES ONLY

1.1 The Model

To analyze how inflation affects capital cost we will use a model similar to that presented in Bergström and Södersten (III:5 in this volume) with some special assumptions added.[1] First, we will assume that there is an expected rate of inflation of 100•p% on the price of capital goods, $P_K(s)$. Therefore we have $P_K(s)=P_K(v)e^{p(s-v)}$. Second, we assume that the firm keeps a constant debt ratio.

This last policy is introduced by assuming that the book value of outstanding debt, S(s), related to the current value of the capital stock, $P_K(s)K(s)$, is a constant:

$$\frac{S(s)}{P_K(s)K(s)} = h.$$

We also assume that the firm finances its gross investments by debt in the same relation, h, so

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[1] Note that different symbols are used in this paper. Cf. also Södersten (1975) and Bergström (1976).

that gross borrowing is $hP_K K(s)I(s)$, where $I(s)$ is gross real investment.

It is assumed that the stock of capital, $K(s)$, depreciates at the exponential decay rate, δ, and as capital gains per unit of capital through price inflation is p, the rate of amortization, to keep the debt ratio constant, is $(\delta-p)$.[1 2]

It will be assumed that the firm can deduct a fraction γ of the book value of capital, $D(s)$, from profits for tax purposes and that profits so defined are taxed at the rate τ. The book value of capital is made up of investments at historical costs.

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[1] Without any amortization the stock of debt at point in time, s, would amount to

$$\int_{-\infty}^{s} hP_K(v)I(v)dv.$$

The current value of the firm's debt, when the rate of amortization is the rate of capacity depreciation less the rate of inflation $(\delta-p)$, is a fraction h of the current value of the capital stock:

$$\begin{aligned} S(s) &= \int_{-\infty}^{s} P_K(s)e^{-p(s-v)}hI(v)e^{-(\delta-p)(s-v)}dv \\ &= P_K(s) \int_{-\infty}^{s} hI(v)e^{-\delta(s-v)}dv \\ &= hP_K(s)K(s). \end{aligned}$$

[2] Failure to adjust the rate of amortization to the rate of capital gains through inflation would obviously result in changes in the average debt ratio. For the implication of this, see page 243 note 3.

Note also that the rate of amortization can be negative--$(\delta-p)<0$--meaning that the firm borrows on its appreciated capital stock (in excess of the gross borrowing to finance gross investment).

The management is assumed to maximize the value of the firm in the portfolios of the stockholders and to observe a rate of return, k, demanded by stockholders for investment in common stocks.

With product price P(s), wage rate w(s), labor input L(s), and interest rate i(s), the objective is to maximize the present value of all future cash flows.[1]

$$J = \int_{s=t}^{\infty} e^{-k(s-t)}\Big[(1-\tau(s))\{P(s)F[K(s),L(s)] - w(s)L(s) - i(s)hP_K(s)K(s)\} - (\delta-p)hP_K(s)K(s) - (1-h)P_K(s)I(s) + \gamma\tau(s)D(s)\Big], \qquad (1:1)$$

where F[K(s),L(s)] is a decreasing return to scale production function.

This maximization may not violate the two equations of motion:

$$\dot{K}(s) = I(s) - \delta K(s)$$

$$\dot{D}(s) = P_K(s)I(s) - \gamma D(s).$$

This is a control problem with control variables labor input, L(s) and gross investment, I(s) and the hamiltonian, H:

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[1] Parameters assumed constant are written without time indices.

$$H = e^{-k(s-t)}[(1-\tau(s))(P(s)F\{K(s),L(s)\}-w(s)L(s)- i(s)hP_K(s)K(s))-(\delta-p)hP_K(s)K(s)-(1-h)P_K(s)I(s)+ \gamma\tau(s)D(s)+\lambda_1(s)\{I(s) - \delta K(s)\}+ \lambda_2(s)\{P_K(s)I(s) - \lambda D(s)\}] \quad (1:2)$$

We assume that this (properly defined) control problem has a solution which calls for decreasing returns to scale in production. We disregard, inter alia, that there would be instantaneous adjustments to the optimal path with infinitely large investment or disinvestment.

The necessary conditions used for (1:2) give:[1]

$$\frac{\partial H}{\partial I} = e^{-k(s-t)}[-(1-h)P_K+ \lambda_1+ \lambda_2 P_K] = 0 \quad (1:3)$$

and

$$\dot{\lambda}_1 + (1-\tau(t))(PF_K-hiP_K) - (\delta-p)hP_K= \lambda_1(k+\delta) \quad (1:4a)$$

$$\dot{\lambda}_2 + \tau(t)\gamma = \lambda_2(k+\gamma) \quad (1:4b)$$

By solving the differential equations (1:4) we get for k, δ and γ constant (but $\tau(t)$ still a function of time):

$$\lambda_1= \int_{s=t}^{\infty} [(1-\tau(s))(PF_K-hiP_K)-(\delta-p)hP_K]e^{-(k+\delta)(s-t)}ds \quad (1:5a)$$

$$\lambda_2 = \int_{s=t}^{\infty} \tau(s)\gamma e^{-(k+\gamma)(s-t)}ds \quad (1:5b)$$

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[1] Time indices are skipped in most cases to save space. The optimal condition concerning labor input is not needed for our purposes.

Therefore λ_1 is the capital value, internal to the firm, of getting another unit of capital, recognizing that a new unit of capital gives rise to future (after tax) marginal value productivities and debt services. λ_2 is the capital value of all future tax savings from depreciation charges following upon an increase of the book value of capital by one unit.

Condition (1:3) above says then that the capital value of expected future cash flows, due to the investment of one unit of capital, $\lambda_1 + \lambda_2 P_K$, must equal the present loss of cash flow from the investment outlay, $(1-h)P_K$.

Noting that condition (1:3) must hold over time all along the optimal path of the firm, it follows that

$$\dot{\lambda}_1 = (1-h-\lambda_2)\dot{P}_K - P_K\,\dot{\lambda}_2 \qquad (1:6)$$

at all points in time. Introducing the assumption that the firm expects future tax rates τ (as well as rates of depreciation for tax purposes) to be constant makes $\dot{\lambda}_2$ in (1:6) equal zero. By substituting (1:4) into (1:3) and using (1:6) with the assumption $\dot{\lambda}_2 = 0$, we may then solve for PF'_K/P_K, which is the gross rate of return before tax on real investment on the optimal path

$$\frac{PF'_K}{P_K} = \delta - p + ih + \frac{k}{1-\tau}\left[1-h - \frac{\tau(\gamma - (\delta-p))}{k+\gamma}\right]. \qquad (1:7)$$

The formula (1:7) gives the minimum gross rate of return that the firm can afford to earn on new investment, leaving shareholders no worse off, i.e. the gross cost of capital.[1]

1.2 Real Cost of Capital

By subtracting from gross cost of capital, given by (1:7), the rate of economic depreciation, we get the net real cost of capital, here called r*. Economic depreciation, then, is defined as the depreciation charge that maintains intact the real value of the original amount invested. By our assumption of exponential decay, this depreciation charge is the rate of capacity depreciation, δ, times replacement cost.[2] This defines real net cost of capital:[3]

$$r^* = ih + \frac{k}{1-\tau}\left[1 - h - \frac{\tau(\gamma-(\delta-p))}{k+\gamma}\right] - p \qquad (1:8)$$

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[1] Letting $PF'_K/P_K = c$, $P_K c$ then stands for what has been called the nominal user cost or rental price of capital. Cf. Jorgenson and Siebert (1968).

[2] Cf Bergström (1976), p 446. By subtracting from gross cost of capital (1:7) the rate $(\delta-p)$ times replacement cost the <u>nominal</u> amount invested would be kept constant. This would define a <u>nominal</u> net cost of capital, directly comparable to (nominal) capital market interest rates, i and k.

[3] If the rate of debt amortization would be kept at δ instead of δ-p an extra term would be added to (1:8), namely

$$\frac{ph\left[\frac{k}{1-\tau} - i\right]}{k+\delta}$$

which means that the inflation induced fall in the average debt ratio would, <u>ceteris paribus</u>, increase, leave unaffected or reduce capital cost, depending on whether

$\frac{k}{1-\tau} \gtrless i$. Cf. page 239.

Now, for the interpretation of (1:8), let us first assume that the rate of depreciation for tax purposes, γ, equals δ-p. As explained in note 2, p.243 this is the rate of depreciation that would keep constant the nominal amount invested. Since h is the portion of the firm's investment financed by borrowing, (1-h) is the portion financed by equity capital, making the net cost of capital a weighted average of the cost of debt and the (before tax) cost of equity. If instead $\gamma > (\delta - p)$, i.e. the firm is allowed to defer taxes through acceleration of depreciation charges relative to what is needed to maintain the original nominal amount invested, the cost of equity is weighted by

$$1 - h - \frac{\tau[\gamma-(\delta-p)]}{k + \gamma} \qquad (1:9)$$

This weight, in turn, is the portion of the firm's investments financed by equity capital.

Thus $\gamma > (\delta - p)$ implies that a third part of capital growth, $\tau[\gamma-(\delta-p)]/(k+\gamma)$, is financed by deferred taxes, adding the weights up to one. However, this last cost of finance is zero and consequently it does not show up in (1:8).

Now, decomposing the net real cost of capital, r* in (1:8), into a real part corresponding to capital cost without inflation and another part that is due to inflation, is the task of general equilibrium analysis, since the effects of inflation on market rates k and i need to be known.

These market rates will react to inflation in a complex way, reflecting both borrowers' and lenders' adjustments to inflation (and taxation).

This paper deals with one side of this market, borrowers' reactions to inflation when nominal interest --but not equity cost-- is deductible and when taxable profit is determined by deductions reflecting depreciations based upon historical investment costs.

On the supply side there are substitution effects between savings and consumption as well as between investment alternatives because inflation influences yield differentials--nominal before tax as well as real after tax--again because nominal interest is taxed and capital gains are taxed at relatively low marginal rates or not at all. These are the problems analyzed in a series of papers by Feldstein _et al_.[1] For our purposes it will suffice to simply assume that the nominal rates of return will rise with the rate of inflation. This means that we study what happens to the cost of capital when there is inflation but when real rates of return to equity and debt stay constant, i.e.:

$$k = k^* + p; \qquad i = i^* + p$$

where starred variables indicate cost of equity and debt, respectively, at zero inflation.[2]

Using our definition of the firm's real net cost of capital and the above assumptions regarding the

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[1] See Feldstein (1976), Feldstein, Green and Sheshinski (1978) and Feldstein and Summers (1978).

[2] It seems, in fact, that the adjustment of nominal interest rates due to inflation would be an approximate increase by the rate of inflation in the Fisherian tradition, although this is a net outcome of complex interactions due to taxation on both borrowers' and lenders' sides of the market. See Feldstein and Summers (1978).

effects of inflation on the nominal costs of equity and debt we get

$$r^* = i^*h + \frac{k^*}{1-\tau}\left[1-h-\frac{\tau(\gamma-\delta)}{k^*+\gamma}\right] + \frac{\tau\ p\ \gamma}{(1-\tau)(k^*+p+\gamma)}\left[\frac{k^*+\delta}{k^*+\gamma}\right] - \frac{\tau}{1-\tau}\,p + \frac{\tau}{1-\tau}\,p(1-h) \qquad (1{:}10)$$

The first two terms of r^* is net capital cost at zero inflation recognizing the possibility that the tax laws may provide for acceleration of depreciation charges ($\gamma > \delta$). Relative to this norm of constant prices, the effects of inflation on the firm's real net capital cost is captured by the last three terms.

The third term reflects that inflation brings about a real reduction in the base on which depreciation charges are taken, assuming that tax depreciation is calculated on historical cost. On the other hand, not taxing capital gains results in a reduction in real capital cost. This is shown by the fourth term. The last term of (1:10), $\frac{\tau p(1-h)}{1-\tau}$, reflects the assumption that the (after tax) cost of equity rises with p and that this increase is not deductible for tax purposes.

This last effect <u>partially</u> offsets the reduction in capital cost from not taxing capital gains. For a <u>complete</u> offset, however, tax laws should also provide for a restriction in the deductability of interest costs, allowing only deduction of real interest, i^*. This can be seen in the following way. The untaxed capital gain and the taxed increased cost of equity--the fourth and fifth terms added--result in a net lowering of capital cost by $\frac{\tau ph}{1-\tau}$ which can be interpreted as the effect of allowing the inflation increased interest on debt to be deductible. We see then, that the inflationary effects via the tax system can be described in two different ways.

The first one says that capital cost is lowered since capital gains are not taxed and raised because the inflation increased cost of equity is not a deductible cost to the firm. The other way, which states the net of these two effects, says that there is a fall in real capital cost because the firm can deduct full interest on debt when determining taxable profits.

Reformulating (1:10) in line with the last interpretation yields

$$r^* = i^*h + \frac{k^*}{1-\tau}\left[1-h-\frac{\tau(\gamma-\delta)}{k^*+\gamma}\right] + \frac{\tau\ p\ \gamma}{(1-\tau)(k^*+p+\gamma)}\left[\frac{k^*+\delta}{k^*+\gamma}\right] - \frac{\tau ph}{1-\tau} \qquad (1:11)$$

making it evident that the net effect of inflation on the firm's real cost of capital depends on two opposing forces: The current practice of basing depreciation charges on historical cost vs allowing the firm to deduct <u>nominal</u> cost of debt--including the part that constitutes compensation to lenders for inflation (p).

Real net cost of capital r*, therefore, will rise, remain unaffected or fall, depending on

$$h \lesseqgtr \frac{\gamma}{k^*+p+\gamma}\left[\frac{k^*+\delta}{k^*+\gamma}\right].$$

For instance, letting $k^* = 3\%$, $p = 7\%$, $\gamma = 20\%$ and $\delta = 10\%$,--not unreasonable figures for Swedish industry in the mid 70's--a firm financing >37.6% of its capital growth by debt (h), would find investment incentives improve as a result of inflation. The advantage from deducting that part of the nominal cost of debt, constituting an inflationary compensation, would outweigh the loss from historical cost depreciation.

Table 1 extends this example to include several alternatives regarding rates of capacity depreciation (δ) and depreciation for tax purposes (γ) as well as the rate of inflation (p). The table indicates values of h above which inflation reduces real cost of capital. An indicated value of h in the table says that all firms with more of its total capital financed by debt will get a lower capital cost by inflation.

It may be noted that the critical values of h falls as the rate of inflation increases. Thus, at high rates of inflation even firms with low debt financing would find their real costs of capital fall as a result of inflation.

Table 1. Ratio of debt to total capital balancing counteracting effects on capital cost

p	$\delta = 0.05$		$\delta = 0.10$	
	$\gamma = 0.05$ (1)	$\gamma = 0.10$ (2)	$\gamma = 0.10$ (3)	$\gamma = 0.20$ (4)
0.02	0.50	0.41	0.67	0.45
0.05	0.38	0.34	0.56	0.40
0.07	0.33	0.31	0.50	0.38
0.10	0.28	0.26	0.43	0.34

Comparing the first and third columns of table 1 brings out another result regarding the effects of inflation on investment projects of different lengths. It takes a higher h to compensate for the loss due to historical cost depreciation the higher the rate of capacity depreciation (δ).[1] Therefore, in times of inflation, historical cost depreciation discriminates against short-lived investments (with a high δ).[2]

We can summarie the effects of inflation on real capital cost via the corporate tax system as follows:

(1) Inflation increases capital cost because depreciation charges are taken on historical cost. This effect is stronger, the shorter the investment period.

(2) Inflation decreases capital cost because deduction of the nominal cost of debt is allowed. The higher the debt ratio, the stronger is this capital cost decreasing effect of inflation.

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[1] By comparing the first column ($\delta = .05$, $\gamma = .05$) with the third ($\delta = .10$, $\gamma = .10$) we compare investments of different life lengths when there is no deferral of corporate taxes due to accelerated depreciations.

[2] This is due to our assumption of amortization.

2. BUSINESS TAXES AND HOUSEHOLD TAXES

2.1 Shareholder Taxation and Capital Cost

In section 1 of this paper we did not take into account that capital income in the corporate sector of the economy is taxed twice. On top the corporate profit tax dividends are taxed in the household sector at stockholders' marginal rate of income tax. To the extent that retained earnings lead to capital gains on corporate stocks these are also taxed in the household sector, albeit at a relatively low rate.[1]

In this section of the paper we pose the very same questions as we did in the first section of the paper, but we take into account the so called "double taxation" of corporate source income.

Now, let k represent stockholders' rate of return on alternative financial investments, exogenously given to the national economy by opportunities on capital markets in the world economy. This rate of return is assumed to be taxed as personal income at the marginal income tax rate, T, of the "representative" stockholder. Therefore stockholders' required net rate of return is $k(1-T)$.[2]

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[1] The analysis here draws upon Södersten (1977) and Bergström and Södersten (III:5 in this volume). It is not implied by our assumptions that there is a one-to-one relation between retained earnings and capital gains. This relation depends on the differential taxation of dividends and capital gains as explains in Bergström and Södersten, III:5 in this volume.

[2] For many countries this assumption may obviously be questioned, bearing in mind e. g. that capital gains on alternative investments open to households often receive a preferential tax treatment.

A further and important assumption here about the cost of equity to the firm, $k(1-T)$, is that k is independent of T. This means that personal taxation of equity income cannot be shifted. If investors have no alternatives, international or national, to avoid a general personal income tax that is applicable to all sources of household income this is a reasonable assumption. In this way, from the management (firm) point of view, an increased personal taxation lowers the cost of equity because the net rate of return to equity which shareholders apply when discounting expected cash flow in evaluating shares, is lowered.

Following Swedish (and U.S.) tax rules we let dividends from the corporate sector be taxed at the marginal income tax rate, T, and (accrued) capital gains, $dV(t)/dt$, at a lower rate, αT, ($\alpha<1$).[1] The value of the firm's common stocks, $V(t)$, can now be formulated as the capital value of all future cash flow (expected with certainty):

$$V(t) = \int_{s=t}^{\infty} \{U(s)(1-T)-\alpha T\frac{dV(s)}{ds}\}e^{-k(1-T)(s-t)}ds \qquad (2:1)$$

where $U(t)$ is the sum of dividends and the second term under the integration sign is the assumed tax

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[1] The parameter α takes care of the fact that the rate of capital gains tax is lower than the marginal rate of income tax and further that in practice capital gains are taxed only upon realization, meaning that the effective rate is lower than the statutory rate when the latter is transformed to a tax on accruals (which in turn presupposes known holding periods). See Bailey (1969).

on accrued capital gains.[1]

The capital value (2:1) can be reformulated to a simpler form[2]

$$V(t) = \int_{s=t}^{\infty} \frac{U(s)(1-T)}{1-\alpha T} e^{-\frac{k(1-T)}{1-\alpha T}(s-t)} ds \qquad (2:2)$$

Dividends U(s) are already defined by the bracketed term in formula (1:1), page 240 of this paper. By insertion of this expression for U(s) in (2:2), we get an expression for the value of the firm in stockholders' portfolios with regard to the profit tax, the personal income tax and the capital gains tax.

Capital cost can now be derived in a manner similar to that of section 1 of this paper. The procedure will not be repeated here.

A complication should be mentioned, though. Even if investments are reversible there will now be a bound -- and upper bound -- on the volume of investment, due to our financial assumptions. With a

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[1] By this formulation we disregard new issues of common stocks. This requires $U(t)>0$, contrary to the case above with profit taxes only.

We assume here that all expectations are held with certainty and that shareholders are identical.

[2] Take the derivative of V(t) in (2:1) with respect to the lower limit of integration, giving

$$\frac{dV(t)}{dt} = - \{U(t)(1-T) - \alpha T \frac{dV(t)}{dt}\} + k(1-T)V(t)$$

which can be rewritten as

$$\frac{dV(t)}{dt} = \frac{k(1-T)}{1-\alpha T} V(t) - \frac{U(t)(1-T)}{1-\alpha T}.$$

From the solution of this differential equation we get (2:2).

constant debt ratio gross investments will be limited to the amount given by the volume that absorbs all retained earnings as the equity financed part. To invest more than this would call for new issues, a possibility we have excluded (here, but not in the case above of profit taxation only) in order to simplify the analysis.

Nevertheless, we treat the present problem as if there were no bound on the investment plan meaning that we study only <u>free intervals</u> where bounds are ineffective.[1]

We proceed, then, as if there were no bounds and after substitution for U(s) from (1:1) in (2:2) and using the same procedure as in part 1 of this paper we can compute the real net cost of capital (to be compared with (1:8)) as

$$r^* = ih + \frac{k(1-T)}{(1-\tau)(1-\alpha T)}\left[1-h-\frac{\tau[\gamma-(\delta-p)]}{\frac{k(1-T)}{1-\alpha T}+\gamma}\right]-p \qquad (2:3)$$

2.2 Double taxation and real capital cost

The next step is to assume, again, that the nominal rate of interest, i, and stockholders' nominal required rate of return, k, increase with the rate of inflation such that $i = i^* + p$ and $k = k^* + p$, where again i^* and k^* express real rates. Note here that our assumption that the net rate of

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[1] Appelbaum and Harris (1978) have studied control problems with both upper and lower bounds on the investment plan. In free intervals "myopic rules" of the unbounded problem are still operative. See also Arrow (1964) and (1968).

return, $k(1-T)$, is used in discounting means that the inflation compensating part of the nominal rate of return on stockholders' alternative investments, k, is also taxed at the marginal rate of income tax, T.

Substituting $k^* + p$ and $i^* + p$ for i and k in (2:3) gives after some manipulations the basic result of our analysis:

$$r^* = i^*h + \frac{k^*(1-T)}{(1-\tau)(1-\alpha T)} \left[1-h - \frac{\tau(\gamma-\delta)}{\frac{k^*(1-T)}{1-\alpha T} + \gamma} \right] +$$

$$\frac{\tau p \gamma}{(1-\tau)\left[\frac{(k^*+p)(1-T)}{1-\alpha T} + \gamma\right]} \left[\frac{\frac{k^*(1-T)}{1-\alpha T} + \delta}{\frac{k^*(1-T)}{1-\alpha T} + \gamma} \right] - \frac{\tau p h}{1-\tau} -$$

$$\frac{(T-\alpha T)p}{(1-\tau)(1-\alpha T)} \left[1-h - \frac{\tau\gamma}{\left[\frac{(k^*+p)(1-T)}{1-\alpha T} + \gamma\right]} \frac{(\gamma-\delta)}{\left[\frac{k^*(1-T)}{1-\alpha T} + \gamma\right]} \right] \tag{2:4}$$

This is the real net cost of capital with regard to both profit taxation and personal income and capital gains taxes. We see that the personal taxes have substantially complicated the expression for real capital cost compared to that with regard to profit taxation only (compare (2:4) to (1:11)). The different terms of (2:4), however, still have an intuitively clear economic interpretation.

The <u>first two</u> terms represent the net cost of capital without inflation. This real net cost of capital at zero inflation is our norm of comparison for the further analysis. The <u>third</u> term represents the capital cost increasing effect, in times of inflation, due to historical cost depreciations (as compared to replacement cost depreciation, inherent in the inflation free cost of capital. Cf the third term of (1:11)).

The <u>fourth</u> term shows that capital cost is reduced, because the full nominal interest on debt is deductible against corporate profits, whereby in fact the "real rate of amortization", p, is deductible for taxation.

The <u>fifth</u> awkward-looking term has to do with stockholders' taxation. It represents, on the one hand, a reduction of capital cost due to the fact that stockholders are taxed at marginal income tax rate T also for that part of the nominal rate of return, k, on alternative financial investments that is a compensation for inflation, p. Stockholders' real rate of return net of tax is then $k(1-T) - p = k^*(1-T) - pT$, implying a reduced cost of equity to the firm. On the other hand, there is an increase of capital cost following from the fact that <u>nominal</u> capital gains on stockholdings are taxed at the rate αT.

It may be noted that the term added by the introduction of personal taxes tends to lower real capital cost, provided capital gains receive a preferential tax treatment (i.e. $\alpha T < T$). In other words, taxing stockholders' nominal rate of return on alternative financial investments at marginal tax rate T, outweights the capital cost increasing effect of taxing <u>nominal</u> capital gains on corporate stock.[1]

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[1] This is not the whole story, however, since personal taxation also affects the third term of (2:4), reflecting the increase in capital cost due to historical cost depreciation.

Expression (2:4) makes it evident that the net effect of inflation on real capital cost depends on four opposing forces. These include current practice of basing depreciation allowances on historical costs, of allowing the firm to deduct nominal costs of debt, of taxing shareholders' nominal rates of return on alternative financial investments and of taxing nominal capital gains on corporate stock.

After some rearranging of (2:4), it can be demonstrated that if

$$T \geq \tau + \alpha T(1-\tau) \tag{2:5}$$

i.e. stockholders' marginal income tax rate is greater than or equal to the total tax burden on retained profits, then net real capital cost r^* will fall as a result of inflation. Assuming the corporate tax rate (τ) to be 50% and α, i.e. that part of (accrued) capital gains that must be declared as taxable income, to be 15%, this condition means that the firm would find real capital cost fall when shareholders' marginal tax rate T exceeds 54%. Assuming, instead, $\alpha = 0.4$, capital cost will fall when $T > 62.5\%$.[1]

If, on the other hand, (2:5) does not hold, capital cost will still fall provided

$$h > 1 - \frac{\tau[(1-Z)(1-\alpha T) + \tau ZQ(1-T)]}{\tau + \alpha T(1-\tau) - T} \tag{2:6}$$

where

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[1] Cf. Bailey (1969) for empirical estimates of α for the U.S.

$$Z = \frac{\gamma}{[(k^{*}+p)\ \frac{(1-T)}{1-\alpha T} + \gamma]}$$

and

$$Q = \frac{\gamma - \delta}{\frac{k^{*}(1-T)}{T-\alpha T} + \gamma} .$$

To explore the meaning of this requirement for the firm's debt ratio we have calculated some numerical examples including several alternatives of T, α, γ, and p. Tables 2A and 2B, which assume the corporate income tax rate τ to be 50%, the rate of capacity depreciation δ to be 10% and stockholders' real required rate of return k^{*} to be 3%, indicate values of h above which inflation will reduce real cost of capital. A certain value of h in the tables, says then that all firms with more of its total capital financed by debt will get a lower cost of capital as a result of inflation.

It may be noted that the critical values of h falls as the rate of inflation and the marginal rate of income rax rise. Also, h falls when the corporate income tax is lowered by way of accelerated depreciation ($\gamma > \delta$) or the capital gains tax parameter α is reduced. The most important result emerging from Tables 2A and 2B, however, is that for reasonable values of the parameters real cost of capital falls as a result of inflation. This conclusion presumes -- realistically -- that most stockholders are located in income brackets with high marginal tax rates and / or that the corporate tax system provides for acceleration of depreciation allowances ($\gamma > \delta$). Taking into account personal taxes on dividends and capital gains, therefore, reinforces the tendencies noticed in the first part of the paper, namely that under certain circumstances, inflation will lower real capital cost.

Table 2. Ratio of debt to total capital above which inflation will reduce real cost of capital

Table 2A: α = 0.4

	T							
	0.3		0.4		0.5		0.6	
p	γ=0.1	γ=0.2	γ=0.1	γ=0.2	γ=0.1	γ=0.2	γ=0.1	γ=0.2
0.02	0.52	0.22	0.39	0.01	0.05	0	0	0
0.07	0.25	0.09	0.03	0	0	0	0	0
0.10	0.14	0.03	0	0	0	0	0	0

Table 2B: α = 0.15

	T							
	0.3		0.4		0.5		0.6	
p	γ=0.1	γ=0.2	γ=0.1	γ=0.2	γ=0.1	γ=0.2	γ=0.1	γ=0.2
0.02	0.42	0.07	0.13	0	0	0	0	0
0.07	0.09	0	0	0	0	0	0	0
0.10	0	0	0	0	0	0	0	0

2.3 Eliminating Distortions with Profit Taxes and Personal Taxes on Dividends and Capital Gains

The results presented in previous sections lead us to the question of indexing. How can the inflationary distortions via the tax system be eliminated?

The standard norm of comparison in the literature on inflation and taxation is capital cost at zero inflation and no distortions from the tax system. Recognizing, however, that governments in many countries, e.g. Sweden, consciously intervene in resource allocation promoting in particular industrial growth by various means of accelerating depreciation allowances[1], another norm is of great interest: The norm of capital cost at zero inflation given the distorting system of taxation. We will first state ways of eliminating distortions relative to this last mentioned norm.

1. (i) Change the system of corporate taxation so that the book value on which depreciation charges are taken may be adjusted for price changes. This makes the third term of (2:4) vanish.[2]

(ii) Furthermore, let only the real interest rate i* be deducted against corporate profits. This eliminates the fourth term of (2:4).

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[1] See Bergström (1977) and Södersten (1978).

[2] This can be seen by substituting $\gamma\tau P_K(s)D(s)$ for $\gamma\tau D(s)$ in (1:1), page 240 and then performing the analysis as we have done it in the paper.

(iii) Change personal taxation so that stockholders are taxed only for the real rate of return on alternative financial investments. In this way nominal after tax cost of equity becomes $k-T(k-p)=k(1-T)+pT$. This in turn means that the real after tax cost of equity is $k^*(1-T)$.[1]

(iv) Finally, let stockholders be taxed only for real capital gains on corporate stock. Capital gains tax at time t would then equal

$$\alpha T\left\{\frac{dV(t)}{dt} - pV(t)\right\}.$$

With all these adjustments net capital cost becomes

$$r_1^* = i^*h + \frac{k^*(1-T)}{(1-\tau)(1-\alpha T)}\left[1 - h - \frac{\tau(\gamma-\delta)}{\frac{k^*(1-T)}{1-\alpha T} + \gamma}\right]$$

where capital cost is still a function of the tax system (in a way intended by the government) but independent of the rate of inflation.

2. As a special case of the above procedure, free depreciation can be allowed.[2] In our model, this would require γ, the rate of tax depreciation to be infinitely large.[3] Rewriting (2.4) under this condition gives

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[1] Since $k = k^*+p$, then $k(1-T)+pT-p = k^*(1-T)$.

[2] This was the case in Sweden during the years 1938-51.

[3] To make an investment "evaporate" immediately γ must go to infinity.

$$r_2^* = i^*h + \frac{k^*(1-T)}{(1-\tau)(1-\alpha T)}(1-h-\tau) -$$

$$\frac{p\tau h}{1-\tau} - \frac{pT(1-h-\tau)}{(1-\tau)(1-\alpha T)} + \frac{p\alpha T(1-h-\tau)}{(1-\tau)(1-\alpha T)}.$$

The first two terms again represent net cost of capital at zero rate of inflation. By applying then the last three rules of case 1) above capital cost becomes independent of inflation (but not of taxation). Thus, investment incentives would be preserved at zero inflation standards.

3. Finally, let us look at the over all norm of no inflationary and no tax distortions. By letting tax depreciations be taken on replacement cost at a rate coinciding with capacity depreciation, (i.e. $\gamma = \delta$), the third term of (2:4) disappears as well as the ratios within the brackets of the second and fifth terms.

As above allowing only real interest to be deductible takes away the fourth term. If, on top of this, the real cost of equity, k^*, is deducted for tax purposes the corporate tax system would be "corrected".

For personal taxation, capital gains on corporate shareholdings should be taxed at the same rate as other capital income ($\alpha = 1$). For the final corrections on the personal taxation side there are two ways to choose between, one real and the other nominal. Remaining distortions from personal taxation may be eliminated either by taxing <u>real</u> capital gains and <u>real</u> rates of return on alternative investments or by taxing <u>nominal</u> gains (at the same rate as other capital income) as well as nominal rates of return on alternative investments. This last alternative means that the two components of the last term of (2:4) cancel out, whereas the first alternative means that both these components are zero.

With all these adjustments capital cost would be

$$r_3^* = i^*h + k^*(1-h).$$

This procedure would thus result in a distortion-free tax system, untouched by inflation. Capital cost would be invariant both with respect to taxes and inflation.

The latter results stated above make it clear that to have a neutral tax system, it is not necessary to have a real norm of taxation. Even a nominal norm will do as long as the norm is consequently stuck to. The principle of real taxation described above could be substituted by nominal taxation--both corporate and personal.

We have already described the choice between real and nominal personal taxation above. To see that there is a similar choice also for profit taxation let the firm deduct nominal rates k and i and tax the capital gains on real corporate capital in the firm. This last rule eliminates the fourth term of (2:4) and the net result is again r_3^* above.

2.4 Concluding Remarks

It seems evident that the most rational and most simple way of indexing the tax system is the first way, described under alternative 1) above. This alternative of indexing results in just that cost of capital intended by the government by the construction of the tax system (in an inflation-free world). Furthermore, it is an easy correction to undertake as the only information needed is the rate of inflation. This rate of inflation is used to adjust book values, nominal costs of debt, nominal rates of return on alternative investments, and the values of common stocks. In practice it would be conceivable to define broad price indices of capital goods to be used for approximate corrections of existing tax systems.

The other two alternatives would change the present tax laws also at zero rate of inflation. The third alternative --alternative 3 --would furthermore require knowledge of capacity depreciations to be applied to replacement cost as the basis for tax depreciations.

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Employment Subsidies and the Behavior of the Firm

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1. INTRODUCTION

The simultaneity of high rates of inflation and unemployment during the seventies has increased the interest in selective employment policies as means to reduce unemployment without increasing inflation. The experiences of large regional unemployment differentials have reinforced this interest. Numerous Western governments have undertaken various programmes of employment subsidization, e.g. the United States, Sweden, the United Kingdom, the Federal Republic of Germany, Belgium, France, the Netherlands and Norway. Among the programs considered are marginal employment subsidies (MES) in which subsidies are payed only for increases in employment.

Marginal employment subsidies may be constructed in a variety of ways. Distinctions can e.g. be made between temporary and permanent schemes as well as between programs focusing on net changes versus gross flows of employment. A large number of different subsidy bases might be used, e.g. the total increase in employment, the increase above a specific threshold or the increase in the firm's wage bill. The programs in operation are characterized by great differences concerning their main goals (preventing layoffs versus fostering hirings), the choice of subsidy base and employer and employee eligibility requirements. The British Temporary Employment Subsidy from 1975 is e.g. intended to be job preserving rather than job creating, whereas the Swedish recruitment subsidies introduced in 1978 are stimulating hirings.[1]

The purpose of the present paper is to elucidate how marginal employment subsidies will affect the behavior of a profit-maximizing firm. Capital and labor are not considered completely variable but adjustable at cost. Two different institutional settings are analyzed, a fixwage regime and a flexwage regime. The firm in the first regime is unable to control its wage and is facing nonwage recruitment costs only. The firm in the flexwage world, on the other hand, can influence the supply of labor to itself by its wage choice. An increase in hirings--or a decrease in quits--will thus be associated with adjustment costs in terms of wage increases. Section 2 contains an analysis of the fixwage regime, whereas section 3 deals with the case of dynamic monopsony. The interest is concentrated on employment subsidies; we are, however, also illuminating certain effects of investment subsidies ("marginal capital subsidies").

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[1] The references contain a list of earlier theoretical, empirical and policy-oriented investigations of employment subsidy schemes.

2. EMPLOYMENT SUBSIDIES UNDER A FIXWAGE REGIME

2.1 Basic Assumptions

Consider a competitive firm producing its output according to the production function $Q = f(K,N)$ homogeneous of degree one. Capital and labor are by assumption quasi-fixed factors; changes in the factors are thus associated with positive costs of adjustment. The analysis is confined to a case with purely external adjustment costs, implying that investment and recruitment of labor have no effects per se on the production activities of the firm. The adjustment cost functions have conventional convexity properties, i.e.

$$C_I > 0 \qquad C_{II} > 0 \tag{1}$$

$$C_A > 0 \qquad C_{AA} > 0, \tag{2}$$

where I is gross investment and A the number of new hires. The rationale for imposing costs associated with capital adjustment has been dealt with in investment literature and will not be discussed in this paper.[1] Current investment costs are in our formulation of two kinds: expenditures for buying capital goods, mI, where m is the (fixed) price of capital goods, and installation costs, C(I), independent in size of the price of the machines.

The assumption of rising marginal recruitment costs has intuitive appeal and might have different sources. In the first place, the costs associated with search for new workers are positive and

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[1] See e.g. Gould (1968).

probably rising at the margin due to the dispersion in space of job seekers. Secondly, the firm will have to provide each new employee with some firm-specific training and the marginal costs for this conversion of "raw" labor into "productive" labor is likely to rise with the number of hirings due to crowding.[1] The analysis will be confined to the behavior of the recruiting firm, thus disregarding layoffs. By assuming homogeneous labor, the possibility of simultaneous hirings and firings is ruled out. The variable A might, however, be reinterpreted as layoffs when $A<0$. Retaining the assumption of convex adjustment costs, the latter interpretation implies $C_A<0$ and $C_{AA}>0$. The realism of separation costs should be obvious; the rationale for their convexity seems perhaps more questionable. Somewhat tentatively, it might be argued that firing costs are rising at the margin due to increasing administrative burdens and overtime requirements within the personnel department.

The problem facing the firm is to maximize its discounted cash flow net of taxes (T) and subsidies (S_N, S_K), i.e.

$$\max\ V=\int_0^\infty e^{-rt}[pQ(K,N)-wN-C(A)-mI-C(I)-T+S_N+S_K]dt \qquad (3)$$

subject to the constraints

$$\dot{N} = A - qN \qquad (4)$$

$$\dot{K} = I - \delta K, \qquad (5)$$

[1] In passing, it might be noted that Edmund Phelps assumes convex recruitment costs in his derivation of the Phillips curve. See Phelps (1971).

where q is the quit rate and δ the rate of depreciation, both exogenously given.

It is assumed that the profit tax is charged at the rate τ on gross income less pure wage costs, hiring costs and costs of installation of capital goods. Moreover, a fraction h of the depreciation $m\delta K$ is deductible. Employment and investment subsidies are included in the tax base. The tax function is

$$T = \tau[pQ - wN - C(A) - C(I) - hm\delta K + S_N + S_K] \qquad (6)$$

where S_N is the amount of employment subsidies and S_K the amount of investment subsidies. The analysis will be restricted to permanent subsidy schemes of the type $S=s\cdot B$, where S is the amount of the subsidy, s the subsidy rate and B the subsidy base. Programmes using net employment changes as base will be distinguished from schemes aimed at subsidizing gross employment changes. A mixed variant will include a threshold. The different possibilities are summarized in the formula

$$S_N = s_1[A-k_1N] = s_1[\dot{N} + (q-k_1)N] \qquad (7)$$

where k_1 is the threshold; $k_1=q$ implies net growth in employment as subsidy base. The subsidy is assumed symmetric, holding for both increases and decreases in employment. Employment reductions will thus be punished by lower subsidies or higher taxes.[1] The scheme described provides the policy-

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[1] Non-symmetric MES-programmes (i.e., $s_1 = 0$ for $\dot{N} < 0$) could be destabilizing as they might create incentives for employment speculation, i.e. exces-

Cont.

maker with two different instruments, the subsidy rate and the threshold. The investment subsidy--or investment tax--is analogously written as

$$S_K = s_2[I-k_2K] = s_2[\dot{K} + (\delta-k_2)K] \tag{8}$$

where s_2 is the subsidy rate and k_2 the capital threshold; $k_2=0$ implies e.g. subsidization of gross investment.

2.2 Properties of the optimal employment and investment policy

The firm has two control variables at its disposal, hirings (A) and investment (I). The Hamiltonian is:

$$H = e^{-rt}[pQ-wN-C(A)-mI-C(I)-T+S_N+S_K+\lambda_1\dot{N}+\lambda_2\dot{K}] \tag{9}$$

where λ_1 and λ_2 are costate variables interpretable as marginal revenues associated with increases in employment and capital. Necessary conditions for optimum are

$$\lambda_1 = (1-\tau)(C_A-s_1), \tag{10}$$

$$\lambda_2 = m + (1-\tau)(C_I-s_2). \tag{11}$$

Cont.

sive employment reductions in a recession in order to obtain eligibility for subsidies during a recovery. This observation would be one rationale for applying some kind of symmetric schemes, intended to shift the adjustment cost function for employment increases as well as employment reductions.

The interpretation of (10) is the following: Along an optimal path, the value of increases in employment should equal the (net) marginal hiring cost. This hiring cost is reduced by a higher employment subsidy and by a higher profit tax (since recruitment outlays are deductible). The interpretation of (11) is analogous; the value of increases in the stock of capital should equal the marginal investment cost, net of taxes and subsidies.

Additional necessary conditions for maximum are:

$$-\frac{\partial H}{\partial N} = e^{-rt}[\dot{\lambda}_1 - \lambda_1 r], \tag{12}$$

$$-\frac{\partial H}{\partial K} = e^{-rt}[\dot{\lambda}_2 - \lambda_2 r], \tag{13}$$

implying

$$\lambda_1(q+r) - \dot{\lambda}_1 = (1-\tau)(pQ_N - w - s_1 k_1), \tag{14}$$

$$\lambda_2(\delta+r) - \dot{\lambda}_2 = (1-\tau)(pQ_K - s_2 k_2) + \tau h m \delta. \tag{15}$$

Focusing on the stationary solution ($\dot{\lambda}_1 = \dot{\lambda}_2 = 0$) we have from Eq. (14) and Eq. (10)

$$\frac{(1-\tau)(pQ_N - w - s_1 k_1)}{q+r} = (1-\tau)(C_A - s_1) \tag{16}$$

and from (15) and (11)

$$\frac{(1-\tau)(pQ_K - s_2 k_2) + \tau h m \delta}{\delta + r} = (1-\tau)(C_I - s_2) + m. \tag{17}$$

The numerator in (16) is the net cash flow obtained by adding a new worker to the firm's labor force. In equilibrium the present value of increasing employment equals the marginal hiring cost. The L.H.S. of (16) expresses the expected capital value of hiring a worker with the quit-probability q. A higher marginal employment subsidy will de-crease this present value (through the negative term s_1k_1). The reason is that the MES-scheme investigated is equivalent to a tax on a fraction of the firm's labor force as well as a hiring subsidy. Consider e.g. a pure net employment subsidy, i.e. $k_1 = q$. The product s_1k_1 ($=s_1q$) is then interpretable as the expected quit tax.

Rearranging Eq. (16) and Eq. (17) gives the marginal productivity conditions for labor and capital:

$$pQ_N = w + s_1k_1 + [C_A - s_1][q+r], \tag{18}$$

$$pQ_K = \frac{m(\delta+r)}{1-\tau} - \frac{\tau hm\delta}{1-\tau} + s_2k_2 + [C_I - s_2][\delta+r] \tag{19}$$

The marginal revenue product is higher than the nominal wage, the difference consisting--in the first place--of the subsidy rate times the threshold (the "tax element" of the subsidy scheme). Secondly, the firm will recover a proportion q of the net hiring costs, thereby recovering 100 per cent in the long run for the average employee (whose expected length of employment is 1/q). Finally, the firm will recover imputed interest on its hiring investments, $r[C_A - s_1]$.

The R.H.S. of Eq. (18) --the implicit rental value of labor services-- will decrease with a higher subsidy, provided that the inequality $q+r-k_1>0$ holds; the effect is unambiguous in the pure net employment subsidy scheme ($q=k_1$) and is reinforced by a higher rate of interest. Similar arguments hold for the rental value of capital services, the R.H.S. of Eq. (19). Capital costs are, however, also affected by the tax on profits.

2.3 Comparative Statics

Consider the stationary solution to the four differential equations (4), (5), (14) and (15). By differentiating the system the determinant

$$D = \begin{vmatrix} pQ_{NN} & pQ_{KN} & -(q+r)C_{AA} & 0 \\ (1-\tau)pQ_{KN} & (1-\tau)pQ_{KK} & 0 & -(1-\tau)(\delta+r)C_{II} \\ -q & 0 & 1 & 0 \\ 0 & -\delta & 0 & 1 \end{vmatrix} > 0 \qquad (20)$$

is obtained. The results of the comparative statics, pursued by solving the differentiated equations by Cramer's rule, are summarized in Table 1.

Table 1.

Parameter increased	Affected endogenous variable N	K	A	I
p	+	+	+	+
w	–	–	–	–
r	–	–	–	–
q	–	–	–	–
δ	–	–	–	–
m	–	–	–	–
τ	–	–	–	–
h	+	+	+	+
s_1	?	?	?	?
k_1	–	–	–	–
s_2	?	?	?	?
k_2	–	–	–	–

Some conclusions emerge from the exercises:

1. An increase in the product price (or a decreasing wage rate) will increase both capital and labor in stationary equilibrium.

2. A higher rate of interest will decrease the equilibrium size of the firm. The same result appears for increases in the quit rate (q), the rate of depreciation of capital (δ) and the price of capital goods (m).

3. A higher tax on profits will decrease the demand for both capital and labor in stationary equilibrium. This effect is due to the assumed tax treatment of "pure" investment outlays, mI (not deductible). More generous treatment of depreciation (a higher h) will, on the other hand, increase the stationary size of the firm (through the resulting decrease in the rental price of capital).

4. A higher employment subsidy threshold (k_1) will reduce the demand for labor but also the demand for capital. The scale effect swamps the substitution effect. A higher investment subsidy threshold (k_2) will, analogously, discourage capital formation but also, through the scale effect, reduce the demand for labor.

Now consider the marginal employment subsidy. We obtain

$$\frac{\partial N}{\partial s_1} = \frac{(q+r-k_1)(1-\tau)[\delta(\delta+r)C_{II}-pQ_{KK}]}{D} \tag{21}$$

$$\frac{\partial A}{\partial s_1} = \frac{(q+r-k_1)(1-\tau)[\delta(\delta+r)C_{II}-pQ_{KK}]q}{D} \tag{22}$$

$$\frac{\partial K}{\partial s_1} = \frac{(q+r-k_1)(1-\tau)pQ_{KN}}{D} \tag{23}$$

$$\frac{\partial I}{\partial s_1} = \frac{(q+r-k_1)(1-\tau)\delta pQ_{KN}}{D} \tag{24}$$

The signs hinge on the expression $(q+r-k_1)$. If the threshold is located at $\dot{N} = 0$ (i.e. $k_1 = q$), the signs are unambiguously positive.

A pure hiring subsidy $(k_1=0)$ will foster both employment and investment. It is interesting to note the existence of the special case $q<k_1<q+r$, where a higher subsidy will increase employment even if the threshold implies a tax in stationary equilibrium.

Consider, finally, the investment subsidy. We obtain

$$\frac{\partial N}{\partial s_2} = \frac{(\delta+r-k_2)(1-\tau)pQ_{KN}}{D} \tag{25}$$

$$\frac{\partial A}{\partial s_2} = \frac{(\delta+r-k_2)(1-\tau)qpQ_{KN}}{D} \tag{26}$$

$$\frac{\delta K}{\partial s_2} = \frac{(\delta+r-k_2)(1-\tau)[q(q+r)c_{AA}-pQ_{NN}]}{D} \tag{27}$$

$$\frac{\partial I}{\partial s_2} = \frac{(\delta+r-k_2)(1-\tau)[q(q+r)c_{AA}-pQ_{NN}]\delta}{D} \tag{28}$$

stating that a rising subsidy will increase employment provided that it increases the demand for capital, i.e. if the inequality $\delta+r-k_2>0$ holds.

The signs are unambiguous for a net investment subsidy $(k_2=\delta)$ and for a pure gross investment subsidy. Also in perfect symmetry with the employment subsidy, a special case appears when a rising investment "tax" increases the demand for capital (if $\delta<k_2<\delta+r$).

2.4 Comparative Dynamics

In the preceding section we have investigated how the stationary equilibrium of the firm will be affected by changes in different parameters. We now turn to the instantaneous effects of changes in the parameters, restricting ourselves to the employment subsidy rate and the threshold. Is it necessarily true that (e.g.) a lower threshold--implying a higher equilibrium level of employment --will produce an instantaneous increase in hirings irrespective of where on its path the firm is located? In order to simplify the analysis, the stock of capital is assumed to be fixed.

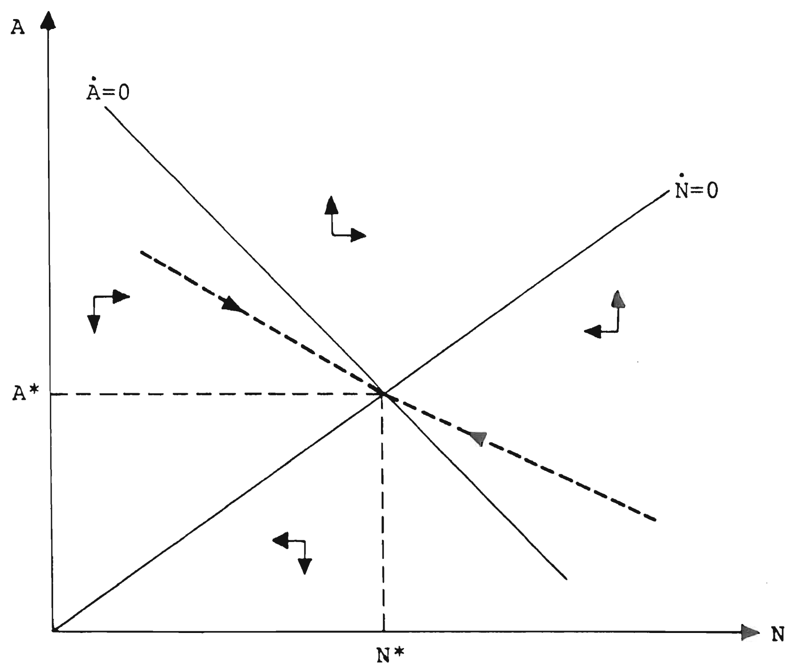
Consider a phase diagram in the (A,N)-space (Figure 1). The differential equation for hirings, obtained from (10) and (14), is

$$\dot{A} = \frac{C_A(q+r) - pQ_N + w + s_1(k_1-q-r)}{C_{AA}}. \tag{29}$$

Implicit differentiation of (29), conditional upon $\dot{A}=0$, establishes a negative slope for the $\dot{A}=0$ line.[1] By differentiating $\dot{N}=A-qN$ for $\dot{N}=0$ we find

[1] $$\left.\frac{\partial A}{\partial N}\right|_{\dot{A}=0} = \frac{pQ_{NN}}{C_{AA}(q+r)} < 0.$$

Figure 1.



a positive slope for the $\dot{N}=0$ line. The nonlinear system can be analyzed in a local region about the stationary solution (obtained as the intersection of the curves $\dot{A}=0$ and $\dot{N}=0$). It can be shown that the equilibrium is a saddle; hence there exists a unique optimal recruitment policy for the firm (the heavy arrows). Starting from an arbitrary point $N_0<N^*$ the firm will approach equilibrium by accessions which decrease over time. If employment reductions are called for, it is optimal to start with a low number of hirings and increase recruitments over time. The model thus implies "employment smoothing" as an optimal response to demand changes.

The slope of the optimal path is

$$y = \frac{\partial A}{\partial N} = \frac{\dot{A}}{\dot{N}} = \frac{C_A(q+r) - pQ_N + w + s_1(k_1-q-r)}{C_{AA}(A-qN)} \tag{30}$$

If a change in a parameter is increasing the equilibrium employment level the instantaneous effect on hirings will also be positive, provided that the new path is everywhere above the old one. In a hypothetical point of intersection between the paths, the slope of the new path must be less steep than the slope of the old one (for $\dot{N} > 0$).

Differentiating (30) with respect to the subsidy rate and the threshold gives

$$\frac{\partial y}{\partial s_1} = \frac{k_1-q-r}{C_{AA}(A-qN)} \lesseqgtr 0 \text{ as } \dot{N} \gtreqless 0 \text{ (if } q+r>k_1) \tag{31}$$

$$\frac{\partial y}{\partial k_1} = \frac{s_1}{C_{AA}(A-qN)} \lesseqgtr 0 \text{ as } \dot{N} \gtreqless 0. \tag{32}$$

The slope of the optimal path is steeper for $\dot{N} > 0$ after an increase in the subsidy rate (if $k_1<q+r$ holds, implying a higher stationary level of employment). Thus no intersection occurs in that region. Likewise, no intersection between the paths can occur in the region $\dot{N} < 0$. It follows that a higher subsidy will induce an instantaneous increase in hirings (Figure 2) irrespective of the firm's actual employment level.[1] By similar arguments it can be shown that a higher threshold always will decrease hirings.

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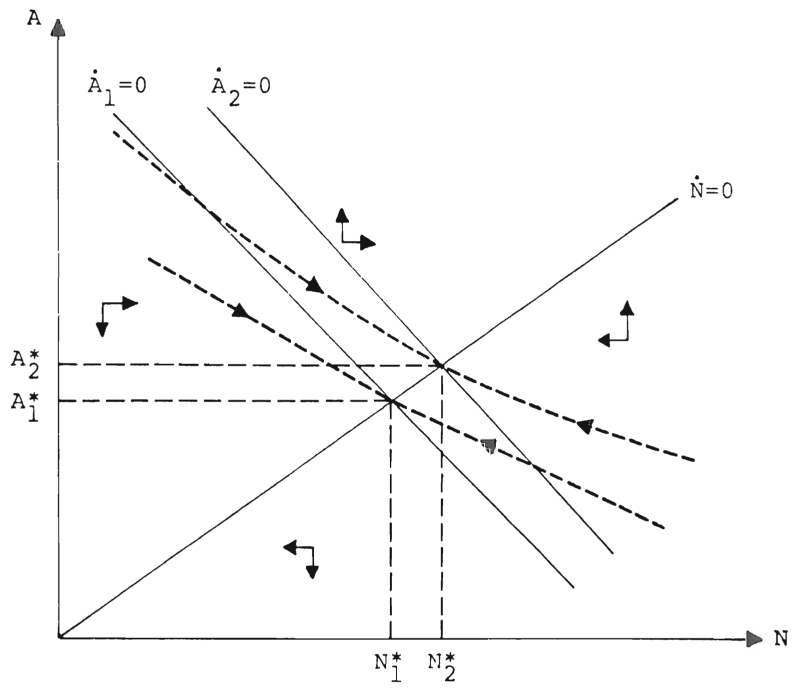
[1] Disregarding the case $k_1>q+r$.

Figure 2.



The special case appears when $q<k_1<q+r$; a higher subsidy will then produce an instantaneous increase in hirings and a switch to a new growth-path aiming at a higher stationary equilibrium with a higher employment tax; the negative subsidy is $S_N= s_1(q-k_1)N$ for $\dot{N} = 0$. This possibility--not easy to discover within a static framework--hinges on the fact that the firm is balancing two opposing forces: the subsidies (taxes) possible to get (avoid) during the adjustment process versus the employment tax in steady state.

3. EMPLOYMENT SUBSIDIES UNDER DYNAMIC MONOPSONY

3.1 Assumptions

The preceding model has treated the quit rate and the wage rate as exogenously given to the firm. We now relax these assumptions by making both quits and new hires dependent on the wage choice of the firm. The differential equation describing employment growth is

$$\dot{N} = [a(w)-q(w)]N, \tag{33}$$

where $a(w)$ is the new hire rate $(A=a(w)N)$.[1] The expected signs are $a_w>0$ and $q_w<0$. Furthermore, we impose "decreasing marginal returns" to the wage recruitment policy, i.e. $a_{ww}-q_{ww}<0$. Wage increases will thus increase employment at a decreasing rate. One argument underpinning the assumption is that quits are likely to reach a lower limit due to retirements, i.e. $q_{ww}>0$. Another argument relies on the dispersion in space of job seekers.

The problem facing the firm is

$$\max V = \int_0^\infty e^{-rt}[pQ-wN-mI-C(I)+S_N+S_K-T]dt, \tag{34}$$

where nonwage recruitment costs are abstracted from; the firm is assumed to be able to control

[1] The number of hirings is thus homogeneous of degree one in employment. Job seekers are likely to contact large firms more often than small ones in order to increase the possibilities of finding vacancies.

the flow supply of labor to itself solely by its wage choice.[1]

3.2 Optimal Wage Policy

Differentiating the Hamiltonian corresponding to (34) with respect to the control variable (the wage rate) gives the first order condition

$$\lambda_1 = \frac{(1-\tau)(1-s_1 a_w)}{a_w - q_w}, \tag{35}$$

stating that the value of adding a worker to the firm's labor force should equal the net marginal cost of changing employment. The subsidy will decrease this adjustment cost, the effect being reinforced by a higher wage elasticity of labor supply.

By using $-\partial H/\partial N = \dot{\lambda}_1 - \lambda_1 r$ an additional necessary condition for maximum

$$\lambda_1[r-(a-q)] - \dot{\lambda}_1 = (1-\tau)[pQ_N - w + s_1(a-k_1)] \tag{36}$$

is obtained. Substituting (35) in (36) gives the steady state condition

$$\frac{[1-\tau][pQ_N - w + s_1(a-k_1)]}{r} = \frac{[1-\tau][1-s_1 a_w]}{a_w - q_w}. \tag{37}$$

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[1] The firm's optimal wage choice should of course be related to the average market wage; the latter is assumed constant in the analysis above. This assumption is not crucial; following e.g. Mortensen and Siven we can introduce wage inflation provided that wages and prices are expected to inflate at the same rate. We can thus interpret "higher wage" as higher wage increase relative to the average wage increase.

Rearranging Eq. (37) gives the marginal productivity condition

$$pQ_N = w - s_1(a-k_1) + r\left[\frac{1-s_1 a_w}{a_w-q_w}\right] \qquad (38)$$

Labor costs are decreased by a higher subsidy rate provided that the inequality

$$a - k_1 + \frac{ra_w}{a_w-q_w} > 0 \qquad (39)$$

holds. A reversal of the inequality requires a "high" threshold and accordingly a negative subsidy in equilibrium.

3.3 Comparative Statics

Consider now the properties of the stationary solution $(\dot{K} = \dot{N} = \dot{\lambda}_1 = \dot{\lambda}_2 = 0)$. Differentiating the four equations under consideration gives

$$D = \begin{vmatrix} (a_w-q_w)pQ_{NN} & (a_w-q_w)pQ_{KN} & B & 0 \\ (1-\tau)pQ_{KN} & (1-\tau)pQ_{KK} & 0 & -(1-\tau)(\delta+r)C_{II} \\ 0 & 0 & a_w-q_w & 0 \\ 0 & -\delta & 0 & 1 \end{vmatrix} > 0 \qquad (40)$$

where

$$B=-(a_w-q_w)(1-s_1 a_w)+rs_1 a_{ww}+[pQ_N-w+s_1(a-k_1)][a_{ww}-q_{ww}]<0$$

as determinant of the system. The comparative statics give results according to Table 2.

Table 2.

Parameter increased	Affected endogenous variable			
	w	N	K	I
p	0	+	+	+
r	0	–	–	–
δ	0	–	–	–
m	0	–	–	–
τ	0	–	–	–
h	0	+	+	+
s_1	0	?	?	?
k_1	0	–	–	–
s_2	0	?	?	?
k_2	0	–	–	–

The results are similar to those obtained for the fixwage regime. Since the firm by assumption is able to control its relative employment growth by its wage choice, a larger number of hirings --corresponding to a higher level of employment-- does not *per se* require a higher wage rate. Changes in the parameters under consideration might have instantaneous effects on the wage choice of the firm; in the long run these effects will, however, disappear.

Our main interest is focussed upon the subsidy parameters. A rising employment (investment) threshold will decrease employment (the stock of capital) in steady state. Concerning the employment subsidy rate, we obtain

$$\frac{\partial N}{\partial s_1} = \frac{[(a_w-q_w)(a-k_1)+ra_w](a_w-q_w)(1-\tau)[\delta(\delta+r)C_{II}-pQ_{KK}]}{D} \tag{41}$$

$$\frac{\partial K}{\partial s_1} = \frac{[(a_w-q_w)(a-k_1)+ra_w](a_w-q_w)(1-\tau)pQ_{KN}}{D} \tag{42}$$

with positive signs provided that the inequality

$$a - k_1 + \frac{ra_w}{a_w-q_w} > 0 \tag{43}$$

holds. The effect is obviously unambiguous when the subsidy base is net increase in employment (k_1=q=a). The special case remains, where a higher subsidy will increase employment even if the subsidy is negative in steady state.

3.4 Comparative Dynamics

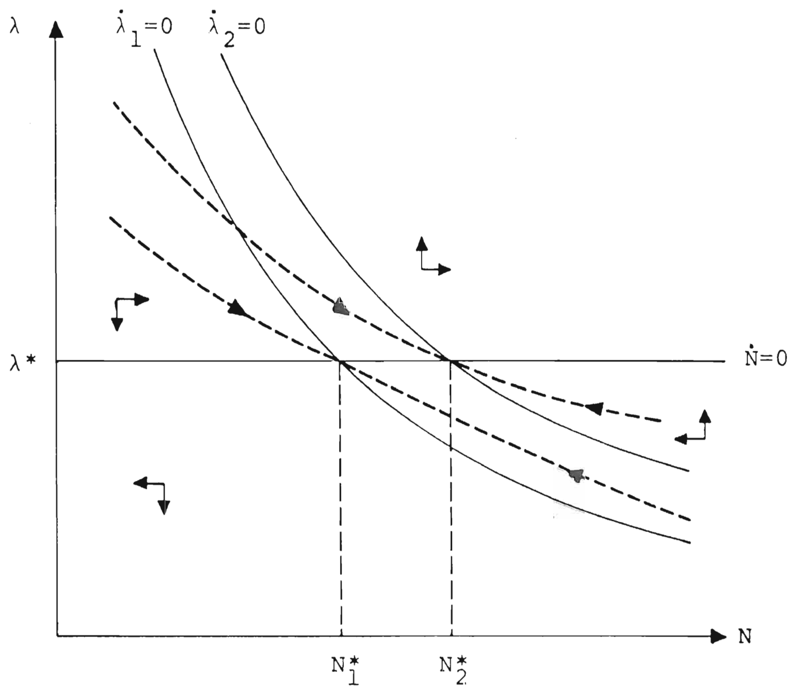
The instantaneous effects will now be explored. How will changes in the subsidy rate or in the threshold affect the wage choice when the firm is outside its stationary equilibrium? The (λ_1, N) phase diagram is illustrated in Figure 3. The differential equation is

$$\dot{\lambda}_1 = -\lambda_1[a-q-r] - (1-\tau)[pQ_N-w+s_1(a-k_1)]. \tag{44}$$

The curve for $\dot{N} = 0$ is horizontal; a higher employment level does not require a higher wage according to arguments already stated (and $\partial\lambda_1/\partial w>0$). By differentiating (44) we have

$$\left.\frac{\partial\lambda_1}{\partial N}\right|_{\dot{\lambda}=0} = \frac{-(1-\tau)pQ_{NN}}{a-q-r} \tag{45}$$

Figure 3.



with negative slope below and close to the $\dot{N} = 0$ curve; a positive slope appears when $a>q+r$. Differential equation (45) implies $\dot{N} > 0$ for points above $\dot{N} = 0$ and vice versa. Moreover, we have $\partial\dot{\lambda}_1/\partial N>0$ implying $\dot{\lambda}_1 < 0$ to the left of $\dot{\lambda}_1 = 0$ and vice versa. The optimal path for $\dot{N} = 0$ implies that hirings (quits) will decrease (increase) over time (since $\dot{\lambda}$ is increasing with $\dot{w}$). The opposite holds true for a contractive path ($\dot{N} < 0$).

The slope of the optimal path is

$$z = \frac{\partial\lambda_1}{\partial N} = \frac{\dot{\lambda}_1}{\dot{N}} \tag{46}$$

Differentiating z with respect to s_1 gives

$$\frac{\partial z}{\partial s_1} = \frac{[1-\tau][(a-q-r)\frac{a_w}{a_w-q_w} - (a-k_1)]}{(a-q)N} \quad (47)$$

with negative slope for $\dot{N} > 0$ in the neighborhood of $\dot{N} = 0$ if

$$a - k_1 + \frac{ra_w}{a_w-q_w} > 0 \quad (48)$$

holds.[1] This inequality has already been found to imply a higher stationary equilibrium. A higher subsidy will thus produce an instantaneous increase in wages and hirings and a similar decrease in the quit rate. Analogously, it is easily demonstrated that a lower threshold has the same effects; the relevant derivative is

$$\frac{\partial z}{\partial k_1} = \frac{-(1-\tau)s_1}{(a-q)N} \gtrless 0 \text{ as } \dot{N} \lessgtr 0. \quad (49)$$

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[1] Conversely, it holds that $\partial z/\partial s_1 > 0$ for $\dot{N} < 0$ close to $\dot{N} = 0$.

4. SUMMARY AND CONCLUDING REMARKS

The main purpose of this paper has been to investigate some microeconomic effects of marginal employment subsidies. We have, however, also compared employment subsidies with investment subsidies. The crucial point of departure from earlier investigations of MES-schemes has been the introduction of adjustment costs with respect to labor. Two different institutional settings have been considered, a fixwage regime and a flexwage regime.

In both cases the basic message that comes out of the analyses is: A rising subsidy leads to a higher equilibrium level of employment. A firm being on a growth-path towards a specific stationary equilibrium will--when the subsidy is increased--switch to a new path aiming at a higher equilibrium level. This change implies an instantaneous increase in hirings and--when wages are flexible--an instantaneous increase in wages. If the firm is on a contractive path, it will analogously switch to a less contractive path, provided that the scheme is taxing employment reductions in the same way as it is subsidizing employment growth. The employment creation is reinforced by the rate of interest and--in the flexwage regime--the wage elasticity of labor supply.

The analyses also illuminate how changes in subsidy thresholds affect equilibrium employment levels. A lower threshold has unambiguously positive employment effects. It might, however, be the case that a higher subsidy will reduce stationary employment, provided that the threshold is high enough.

A number of questions have been left out of focus of the present paper. Among them are: How are MES-schemes affecting the incentives for labor hoarding and inventory building? How are MES-schemes influencing price formation if we e.g. assume that the firm is acting as a temporary monopolist in the goods market as well as a temporary monopsonist in the labor market? Which are then the implications for inflation and unemployment in the aggregate?

Some heuristic remarks will be given to the last problem. A question to be answered could then be phrased like this: Assume that the natural rate hypothesis is valid -- would we then expect a MES-scheme to have any effect on the natural rate? Consider again the types of adjustment costs in focus of the present paper. We have analyzed them as polar cases, thus disregarding the probably more realistic case when the firm responds to a higher subsidy by adjusting its wage choice as well as its non-wage recruitment efforts. The latter response will mean increased search in the labor market, thereby enhancing the unemployed worker's probability of getting a wage offer. Job search models have, however, generally ambiguous implications for unemployment effects of increased production of information in the labor market. This inconclusiveness hinges upon the offsetting reservation wage effect resulting from increased job availability. The empirical studies, on the other hand, are more decisive in their messages; job availability seems to be the most important determinant of the duration of unemployment, whereas unexpected inflation plays a fairly marginal role.[1] Taking this empirical information into account, complete policy pessimism concerning MES-programmes seems unwarranted. A more reasonable standpoint would be to expect some effects on the natural rate, provided that the MES-schemes give rise to more intensive recruitment efforts on part of the firms. Accepting the notion of some "natural" rate of unemployment, consistent with stochastic equilibrium in the labor market, does not invalidate the case for selective employment policies.

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[1] Barron (1975), Axelsson and Löfgren (1977), and Björklund and Holmlund (1981).

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Part IV
Applications

Targeted Wage Subsidies: Their Rationale and Effectiveness

John Bishop and Robert Haveman

INTRODUCTION

Official and unofficial estimates of the level and expected growth of potential GNP for the U.S. have recently been revised downward; the primary bases for this are a definition of the full-employment/unemployment rate and a reduction in the growth of labor productivity (Economic Report of the President, 1977; Perry, 1977). The 3.2% change in GNP per percentage point change in the unemployment rate that is implicit in Okun's law has been revised downward to the 2.1-3.1 range (Clark and Freeman, 1977; Perry, 1977). These indications of structural changes in labor markets reinforce statistics that indicate excessively high and sticky unemployment rates among youths and blacks, the increasing labor force participation of women, and the decreasing labor force participation of men. Policymakers apparently perceive the problem similarly. In both the United States and Western Europe, targeted employment subsidy programs have been enacted to combat recent unemployment and to offset the structural rigidities of the labor market by focusing on employment stimulus on workers that are currently in excess supply. Wage (or employment) subsidies and direct public service employment (PSE), the primary measures undertaken, have appeared in various guises. The first can involve a subsidy aid to (1) recruitment (additional hires), (2) the employment stock, or (3) changes in the employment stock. Each of these subsidies can be targeted on particular types of labor (say, by age, sex region, unemployment duration, or education), or it can be general in nature. Moreover, the subsidy can be a flat amount, or it can vary with the level of earnings, the wage rate, or the duration of coverage. It can be paid to either the employer or the worker, and can be paid directly or via a tax credit. Similarly, direct PSE (which is, in effect, a 100% wage subsidy) can vary by the degree of selectivity, the level of government, and the output produced.

Examples of several of these variants have been recently implemented (Haveman and Christiansen, 1978). The New Jobs Tax Credit in the United States, for example, is a constrained marginal-stock subsidy with no targeting. It provides, for 1977-78, a tax credit, equal to 50% of the unemployment insurance tax base ($4,200), for the first 47 hires in a firm above 102% of the previous year's employment level. In contrast, the British Temporary Employment Subsidy of 1975 is a reverse recruitment rather than a stock subsidy, and like the New Jobs Tax Credit, it is temporary and nontargeted. This program subsidizes about 30% of the wage costs, for up to one year, of workers who would otherwise be laid off. In 1974, the West German government introduced a temporary, targeted, recruitment subsidy with a marginal-stock constraint. For six months a wage subsidy of 60% was paid to firms in specified regions for employing registered unemployed workers, provided that firm employment increased from its level at a stipulated date prior to passage of the act.

The Netherlands, France, and Sweden have also recently adopted targeted employment subsidies. In the Netherlands, for example, six months subsidization of 30% of the wage costs of long-term unemployed workers hired is provided; the duration is extended to one year if the worker hired is over 45 years old. The French program is similar, except that the target group is extended to include youths and first-time job seekers. The Swedish program subsidizes, for six months, about 50% of the wage costs of workers threatened with unemployment, provided the firm retains them and places them in some form of training program. For those countries mentioned, the percentage of the labor force on which wage subsidies are paid varies from about .3% of the labor force (West Germany) to 3-4% in Sweden. In 1978, the New Jobs Tax Credit (NJTC) applied to the employment of nearly 1% of the U.S. labor force at a total budget cost of at least $2 billion.

Few reliable evaluations have been made of these targeted employment subsidies, but the numerous extensions of what were to be temporary programs suggest that they have not been viewed as failures in achieving their primary objective-employment increases. Indeed, in the United States, the imminent lapse of the NJTC prompted a number of alternative proposals. Congress has substituted for NJTC a Targeted Jobs Credit that for certain hard to employ workers would subsidize firms for 50% of the first $6,000 of wages paid during the first year of employment to all low-income workers and 25% for the second year of employment.

This paper evaluates these programs from two contrasting perspectives: a macro perspective applied to the general class of programs and a micro perspective applied to a specific program. In the first half of this paper we present the macroeconomic rationale for targeted employment subsidies and examine how macroeconomic relationships like Okun's Law will change if they are successful. If these measures are to be successful, firms must respond to these subsidies by trying to increase employment. Evidence on the existence and magnitude of firm response to a specific program, the New Jobs Tax Credit, is presented in the second half of the paper.[1]

1. THE MACROECONOMIC RATIONALE

The economic rationale of targeted employment subsidies is straigthforward: by reducing the price of labor at the margin, employment can be encouraged and unemployment reduced. Such subsidies lower the costs to producers of expanding output, and could be expected to weaken pressure for price increases. Subsidies of newly hired workers or of increases in the number of employees tend to benefit new businesses more than existing ones; encouragement of such businesses would further weaken upward price pressure. For all of these reasons, targeted employment subsidies will tend to be expansionary. A temporary employment subsidy encourages firms to hire workers and incur labor costs earlier than they would otherwise; as a result

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[1] The first half of the paper was jointly written by John Bishop and Robert Haveman. The study of NJTC reported in the second half of the paper was done by John Bishop.

inventory will be accumulated faster and maintenance and investment spending will tend to accelerate. Permanent, targeted programs will tend to induce the substitution of workers in the target groups for those who are not and for capital. Econometric studies of the demand for specific categories of labor have found firms to be quite responsive to changes in relative wages (Hamermesh and Grant, 1978).

Experience with the WIN tax credit, however, suggests that a small subsidy that imposes substantial administrative and surveillance costs on firms will not create many new jobs for its target group. Nontargeted wage subsidies administered through the tax system seem to produce larger responses. Three separate studies using different data sets have found evidence supporting the hypothesis of major employment responses to the NJTC (Bishop, 1978; National Federal of Independent Business; Perloff and Wachter, 1978).

Normally, as the economy comes out of a recession GNP grows much faster than employment. Economic theory, however, predicts that a nontargeted wage subsidy should cause the substitution of labor for other factors of production. When such a subsidy like NJTC is put into operation, it should, therefore, raise the growth rate of employment above the growth rate of output. This is exactly what has been happening for the last year or so. Between the second quarters of 1977 and 1978, the growth rate of construction put in place was 4.5% while the growth rate of construction employment was 8.2-9.9% and of construction manhours was 10.4%. Even in retailing, where cyclical increases in sales are typically handled without hiring extra workers, employment growth--3.4% in household data and 4.0% in establishment data--outpaced the 3.0% growth of deflated retail sales that economic theory predicts. It is so unusual for a cyclical expansion to produce faster employment growth than output growth that the event must be considered to be strong evidence that NJTC is having a major impact.

Evaluation of employment subsidy programs must be based on their net job creation impact, which can be defined as the employment level in the economy with the policy less that without it. Clearly, the net job creation impact is likely to be smaller than the gross number of workers subsidized, because (1) the output produced by the workers subsidized competes with output produced by non-target-group workers, (2) the financing of the program entails increased taxes or borrowing, which tend to reduce demands elsewhere in the economy, and (3) some of the subsidized workers would have been working even in the absence of the subsidy. This is, of course, true of all alternatives to a targeted employment subsidy program, including the general expansion of aggregate demand to which employment subsidies are being compared in this paper. The ratio of net to gross job creation is an indicator of how much displacement is occurring; it can only be estimated in the context of a fully specified, general equilibrium model. At a minimum, such a model must be able to estimate the degree to which the categorical subsidy results simultaneously in an increase in potential GNP and in a reduction in the gap between potential and actual GNP; it must also estimate the effect of the subsidy on the distribution of wages and employment opportunities. We shall deal with each of these.

If an employment subsidy program is targeted on groups of workers in excess supply or on groups which will readily enter the labor market if the wage they can earn goes up, GNP will rise without causing inflation to worsen. An employment subsidy program targeted on handicapped workers, transfer program recipients, and low-income youth would seem to meet this test, as large numbers of these workers are unemployed because of labor market rigidities (e.g. legal and conventional minimum wages). Hence, substantial employment increases could occur without upward wage pressure and both actual and potential GNP would increase. Econometric work suggests that these target groups do in fact respond easily to changes in the demand for labor. A wage subsidy on their employment, paid for by a tax on other workers, would most likely raise the potential level of GNP which the economy could attain without inducing inflation.

The benefits of expanding potential GNP in this manner are increased by the fact that the labor supply decisions of targeted groups are distorted by high employer and employee taxes on labor income and by even higher benefit reduction rates in welfare and other transfer programs. Because these distortions tend to reduce the work effort of people who would otherwise prefer to work, employment increases induced by employment subsidies will increase GNP without causing any serious loss in highly valued leisure. Moreover, the increase in tax revenues and decrease in transfer costs that a categorical employment subsidy should produce reduce the net budgetary cost of the program and benefit other taxpayers. Even if the cost were equal, the public seems to prefer to help people by giving them a job rather than a handout. This suggests the public receives direct psychological benefits from substituting a job for welfare dependency.

A subsidy of one of the major costs of doing business will exercise downward pressure on prices during the transition to a new price level. The study of monthly changes in retail prices presented in the final section suggests that the NJTC has had such an effect. The coefficients imply that nonfood commodity retail prices were 2 percentage points lower in June 1978 than they would have been. While wholesale prices on nonfood consumer finished goods were rising 6.56% between May 1977 and June 1978, the retail prices for these products rose 4.73%. Either the distribution sector has suffered a major compression in its margin, or manufacturing firms have been discounting below wholesale list prices, or both. Since the NJTC is temporary, it is reasonable to expect any price impacts it may have to appear as discounts from list prices rather than as reductions on list prices.

A one-shot reduction in the price level will produce long-lasting reductions in the rate of inflation only if there is substantial backward looking feedback of price inflation into wage inflation (Gramlich, 1978). Perry (1978) provides some evidence that wage determination is of this backward looking catch up variety. Lagged price and wage changes are so highly correlated, however, that it is very hard to tell whether inflationary momentum is primarily a case of wages chasing wages, or of wages chasing prices. The model in which lagged changes in wages and lagged changes in prices compete with each other (Perry, p. 277) implies that both have an effect, but that inflationary momentum is primarily a case of wages chasing wages. When a once-and-for-all 1 percentage point reduction in the price level is simulated in this equation, the reductions in wage and price increases in the following six years are .21, .15, .126, .103, .034, and .068 percentage points.

The direct and indirect effects of employment subsidies on the price level just described do not exhaust the effects of an employment incentive on inflation. A subsidy of wages may cause an increase in the wage rates of industries that employ large numbers of targeted workers. If other industries attempt to reestablish historic differentials, this stimulus may increase the momentum of the wage increases. The rise in unit costs that this stimulates will result in higher prices.

In addition to their effects on actual and potential GNP and on prices, categorical employment subsidies will tend to shift the composition of employment and earnings toward low-skill target group workers. If more equal distribution of the adverse effects of poor economic performance is desired, this is a major benefit of categorical employment subsidies. One consequence of this redistribution is that, even with a constant GNP, the number of employed persons will increase as low-productivity workers are substituted for those with greater skills.

Given the nature of their design, targeted employment subsidies can also alter the composition of employment patterns, across the work force, whether one measures by hours worked per week or by weeks worked per year. The demand for part-time relative to full-time workers can be encouraged. Similarly, the use of part-year rather than full-year workers can be encouraged. Those who prefer such work patterns are likely to find expanded employment opportunities--women, youths, and older workers in particular are well represented in such groups. On the demand side, such compositional effects can be achieved by targeted employment subsidies both through the design of the payments structure (in altering the mix of preferred hours among employers) and by targeting the subsidy on specific production sectors of the economy. On the supply side, such subsidy programs could provide different subsidy rates to different groups (e.g. the disabled), evoking differential labor supply responses.

The macroeconomic relationships between changes in GNP, the GNP gap, and the unemployment rate will be altered by these effects of a targeted employment subsidy which both stimulates and redistributes employment. In standard treatments, policy-induced increases in aggregate demand are viewed as closing the gap by increasing actual GNP toward some exogenously determined potential GNP. As indicated above, however, the effect of a targeted employment subsidy is simultaneously to increase both actual and potential GNP. The shift in true potential induced by SESP will not be captured in measured potential, however, so a wage subsidy-induced increase in GNP will reduce the measured GNP gap by more than it reduces the true gap.

Similarly, targeted employment subsidies also alters the relationship between the measured GNP gap and the unemployment rate. A targeted employment subsidy-induced increase in GNP will be associated with a larger increase (decrease) in employing (unemployment) than is typically associated with changes in GNP induced by general aggregate demand, and the rate of productivity increase, as conventionally measured, will fall.

Consider the following accounting relationship, in which (GNP, productivity (A), employed capital (K), hours worked per week (H), labor force participation rate (L), are all measured as percentage rates of change:

$$d\ GNP = dA + (1-\kappa)_L dK + \kappa_L(dH + S_n dL - S_n dU),$$

where U = -100 log (Emp/Lab. Force) ≈ the unemployment rate, κ_L is the share of labor, and S_n is the ratio of the skill level of newly employed workers to the economy-wide average. Okun's Law, a reduced form of (1), states that a 1 percentage point cyclical change in U is associated with a 3.2% change in GNP. Although a percentage point decrease in U is directly associated in (1) with an increase in GNP equal to $\kappa_L S_n$ (approximately .7%), cyclical changes in other determinants of GNP--namely, L, H, K, and A, the partial derivative of each of these variables with respect to U is negative. It is the sum of these effects that makes up the difference between .7 and 3.2.

Because of the characteristics of targeted employment subsidies, there are at least three reasons why a 1 percentage point changes in U induced by, say, a targeted marginal stock employment subsidy is not likely to increase GNP by 3.2%. First, subsidy-induced reduction of U will shift the composition of employment toward low-skill workers (i.e. those with $S_n < 1$). Indeed, the very purpose of such a subsidy is to encourage firms to employ and to train workers whom they would otherwise find it unprofitable to hire. The inevitable result of such substitution is to reduce measured productivity, at least in the short run. And although the training and work experience received by the employed workers will manifest itself in future increases in productivity, S_n and $|dA/dU|$ will fall as these costs are recorded in firm accountants.

Secondly, targeted employment subsidies encourage the hiring of part-time workers (especially, if the subsidy is paid on the first $N of earnings as has been the case in the United States) or the substitution of additional workers for increased overtime of existing workers. As a result, the response of H to changes in U will be smaller than otherwise--$|dH/dU|$ will fall.

Thirdly, to the extent that the unskilled labor is not complementary with capital services, the induced expansion in unskilled labor will be associated with a smaller rise in the rate of utilization of capital than in the case of an equivalent general demand stimulus--$|dK/dU|$ will fall.

Finally, because of the limited knowledge of behavioral responses, the effect of targeted subsidies on $|dL/dU|$ is unknown. On the one hand, a targeting designed to open employment opportunities for low-skilled workers, who currently form a high proportion of discouraged workers who are not longer actively seeking work. On the other, in the face of substantial measures unemployment of unskilled labor, targeted employment subsidies may not generate as large an increase in labor force participation as would an equivalent reduction in U stimulated by a general expansion in demand.

Thus, at least during the period of adjustment following the initiation of a well-designed, nontrivial targeted employment subsidy, Okun's Law is likely to be repealed. This repeal is a direct consequence of the fact that the primary objectives of the targeted employment subsidy are to increase employment and potential GNP and to distribute more fairly the costs of high unemployment, from whatever source; the objective is not to decrease the gap between actual and potential GNP. The reduction in the Okun multiplier that might be caused by a targeted employment subsidy would be evidence that the policy is having the effects desired.

2. THE IMPACT OF THE NEW JOBS TAX CREDIT

The economic impacts of a targeted employment subsidy which we have described will not materialize if firms fail to change their behavior in response to the subsidy. In some past programs, that response has not been substantial. Most employers that hire target group workers for whom a subsidy is available from the WIN or JOBS program neglected even to apply for the money (Hamermesh, 1977) apparently because of the paper work involved in applying for the subsidy. A further disadvantage of this approach seems to be that the subsidy adheres to specific individuals. Employers may feel that eligibility for the subsidy signals that the job applicant is likely to be a worker of low productivity--leading to the paradox that the programs may in fact lower the subsidized worker's chances of getting a good job.

An alternative approach is to subsidize employment generally. First proposed by Nicholas Kaldor in 1936, this approach has more recently been refined and analyzed by Fethke and Williamson (1977) and Kesselman, Williamson, and Berndt (1977). These analyses suggest that by paying the subsidy only for increases in employment over a threshold level based on a firm's past employment--that is, by designing a so-called marginal employment subsidy--it is possible to achieve rather large increases in employment at rather limited cost to the government.

This law provides businesses a tax credit against corporate or personal income tax liability for expansions in employment in 1977 or 1978.

> The credit is 50 percent of the increase in each employer's wage base under the Federal Unemployment Tax Act (FUTA) above 102 percent of that wage base in the previous year. The FUTA base for a year consists of wages paid up to $4,200 per employee.....

> The employer's deduction for wages is reduced by the amount of the credit. Therefore, although the maximum gross credit for each new employee is $2,100, the effective credit ranges from $1,806 (for a taxpayer in the 14-percent tax bracket) to $630 (for a taxpayer in the 70-percent bracket).
>
> The total amount of the credit has four limitations: (1) the credit cannot be more than 50 percent of the increase in total wages paid by the employer for the year above 105% of the previous year, (2) the credit must be no more than 25% of the current year's FUTA wages, (3) the credit for a year cannot exceed $100,000 and (4) the credit cannot exceed the taxpayer's tax liability. Credits which exceed tax liability for a year may be carried back for 3 years and carried forward for 7 years. (Joint Committee on Taxation, 1977)

The requirement that the total wages paid rise by at least 5% is designed to insure that the NJTC is based on actual increases in employment rather than artificial increases in unemployment insurance wages (for example, an employer could increase unemployment insurance wages by dividing full-time jobs into part-time or part-year jobs). The requirement that the credit not exceed 25% of FUTA wages limits the amount of credit that new and rapidly expanding businesses can receive. (An extra 10% subsidy of the first $4,200 for each worker is available for hiring handicapped workers, with no limit on the total amount of subsidy. This paper does not analyze the effects of the credit for the handicapped).

In this half of the paper we examine the effect of NJTC on employment demand and pricing policies in the construction, trucking, wholesaling, and retail sectors of the economy. Employing 22.7 million workers in 1976, these industries provided 26% of the nation's jobs and 27% of the hours worked by all persons engaged in production.

Time series studies of employment demand have neglected these industries, despite their importance and the availability of reasonably good monthly data on input and output prices, wages, employment, hours worked, and sales or output. Wages tend to be low: average earnings in the retail sector are two-thirds the national average; construction earnings are only slightly lower than that average, but vary greatly. A large share of the nation's low-earning workers is employed in these industries--in 1970 45% of teenagers, 21% of black males, and 23% of women.

Because the life of capital equipment is short and rates of labor turnover are high, the response of construction and distribution to changes in input prices induced by tax policy may be speedier than in the rest of the economy. NJTC places a $100,000 cap on the amount of subsidy each firm may receive, and one would expect the most noticeable response to it to occur in industries dominated by small and medium sized firms like construction and the distribution sector.

First we will describe what theory predicts firms should do when faced with a marginal wage subsidy of this kind. After a review of two other studies of NJTC, we proceed to a description of our estimating equations, our methods for testing hypotheses and then our results.

The Likely Impact of the NJTC

Key features of the NJTC are that it is (a) a fixed proportion of earnings up to a rather low maximum, (b) marginal and (c) temporary. Each of these features has important consequences. The first feature focuses the employment stimulus on low-wage, part-time, part-year workers, a group that currently suffers from very high unemployment rates. The second feature, that the subsidy is based on a threshold employment level defined by last year's employment, makes possible a high rate of subsidy at low cost to the treasury; it also restructures the relationship between the marginal and average costs of existing firms and between the average costs of new and existing firms. The third feature, that the subsidy expires at the end of 1978 and has an eligibility threshold that is updated each year to reflect last year's change in employment, tends to make it an "automatic destabilizer".

Employment

The first crucial feature of the NJTC is that it is paid on only the first $4,200 of earnings of each extra worker. Among full-time, full-year workers, therefore, the NJTC works to the advantage of low-wage workers because the proportionate subsidy of their wages is greater. The NJTC also tends to provide a proportionately larger subsidy of part-time and part-year workers, and should consequently stimulate part-time and temporary employment.

Since members of minority groups, women, and teenagers predominate in all three types of employment --low-wage, part-time, and part-year-- the NJTC should, as a consequence, target the employment stimulus on groups that currently experience very high rates of unemployment.

Price inflation

The impact of the marginal employment subsidy on the pricing policies of firms is of major importance. If the subsidy is immediately passed on to consumers, the employment stimulus will be larger because the lower price will cause an expansion in demand for real output. This once and for all reduction in the price of output will also temporarily reduce inflation. How large these effects will be depends on how firms set prices.

Tax incidence theory tells us that the size of the price reduction induced by the subsidy depends upon the nature of the market and the slopes of the demand and supply curves. If industry demand is defined as $P_d = B + bQ$, $b<0$, and the supply curve as $P_s = A + \alpha Q + S$, $\alpha>0$, $S<0$, the impact of a subsidy (S) on price in a competitive industry is $dP/dS = b/b-\alpha$. An industry's long-run supply curve depends on the average costs of production of new entrants and the incremental total costs of expansion by existing firms. If there are no factors specific to the industry (i.e., the price of factors supplied to the industry does not depend on that industry's output), the long-run supply curve should be quite flat ($\alpha \approx 0$). Thus, except for agriculture and mining, dP/dS should be closer to 1 than to zero. In the long-run, shocks to demand should have only minor effects on price; and changes in costs of production will be passed on to the consumer almost completely. In the long-run, prices will behave as if they were set according to a standard markup on normal average costs.

Normal average cost pricing is also a popular theory of short-run pricing behavior and currently predominates in certain lines of econometric work on inflation (Nordhaus, 1974). For competitive industries like retailing and services, the basis for using this theory to predict short-term pricing behavior is that rates of entry and exit are very high and that, since most firms operate with substantial excess capacity, marginal costs do not increase as sales rise. For oligopolistic industries, in contrast, the primary theorethical justification for firms administratively setting prices according to a normal average cost rule is limit price theory. According to this theory, prices in an oligopolistic industry are set in order to forestall or minimize entry of new competitors into the industry. Prices are therefore, set below the average costs of new entrants and adjusted up or down as these costs change. To the extent that changes in the normal average costs of existing firms approximate changes in the costs of entry, normal average costs will be good predictors of short-term pricing behavior.

A permanent marginal employment subsidy with a fixed threshold changes the relationship between the average costs of existing firms and the average costs of new entrants. The fact that new firms receive a subsidy on all their workers rather than just a few will give them a cost advantage, even though the subsidy per worker is half the standard amount. Existing firms that choose to expand by bringing out a new product line or opening an establishment to serve a new market will also have a cost advantage over firms that are already serving that market. Such a marginal employment subsidy would cause the limit price that would otherwise forestall entry of a new firm to decline by substantially more than the average costs of existing firms.

New firms compete at a substantial disadvantage, because they lack an established reputation with customers, have inexperienced managers, and need to start from scratch in recruiting and training a labor force. The advantages that a permanent marginal employment subsidy would give new firms are not likely to outweigh these disadvantages completely. When the costs of energy, materials, and capital are included, the cost advantage (at current levels) is only 2% in manufacturing, 1.5% in retailing, and 3-4% in services. Relative to the current environment, however, it could be expected to provide an important stimulus to the formation of new firms and the expansion of small ones.

A permanent marginal employment subsidy with a fixed threshold and no upper limit on the subsidy per firm might, therefore, reduce prices by more than it reduces the average costs of existing firms. It is somewhat more difficult to predict however, whether the temporary and constrained New Jobs Tax Credit of the 1977 Tax Reduction and Simplification Act will have a substantial impact on prices.

The $100,000 maximum on the credit offered any one firm limits the size of the subsidized expansion to 48 workers for existing firms and 96 for new firms. The expiration date means that a new firm cannot plan on receiving a subsidy for more than the first two years (i.e., for a maximum of 192 workers). As a result, the credit will be of only minor help to entrants into industries with scale economies that require firms to employ many more than that. Almost 50% of all private wage and salary workers are in firms that employ more than 500 workers. In many cases, however, the large firms compete directly with small firms in certain segments of their business. The NJTC should be more effective in such situations. Computer software, auto parts manufacture, and steel wholesaling and fabrication are examples of this type of industry. In these markets the cost advantage of small but growing firms is likely to produce a major reduction in prices and reduce the larger firms' share of the market.

The fact that permanent increases in employment receive an NJTC subsidy only in the first year also lowers the impact of the subsidy on average costs of production over a 10-year horizon. This feature will limit the credit's effect in lowering the entry-forestalling price. It also means, however, that the potential entrant can be sure he will get the credit even if his attempt at entry fails. If he fails to make profits, the credit (which can be carried forward for 7 years) is still worth something to potential purchasers of the business.

The Hypotheses

The list of ways in which the NJTC may be changing firm behavior is quite long.

In the empirical work of this chapter, however, only three hypotheses will be examined:

(1) Employment will rise
(2) Hours worked per week will fall
(3) Prices will fall.

Behavior will change only if the firm is aware of the subsidy and can increase its tax credit by increasing employment. Small firms tend to be unaware of the credit (only 30% of firms with 1-10 employees had heard of it by February 1978). Firms with over 2,000 employees will generally have hit the $100,000 cap without having to change their behavior. Consequently industries dominated by medium-sized firms should respond more than industries composed wholly of either small or large firms.

The study reported in this chapter uses aggregate time series data on three industries where response is likely to be large --construction, retailing, and wholesaling-- to test for an effect of NJTC.

Specification

In a world of perfect information, no inventory, and zero adjustment costs, a firm would be able to achieve an ideal level of employment and scheduled hours of work per week that would be solely a function of the current level of sales and of the prices of output and each input. In a world of imperfect information, inventory holding, and adjustment costs, the firm's optimal employment and hours in period t depends upon the realized level of employment in period t-1 and upon anticipated levels of sales and input prices in both current and future periods.

$$E_t = f(S^e, \frac{W^e}{P^e}, \frac{Q^e}{P^e}, E_{t-1}) \qquad (2)$$

S, W, P, and Q denote sales, wages, output prices, and input prices respectively, and the e superscript denotes a vector of anticipations of future values, based on all information available up to time t.

When the observable lagged values of S, W, P, and Q are used in an estimating equation, lag distributions will vary, not only because adjustments to different stimuli take different amounts of time but also because the expectation formation process for each variable will have different lag structures.

Since the information set used to predict future values of a particular variable may include other variables in the model, coefficients on lagged values of sales or wages may not follow a regular pattern. The primary objective of this study is to obtain unbiased measures of NJTC's impact on employment and prices. Imposing regularity conditions on the lag structure might bias our estimates of the NJTC's effect. Consequently, estimating techniques are employed that produce free estimates of the lag structure.

Since E_{t-1}, E_{t-2}..., etc., are themselves a function of lagged values of S, W, P and Q, we may substitute the lagged dependent variable out of the equation. Since expectations about P may be formed very differently from expectations about W and Q, the most general way to write our equation in terms of observable, contemporaneous, and lagged values is

$$E_t = f(\underline{S}, \underline{W}, \underline{P}, \underline{Q})_e u_t, \tag{3}$$

The bar denotes a vector containing current and lagged values of the variable.

Econometric studies of labor demand often estimate their models under some rather strong maintained hypotheses, many of which have recently received severe criticism. Clark and Freeman (1977) using aggregate data for manufacturing have tested and rejected the hypothesis that the real price of capital has an impact on employment demand that is equal and opposite to the effect of real wages. Constraints requiring identical lag structures across variables have also been found to be inconsistent with the data (Sims, 1972, 1974; Clark and Freeman, 1977).

Estimates of systems of demand equations that have included materials and energy inputs typically reject the weak separability of materials and energy from capital and labor (Berndt and Wood, 1975; Gollop, 1974). This rejection implies that the correct specification of a labor demand function contains the prices of materials and energy. Since the prices of materials may be correlated with the cost of capital or wage rates, estimates of labor demand functions derived from a value-added production specification are likely to be biased.

A number of other potentially troublesome maintained hypotheses, relating to the exogeneity of industry sales and wage rates in regressions predicting employment, will be tested. Sims has shown that, under fairly general conditions, a test of the hypothesis that coefficients on future values of the wage rate or on sales are all zero can be regarded as a test of the hypothesis that the equation is in fact structural. Rejection of this hypothesis will be taken as evidence for simultaneity, and the equation will be reestimated using two-stage least squares. Potential exogeneity problems with the price of output are eliminated by treating P as a function of nominal input prices and solving P out of the model.

Our models were estimated under two alternative sets of maintained hypotheses. The relative wage model assumes that the information set used in generating expectations about future input price ratios is limited to current and lagged information about input price ratios. This specification implies that a simultaneous 5% increase in all input prices will leave current and all future employment levels unchanged. Although the tests for exogeneity that were applied to this model were rejected for some industries, there was no attempt to apply 2 SLS using this model, because to do so would have involved simultaneously instrumenting all input prices.

The second, somewhat more general, specification is the nominal input price model. Using nominal input prices rather than price ratios as regressors means that we are dropping the assumption that the information set is limited to input price ratios. Firms are certainly aware of the history of nominal prices. Rational behavior implies that expectation formation take into account the noise-to-signal ratio of a series, and this, in turn, implies that the time pattern of response to each nominal input price should be estimated separately. In this model we choose not to impose the constraint that the coefficients on input prices sum to zero, because errors in measurement of the rental price of capital and of price indexes for consumable materials and business services are likely to be larger than errors in measurement of wholesale prices and wage rates (especially in the disaggregated retail industry models). Imposing this constraint would increase the transmission of a bias arising from an error in variables to the wage coefficients. (Clark and Freeman, 1977, demonstrate this for simple cases). If we are wrong, and the constraint should have been imposed, we lose efficiency only.

Since our primary purpose here is to provide a powerful test of the effects of the NJTC, the specification of this variable is important. The effect of the tax credit is likely to be very different from the effect of an equivalent change in the wage rate. The NJTC is capped, temporary, and marginal; it requires that the firm has tax liability if it is to receive benefits. In February 1978, more than half of all firms were unaware the credit existed and many of those that had heard of it wrongly thought themselves to be ineligible.

In February 1978, a Census Bureau survey asked a large sample of firms whether they had heard of the tax credit and if so, when they had heard of it. Large firms were much more likely to have heard of the credit and to have heard of it immediately after its passage in May 1977. Using the distributions of retailing firms into categories on the basis of the number of their employees in the 1972 Enterprise Statistics, we estimated the proportion of retail employees in firms that knew about the credit for each month of 1977 and 1978. (Firms employing more than a thousand workers were excluded from this calculation).

It was assumed that once a firm knows about the credit its response to the credit will be distributed over the following six months. The NJTC variable is, therefore, an average over the past six months of the proportion of firms (weighted by employees) that knew about the credit. The firms that reported hearing of the credit before it was passed were assumed to have waited until passage before responding. Defining the NJTC variable in this way means that, although the House passed a bill with the credit in early March, we are assuming that anticipation of that credit was not responsible for any part of the spring 1977 upswing in employment.

The NJTC variable had a value of .057 in June 1977, and rises at an average rate of .424 per month. By March 1978 it had achieved the value of .435. In June 1978 its value was .572. Multiplying the coefficient on NJTC by .435 provides our estimate of the credit on the March 1978 value of a dependent variable.

Note that this specification implies an assumption that almost the entire impact of the credit on the average level of employment will occur in 1978 rather than 1977, although in fact, it might have had important impacts on the level of employment in November and December 1977.

Results for the Employment Models

Relative input price model regressions using three-year distributed lags on sales, wages, the rental on capital, and materials input prices are presented in Table 2. Corresponding nominal input price model regressions are presented in Table 4. The two-stage least squares results for construction and retail aggregates are presented in Table 5. All the results reported are for models estimated with data transformed to correct for serial correlation of residuals. The estimate of $\hat{\rho}$ used to correct the data is presented in the second to last column of the tables. The Durbin Watson statistic is for the regression using the transformed data and is therefore a test for second-order serial correlation of the residuals.

For the construction industry, the output variable is construction put in place, deflated by an interpolated NIA deflator for structures. For the retail industry, aggregate output is defined as retail sales, deflated by the consumer price index (CPI) for commodities. Industry-specific output measures for the disaggregated segments of the retail industry are retail sales for that segment of the industry deflated by the appropriate components of the CPI. For trucking, the output variable is a seasonally adjusted index of the volume of general freight hauled by Class I and II common carriers of property. For wholesaling, we use the sales of merchant wholesalers deflated by the CPI for commodities. For trucking and wholesaling, only partial coverage of the industries is provided by these indices, and the data on employment and hours are obtained from separate samples of firms than are the data on retail or wholesale sales. When industry subaggregates are being used, sampling error in the industry-specific sales variable can become a serious problem. All of the disaggregated runs, therefore, contain the additional scale variable of current and lagged total retail sales. The impact of changes in wage rates and other input prices on employment is presented in columns 2 through 7 of these tables.

Our focus is on the NJTC variable, however. Most of the coefficients are positive. In the relative input price model, we may reject at the .05 level or better the hypothesis that NJTC has had zero or negative effects on employment for the following industries: construction and the industry subaggregates for apparel, food, furniture, and other retailing. In the nominal input price model, statistically significant, positive coefficients on the NJTC variables are obtained in the 2SLS result for construction and retailing establishment data aggregates. In the OLS results, statistically significant, positive coefficients are obtained for eating and drinking places and for other retailing. Tables 3 and 6 summarize the sensitivity of the NJTC coefficient to reductions in the length of the lags on all variables. At the bottom of these tables we sum the effects implied by each industry equation across industries, to obtain for March 1978 a total effect for the industries studied. For the relative wage model, the estimates of employment stimulus are 470,000 for the preferred 3-year lag. In the nominal input price model of Table 6, estimates of employment stimulus range between 225,000 and 580,000. During this period employment rose 1,140,000 in these industries and roughly 3,800,000 in the nation as a whole. These results are consistent with the observation that between 1977:II and 1978:II rates of employment growth in both construction and retailing have substantially exceeded the rates of output growth. For example, while the growth rate of construction put in place was 4.5% over this period, the growth rate of employment was 8.2-9.9% and that of manhours was 10.4%. Even in retailing, where cyclical increases in sales are typically handled without hiring extra workers, employment growth--3,4% in household data and 4.0% in establishment data--outpaced the 3.0% growth of deflated retail sales.

Hours. Table 7 presents coefficients on NJTC in regressions predicting the lag of hours worked per week. Coefficients are consistently negative in retailing. Statistically significant negative coefficients are obtained for the retail aggregate and for food, furniture, and general merchandising.

The coefficient in the construction hours equation may be biased by simultaneity. The manhours 2SLS regression reported in Table 5 has a considerably smaller coefficient than the corresponding employment equation. When one takes into account the reduction in average hours worked per week the New Jobs Tax Credit seems to be producing in the retail sector, the percentage increase in manhours worked is likely to be only half the percentage increase in employment.

Results in the Retail Price Models

In competitive industries like those studied, reduced marginal costs imply reduced prices. To test this relationship, the monthly rate of change of the retail price was regressed on current and lagged changes in a number of industry cost variables--wage rates, wholesale price of the product, the price of materials, services, and energy consumed by the distribution sector, the rental price of capital, and excise taxes--the unemployment rate, seasonal dummies, and trends on the seasonal dummies. Tables 8 and 9 present the coefficients on the first difference of the NJTC variable described above. For nonfood commodities and restaurant meals, the retail trade margin is negatively and significantly related to the timing of NJTC knowledge. Between May 1977 and June 1978 nonfood commodity retail prices rose 4.73% while wholesale prices of nonfood, consumer finished goods were rising 6.56%. This discrepancy of 1.83 percentage points is quite close to the NJTC effect of 2.2% (.038 × .572 × 100) estimated by the preferred model (column 1). The observed decline in the margin is particularly surprising given recent increases in the relative price of imported consumer goods. (Imported products, it should be noted, are included in retail but not wholesale price indexes).

The payroll of the distribution sector is less than 20% of the retail price of the commodities sold to consumers. Only in the restaurant and tavern industry does payroll approach 30%. Consequently, there is only a limited amount of room for reductions in prices in response to a subsidy of payroll costs.

Among the subsectors, the pattern of coefficients is consistent with a priori expectations. For example, the large negative NJTC coefficients in the restaurant industry equation suggest that in this low-skill, intensive sector the 8-12% policy-induced reduction in marginal costs resulted in a 1.1% decline in output price during the 12-month period. Estimates for moderatly wage-intensive retail industries (apparel, furniture) indicate that the 5-7% reduction in marginal costs induced here is associated with a smaller .5% reduction in prices over the period. In contrast, the small-margin, non-wage-intensive retail food industry has a nonsignificant positive coefficient, reflecting the fact that incremental employment in this sector tends to contribute more to the quality than to the volume of output.

The final rows of Table 9 indicate the reduction of consumer costs due to NJTC-induced compression of the distribution margin implied by the equations. The cost savings of \$1.9-\$3.6 billion can be compared with the expected 1977 credit claim of \$1.5-\$2.0 billion and the expected 1978 claim of \$2.0-\$3.5 billion.

Caveats and Conclusions

These estimates, it should be noted, measure the impact of NJTC on that sector of the economy in which the largest response is expected. While it is possible that across-industry displacements might result in NJTC reducing employment and raising prices in industries not studied, this result would be surprising. Further, while limited awareness of the existence of NJTC may have reduced its measured effectiveness, a permanent credit may not have as large an effect as a temporary program. A permanent credit would not induce firms to build up inventories, as NJTC may be doing. If, in a permanent marginal NJTC, the threshold of eligibility were revised periodically to reflect more recent employment experience, raising current employment would reduce the future expected subsidy, thus inducing a smaller response.

No set of estimates based on the first 12 months of experience with a program can be conclusive. Perhaps the NJTC variable is capturing other exogenous forces that are inducing contemporaneous employment increases and price decreases in the sectors studied. And, if that is the case, perhaps improved specifications would reduce the impacts attributed here to NJTC. Longer or shorter lags, adding the price of energy, or assuming a once-and-for-all shift in the relationship during 1974, do not, however, cause major reductions in the NJTC coefficients. There may, nevertheless, be other factors at work, and the conclusion that the NJTC is having major effects on employment and prices must remain tentative until better data on more periods of observation becomes available. These estimates, it should be emphasized, are based on procedure that is more robust with respect to assumptions about the impact of taxation changes than are those used to estimate the response of investment spending to taxation changes. The procedure in most investment studies is to imbed a multiplicity of tax provisions in a single variable for the rental cost of capital, and to base statements about the effect of specific tax provisions on the magnitude and significance of this variable. Such analyses are joint tests of the effect of current and expected capital goods prices, financial market conditions, tax provisions, and the validity of the formula, and not of the policy change alone.

Table 1. The History of the Tax Treatment of Capital and Labor Income and of Relative Input Prices

	No tax	1950.01	1955.01	1960.01	1965.01	1972.01	1975.01	1978.03
		Year: Month						
Present value of deprec. deduct.								
1. Structures		.287	.445	.508	.508	.508	.508	.508
2. Retail equipment		.417	.580	.644	.698	.720	.720	.720
3. Trucks		.799	.849	.849	.908	.951	.951	.951
Implicit rental cost	No tax							
4. Structures-corporate	.094	.161	.170	.164	.159	.158	.158	.158
5. Equipment-corporate	.207	.278	.288	.288	.245	.235	.235	.224
6. Equipment-proprietorship	.207	.237	.237	.245	.222	.224	.221	.213
7. Trucks-corporate	.37	.439	.447	.447	.398	.382	.382	.373
Log ratio of retail wage to								
8. Wholesale price of cons.fin.goods		0	.157	.329	.505	.731	.612	.703
9. Price of business serv. and materials		0	.128	.261	.415	.591	.501	.533
10. Price of capital goods		0	.042	.058	.136	.211	.176	.206
11. Rental cost of capital		0	.155	.217	.497	.717	.657	.747
12. Nominal compensation in retail		1.00	1.294	1.619	1.953	2.967	3.672	4.701
13. Marginal tax rate on compensation of low wage labor		.169	.216	.238	.282	.290	.322	.329 (-.171)

Table 2. Equations Predicting Employment: Relative Wage Model[a]

	ETC	Wage 10	Wage 1 Yr	Wage 2 Yr	Wage Total	Other Inputs	Capital Rental Rate	Capital Price	Sales 10	Sales 1 Yr	Ind Sales 3 Yr	Total Ret. Sales 3 Yr	Σ_e	ρ	D.W.
Retail and Wholesale HH Data	.094 (.055)	.176	.102	-.631	-.420	---	.595	-.581	.230	.667	1.153	---	.0117	.62	2.02
	.068 (.041)	-.199	-.430	-.482	-.295	.574	.307	-.507	.288	.626	.897	---	.0117	.50	1.76
Retail Established Data	.048* (.026)	.150	.127	-.187	-.232	---	.165	-.367	.273	.563	1.013	---	.0041	.78	2.08
	.045* (.028)	.074	.097	-.229	-.488	.313	.157	-.371	.264	.558	.995	---	.0040	.78	2.15
Eating and drinking (64-78:03)	-.025 (.06)	-.087	-1.310	-2.63	-3.10	3.88	.873	-1.948	.158	.693	-1.316	2.532	.005	.15	1.809
Apparel (52-78:03)	.0125** (.064)	-.202	.62	.182	-.162	-.0196	.330	-.660	.329	.514	.6034	.682	.013	.27	2.03
Other retail (61-78:03)	.0727** (.0266)	.014	-.223	-.148	-.038	-1.124	.296	0	.253	.481	.091	.815	.003	.42	1.602
Food (61-78:03)	.112** (.037)	-.134	.064	.076	-.707	-.6903	-.177	0	.213	.659	-.035	.998	.005	.45	1.602
General merchandise (52-78:03)	-.054 (.0417)	-.221	-.288	-.355	-.28	-.796	.339	0	.403	.658	.909	.141	.0089	.41	1.92
Furniture (61-78:03)	.122** (.026)	.167	.084	-.412	-.488	-.315	.702	.568	.1624	.37	.597	-.23	.003	.28	1.89
Wholesale (52-78:03)	.007 (.021)	-.088	-.149	-.417	-.296	.346	-.228	-.445	.126	.303	-.019	.275	.0031	.715	1.51
Construction est. (52-78:03)	.230** (.082)	-.283	-.128	-.321	.285	.224	-.674	---	.254	.355	.176	0	.0154	.789	1.71

[a] All input prices are entered as ratios to the wage. This imposes the constraint that an equal percentage change in all input prices leaves employment levels in all future periods unchanged.

Significance levels ** .01
* .05

Table 3. The impact of the NJTC on employment under alternative specifications of the relative wage model

Industry	Time Period	Employment 1977 (000)	3 Yr Lag	2 Yr Lag	1.5 Yr Lag
Eating and drinking	61-78:03	3854	-.025	-.054	-.006
t-value			-.41	-1.08	-.19
(se)			(.0050)	(.0059)	(.0066)
Apparel	52-78:03	821	.0125	.028	.067
t-value			.20	.63	1.67
(se)			(.013)	(.013)	(.014)
Other retail	61-78:03	4021	.073	-.028	-.026
t-value			2.74	-1.24	-1.57
(se)			(.0029)	(.0035)	(.0041)
Food	61-78:03	2116	.112	.113	.184
t-value			3.04	3.44	5.25
(se)			(.0048)	(.0057)	(.0072)
General merchandise	52-78:03	2541	-.054	-.035	.051
t-value			-1.28	-.953	1.35
(se)			(.0089)	(.0094)	(.0107)
Furniture	61-78:03	551	.122	-.024	-.018
t-value			4.73	-1.47	-1.14
(se)			(.0031)	(.0045)	(.005)
Wholesale	52-78:03	4389	-.012	-.014	.045
t-value			-.54	-.68	2.20
(se)			(.0032)	(.0033)	(.0037)
Trucking	61-78:03	1131	-.224	.251	.213
t-value			.070	4.73	4.49
(se)			(.0063)	(.0091)	(.0110)
Constr. est.	52-78:03	3844	.230		
t-value			2.81		
(se)			(.0154)		
Increase in employment by March 1978 (000)		474			

Note: The standard error of the coefficient and the regression are located beneath the coefficient.

Table 4. Employment in Construction and Distribution Industries[a]

	ETC	Hourly Compensation in Nominal Terms 1 Q	1 YR	2 YR	Total	Mate-rial Price	Rental Fixed Capital	Sales 1 Q	1 Yr	Ind. Sales 3 Yr	Total Ret. Sales 3 Yr	σ_e	ρ	DW
Construction estab. data	.065 (.104)[b]	-.230	.701	.237	-.638	1.162	-.235	.531	.745	.947	0	.0143	.818	1.98
Retail & wholesale HH data	.041 (.071)	-.795	-.583	.700	.092	.623	-.143	.274	.741	1.017	0	.0122	.657	2.00
Retail estab. data	.067** (.034)	.187	.475	.402	-.171	.343	-.159	.286	.515	.777	0	.0043	.846	2.24
Eating & drinking	.250** (.066)	.122	-.447	-.580	.054	.526	-.218	.387	.605	-.515	1.275	.0060	.584	1.54
Food	-.044 (.031)	-.005	-.339	-.126	-.106	.497	-.116	.091	.414	.506	.206	.0046	.616	1.89
Apparel	-.119 (.052)	-.095	-.590	-.780	-.653	.728	.019	.318	.406	.007	.900	.0140	.387	2.04
Furniture & appliance	-.001 (.033)	.183	-.070	-.400	-.665	.014	.538	.212	.605	.267	.915	.0041	.663	1.73
General merchandise	.073 (.062)	-.163	-.337	-.296	-.151	-.344	.390	.379	.615	1.020	-.126	.0092	.575	2.09
Other retail	.053* (.027)	-.037	.078	.476	-.355	.142	.185	.173	.474	-.487	1.668	.0036	.510	1.49
Wholesaling	.007 (.028)	.165	.143	.174	.089	.135	-.200	.147	.324	.203	.273	.0032	.774	1.49
Trucking	-.013 (.061)	-.317	-.200	.097	.085	-.533	.223	.377	.523	.984	-.514	.0072	.408	1.83

[a] Real sales and nominal input prices have 3-year lag. [b] (se)

Significance levels ** .01
* .05

Table.5 Comparison of OLS and 2SLS Models of Employment, Nominal Input Price Model

	NJTC	Wage 1 0	Wage 1 YR	Wage 2 YR	Wage Total	Mate-rial Price	Capital Rent	Sales 1 0	Sales 1 Yr	Ind. Sales 3 Yr	σ_e	ρ	DW
Construction													
Ordinary least sqs.													
Employment HH data	.095	-.744	-.114	.59	-.477	.672	-.075	.521	.767	.799	.0251	.722	1.89
	(.152)[b]												
Estab. data	.065	-.230	.701	.237	-.638	1.162	-.235	.531	.745	.947	.0143	.818	1.98
	(.104)												
Manhours	-.046	.100	.99	.009	-.701	1.273	-.283	.598	.891	1.068	.0280	.580	2.17
	(.138)												
Two-stage least sqs.[a]													
Employment HH data	.199	-.371	1.089	.369	-.351	.518	-.039	.485	.677	.659	.0265	.668	1.70
	(.133)												
Estab. data	.174*	-.944	1.133	.259	-.614	1.064	-.196	.556	.771	.959	.0148	.820	1.89
	(.098)												
Manhours	.048	-.330	1.283	.241	-.800	1.235	-.206	.591	.977	1.140	.0287	.601	2.14
	(.131)												
Retail													
Ordinary least sqs													
Employment HH data	.041	-.795	-.583	.118	-.490	.622	.016	.274	.743	1.019	.0122	.657	2.00
	(.071)												
Estab. data	.067**	.187	.476	.407	.288	.342	-.159	.287	.516	.778	.0043	.845	2.24
	(.034)												
Two-stage least sqs.													
HH data	.056	-1.200	-.706	.115	-.491	.694	-1.96	.298	.751	1.050	.0123	.657	2.01
	(.067)												
Estab. data	.069**	.094	.415	.390	-.164	.364	-.170	.290	.518	.792	.0043	.846	2.26
	(.032)												

[a] Double 2SLS involves applying two-stage least squares to the data twice. In the first application we assume that at all lags is endogenous. This produces a consistent estimator of $\hat{\rho}$ which is used to transform the data. 2SLS is then applied to the data a second time, assuming only the current w endogenous.

[b] (se) Significance levels ** .01
* .05

Table 6. Impact of Employment Tax Credit on Employment Under Alternative Lag Structure Nominal Input Price Model

Industry	Time Period	Employ-ment 1977 (000)	Coefficient on Employment Tax Credit		
			3 Yr Lag	2 Yr Lag	1.5 Yr Lag
Construction HH	51:02-78:03	3844	.095	.124	.194†
t-value			.62	.89	1.43
(se)			(.0251)	(.0261)	(.0263)
Construction estab.	51:02-78:03	3844	.065	.149†	.190**
t-value			.63	1.57	2.06
(se)			(.0143)	(.0147)	(.0148)
Retail and wholesale	51:02-78:03	18292	.041	.002	.012
t-value			.57	.03	.21
(se)			(.0121)	(.0122)	(.0122)
Retail estab.	51:02-78:03	13903	.067**	.016	.044†
t-value			1.96	.55	1.56
(se)			(.0043)	(.0044)	(.0046)
Eating & drinking	58:02-78:03	3854	.250**	.161**	.127**
t-value			3.79	3.43	3.90
(se)			(.0059)	(.0064)	(.0065)
Food	58:02-78:03	2116	-.044	.036	.089†
t-value			1.40	1.24	1.51
(se)			(.0046)	(.0051)	(.0053)
Apparel	52:02-78:03	821	-.119	-.125	-.122
t-value			2.27	2.59	2.56
(se)			(.0140)	(.0140)	(.0140)
Furniture and appliance	58:02-78:03	551	-.001	-.035	-.049
t-value			.02	1.67	2.41
(se)			(.0041)	(.0042)	(.0043)
General merchandise	52:02-78:03	2541	.073	-.004	.050
t-value			1.18	.08	1.05
(se)			(.0092)	(.0099)	(.0170)
Other retail	61:02-78:03	4021	.053*	-.007	-.016
t-value			1.94	.52	1.22
(se)			(.0026)	(.0029)	(.0031)
Wholesaling	51:02-78:03	4389	.007	-.007	.019
t-value			.27	.36	1.00
(se)			(.0032)	(.0033)	(.0035)

Table 6, continued

Industry	Time Period	Employment 1977 (000)	Coefficient on Employment Tax Credit 3 Yr Lag	2 Yr Lag	1.5 Yr Lag
Trucking	58:02-78:03	1131	-.013	-.006	.029
t-value			.21	.18	.93
(se)			(.0072)	(.0076)	(.0078)
Life insurance	61:02-78:03	519	.019	-.014	-.001
t-value			.55	.66	.03
(se)			(.0030)	(.0039)	(.0041)
Increase in Employment by March 1978 in Construction and Distribution (in Thousands)					
Using detailed indust. model			566	471	581
Using estab. data aggregates			441	334	580
Using HH data			398	225	379

All models were estimated with the same ρ correction.

Significance levels ** .01
* .05
† .10

Table 7. Hours Worked Per Week in Construction and Distribution

	Impact of NJTC Under Alternative Specifications (Nominal Compensation Model)		
	1.5 Yr Lag	2 Yr Lag	3 Yr Lag
Construction	.034	.041	.022
t-value	.77	.90	.40
(se)	(.0166)	(.0167)	(.0167)
Retail[a]	-.028*	-.021**	-.049**
t-value	3.66	2.83	2.58
(se)	(.0033)	(.0031)	(.0026)
Eating & drinking[a]	-.002	-.039	-.101
t-value	.07	.94	1.49
(se)	(.0059)	(.0059)	(.0055)
Food	-.027*	-.032*	-.023
t-value	1.77	1.81	1.02
(se)	(.0048)	(.0048)	(.0047)
Apparel	-.005	-.006	.008
t-value	.22	.31	.32
(se)	(.0067)	(.0067)	(.0066)
Furniture	-.061*	-.064*	-.088
t-value	3.95	4.26	3.76
(se)	(.0056)	(.0053)	(.0034)
General merchandise	-.079*	-.030	.023
t-value	3.72	1.31	.74
(se)	(.0060)	(.0057)	(.0055)
Other retail	.006	.024	-.021
t-value	.58	2.42	.89
(se)	(.0036)	(.0031)	(.0028)
Wholesaling	.017	.023	.013
t-value	1.86	2.33	1.10
(se)	(.0032)	(.0031)	(.0026)
Trucking	.004	.029	-.105*
t-value	.17	1.34	2.31
(se)	(.0080)	(.0076)	(.0072)
Life insurance	-.013	.027	-.080
t-value	.66	1.13	1.73
(se)	(.0060)	(.0052)	(.0040)

[a] 64-78:03

Significance levels ** .01
* .05

Table 8. Equations Predicting the Rate of Change of Retail Prices of Commodities

					Sum of Coefficients on							
	NJTC	Sales Tax	Con-trols	Δ log Unemp.	Wage	Whole-sale Price	Service & Mat. Price	Rental on Capital	σ_e	ρ	DW	R^2
Food away from home	-.036** (.013)	1.0	-.015 (.007)	-.016** (.003)	.332	.243	.122	.137	.0017	0	1.87	.723
Nonfood commodities	-.038** (.015)	.93* (.515)	-.001 (.009)	-.003 (.005)	.186	.539	.040	.044	.0020	0	1.88	.755
Apparel	-.017 (.022)	1.0	-.006 (.012)	-.008 (.006)	.049	.625	.075	-.005	.0029	0	1.93	.841
Furniture	-.016 (.017)	1.0	-.003 (.009)	-.011** (.005)	.087	.459	.306	.102	.0015	.41	1.79	.559
Food	.046 (.039)	1.0	-.022 (.023)	.001 (.011)	-.030	.720	.509	-.044	.0054	0	2.51	.700
All commodities	-.018 (.017)	1.32** (.574)	-.006 (.009)	-.0002 (.005)	.274	.684	-.004	-.035	.0002	0	2.23	.733

Note: The commodity price indices used exclude prices of owner-occupied housing. In the disaggregated equations (1, 3, 4 and 5) the coefficient on the state and local excise tax rates was constrained to be 1. The sales tax variable in the equation for all and nonfood commodities includes federal excise taxes.

All models were estimated for 53:03-78:06 except Furniture, which was estimated from 58:03-78:06.

Significance levels ** .01
* .05

Table 9. Impact of the NJTC on the Margin between Retail and Wholesale Prices

	Coefficient on NJTC under Alternative Specifications[a]				
	1 Yr Distributed Lag			6 Month Lag	1 Yr Lag
	Trends on Seasonals		No Trends	Trends	Trends
CPI Component	with Q	w/o Q	with Q	with Q	with Q
Food away from home	-.036**	-.037**	-.032**	-.033**	-.051**
t-value	.013	.012	.013	.013	.018
(se)	(.0017)	(.0017)	(.0017)	(.0018)	(.0017)
Nonfood commodities	-.038**	-.038**	-.031*	-.038**	-.049**
t-value	.015	.015	.016	.015	.020
(se)	(.0020)	(.0021)	(.0022)	(.0020)	(.0020)
Food at home	.051	.041	.051	.051	.011
t-value	.039	.038	.040	.038	.059
(se)	(.0053)	(.0053)	(.0052)	(.0052)	(.0053)
All commodities	-.018	-.019	-.013	-.018	-.036
t-value	.016	.016	.017	.016	.022
(se)	(.0022)	(.0022)	(.0023)	(.0022)	(.0022)
Reduction in consumer cost between 6/77 and 6/78 (in billions)					
All commodity regressions	3.4	3.6	2.4	3.4	2.5
Disaggregated regressions	2.8	3.3	1.9	2.8	2.3

[a] The standard error of the coefficient and the regression are located beneath the coefficient. Models 1-4 estimated on monthly data 1953:03 to 1978:06. For Model 5, sample period ends 1978:01. Weights for Q are based on the 1967 input-output table, which includes gasoline, electricity, telephones, containers, cellophane packaging, supplies, insurance, auto repair, and legal fees.

Significance levels ** .01
* .05

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Capital Gains Taxation and Effective Rates of Return

Rolf Rundfelt

Capital gains on shares have been taxed in Sweden throughout the twentieth century even though the first formal rules were not passed until 1910. Until the mid-sixties the rules for taxation of capital gains on shares was rather generous in Sweden. In 1966, however, the rules were made more severe and the tax was made perpetual. This aggravation coincided with an acceleration of inflation rates. In 1976 there was a further increase in tax rates. As a consequence, the cost of capital has been increased and structured in such ways as to make it quite expensive for companies to issue new shares. Inflation on the other hand has made debt financing relatively less expensive.

The purpose of this paper is first to present a background to the existing rules on capital gains taxation of shares in Sweden. This is done in section 1. In section 2 we make an estimate of how tax rules have affected the rate of return on shares. In this section we also show how the law enacted in 1976 comes out in comparison with the law from 1966. A rather unexpected result is that the after tax returns are higher than if the tax from 1966 still had been in force.

In section 3 we discuss the consequences of the present tax system for the cost of capital. It is shown that an increase in the inflation rate with one percentage point requires an increase in the rate of return on equity with almost three points to keep shareholders' real rate of return unchanged. One way to counter this increase would be to introduce a system for capital gains taxation in which only real capital gains were taxed.

In section 3 we also summarize existing proposals for inflation accounting and taxation of real profits in some countries.

In conclusion an example is given in which we show how a tax on real capital gains only would affect the rate of return on shareholders' capital.

1. TAXATION OF CAPITAL GAINS ON SHARES, A REVIEW

Explicit rules about taxation of capital gains on shares in Sweden are first to be found in a law from 1910. In this law, a distinction was made between "speculation gains" liable to taxation and other capital gains. Whether the purchase was to be considered a result of speculation or not was determined by the individual's intent when buying the shares. If the motive was to make a profit, speculation was presumed, which meant that the capital gain was taxable. Experts soon realized, however, that it would hardly be possible to make the shareholders reveal their true motives and therefore speculation was given a more operational definition--as a sale within five years from the purchase. The whole profit from such a short-term transaction was to be included in taxable income.

Another reason for taxation was the presumption that short-term capital gains were used for consumption. Gains on long-term investments could, on the other hand, to a larger extent be supposed to be reinvested. Therefore, there was no need, as had been suggested by someone, to make a difference between gains that had been reinvested and other gains.[1] The problem was, however, that the five year interval during which capital gains were subject to full taxation tended to lock in investments producing an erratic pricing behavior in the stock market.

In the 1949 Committee report on capital gains taxation it was recommended that the tax on speculative gains should be kept. But the calculation of taxable gains was changed in order to reduce the "locking-in effect". Therefore the tax rate was reduced from 100 per cent of the capital gain to 75 per cent if the holding period was between two and three years, from 75 to 50 per cent if the holding period was between three and four years, to 25 per cent for the fifth year and to 0 per cent after five years. This method was also assumed to give the person, subject to taxation, compensation for inflation. Capital gains due only to the falling value of the Swedish crown should not be taxed according to the Royal Commission. It was, however, considered practically impossible to

[1] See "Betänkande angående beskattning av realisationsvinster m m", SOU 1949:9, p.39.

reflate the purchase price in order to neutralize the effects of inflation. A gradual decrease in tax rates would therefore reduce the effects considered unfair in the old capital gains taxation system.

Between 1945 and 1964 the rate of return on shares was high in Sweden (cf Fig.1B, p.364). The real rate of return before taxes (dividends included) amounted to an average of 7-8 per cent per year. The 1965 Committee that investigated capital gains on shares, believed that the system for taxation of capital gains had contributed considerably to this high return, partly through increasing the demand (because of the exemption from taxes after five years) and partly through reducing supply (because of the unwillingness on the part of owners to sell from short-term possessions).[1] Against the background of this experience the committee suggested measures to a) moderate the price increases on shares and to b) increase mobility on

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[1] It should be noted that none of these arguments is persuasive. First, there is nothing that contradicts that the rise in prices of shares was caused by e.g. high profits in the industry. Secondly, it is not all that evident that taxation of gains on shares would lower the yearly rise in prices even if the price level initially would fall. Thirdly, the taxation is relatively favorable only when compared to bank savings. If the committee's hypothesis should be right one would expect a relatively higher rise in share prices in companies with a low pay-out ratio, something that has not been shown. Fourthly, even if supply would be reduced because all taxpayers preferred to keep their shares for at least five years, there is no reason to expect that after the initial holding period the propensity to sell would be materially affected.

the share market. The method chosen to reach these goals was to introduce in 1966 a perpetual taxation of capital gains on shares. If the selling took place more than five years after the acquisition, 10 per cent of the proceeds of the sale was to be included in taxable income, provided that the rise in prices could be supposed to be at least 5 per cent. For shares that had been owned less than five years the old rules were kept.[1]

The question of taxing only real capital gains was also discussed. The committee refrained, however, from proposing an amendment of the law, arguing that the problem concerned all capital gains, not only gains on shares.[2] It was, however, pointed out (as was also done by the previous committee) that this did not imply that the whole gain on long-term holdings should be taxed. In practice, the committee had accepted the idea that shareholders should be allowed some compensation for inflation.

The possibility to exempt gains reinvested in shares from taxation was also discussed within the committee. No specific reasons against such a principle were given. It was, however, pointed out that the United States had refrained from giving tax exemption when income from selling securities

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[1] According to the committee's suggestion, the model rule of 10 per cent was only a help rule. The main proposition instead was that 30 per cent of the gains should be taxed.

[2] See <u>SOU</u> 1965:72, p. 211. As a question of detail it can be noted that in 1967 a real taxation of real estate was introduced.

was reinvested, and that they probably had good reasons for doing so![1]

Concerning the right to deduct capital losses, the rule since 1910 had been that the taxpayer had a right to deduct losses calculated in the same way as taxable capital gains provided the losses could be offset against gains during the same year. According to the method introduced in 1966 short-term losses could never be offset against gains from shares held for more than five years.

Already in 1970, a new committee was set up to investigate taxation of capital gains. A wish to coordinate the rules concerning taxation of capital gains on shares with the rules for real estate was clearly displayed and better methods were asked for to increase mobility in the stock market.

On the first question the committee argued that there were many possibilities to reach coordination. Some basic principles were set down. Taxation should be

a) eternal;
b) based on the real gain;
d) based on the whole gain during a short initial period.

From these starting points the capital gains taxation on shares now in force was introduced on April 1, 1976, implying that

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[1] See SOU 1965:72, p. 238. In some cases, United States' tax law allows exemption when reinvestment is made in, for example, real estate.

1) on <u>short-term</u> holdings (less than two years) the whole realized gain be included in taxable income;

2) on <u>long-term</u> holdings, 40 per cent of the realized gains are included in taxable income;

3) <u>losses</u> be calculated in the same way as gains. Losses may, however, be offset against gains within a six-year period;

4) two help rules for calculating taxable gains should apply a) 20 per cent of the proceeds of the sale can be taken up as taxable income; b) for shares bought before January 1, 1971, one may choose 2/3 of the price valid on December 31, 1975 as an alternative to the actual purchase price. Adjustment must, however, be made for stock issues after that date.

<u>Concluding Remarks</u>

Present rules for taxing capital gains on shares were outdated even before they came into force. The taxation of gains on shares is now more severe than for almost any other kind of investment. The reason is high inflation in combination with a taxation of nominal gains. Tax rules furthermore are rather complex. To be sure, there is one help rule given that facilitates the calculation of taxable income. As is shown in the next section this rule is rarely to the advantage of the taxpayer.

2. TOTAL RETURN OF SHARES BEFORE AND AFTER TAX

In this section estimates are presented of the total rate of return for a population consisting of almost all (118) shares quoted on the Swedish Stock Exchange at the beginning of 1965. Total returns can be estimated for any full 12-month period starting from the 1st of January, 1965. In this text results are published for the 14-year period from 1965 to 1978 and for the 10-year period from 1969 to 1978. In order to see how the rate of return is affected by the capital gains taxation, a division is made between dividends and capital gains. We also assume that all capital gains are realized at the end of the holding period. Depending on the marginal tax rate, after tax returns are shown to vary between 3 and 5 per cent compared with a before tax return of around 6.5 per cent. If the tax rules enacted in 1966 still had been in force, the after tax return had been marginally lower. It is also shown that for most shares it is unprofitable to use the simplest rule for calculating the taxable capital gain, i.e. the rule according to which 20 per cent of the selling price is included in taxable income.[1]

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[1] Estimates of the total return on Swedish quoted shares for the last 25 years are published yearly by Svenska Handelsbanken (Common stock total return 1954-1978, Svenska Handelsbanken, 1979). These estimates, however, do not _inter alia_ allow for the effects of taxes.

Internal Rate of Return

Total return before tax is computed as an internal rate of return (IRR).[1]

It should be noted that IRR is not computed on a per share basis but for each company as an entity. This facilitates the weighting process when computing IRR for the stock market as a whole. On the other hand, a correction must be made for contributions to the firm made by other than the original investors. One typical example would be when one company buys another company and pays with a new issue of shares.

Brokerage fees are not included. In Sweden these would amount to around 0.6 per cent on each transaction. This means that they are much smaller than for instance in the U.S.

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[1] Through the formula

$$V_o = \sum_{i=1}^{n} \frac{D_t}{(1+r)^t} + \sum_{t=1}^{n} \frac{O_t}{(1+r)^t} + \frac{V_n}{(1+r)^n} - \sum_{t=1}^{n} \frac{N_t}{(1+r)^t}$$

where

r = the internal annual rate of return compounding annually

V_o = the initial investment computed as the total number of shares times the share price

V_n = ending value of investment

D_t = dividend at time t

O_t = other distributions (not taxable income) at time t and finally

N_t = new issues at time t.

Taxes

Surprisingly little data are available on the distribution of shares among different categories of owners. According to some sources the part owned by physical shareholders have, however, diminished during the seventies to around 50 per cent. The other 50 per cent are owned by various institutions among which the central pension fund is the fastest growing.

Pension funds as well as other charitable institutions own somewhere around 15 to 25 per cent of all shares. These owners do not pay taxes on their capital income. Consequently, the rate of return on shares before tax (Table 1) is representative of income received by these institutions. Other institutional shareholders do pay taxes, although in some cases, at reduced rates.

In this study our main interest is to show the effects of taxes on the rate of return obtained by a typical household. For the household two kinds of taxes are of interest. First of all dividends have to be reduced with the marginal tax rate. For an average, physical shareholder in Sweden, these would amount to something like 70-80 per cent.

We have then ignored the fact that the first 800 Swedish kronor (1600 Skr for a married couple) of interest and dividend income is not taxable income.

Table 1. Total nominal rate of return on all shares before tax. Per cent

	1965-1978	1969-1978
Total return	6.5	6.7
thereof		
capital gain	3.0	3.0
Change in consumer price index	7.0	8.1

Table 2. Total return on all shares after tax 1965-1978. Present tax rules

Marginal tax rate, %	50	60	70	80	90
Total return	4.7	4.3	3.9	3.5	3.1
thereof					
capital gain	2.8	2.8	2.8	2.7	2.7
Effective tax rate, % (total after-tax return/total before-tax return)	28	34	40	46	52

Table 3. Total return on all shares after tax 1965-1978
Taxes calculated according to the law enacted in 1966

Marginal tax rate, %	50	60	70	80	90
Total return	4.5	4.1	3.7	3.3	2.8
thereof					
capital gain	2.7	2.6	2.6	2.5	2.5
Effective tax rate,%	31	37	43	49	57

Table 4. Total return on all shares after tax 1969-1978
Present tax rules

Marginal tax rate, %	50	60	70	80	90
Total return	4.7	4.3	3.9	3.5	3.0
thereof					
capital gain	2.8	2.8	2.7	2.7	2.7
Effective tax rate, %	30	36	42	48	55

Table 5. Total return on all shares after tax 1969-1978
Taxes calculated according to the law enacted in 1966

Marginal tax rate, %	50	60	70	80	90
Total return	4.5	4.1	3.6	3.1	2.7
thereof					
capital gain	2.6	2.5	2.5	2.4	2.3
Effective tax rate, %	33	39	46	54	60

Table 6. Number of cases where different tax rules were used to calculate the capital gains tax according to 1976 law
Per cent

	1965-1978	1969-1978
Main rule (40% of the capital gain is taxable income)	57	56
Help rule I (20% of selling price is taxable income)	14	12
Help rule II (2/3 of the price on the last day of 1975 is taken instead of actual purchasing cost when calculating capital gain)	47	50
Total	118	118

The capital gains tax is somewhat more complicated to estimate. The holding period was assumed to be 1965-1978 or 1969-1979 (see above). We have thus made the assumption that all shares bought in early 1965 or 1969 were sold in late 1978. As the holding period then is more than two years profits on such a sale would have been taxed according to the rules for long-term possessions. As will be remembered these rules give the taxpayer the possibility to choose between three alternatives in order to arrive at the taxable income. For each of the 118 shares taxpayers are assumed to choose the alternative which maximizes the total return after tax.

The purpose of these assumptions is not to describe the actual behavior of the stockmarket. In practice most portfolios are held for a longer period and sales are often made only to offset other capital gains/losses in order to minimize overall capital gains taxes. It would have been of great interest to show the actual tax paid on capital gains from shares. This is, however, not possible. No information is available on capital gains on shares from the tax assessments which are made yearly to determine taxable income. As a general proposition one can, however, conclude that if actual holding periods exceed the 10 to 14 years we have assumed in our calculations, capital gains taxes are exaggerated and vice versa.[1]

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[1] For a study that discusses actual holding periods and effective capital gains taxes for shares; see Bailey, M., "Capital Gains and Income Taxation" in Harberger, A.C. and Bailey, M., (1969), The Taxation of Income from Capital, The Brookings Institution, Washington.

Total return on all shares was 6.5 per cent before tax between 1965 and 1978 (see Table 1). The corresponding figure for the last ten years, 1969-1978, was slightly higher, or 6.7 per cent. The capital gain for both periods was 3.0 per cent, which means that dividends have increased somewhat in importance. For both periods the total rate of return is considerably lower than the rate of change in consumer prices, which amount to 7.0 and 8.1 per cent respectively. In Tables 2-5 total return for the two holding periods is given on an after-tax base. Tables 2 and 4 are based on the tax rules enacted in 1976 while Tables 3 and 5 illustrate what the total return would have been, had the rules enacted in 1966 still been in force.

By comparing Tables 2 to 3 and 4 to 5 we see the difference between the present tax rules and the rules introduced in 1966. When looking at the total return, the difference is rather small. This is so because dividends are taxed in the same way in both cases. The tax on capital gains is, however, almost twice as high according to the old rules. It is interesting to note that despite the increase in tax rates in 1978 the tax burden has been reduced. This seemingly contradictory result is due to the introduction of "loss carry-forward" in 1976, i.e. the right to offset losses against gains within a six-year period.

Another way to illustrate the difference between the different tax rules is to compare the effective tax rate. This rate is calculated as the total after-tax return divided by the total before tax return. The effective tax rate lies between 28 and 52 per cent for 1965-1978 using the present rules. With the old tax rules the effective tax rate is 3-5 points higher.

It is also possible to calculate the effective tax rate on capital gains only. In Table 2, for example, we can see that the tax rate varies between approximately 7 to 10 per cent. This is due to both the long holding period and to the possibility to use different rules for calculating the capital gains tax for different shares.

When comparing the different rules which can be used for calculating taxable income according to the present rules, we can see from table 6 that the first help rule is dominated by the main rule and the second help rule. For most taxpayers this is a disadvantage as the first help rule is by far the easiest to use. The main rule, in particular, requires that taxpayers keep records on stock issues, etc., for very long periods of time, which makes it very complicated to use in practice.

Concluding Remarks

The total rate of return on Swedish shares before taxes has been very low for the last 10 to 14 year-period. For an average portfolio the rate of return is lower than the inflation rate and about as high as the normal interest rate on bank deposits.

On an after-tax basis the total return on shares is, however, considerably higher than the interest on bank savings. For a person with marginal income taxes of 70 per cent the return on shares would be around 2.8 per cent as compared with 1.9 per cent on bank savings.

In spite of this it seems likely that the return on shares lies far below expectations. One reason for this is that the tax rules for other investments, including real estate, are far more generous. It can therefore be argued that the present system for taxing capital gains on shares is not neutral. The implications of this and a system for a neutral taxation of capital gains are discussed in the next section.

3. TOTAL RETURN AND TAXES

In this section we show the combined effects of a nominal taxation of share income and inflation on cost of capital. An increase in the inflation rate with one point increases the cost of capital with three points in an example given.

One way to eliminate this distortion would be to tax only real profits. At present a debate is going on in several countries on how a system for real taxation should be designed. As an illustration we present the outline of the British proposal for inflation accounting.

In the final part of this section we will give an example of how share prices could be affected if we had a system for real taxation in Sweden.

How Is Cost of Capital Affected by Taxes?

Between 1965 and 1978, rates of return on equity (after corporate income taxes) for Swedish engineering companies[1] has been around 10 per cent. For the same period, rates of return on shareholders' capital has been 6.5 per cent (see Table 1, p.355). Before 1965 the rate of return on shares was closer to the rate of return on equity. As the return on shares has fallen relative to the return on equity there has also been a significant decline in the ratio between the market value of shares and the book value of equity. This is especially true after 1972 when inflation rates started to increase sharply.

Table 7. Market value of shares and book value of equity for major Swedish engineering companies

	1965	1970	1978
Market value in per cent of book value (historical cost)	100	76	49
ditto (replacement cost valuation)	97	73	41

[1] Industrikonjunkturen, Spring 1979, Federation of Swedish Industries, p. 172. In fact, engineering companies only make up 40 per cent of all shares quoted on the Swedish stock exchange. The engineering industry has been more profitable than most other industries. One reason is that the engineering companies have big foreign subsidiaries with a higher profitability than domestic companies. It is assumed, however, that the level of profitability of the engineering industry is roughly representative for all quoted companies.

For major engineering companies the ratio between market value and book value has fallen to less than 50 percent. The fall is even more pronounced if assets are valued at replacement cost (see Figure 1A).

Share prices are influenced by expectations, rumors and other factors, many of which cannot be quantified. Still, in order to explain the big difference between profitability in industry and the yield on shares, for such a long period as 10-15 years, one need to look for more fundamental explanations. One such factor is the tax system, according to which both nominal and real profits are taxed, both in the companies and in the households.

The picture from Figure 1A is largely confirmed by data on all manufacturing firms in Figure 1B, where a sector weighted stock market index represents the market value of all manufacturing firms. We note that the rate of depreciation assumed[1] makes very little difference for the rate of change of the value of net worth, provided initial values have been scaled properly. The "levels" between I and II are very different. What Figure IB reveals is the strong trend break in the market valuation compared to the replacement valuation that occurred around the middle of the 60's.

To a large extent this must reflect an adjustment in the valuation of discounted future profit capacity in the hands of the individual after tax.

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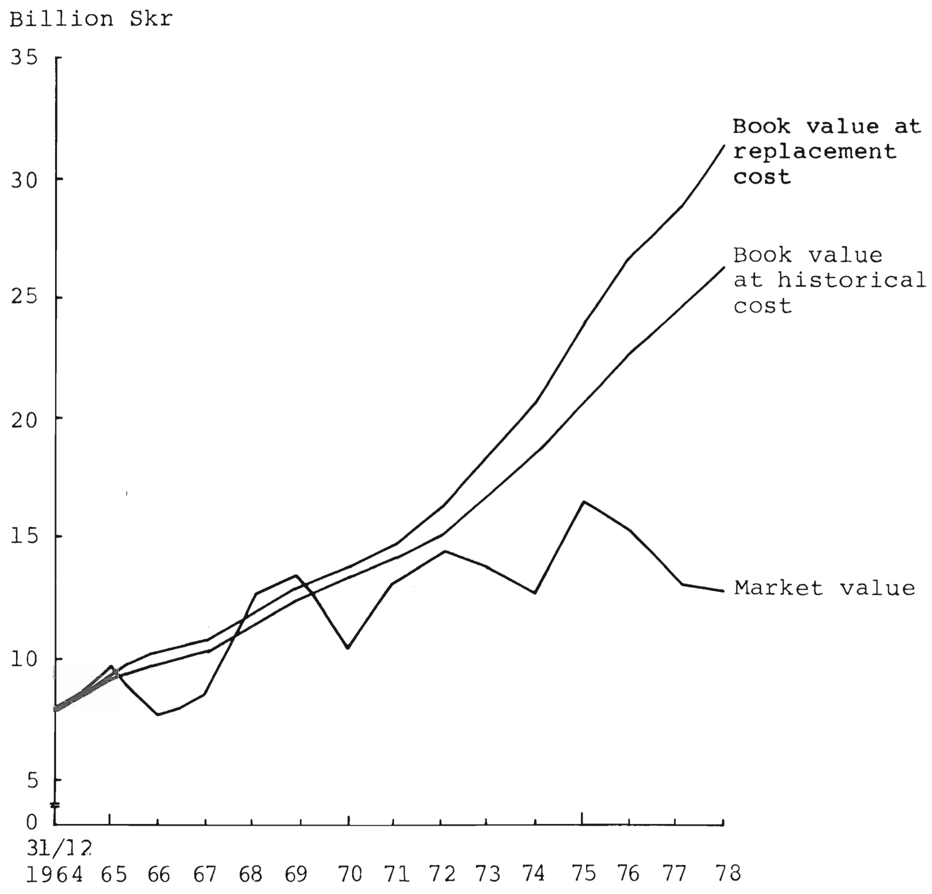
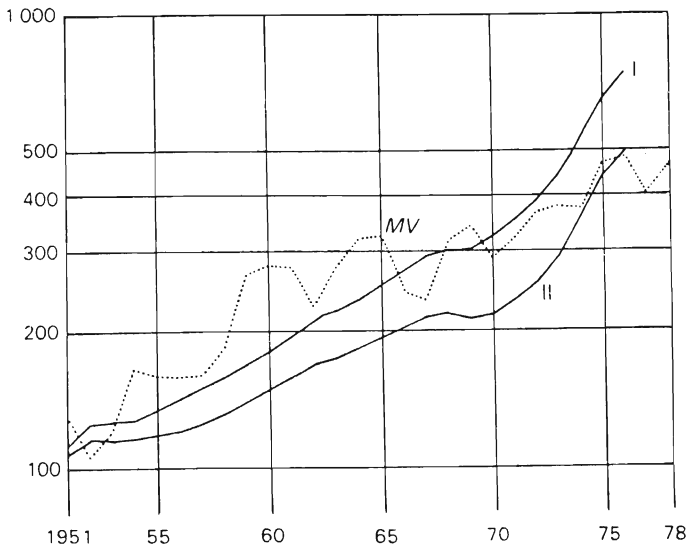
[1] 2.7 and 10 per cent respectively. See note to Figure 1B.

Figure 1A. <u>Market value of shares and book value of equity for major Swedish engineering companies</u>



<u>Source</u>: Estimates made by the Federation of Swedish Industries. Book value of equity at replacement cost has been calculated including actual historical costs. The rate of depreciation is assumed to be 6,7% corresponding to an average for a period of 15 years.

Figure 1B. Net worth in Swedish manufacturing 1951-1978, replacement (I and II) and market (MV) valuations
Index 1949=100; logarithmic scale



Source: Eliasson, G., Profit Performance in Sweddish Industry, Industrikonjunkturen, Autumn 1976, and later updating of data at IUI; also see Eliasson, G., Carlsson, B., Ysander, B.-C. et al., Att välja 80-tal (Choosing the 80's), IUI, Stockholm 1979. Note that the replacement value has been estimated as total assets (cumulated and price adjusted net investments from initial assets 1913) less debt. Curve I assumes 2.7 per cent depreciation on replacement value of physical assets. Curve II assumes 10 percent.

1965, as mentioned, witnessed a sharpening of capital gains tax rules for shares. From then on the progressive income tax scales were gradually raised and the 70's witnessed a politically heated discussion of the "socialization" of industry profits combined with a downward movement of the rate of return to equity. One interesting thing will be to see whether an expected favorable change in capital income and corporate income taxation, an expected improvement in profitability in manufacturing (from present low levels) and a reversed opinion of the acceptability of private ownership and the capitalistic economic system will change the relative development of the curves in Figure 1B again.

The taxation of nominal profits means that the cost of equity capital before taxes will increase by more than the inflation rate if the real rate of return of the shareholders is to be kept constant. To illustrate, let us assume that shareholders expect a real rate of return of 2 per cent, net of all taxes. The marginal income tax is 75 per cent and the company tax is 50 per cent.

The company pays out 8 per cent on equity as dividends. If there is no inflation this will obviously satisfy the shareholders' required rate of return. If the shareholders also expect the company to be able to pay out 8 per cent in the future the market value of shares will equal the book value of equity.

With inflation, dividends in relation to equity will remain at 8 per cent as assumed. Earnings will have to rise, however, for shareholders to be compensated for inflation by capital gains. If we assume that there is a one-to-one correspondence between retained earnings and capital gains[1] the question is; what is the necessary increase in earnings (cost of equity capital) if shareholders are to be fully compensated for inflation.

The answer is given in Table 8.

The table shows that an increase in the rate of inflation with 10 points increases cost of capital with 28.6 points. Because nominal gains are taxed the company must calculate with an increase in its cost of equity capital with a factor that is almost three times the rate of inflation.

It must be observed that this result first of all follows from the assumption that the rate of real return required by shareholders' net of tax is constant regardless of the inflation rate. Bergström-Södersten in their paper on p. 233 use another assumption, namely that the market before tax rate of return on equity remains constant in real terms. Hence, the after tax real rate of return received by shareholders will fall as a result of inflation.

The reason for arguing that the required after tax real rate of return is constant is mostly empirical. For Swedish households shares are a minor part of their total portfolio of assets. Presently, yearly savings amount to more than 20 billion

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[1] A one-to-one correspondence requires that shareholders expect that future dividends will increase with inflation.

Table 8.

	Rate of inflation(%) 0	5	10
1. Required real rate of return (%)[a]	2	2	2
2. Required rate of return before personal income taxes (line 1 / (1-0.75) (%)	8	8	8
3. Capital gain = compensation for inflation (%)	0	5	10
4. Capital gain before capital gains taxes (line 3/(1-0.3)[b] (%)	0	7.1	14.3
5. Nominal cost of capital after corporate taxes (line 2+4) (%)	8	15.1	22.3
6. Cost of capital before corporate taxes (line 5 / (1-0.5) (%)[c]	16	30.2	44.6

[a] Eliasson cites a company that actually uses 2 per cent as their target rate of real return. See Business Economic Planning, 1976 op.cit., p.170 ff.

[b] $0.4 \times 0.75 = 0.3$

[c] Normally, part of the corporate tax is deferred. It is assumed that any deferral of taxes is reflected in lower interest costs. We also assume that unrealized gains on plants and machinery are included in profits. However, these will only account for a smaller part of profits, except when inflation rates are rising rapidly.

Skr. Out of this less than 1 billion are invested in shares. Much more important is savings in real estate, tax-exempt bonds, etc. In most cases it is expected that these investments will yield a positive real rate of return after taxes. Therefore, a rational investor who is considering an investment in shares would have to take these alternatives into account.

Double Taxation of Profits

The increase in cost of capital in relation to inflation is not primarily caused by the double taxation of profits. If holders of debt were to require a real interest of 2 per cent after tax, the cost of debt for a company would have to be 48 per cent if the inflation rate is 10 per cent. In spite of interest costs being deductible when calculating corporate taxes, there is a rise in the cost of borrowed capital with more than 4 points for a rise in the inflation rate with one point if holders of debt are to be given a constant real return.

In inflationary times, shareholders consequently have an advantage in comparison to holders of debt as the former get part of their return as a capital gain.

Nominal Profits Should Not Be Taxed

It is obvious that the present system for taxation in which some, but not all nominal profits are taxed, creates distortions in a number of ways. When inflation rates are high it is not realistic to expect the corporate sector to be able to increase its profitability so that debt holders and shareholders are given a constant real return. Rather the opposite. High rates of inflation seem to be associated with erratic movements in relative prices that makes it more difficult for firms to maintain normal profit rates (see Eliasson's and Lindberg's paper, p.381). For other investment alternatives this is, however, possible. Investments in real estate have already been mentioned as perhaps the best example. Thus, since 1967 the purchase prices of real estate has increased in line with the increase in the consumer price index. Taxable income is then calculated as the selling price minus the adjusted purchase price.

Capital gains on other assets, stamps, art, jewels, etc., are not taxed at all, in principle at least not after a five-year holding period.

In summary, it can be argued that the tax system discriminates against savings in interest-bearing assets and, to a somewhat smaller degree, against shares. As a consequence, one would expect that the companies should experience difficulties in raising new capital in the private market. This seems also to be the case as is vividly illustrated e.g. from the Swedish discussion on wage-earners' funds. The simplest way in which this discrimination could be avoided would be to eliminate the nominal part of profits from taxation.

Taxation of Real Profits And Interests

In the case of interest it is clearly not sufficient to change the corporate tax system to a real basis. As interest costs are deductible at the company level only personal income taxes are relevant. For these to be neutral and not to influence the decision to lend regardless of the rate of inflation, the nominal part of interest payments have to be eliminated when calculating taxable income.

For income on shares the problem is more complicated. A neutral taxation of income on shares requires that the "inflationary" part of profits be eliminated from both corporate and personal taxable income.

As to the personal income tax this could be achieved in two ways. The simplest method would be to change the present rules for calculating taxable capital gains. The taxpayer for instance could be allowed to index the purchase price, as with real estate so that when selling the shares, only the real capital gain would be taxable.

The other method would be to allow the compensation for inflation to be deducted from dividends. In most cases this would mean that dividends would not be taxed at all. On the other hand, taxable capital gains would be correspondingly higher. As capital gains normally are realized only after several years, this method would result in a larger tax credit than the first method.

To illustrate the difference between the two approaches in granting the shareholders relief from the effects of inflation, we can use a simple example.

Assume that the required real rate of return is 6 per cent. The inflation rate is 8 per cent. The expected rate of return on equity is 14 per cent which means that book value of equity and the market value of shares are equal. The dividend yield is 4 per cent.

Assume furthermore that the expected holding period is 10 years and that the tax on realized capital gains is 30 per cent. The tax on dividend income is 75 per cent. We can then calculate the total effective tax on share income.

Effective tax will be 4/14 • 0.75 + 10/14 • 0.30 = 42.9 per cent. This calculation, however, does not take into account that the capital gains tax will not be payable until after 10 years. The advantage of being able to defer the capital gains tax can be translated into a lower capital gains tax rate. A nominal rate of 30 per cent will thus be equivalent to only 22 per cent if the capital gain is realized after 10 years.[1]

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[1] The capital on realization after T years per unit of initial investment is $(1+r)^T$, and the net capital after tax, say C_T, is

$$C_T = [(1+r)^T-1][1-t_g] + 1 = (1-t_g)(1+r)^T + t_g,$$

where r is the expected accrual rate and t_g is the capital gains tax rate at the time of realization. The annual net or tax-free rate of accrual, s, that would generate this value of C_T is

cont.

The effective tax with a nominal taxation will consequently be

$4/14 \cdot 0.75 + 10/14 \cdot 0.22 = 37.1\%$.

If shareholders are allowed to deduct a compensation for inflation when calculating the taxable capital gain, taxable capital gains will be reduced from 10 to 2 per cent.

It seems likely that such a reduction will be accompanied by an increase in the capital gains tax rate. Let us assume that all real capital gains will be included in taxable income, e.g. that the tax rate on the real capital gain is 75 per cent. If capital gains are realized only after 10 years this will be equivalent to a tax rate of 65.9 per cent.

We can now compare the effective tax on shareholders' income between the two methods.

Cont.

$s = \sqrt[T]{C_T} - 1.$

Finally,

$g = \frac{r - s}{r} = 1 - \frac{s}{r},$

where g is the effective capital gains tax rate.

Source: Bailey, op.cit., p.24.

		(1) Adjustment of capital gains only	(2) Adjustment of both dividends and capital gains
1.	Dividend income	4	4
2.	Deductible compensation for inflation	-	-4
3.	Taxable dividend income	4	0
4.	Tax on dividends (0.75 • line 3)	3	0
5.	Capital gain	10	10
6.	Deductible compensation for inflation	-8	-4
7.	Taxable capital gain	2	6
8.	Tax on capital gain (0.659 • line 7)	1.3	4.0
9.	Total tax (line 4 + line 8)	4.3	4.0
10.	Total tax in per cent of total before-tax income	30.8	28.6

By allowing compensation for inflation to be deducted from both dividends and capital gains the effective tax rate will be reduced by almost 1/10 in comparison with a deduction from capital gains only.

Corporate Taxation of Real Profits in Different Countries

Many countries have experienced high rates of inflation in the seventies and some also in the sixties. As this inevitably creates distortions in the financial markets, one would expect that these countries had taken the necessary steps to eliminate the disadvantages. One such step is the introduction of a system for real taxation. At present, however, only countries which have experienced hyper-inflation, have introduced consistent systems for real taxation. In other countries, like the U.K. *ad hoc* measures have been tried; e.g. stock relief and accelerated depreciation. Because of the high rate of inflation, several countries are, nevertheless, discussing how a system for taxing only real corporate profits should be constructed. Among these countries are the U.K., the Netherlands, Finland and Sweden.

A system of real taxation requires a system of real business accounts. We will here discuss one of the proposals that have been put forward for inflation accounting.

Inflation Accounting in the U.K.

In March 1980, SSAP 16 on inflation accounting was adopted by the British accountants.

According to this scheme, operating profits of a company shall be determined as the surplus after allowing for the impact of price changes on the funds needed to maintain operating capacity. Normally this will reduce operating profits. Part of this reduction is, however, reversed as a "gearing adjustment". In short, the gearing adjustment is calculated as the debt ratio (debt to debt + equity) times the reduction in operating profit due to price changes. To illustrate, let us assume that operating profit on a historical cost basis is 100 and the debt-equity ratio is 1. If current cost adjustments amount to 60 the current cost operating profit will be 40. To this figure we shall add the gearing adjustment to obtain a current cost profit attributable to shareholders. The gearing adjustment will be 50 per cent of 60 = 30 and current cost profit consequently 70.

Inflation accounting in the U.K. is based on current cost accounting. This means that only specific price changes influence reported earnings. If these are higher than the inflation rate measured by the CPI the tax will of course be lower than if the adjustment was based on the change in the CPI (general price level accounting). Normally, however, the reverse would be true. If prices of industrial goods rise less than the CPI the British method for taking inflation into account when calculating real profits will lead to higher taxes than a system based on the general purchasing power principle.

When comparing SSAP 16 with other models for inflation accounting one has to distinguish between two types of models. The <u>first</u> type, to which SSAP 16 belongs, is <u>finance-oriented</u>, i.e. there is no real profit until the firm has earned enough to maintain its capacity reinvestment net of tax. The <u>second</u> type focuses on the return <u>on shareholders' equity</u> in nominal and/or real terms where the difference is measured by the CPI.

To illustrate the difference between the two types of models one can look at the oil companies in 1979. There was an increase in the price of oil <u>relative</u> to most other prices. Following SSAP 16 this increase in relative prices would not be included in net profits if inventories were financed with equity. In the other type of models this gain would be included.

If SSAP 16 is a typical example of a finance-oriented inflation accounting model, FAS 33--the American standard for inflation accounting, is an example of the second type. The fact that UK and USA have chosen different models implies a potentially serious complication for global harmonization. At present, most countries seem to prefer the British approach.[1] This is especially true for those countries which look at profits as a nature of "dividend capacity". This is not surprising as debt-equity ratios deteriorate and the problems of raising new equity increase.

Another problem with inflation accounting is that most models are rather difficult to use and to control. This means that tax assessments cannot automatically be based on the real accounts of individual companies. However, the Hofstra report[2] (a blueprint for a new Dutch system) tries to deal with this problem. According to Hofstra, nominal profits shall be reduced with the decline in general purchasing power of equity during the year. If equity is 1500, the inflation rate as measured by the CPI, 10 per cent and nominal profits 500, the real taxable profit would be $500-(0.1 \cdot 150) = 350$.[3]

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[1] One particular variant of the type of model has been developed in Sweden, where in 1974 a recommendation based on the framework of Edwards & Bell was published. See Bröms-Rundfelt; Inflationsredovisning, Federation of Swedish Industries, 1974.

[2] H.J. Hofstra, Inflation Adjustment and the Tax System, A report submitted to the Dutch Minister of Finance in December 1977.

[3] Assuming realized holding gains amount to at least 150.

There are two main advantages with this method. First of all it is very simple to understand and to control. This is a _sine qua non_ if also smaller companies are to be included in the tax reform. It is unlikely that a system for inflation accounting like the British can be extended to smaller companies, partnerships, etc.

Secondly, the Hofstra report focuses on the preservation of the purchasing power of equity. For a neutral tax system, e.g. a system which treats all investment alternatives equal regardless of inflation, this is the most natural solution.

Rate of Return on Swedish Shares in a System with Real Taxation

In this final part we will illustrate how an introduction of a system for real taxation affects the rate of return on shares. It is assumed that the rate of return on equity before corporate taxes and inflation is the same as during the period 1965-1978.

In that period the nominal rate of return was 20 per cent before corporate income taxation.

With 50 per cent corporate tax, a 40 per cent pay-out ratio, 75 per cent marginal personal income tax, capital gains equal to retained earnings and the _present rules_ for calculating taxes on capital gains, the real return on shares would be -1.8 per cent assuming an inflation rate of 7 per cent (see Table 9).

Table 9. Rate of return comparisons with present nominal and real corporate income tax systems

	(1) Present tax system	(2) Nominal corporate tax and real capital gains tax	(3) Real corporate and capital gains tax
Nominal return on equity before tax	20	20	20
Corporate tax (50%)	-10	-10	-6.5
Nominal return on equity after tax	10	10	13.5
(Dividends)	(4)	(4)	(4)
Shareholders' taxes on dividends	-3	-3	-3
(Capital gain)	(6)	(6)	(9.5)
Shareholders' taxes on capital gains [a]	-1.8	+0.3	-0.8
Nominal return on investment after taxes	5.2	7.3	9.7
Inflation	-7.0	-7.0	-7.0
Real return on investment after tax	-1.8	0.3	2.7

[a] 40 per cent of the real gains is assumed to be included in taxable income and taxed to 75 per cent. In the first column there is a real loss which is assumed to be deductible from other income.

Between 1965 and 1978 the shareholders' nominal rate of return before taxes has been approximately 6 per cent (see Table 1). This corresponds to a real rate of return after taxes of about -4 per cent. This figure is lower than what could have been expected had retained earnings resulted in capital gains of equal size. The explanation must be that shareholders did not expect that future earnings in industry would be high enough to compete with alternative investments.

It is not possible to project what would have happen to shareholders' return if we had had a system for real taxation. As can be seen from the tables above, real taxation of both corporate profits and capital gains would have resulted in a real rate of return of 2.7 per cent after taxes, under the assumption that retained earnings equal capital gains.

That is an improvement with 4.5 percentage points compared to table 7. With a nominal taxation of corporate profits and a real taxation of capital gains, the improvement would be approximately halved; i.e. that rate of return after tax would have been 0.3 per cent.

Concluding remarks

Around 1900 there was a general consensus that capital gains arising from inflation should not constitute income. Consequently, purely nominal gains should not be taxed. This conclusion has been repeated many times since. Still, as inflation rates have increased, so has the tax on capital gains on shares! One reason for this seemingly contradictory development is the technical problems involved.

In order to get a constant real return on shares it is necessary to introduce both a real corporate tax system and a real capital gains tax. As could be learned from the Hofstra report, it may be possible to construct a rather simple real corporate tax system.

A real capital gains tax may be still easier to design technically. On the other hand it may prove very difficult to get the necessary support from shareholders. They will have to keep very detailed records on every transaction so that nominal gains can be calculated. Bearing in mind the strong criticism that has been put forward against the present rules for calculating taxable capital gains, one can imagine that it might prove even more difficult to implement a system for real taxation. On the other hand it is not likely that the capital gains tax can be abolished altogether, considering the high taxes on earned income. Even though a tax reform is long over-due in Sweden it is far from certain that anything will happen the next few years.

Allocation and Growth Effects of Corporate Income Taxes

– Some Experiments in Quantification on a Micro-to-Macro Model of the Swedish Economy[1]

Gunnar Eliasson and Thomas Lindberg

1. INTRODUCTION

Taxes can be used directly to affect the composition and volume of demand and supply since they place a wedge between supply and demand prices. This is widely recognized in professional literature.

By affecting supply and demand, prices are also indirectly affected through market feed backs across markets and over time. This has hardly been recognized in proportion to its potential importance in a dynamic market allocation process. To some extent this may depend on the prevalent use of comparative static models in the analysis of allocation effects. A satisfactory analysis of dynamic efficiency requires a disequilibrium specification of the market processes, and an explicit representation of decision-makers' response to changing price signals. Four aspects in particular have to be recognized: (1) How do agents interpret current prices (expectations)? (2) How fast

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[1] This paper is a first step in a more ambitious project, started at the IUI some time ago, entitled: Profitability, Taxation and Growth.

and with (3) how large steps do decision-makers respond to these expectations? (4) How are different markets interlinked?

Misallocation effects may be multiplied by tax wedges when exogenous shocks put the pricing mechanisms substantially out of equilibrium. In a dynamic theoretical setting one may talk about disequilibrium and instability as related concepts. Dynamic allocative efficiency will be interpreted here as "getting on to and staying sufficiently close to the highest possible steady growth path". This is partly discussed in Ysander (III:6), and will be elaborated further in this paper.

The theme of the paper is: How is the structural adjustment process affected by corporate income taxes? To answer this question we have to design a set of relevant market scenarios as well as a set of different tax regimes.

The paper begins with a discussion of the rate of return requirement in the investment allocation process. Do tax benefits drive the required return down with less or more long run growth as a consequence? Section 3 briefly introduces the micro-macro simulation model --the analytical tool. Emphasis is on those parts of the model that are important in this context. As in all empirical research, design of measurements or experiments are crucial --a problem dealt with in section 4.

Lack of space and time made it necessary to limit the market change scenarios to permanent changes in relative prices of varying speed. These were the ones believed to be relevant for the post 1973/74 oil crisis period.[1] Several fiscal depreciation regimes are superimposed on these market scenarios. Hence both taxes and the competitive situation are varied. We will therefore also be able to analyze the consequences of market change during a given tax regime.

Problems related to erratic market prices and unstable supply structures as a consequence of large and fast changes in market conditions are discussed in section 5. The paper finally concludes by returning to the rate of return - rate of growth relationship and how tax wedges affect it. Such a matter cannot be investigated empirically without access to micro firm information. This is where the micro-to-macro model clearly shows a comparative advantage.

The micro to macro model of the Swedish economy[2] developed at the IUI provides a convenient, numerically specified "theory" to analyze dynamic allocation problems in a business taxation context. All

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[1] Recent IUI research indicates that very large and permanent relative price changes between sectors are rare if you allow for a sufficiently long time period. Hence it would be interesting to complement the results reported here with a series of large but transient relative price changes, that return to original positions after a period of varying length.

[2] Eliasson, G., with Olavi, G. and Heiman, M. (1976b) "A Micro-to-Macro Interactive Simulation Model of the Swedish Economy - Preliminary Documentation." Economic Research Report B15, Federation of Swedish Industries. Stockholm, and Eliasson, G., ed. (1978), A Micro-to-Macro Model of the Swedish Economy, IUI Conference Reports, 1978:1. (IUI) Stockholm 1978.

four aspects of stability mentioned above are explicitly covered in the model. As the model stands now it has not been fully calibrated and several tests and estimations remain before one can talk of the simulations as quantified results on the Swedish economy. The important thing is, however, that it forces the investigators to think in dynamic terms when analyzing the allocation problems associated with the corporate income tax system.

As theoretical results from a market based economic system like the Swedish economy they should, however, be considered quite realistic. In this particular model version and experimental setting there is one misspecification that has to be kept in mind. The individual firm dividend decision is not yet fully integrated with the investment decision, an erroneous feature that it shares with much theory on the matter. We will take great care to formulate our results with this in mind.

It will be demonstrated here that the dynamic misallocation effects of the corporate income tax system may be sizable when markets are substantially out of equilibrium and short term relative price movements are unreliable indicators of long term price movements, but the interpretation of these effects may turn out somewhat surprising.

2. TAX DEPRESSED RETURN REQUIREMENTS

One particular price variable affected by the tax wedge, that is studied in our simulations, is the rate of return requirement of the individual firm. The effects on investment from the faster than economically motivated fiscal depreciation scheme now prevalent in most industrial nations can be expressed in at least two different ways. Speeded up fiscal write offs create hidden tax credits that can be regarded as interest free borrowing. Since there is no competitive alternative because of the tax wedge, the cost of capital is lowered. Hence, borrowing and more investment will be economically motivated. Alternatively one can say that the firm lowers its cut off rate on the margin until expected returns to investment meet the marginal supply price of funds. This in turn is dependent on the expected return to the investment itself, since there are no other competing alternatives due to the tax wedge. In a neoclassical, static equilibrium setting the two formulations come to the same, since the rate of return requirement appears in the cost of capital expression and is equal ex ante and ex post. The rate of return is lowered ex post as firms increase investments each period.

Several allocation aspects have to be considered. For each given set of future price rays the lowering of the supply price of funds, through speeded up fiscal depreciations may <u>increase the rate of investment</u> through plough back (a volume effect).

For each given set of future price rays there may also be <u>an alternative allocation</u> of the same volume of investment among firms that creates a larger capacity increment. This allocation is, however, blocked by the tax wedge between the supply price of funds of the firm to the outside market and the indigenous demand price of the firm of its own funds. Figure 1 does not reject the hypothesis that a misallocation of investment resources may have taken place in Sweden during the postwar period.

There is, however, also a third possible source of the misallocation of funds demonstrated in Figure 1, that requires a truly dynamic theory of allocation to capture, namely misinvestment on the basis of erroneous anticipations on the part of the firm about future prices and/or an overly slow phasing out of old capacity made unprofitable through relative price change. If production is maintained at low profit plants or in subsidized loss operations the economy at large loses the extra output that locked in labor could have produced elsewhere.

The micro-to-macro model allows us to analyze these three effects. Some preliminary experiments on this model will add to the discussion in some papers already presented at this meeting, particularly those on the cost of capital effects of corporate income taxation (e.g. Bergström-Södersten; III:5 and III:7). The effects of initial productivity and profitability distributions across firms[1] and their development during the structural adjustment process can be studied during the simulations. The tax change, through rate of return requirements and the resource allocation process between firms, will be explicitly

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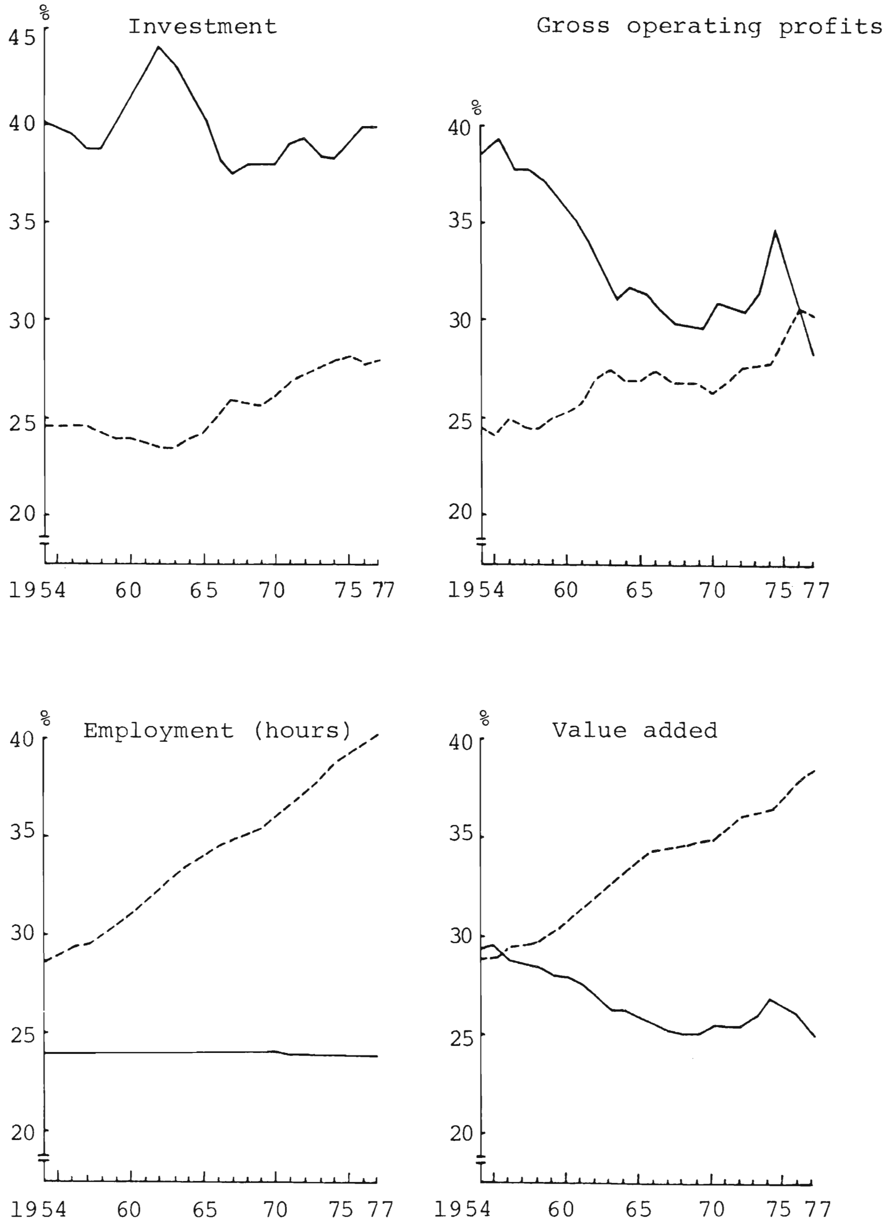
[1] As described e.g. in Lindberg, T., "Industrial profits - their importance and evaluation" in IUI 40 years - The Firm in the Market Economy, IUI yearbook 1980/81.

Figure 1. Share of investment, employment, value added and operating profits in percent of total manufacturing for Engineering industries and Raw material[a] based industries



—— Raw material based industries

---- Engineering

[a] Mining, steel and forest industries.

linked to economic growth over an extended period of time. This is a typical dynamic market allocation problem very suitable for a micro-to-macro analysis with explicit, interlinked market processes, where conventional macro based econometric techniques have their obvious limitations in clarifying what is going on. Complex events within and between firms --through markets-- are not concealed in statistical aggregates in the micro-to-macro approach.

3. THE MICRO-TO-MACRO MODEL

a) A disequilibrium theory

The micro-to-macro model (MOSES[1]) integrates a number of firm decision models through an explicit market process (the micro-to-macro-to-micro link) with the entire economy. Several restrictive (unrealistic) ceteris paribus assumptions can be removed. This is necessary or at least very desirable when studying a "simultaneous" interactive process between firms both across the economy and over time. It allows us to catch and to quantify very complex causal time sequences in the economy. As expected some unexpected results appear.

The model is based on (1) a variable number of individual firm, production planning and investment financing models, that are (2) integrated (and aggregated) through explicitly modelled labor, product and credit markets, all being (3) constrained within a macro model of the rest of the economy. The most important exogenous variables besides a) Government policy parameters, are b) foreign prices (one index for each of the four industrial markets), c) the foreign rate of interest, d) the rate of technical change--embodied in new investment--and e) total labor supply. The model is a disequilibrium one in the sense that markets are not fully cleared and stocks are not

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[1] MOSES for **MO**del for **S**imulating the **E**conomy of **S**weden.

kept at desired levels, and the state of disequilibrium feeds back on total systems behavior through its effects on relative and absolute prices. Markets adjust towards an equilibrium region (or a bounded space) in discrete steps. Once the economy has reached this region it tends to stay there if not subjected to outside shocks. Hence, stability regions would be an appropriate name as well. A business cycle around a steady state growth path, bounded from above and below in a number of relevant variables, would be a case in point. Adjustment steps may be too large, and overshooting of equilibrium can occur, something that in turn unsettles the equilibrium space towards which the next adjustment takes place.[1]

Hence, the model has no unique equilibrium point (solution) any time. Roughly speaking the model system then can be said to be stable in the Liapunov sense.[2] However, with the notion of a "bounded equilibrium region", that is not very small or infinitesimally small, as Arrow-Hahn (1971) tend to make it, stability takes on a truly empirical dimension. How large a part of a production sector can disappear in 10 years before the term instability is warranted? The determination of boundaries is a "political problem".

We will deliberately keep this somewhat "imprecise" definition of stability in relation to an equilibrium region. It seems to us empirically relevant. Furthermore, long run growth is to a large extent endogenous in the model and dependent on its stability properties in this sense. It is as will be seen, very difficult to keep the model economy on a too narrowly bounded equilibrium growth path, and this fact is an essential part of the dynamic efficiency problem, discussed here.

The model has a very elaborately developed short-term and long-term supply side embodied in the

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[1] See Ysander; III:6 in this volume.

[2] See Arrow, K. and Hahn, F.H. General Competitive Analysis. San Francisco, 1971, pp.279-284. Perhaps what La Salle, J. and Lefschetz, S. (Stability by Liapunov's Direct Method with Application, Academic Press, New York, 1961) call "practical stability" is an even better definition of the "stability" concept that is useful for our analysis.

individual firm planning process. There is an explicit link from the price and quantity outcomes in markets, through profit determination and cash flows via the rate of return, the rate of interest and borrowing, to new techniques of production.

Hence productivity at the individual firm level is endogenous and for the whole model system economic growth can be said to be endogenous under an upper technology constraint. There is another complete integration between the monetary sector and the real system across product, labor and financial markets. This makes the model truly dynamic in the sense that structural change is also endogenously determined. The micro model is complete with traditional Leontief input-output and Keynesian aggregate demand systems. Thus, price determination and income generation are combined in a theoretical (albeit numerical) model.[1]

The model project requires substantial data-base work at the micro level. The regular planning survey[2] of the Federation of Swedish Industries has been designed according to the format of the model, and the model is currently loaded with data from the 30 to 40 largest Swedish groups. The idea is to design a measurement system around financial decision units and to use the high quality data that exist at the firm level directly for an improved understanding of what goes on at the macro level.

This is one of the primary purposes of the empirical part of the model project. Direct observation of the units of measurement allows the use of very simple and efficient estimation techniques at the micro level. Some of this has been done and much is under way, but more data-base work has yet to be undertaken before the model has a sufficient empirical footing.

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[1] A complete description of the model as it stood in autumn 1977 is found in Eliasson, G. (1978) op cit. Also see Eliasson, G., "Competition and Market Processes in a Simulation Model of the Swedish Economy", AER 1977:1.

[2] Covering ca 80% of output in Swedish manufacturing.

b) Some properties of the model

Until recently, most analytical work on the model has been concerned with sensitivity analysis aimed at ascertaining the properties of the entire economic system. Even though positive influences on the model economy (like fiscal or monetary stimuli) generate normal short-term or medium-term effects, as in conventional macro-models, reversals take place sooner or later (cf. the Le Chatelier-Brown principle). We have consistently found that if shocks, positive or negative, are large and sudden enough, they disturb the market signalling system and lead to erroneous investment and production decisions which cause lasting damage in the form of lost growth. This has helped to clarify the restrictive nature of traditional equilibrium assumptions. It is interesting to notice that pushing the economy too fast, too far towards short term optimum performance (call it "short term equilibrium") tends to produce instabilities. A conflict between short term (static) allocative efficiency and long term dynamic efficiency clearly exists in the model economy.

Part of the reason for these growth effects is the long transmission times of price disturbances that upset the relative price structure and make it difficult for individual firms to interpret price and wage signals in the markets. Most of the problem has to do with adjustment step size and time frequency of response at the micro level and the across market linkages, notably efficient arbitrage in the labor market. A brief period with high prices and profits easily changes into wage drift and a cost crisis that takes years to correct if the initial disturbance was strong enough. Firms grow cautious and investments are hurt. The model has exhibited good performance in tracking price transmission through the economy and also longer term growth rates.[1] High and irregular inflation rates that split up relative prices in an unpredictable fashion have been shown to affect growth in a decidedly negative way.

c) The investment decision in MOSES

The core process in the experiments is the micro unit (i.e. the individual firm) investment decision.

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[1] See p.71 in Measurement and Economic Theory, IUI Research program 1978/79. Stockholm 1979.

A combined capital budgeting, accelerator model of the Meyer-Kuh (1957), Eliasson (1969)[1] type is used in the planning system of the model firm. The firm calculates its cash inflow net of taxes, interest charges, dividends and mandatory financial requirements from working capital accumulation (inventories, trade credits, etc.). The firm is prepared to add to this cash flow by increasing its leverage if there is a positive gap between its internal, nominal rate of return and the current interest rate. This borrowing function is crucial for the tax experiments below.

Total internal and external cash inflows so calculated determine the upper limits of investment financing available each period. In the individual firm planning process management then checks back at current operating rates. If equipment stands idle new capacity investments are reduced in proportion to the degree of capacity utilization. In the present set up of the MOSES economy,[2] long term expansionary expectations are not allowed to override the short term financing and/or capacity constraints on investment spending.

This paper is concerned with the macro allocation (growth) effects of the investment decision at the firm level. One important set of price variables that guides the allocation process that we are particularly interested in is the market interest, the rate of return requirement in the firm and the ways by which the corporate income tax places a wedge between these price variables and hence affects the investment allocation process. As mentioned, there is one sophisticated and one simple financial investment model at the firm level. The one we use here is simple in comparison with the sophisticated optimization machinery in

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[1] Meyer, J. and Kuh, E., The Investment Decision--An Empirical Study. Cambridge U.S. 1957; Eliasson, G., The Credit Market, Investment Planning and Monetary Policy, (IUI). Uppsala 1969.

[2] There are currently two versions of the investment-financing decision. The simpler model described here and used in the experiments assumes "static expectations" (today is tomorrow for ever) from the traditional investment literature. The more elaborate version (sketched in Eliasson, G., 1976b, op.cit., to be described in a forthcoming volume) allows long range expectations to override short period expectations when investment plans are drawn up.

several other papers in this conference volume, although it has the comparative advantage of explicitly tracking the "price-behavioral response-aggregate market price" sequences throughout the entire economy. We have chosen the simple or naive version for three reasons. Most important, the sophisticated firm model is not yet ready and tested for empirical use and (quite) expensive to run on a full scale. Second, we are interested in the allocation effects on the total economic system of corporate income tax changes. This requires a relevant, dynamic "surface" behavior at the firm level. As long as one can assume approximately that the effects of fine details in the firm decision process cancel at the macro level and/or that the adaptive expectations and search behavior postulated for the MOSES firm constitute good approximations at the firm level, this will be sufficient. There is in fact (and thirdly) no real evidence to the contrary. However, the results reported on have to be judged with a view to these imposed *a priori* constraints.

For the tax experiments to be carried out below, we need not concern ourselves with the exact formulation of this accelerator component in the cash flow investment function. We only need to remember that in manipulating the corporate income tax system the Government affects not only the cash flows and rate of return characteristics of firms directly but also activity levels in the economy indirectly. This is a typical micro-to-macro and then macro-to-micro feedback. So even though not very large in a short period context, if the parameter change affects first the investment and then the cyclical characteristics of the entire economy, through demand feedback, the accelerator may click in to affect investment and capacity growth again. We know already from sensitivity analysis of the total model system that these feedback effects may cumulate into considerable magnitudes over time.

In its present form the cash flow-accelerator investment function can be said to exhibit some *ad hoc* features when viewed against the backdrop of current neoclassical investment theory. However, it relates back to earlier, Keynesian type investment functions that have gained empirical support in macro econometric work and also in direct investigations of capital budgeting and planning practices within firms. The latter must naturally be the overriding information base when building a micro firm based model.

d) Corporate income taxes and dividends

The corporate income tax enters the investment decision process critically in two ways:

1) through tax leakage in dividend (or cash) flows,

2) through its effects on rate of return requirements that affect the propensity to borrow.

Fiscal write-off rules in Sweden are relatively generous. Within broad operating limits it is possible to target a long run dividend policy and to report income for taxation accordingly.

It is possible to delay dividend increases substantially until an increase in operating profits is known to be of a more permanent nature. Higher investments in construction, machinery and inventories make this easier in the short term, and also in the long term if new investments also turn out to yield a higher return. Likewise, deteriorating profits do not have to lead to reduced book profits and dividends immediately for the same reasons. Hence, fiscal depreciation rules facilitate short term stability in dividend pay out rates. This feature is supported by reported experience and empirical evidence and has to go into individual firm model specifications. We have thus incorporated the flexibility allowed for in Swedish corporate tax laws without exactly representing all the detailed arrangements provided by investment funds, special deductions etc, which would have made the fabric of the firm model unnecessarily complex for our purposes.[1] More exactly it is assumed that

1. Firms target a dividend that corresponds to an empirically estimated real pay out on equity (as shown in the books).

2. The corporate income tax then is a fraction (somewhat larger than unity) of the dividend, all (1 and 2) provided that

3. the nominal return to total assets is higher than a certain lower limit which most firms pass under normal circumstances. If this return-requirement is not satisfied,

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[1] This is why we used the term "relevant surface" behavior in the section before.

4. no dividends are distributed and taxes are calculated as nominal rates on net taxable income.

(The rate of depreciation used here is the general rate that the law prescribes, a parameter that we can vary in our experiments.)

5. A general constraint that applies throughout is that taxes and dividends paid are always less than or equal to book profits.

6. The tax-dividend relation furthermore, has been made positively dependent upon the nominal tax rate, implying that firms will increase the dividend pay-out rate in response to a lowering of the tax rate (and vice versa).

Implicit behind these specifications is the assumption that, except in extreme situations, the firm never runs out of depreciable assets to the extent that the dividend-tax relationship breaks down. This is probably a quite acceptable approximation and to model more fine detail here would detract attention from our chosen problem and would bring us right into the intricate mess of tax considerations that corporate finance people in most industrialized countries have to spend considerable time on.

These assumptions defining the dividend decision are crude rules of thumb, albeit therefore not in contradiction to observation.[1] There is no reason to expect that these simplifying specifications have biased our experiments. We use them until a better empirical foundation has been obtained.

e) The rate of return requirement

Rate of return requirements appear implicitly in the investment process, although they are very explicit in short term production planning. The propensity to borrow depends on the difference between the nominal after tax return on productive investments in the firm and in alternative financial investment opportunities. Hence, the before tax, *ex ante* rate of return (requirement) can

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[1] The dividend formula is in fact taken directly from actual practice reported on in a Swedish firm. See Eliasson,G., Business Economic Planning Theory, Practice and Comparison, John Wiley & Sons, London etc., 1976a, pp. 170-174).

always be calculated as well as (of course) the *ex post* rate of return realized.

The after tax nominal rate of return on net worth (valued at replacement costs) of a firm can be shown to be:[1]

$$RNWT=\Big[(1-T)RNW+\underbrace{T\cdot(DP+RHOBOOK-RHO)\frac{K1}{NW}}_{\text{Tax leverage}}\Big]\cdot\frac{NW}{NW-TC} \qquad (1)$$

where (the before tax return)

$$RNW = RN + \underbrace{(RN-RI)\cdot\frac{BW}{NW}}_{\text{financial leverage}} \qquad (2)$$

and

$$RN = \left(M\cdot\frac{S}{A}\right)-\left(RHO\cdot\frac{K1}{A}\right)+\left(DP\cdot\frac{K1}{A}\right) \qquad (3)$$

M	=	Operating gross profit margin in terms of S
S	=	Sales
T	=	The nominal tax rate
RN	=	Nominal rate of return on total assets
RI	=	Market interest rate (endogenously determined in the model)
DP	=	Price change on investment goods
RHOBOOK	=	Fiscal depreciation rate
RHO	=	Calculated economic rate of depreciation
K1	=	Fixed assets at replacement cost
A	=	Total assets valued according to a replacement cost formula
BW	=	Total debts
NW	=	Net worth = (A - BW)
NWBOOK	=	Net worth as it appears in the books, i.e. total capital with the fixed part valued at historic cost, less BW
TC	=	T$\cdot$(NW-NWBOOK) = hidden tax credit.

The idea behind (1) is that fiscal write offs (RHOBOOK) do not reflect the economic rate of depreciation (RHO) of assets. Hence hidden reserves are accumulated and figure in the "true" balance sheets of the firm as non-interest bearing tax credits, and are regarded as such by firm

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[1] Expressions (2) and (3)--called the separable additive targeting formula--are derived in Eliasson, G. (1976a), *op. cit.*, pp.292 ff.

management. Tax credits yield a leverage contribution to the return to equity, in the same way, see (2), as does borrowing at an interest rate that is lower than the return to total assets. The firm controls the size of its tax credits through its investment decision and its ability to avoid losses.[1]

While borrowing, and indirectly investment, are in turn driven by inter alia the relationship between RNWT and RI (see further below) the production decision of the individual firm is controlled by an endogenously targeted value on M.[2]

f) The tax leverage

The tax leverage operates by lowering the effective tax rate below the nominal rate T, which essentially means raising the rate of return above that with full taxation (= (1-T) • RNW) for a (NB!) given, before tax rate of return. The last point is the interesting one in this paper. To what extent can the before tax rate of return be assumed given in a total model context, or how does the investment decision, that is affected by rate of return requirements within the firm, and hence taxes, affect the rate of return on investment?

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[1] This way of defining and interpreting RNWT is of course slightly arbitrary. We could alternatively exclude the potential tax burden from the denominator and subtract both the actual and the potential tax each year from profits in the numerator. In the longer term the results should be the same. In the short term, however, this measure could behave erratically during inflationary times. Alternatively one could as well remove the potential tax from the asset measure (the denominator) only, arguing that firms feel no "responsibility" to earn a return on the interest free tax credit. This suggestion is in fact the one most compatible with our hypothesis about before tax rate of return effects of accelerated depreciation, and quite testable.

[2] See Albrecht, J., "Production Frontiers of Individual Firms in Swedish Manufacturing 1975 and 1976" in Carlsson-Eliasson-Nadiri (eds), The Importance of Technology and Permanence of Structure in Industrial Growth, IUI Conference Report 1978:2.

In formula (1) above, the size of the interest free tax credit in proportion to net worth:

$$\frac{NW}{NW - TC}$$

boosts the after tax rate of return by allowing the firm to earn its after tax rate of return net of this tax credit. Each period new such credit is generated to the extent that the inflation in equipment prices plus the rate of fiscal write off allowed exceeds the economically motivated depreciation of equipment (DP + RHOBOOK - RHO). This calculation abstracts of course from the additional leverage that comes from investing at a higher return than the interest rate.

The tax leverage can only be exploited on investments in depreciable goods[1], not on alternative investments in nominal financial assets. For these the after tax rate of return would be:

$$RFAT = (1-T) \cdot RI \qquad (4)$$

where RI is the going interest rate.

As the business world is now shaped in the MOSES model the firm borrows to invest, or abstains from lending its cash flows for two reasons:

(a) It earns a real return on these investments that is higher than what it can earn on financial investments.

(b) The tax system allows the corporate income tax to be postponed by extending an interest free tax credit. A tax wedge, so to speak, enters the decision to allocate cash flows.

The two considerations have to be taken simultaneously. For instance it might be remunerable to borrow for investment purposes to exploit the tax credit even if the interest rate is higher than the rate of return realized before tax.

The crucial point now is to allow these considerations to affect the borrowing decision and then

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[1] An inventory accumulation means even more favorable tax credit benefits in Sweden. We abstract from them in this formal context.

the investment decision. In the current version this is done in a fairly crude fashion by simply assuming:

$$DBW = a + b \cdot \left(RNWT - (1-T) \cdot RI\right) \quad b > 0 \qquad (5)$$

where DBW is the net rate of change in outstanding debt. Add the net increase in debt so determined to net cash inflow from current operations in the firm less mandatory current capital accumulation, taxes, dividends and interest payments and the investment budget is obtained. This is the upper investment spending limit for the period. The current rate of capacity utilization determines the extent to which it will be used for investment in machinery and equipment or added to liquid assets.[1]

First, (5) represents an average profitability criterion for the entire firm based on returns on already invested capital that determine the rate of borrowing. Note, however, that marginal considerations appear very importantly anyhow, since firms compete with one another for external finance in the model credit market, determining the interest rate (RI) in the process.

Second, (as mentioned) long term considerations are not allowed to override short term considerations in the model version used in this paper.

These two objections will be removed in due course. For the time being this is the analytical tool we have and the principal long term results should be the same. It always pays for the firm to invest and to gear up through borrowing as long as (RNWT-(1-T)•RI) is positive even though RN or RNW decreases in the process. In this sense the investment function incorporates marginal rate of return considerations.

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[1] Much along the lines hypothesized and empirically tested in Eliasson, G. (1969), op. cit.

4. EXPERIMENTAL DESIGN AND RESULTS

We have subjected the firms to combinations of three different market environments and two fiscal depreciation regimes.

The market environment reference base case is described by historic relative and absolute price change from 1968 to 1976 as shown in Figure 2, and then a continuation of trends through 1987 ("stable market environment").

In one market scenario we pivot relative prices more in favor of investment goods industries (applying a linear transformation during a four year period beginning in 1969) subjecting the raw material sector to stronger competitive pressure from abroad ("slow pivoting"). Throughout this scenario absolute export price change is the same as in the base case above. Only relative export prices change.[1]

In another (volatile) market scenario we pivot relative prices much faster (i.e. the transformation is completed within one year) against raw material producers ("fast pivoting"). The change, however, does not begin until 1974, immediately after the extreme raw materials price hike in Sweden 1973/1974. Again the absolute export price development is kept the same.

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[1] Note from Figure 2 that the improvement in relative prices for engineering (i.e. the investment goods industries) is broken in the 80's. This, of course, only reflects the fact that due to earlier improvements, engineering is now the largest sector, and relative prices should tend towards index 100 as the sector approaches 100 percent of manufacturing.

As for fiscal write-offs, we have assumed the average lifelength of total fixed assets to be 4 and 20 years respectively compared to 7 years on the average in the reference case.

In a first A series of two experiments we accelerate and slow down fiscal depreciation rates around the reference case with a stable relative price environment assumed.

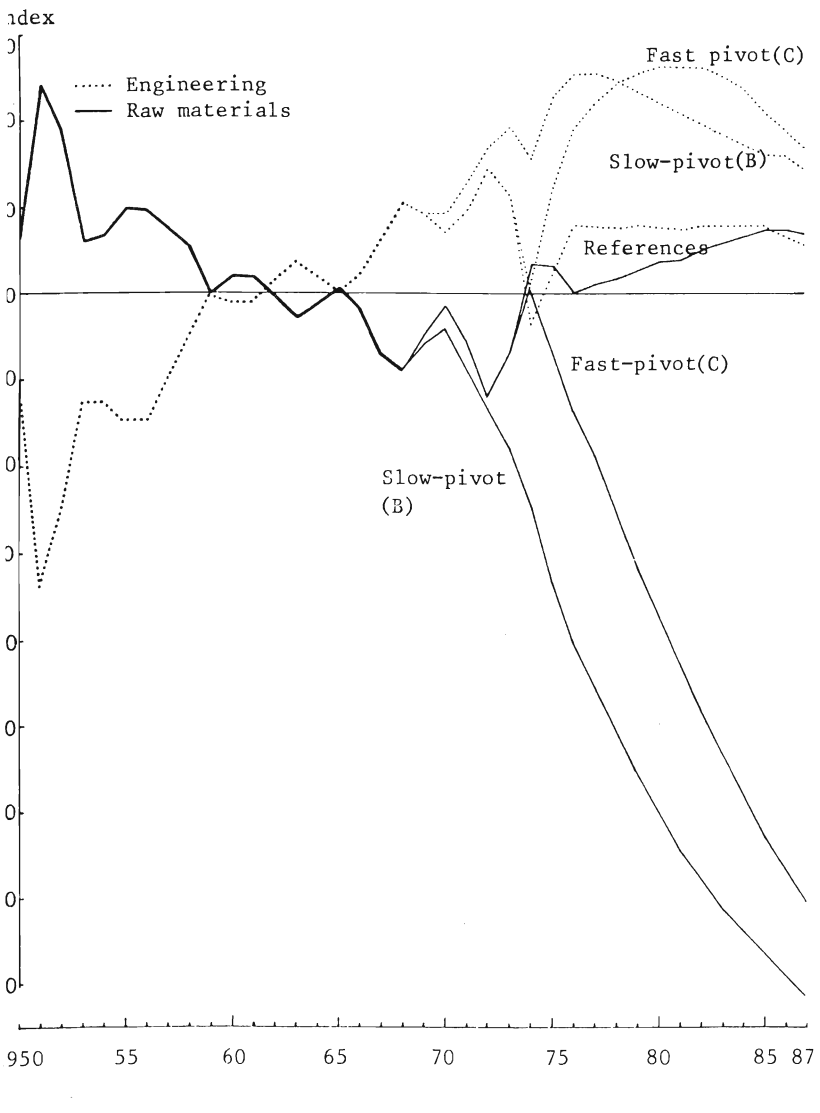
In a second B series of two experiments we do exactly the same for the slow relative price pivoting.

And in a third C series of experiments we do the same for the fast relative price pivoting (the volatile market environment), except that we also add an experiment, combining the fiscal regimes. In the slow depreciation case we repeated the experiment as before during the pivoting up to 1974, but with faster fiscal depreciation after 1974. This was to see whether more generous cash flows in engineering industries with a bright future (and raw materials now basically out of business) would speed up growth.

For the discussion to follow the reader should note that the strong inflationary wave in 1973-74 is followed--as in reality--by a strong but temporary improvement in the relative price trend for raw materials (see Figure 2).

The reference case run used for comparison begins in 1968 and covers a statistical history of 9

Figure 2. Relative export prices 1950-1987
Index 100 = average price for all exports



years before it enters the future. It runs along historically known exogenous data to begin with and then on a trend projection. The model version used (being ready in mid-1978) traces historical trends and inflation rates well, however not so well for cyclical macro behavior. Besides, there are slight differences between actual and simulated intersectoral growth rates that take on sizable proportions towards the end of the 20 year simulations that we perform here.[1]

The set of trend projections of exogenous data does not represent a realistic forecast --the recent IUI medium-term assessment of the Swedish economy (from which Figure 1 has been fetched) projects a rather stronger expansion of engineering industries and a faster contraction of raw materials. Quantified effects from the simulation runs have been scale-adjusted and presented with reference to the above mentioned 1968-1987 base and is shown in Figures 5A to 5G. This allows us

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[1] Because of the logics of the model they most probably depend on inconsistencies between (1) exogenous export prices used and national accounts statistics and/or (2) inconsistencies in the input/output structure and the composition of total demand as calculated by the model and/or in the (3) exogenous assumptions on relative technical change in the various sectors. Since we do not want to tamper with the official macro data bases --put together under frustration and effort-- until we know better, we have chosen to experiment with the technical assumptions arrived at by Carlsson, B. and Olavi, G. ("Technical change and the longevity of capital in a Swedish simulation model" in Eliasson, G. (ed), 1978 op. cit.) So far, however, we have not succeeded in fine tuning sectoral changes to our satisfaction. On this score we are looking forward to the implementation of a new micro-firm data base that should improve things considerably.

to compare simulations with time series material all the way back to 1950.[1] These are our results:

Experiment series A (stable market environment (= REF)):

Lowering the rate of fiscal write off from 7 to 20 years (it is still above the calculated economic rate of some 30 years, used in the model) slows down investment spending in industry considerably (Figure 3A) to approximately 75% of the level in the reference case for some 10 years. Thereafter bottlenecks in the production system, and a general increase in prices generate an investment boom for several years. Accelerating fiscal write-offs from 7 to 4 years increases investment spending somewhat throughout the whole period.

Industrial output, however, is affected quite differently, depending upon which of the two scenarios we play, (Figure 4). For the first 5 to 8 years there is an increase in output compared to the reference case in both runs. In the expansive fiscal case this occurs through a demand effect via increased investment spending, and in the tightened fiscal case through a more efficient utilization (!!!) of existing capacity. Profit mar-

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[1] The assumption implicit in Figures 3 to 7 is that effect time profiles do not depend on the same specifications that produce erroneous cyclical behavior. We do not argue that it is altogether acceptable to do so. Several years of experience with calibrating the micro-to-macro model do, however, suggest this assumption. See for instance the article on estimation by Eliasson, G. and Olavi, G. (pp.95-101) in Eliasson (1978, op.cit.). If we abstain from drawing conclusions from the diagrams on year to year changes but rather look at longer term changes there should be no problem.

gins are coming down but rates of return are maintained because of a more efficient utilization of capacity. More resources are freed for private consumption. This is, however, a transitional phase that reverses itself in the second decade of the simulation (see below).

When we look at the allocation pattern between sectors the process gets more involved and interesting. (See Figures 5A-G).

First of all it is interesting to note how loosely correlated investment spending and production is in the short term at both sector and total industry levels.

Second, the allocation effects from varying write-off times compared to the reference case are as expected on the investment side although they are small. Accelerating fiscal write-offs increase the relative share of investment that goes to raw materials to begin with. In the longer term the effects cancel and vice versa for slowing down fiscal write-offs.

In the slow fiscal write off scenario total investments have been lowered in the first decade. Firms therefore have to cope with less and less modern machinery and somewhat higher wage levels. They respond in the second decade by reducing output to maintain or increase profitability. This is not necessary in the accelerated fiscal write-off case.

We can learn from this that the traditional "static" allocation story holds in the short run (up to 5-7 years) but then has to be modified in several ways.

Experiment series B (SLOW Price PIVOT):

When relative prices are pivoted slowly in favor of engineering industries (compared to the base case) a slight initial, extra investment spending period in the raw material sector can be observed (Figure 5A) due to a temporary raw materials cyclical improvement in 1969/70. The relative cyclical price improvement in 1973/74 is however removed in this case. The deteriorating competitive situation cuts into profits very fast to offset the misallocation effect on investment on the basis of past profits. (Figures 2, 5A and 5E). The raw materials sector then gradually fades away for some 10 years. With a slower fiscal write-off, investment spending in the raw material sector is curtailed somewhat faster. The waste of investment resources in the raw material sector due to generous fiscal write-offs, however, does not seem to mean much - contrary to the traditional view. Generous fiscal write-offs help the expanding engineering sector even more in the longer (beyond 5 year) run and this is most clearly seen in both total and relative investment and output levels (Figures 3A, 4 and 5A).

Hence, while static allocative efficiency seems to have improved in the short run through a tightening of fiscal depreciation rules, bottlenecks in capacity develop after some time, instabilities are generated and a sudden investment boom to replace capacity is started up around years 8 to 10. The very strong differences in the investment cycle generated by the fiscal parameter change are clearly demonstrated in Figure 3A. The interesting thing is, however, that it takes so long (Figure 4) for the effects to show in output in all experiments. Table 1 illustrates this in compact form. In fact, looking at the first 10 years only may suggest a conclusion that is entirely wrong. By tightening up fiscal depreciation rules investment can be reduced by 25% with no loss in output for the first 10 years.

Even more important, however, seems to be that expanding firms in the engineering sector do not grow as fast because of less generous fiscal stimulus. One may perhaps conclude that long run dynamic efficiency has not improved or that a tight fiscal policy vis-a-vis firms has raised the discount rate and shortened the planning horizon, producing less growth in the long run.

As in the A series of experiments, accelerated fiscal write-offs also here lower the real rate of return on total assets in the long run--and vice versa. This is, however, not the whole thing. A most interesting feature of the real world appears when relative prices are pivoted against raw materials. In the early 80's, firms in the raw material sector are beginning to feel the competitive pressure to the extent that several of them close down, since they cannot produce at acceptable profit rates. Earlier, the expanding engineering sector had not been able to employ people at the rate desired without pushing up wages at the expense of its own profitability performance. With several large raw material producing firms leaving the market, labor is freed for employment in the engineering sector. These firms take off at a fast rate and at general wage increases, that are slow enough not to eliminate incentives to invest and grow, as was the case in the A-series. The importance of strong competition between the "old" and the "new" industries in factor markets is vividly illustrated in a quite Schumpeterian fashion. Output shoots above the base case in the second decade of the simulation. (Figures 3a and 4 and Table 1). The total allocation effect hence is very large, and this simulation illustrates that the waste accomplished through mistaken investment decisions themselves may be small or negligible. The real social and private waste occurs when production continues in the relatively inferior production plants. Labor is locked in there at market wages, which the plant is able to pay as it is run down gradually at a slight return above current costs. A somewhat higher overall wage level than otherwise is maintained and expanding firms cannot easily attract labor with generous wage offers without generating wage drift that endangers their own expansion plans. This deprives the entire economic system of a larger output from the same labor elsewhere. If so, a fast deterioration of the competitive position of such firms, to the extent that they are forced to shut down, will produce a higher "social return" than a gradual deterioration that allows inferior firms to keep producing until they fade away, due to dwindling financial resources to invest.

There are three additional qualifications to this conclusion. The <u>first</u> one is political. The govern-

Table 1. Investment and output effects of fiscal experiments in manufacturing
In percent of reference base case (= 100) on the average

	Investment 1968-77	Investment 1968-87	Output 1968-77	Output 1968-87	Raw material output 1974	Raw material output 1977	Raw material output 1987	Number of firms closed down[a]
A-EXPERIMENTS								
Base case, with fast write-off	110	110	104	103	100	102	110	0
Base case, with slow write-off	73	105	100	97	99	97	128	0
B-EXPERIMENTS								
Slow price pivoting, with fast write-off	123	123	104	109	89	74	81	11
Slow price pivoting, with slow write-off	75	-	100	-	94	76	-	0
C-EXPERIMENTS								
Fast price pivoting with fast write-off	110	102	104	102	100	99	64	12
Fast price pivoting with slow write-off until 1987	73	128	99	102	98	93	58	7
Fast price pivoting with slow write-off through 1973, then fast	87	132	100	104	98	94	50	9

[a] All in raw material sector and after 1980. Initial number of firms in each sector is 15.

ment may step in with a social welfare program for dying firms as it has done in Sweden during the last few years, and in other countries like France and England for many years. Then the beneficial allocation effects will be further delayed (or disappear) and output will be lost in the long run. There has not been time and money for simulating the Swedish government subsidy program on the model yet, but such an experiment is certainly feasible.

Second, if the relative price change is too sudden and too strong, market prices throughout the economy may be thrown out of equilibrium to the extent that instabilities develop that hurt growth more than what is achieved through the improved allocation discussed above. The relative price pivoting in export markets assumed in the B set of the experiments was not enough to force the model economy into such an unstable situation.

Third, it may be argued that labor thrown out of their jobs, nevertheless will not move to the new jobs being offered. Geographical distance, that is not explicit yet in this model, may be one reason. This feature of real life can be said to be covered in a somewhat crude way in the current model version. The labor market search pattern and wage response parameters of labor and firms allow a quite realistic wage level differentiation to develop between firms in those simulations that best capture postwar Swedish economic development. This may be interpreted as partly due to labor immobility because of geographical distance etc. If unemployed labor would be 100 percent deprived of income it certainly would move to a job offered.

Each period, each member of the labor force has a well defined "reservation wage"; when on a job his/her current wage plus a "mobility threshold", that can be varied; when unemployed an unemployment benefit amounting to a fraction (here 60 percent) of the average wage in manufacturing. Labor moves voluntarily when offered a wage higher than his/her reservation wage. The objection then is not really that geographical distance etc. suggests other, higher reservation wages--they can be changed in a new series of experiments if somebody comes up with better empirical information than we have. The point is that if labor does not move to accomplish a more efficient allocation they have been stimulated to stay where they are by a combination of taxes, subsidies and unemployment benefits. The allocation in the experiments reported here has been accomplished on a parameter specification that seems to be quite good for the postwar Swedish economy. The experiments suggest that you can improve that allocation by varying the tax-subsidy and even unemployment benefit parameters that stimulates labor move.

5. STABILITY AND TAXES--THE OPTIMUM SPEED OF STRUCTURAL CHANGE

Profitable firms trying to expand in experiment series A with generous fiscal treatment tended to drive up wages (overshooting) and imperil their own profitability position if expanding too rapidly. The business situation for expansive firms was dramatically improved when relative prices were pivoted in the B series of simulations, favoring engineering firms and forcing several raw material firms out of business, making labor available for expanding firms in the process. Stability in the market price system and of total economic development was increased here. However, a typical characteristic of the micro-macro model[1] is that when price change gets faster and stronger, feed back effects through the entire economy may create a different type of instability. The production structure cannot adjust fast enough, but the speeded up adjustment makes market prices irregular, jumpy and difficult to interpret by the firms. In earlier versions of the model, loaded only with synthetic firms, inter-firm variation in productivity was very small- there was so to speak only a very thin Salter tail of relatively low performance firms--and almost an entire sector could close down in a few years from a sudden relative price change. The curtailed domestic supplies and the new labor market situation that followed kicked the economy into an entirely new state, which in turn changed the price structure drastically, etc.

This time half the data base consisted of real firms, and even though some essential, individual firm information was still of a synthetic nature at the initial year 1967, between firm productivity variation was much larger. Hence the systems effects were not as dramatic as they had been earlier.

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[1] See Eliasson, G., "Experiments with Fiscal Policy Parameters on a Mirco-to-Macro Model of the Swedish Economy" in Haveman-Hollenbeck (eds): Microeconomic Simulation Models for Public Policy Analysis, Academic Press 1980.

<u>Experiment series C</u> (FAST price PIVOT):

The critical stability issue this time has to do with the rate of structural change policy makers are willing to absorb. One may say that the C series is similar to the Swedish policy response during the 1973/74 oil price shock. Raw material prices were allowed to be transmitted through the economy and be followed by a strong surge of wage drift as absolute prices leveled out unexpectedly in 1975 and after, mainly through a strong drop in raw material prices. The effects are dramatic in the model experiments. Raw material producers invest and expand through 1974 and then everything suddenly collapses with the sector (almost all firms) practically disappearing during the 80's. The instability created has to do with the speed of disappearance, of a large sector, employing in 1974 some 20 percent of the entire labor force in industry, to something quite insignificant, a little more than 10 years later (see Figure 5C). The interesting thing is what this means to the rest of manufacturing and what difference depreciation rules make.

The first thing to note is that generous depreciation rules turn out to be a killing experience for the raw material sector. Firms invest (see Figure 5A) and expand too fast, only to go bankrupt when the market price situation suddenly turns around. Only three firms of 15 are left at the end of the simulation. Other sectors benefit from released labor and slower wage increases, but total industry output remains below that in the matching B run, when prices turned against raw materials earlier and at a slower rate. This misallocation due to a too fast adjustment of production structure cannot be made up for in 15 years.

Next, when depreciation rules are tightened up investment slows down in all sectors during the first decade. Obviously, this means very little for output, even though investment is reduced substantially. It saves several raw material producers from overexpansion and close down in the 80's (only seven close down compared to 12 in the earlier run). In this way the raw material sector contributes to growth while other sectors, notably investment goods industries, find time to catch up. Output in total manufacturing, as well as raw material production, throughout the 20 year period is in fact higher than in the scenario with generous fiscal write-offs.

It may be of interest to ask which tax regime gives the best results--the optimum rate of structural adjustment given full knowledge of the market scenario. It appears that results in terms of growth in output are much improved when fiscal depreciation rules are kept tight until the raw material boom is over in 1974 and then accelerated for the rest of the period. However, the extra output gain during the second decade is costly in terms of investment, presumably because of the drastic intersectoral change that takes place. Some further micro detail is worth observing. In the earlier experiments relatively profitable raw material producers locked up labor resources and kept engineering firms from expanding during the first half of the simulation period. Now tight fiscal rules have kept raw material firms from expanding during that period. When the market turns decisively in favor of the engineering sector from 1974 and onwards, there is enough labor for firms in that sector to expand without strong wage drift. With more generous fiscal depreciation rules they expand employment so heavily that they drive up wages to such an extent that two additional raw material producers have to close down. The result is a higher total output throughout the 20 year period than in all other experiments and in particular during the second 10 year period. There obviously cannot be a simple one-to-one correspondence between profitability and growth at the macro level. The reallocation of resources between firms that enhances output reduces rates of return in high performance, rapidly expanding firms and vice versa, leaving very little of stability in a macro relationship.

6. PROFITABILITY AND TAXES

The allocation effects of the fiscal depreciation experiments are also mirrored in the before tax returns to capital (see Section 2).

The individual firm may overinvest, driving down the before tax rate of return, while the after tax rate of return on equity increases because of a more generous fiscal depreciation rule (series A), or it may invest too much in the wrong market for the same reasons, driving down all rate of return measures (series B and C).

An expansive sector being further stimulated by generous fiscal write-offs may drive up the wage level for other sectors and hold rates of return down there. If market conditions are suddenly reversed (C series), the magnitude of the earlier misallocation and the speed with which it is corrected, determines the rate of return consequenses in other sectors and for all industry. The faster low profit firms disappear, the faster overall profitability recovers. On the whole, the complexity of the allocation machinery should warn us not to expect as clear and transparent conclusions on the rate of return side as on the growth side in earlier sections.

We will examine the real rate of return to capital in all industry,[1] and each of the two markets raw materials production (RAW) and engineering (DUR)-- under the two tax regimes; under stable market conditions (series A) as well as when the environment is changing on the price side (series B and C). Finally, we will examine individual firm behavior at the micro level.

a. Macro level

In the stable market environment (= A-series of experiments) an increase or decrease of depreciation allowances leaves profitability almost unaffected, when viewed at the total industry level. (See Figure 6A and Table 2). As would be expected

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[1] The real return to capital has been calculated with a replacement cost valuation of the fixed assets. Nominal capital gains from price increases on goods in stock have not been subtracted. Capital gains due to relative price changes on investment goods have also been disregarded.

from section 2, a more generous depreciation rate lowers the before tax return 2% on a yearly basis through an expansion of investment at lower cut-off rates on the margin, without lowering the after tax return on net worth. A reduction of the fiscal write-off rate yields no discernible long term deviation from the reference case.

With a slowly introduced price disadvantage for the RAW sector in the B-series, the "best" fiscal policy at the total industry level seems to be the generous one. In the long run, a rate of return level 22% above that in the reference case is attained. Over the first ten-year period an improvement of 5% can be compared to a deterioration of 2% in the tight policy alternative.[1] When foreign prices are drastically turned around, in the C series, the situation is reversed. A harsh fiscal policy leaves all industry 18% better off on the rate of return side, instead of 1% as in the generous case.

In the last experiment on the C-scenarios, we start with a fiscal depreciation rate of 5%. Once raw material firms are "safely on the downward side" from 1974 and on, we raise the rate to 25%, with a view towards stimulating investments in profitable growth sectors. One result of this is much more total output (see Figure 4 and Table 1). Compared to the case with generous fiscal rules, the overall allocation of resources has improved a

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[1] Due to practical and cost considerations this latter run was (unfortunately) not carried further than 10 years.

Table 2. Real return to total capital before tax

Index 100 = Reference base case.

Scenario	Foreign price development	Fiscal depreciation rate	Raw materials			Engineering			Total industry		
			1968-1977	1978-1987	1968-1987	1968-1977	1978-1987	1968-1987	1968-1977	1978-1987	1968-1987
A	Neutral	25 %	109	109	109	97	100	99	98	98	98
		5 %	105	153	129	86	89	87	96	105	100
B	Slow pivoting	25 %	68	10	39	122	176	149	105	139	122
		5 %	82	-	-	105	-	-	99	-	-
C	Fast pivoting	25 %	97	23	60	106	164	135	98	105	101
		5 %	97	20	58	91	166	128	97	139	118
		5→25 %	95	21	58	91	168	130	96	121	109

Note: The profitability in the two sectors is expressed in relation to Total industry.

lot through a clever policy arrangement. Both the private and the social benefits from this extra allocation effect are large.

Such action also makes rates of return at the total industry level increase substantially, but not to the level obtained when fiscal depreciation rules were kept tight throughout the entire period and forced the firms to economize on capital account. The other side of this has already been observed in earlier sections. A more generous fiscal policy stimulated investment and growth in engineering. Demand for labor increased as did the wage level, driving down before tax returns to investment slightly throughout industry.

b. Markets and industries

In Figures 5D and 5E the shares of total industry profits represented by the two subindustry groups are shown. In Figures 6B and 6C before tax rate of return variations around the base case are illustrated. It should be noted that in the initial position raw material industries (RAW) are inferior to engineering (DUR) in respect of profitability, yielding only 65% of the manufacturing average.

Speeded up fiscal depreciations in the stable market A-series, improved the relative rate of return position of the depressed raw material producing firms. In the markets for durable goods, profitability stayed at the earlier level. Behind this shift in favor of raw material producing firms, we find an uneven distribution of investment expenses. RAW responded immediately and heavily with investments as well as with increased hiring of labor to the tax incentive. Investments in DUR, on the other hand, were not affected at all during the first years. The different profitability positions at the beginning thus were crucial for the decisions to invest and expand. An investment-boom in DUR did come about, but it was delayed until the second decade of the simulation.

When nominal rates of return on net worth before and after tax are compared with those in the reference case, we find that the generous fiscal write-off rules increase the after tax rate of return relatively more and uniformly in all four industrial markets. This is the typical effect of tax-leverage from the interest free tax-credit (see (1) in section 3 e). This result would have been even more interesting if the model had allowed for a third source of finance, namely new issues of share capital. In the current model version no stock exchange exists. The only investor watching the rate of return development and comparing it with alternative investment opportunities, is the firm itself.

The generous fiscal policy resulted in the expected increase in investments (+10% at the all-industry level). Since the lion's share is directed to the relatively unprofitable raw material sector in the first years, the overall output effect is limited to an increase of 2.5% and the return on total capital to a decrease of 2%.

Under the opposite, tight depreciation regime returns to capital in the raw material sector increases strongly while they decrease in the investment goods industries. The reason is the depressed investment cycle, generated by the fiscal rules, throughout industry. It hurts durable goods producers for some 10 years. Then a strong replacement, investment cycle sets in. The simulation, however, ends with a permanently reduced investment goods producing sector (DUR).

As a consequence of the gradual favoring of DUR in the B-series, profits and cash flows fade away slowly in the raw materials sector. Faster fiscal write-offs mean more investment in that sector than would otherwise have been the case, but the stimulus mostly increases investment in the already expanding DUR-industries. This expansion worsens the relative competitive situation of raw material producers even further. During the second half of the simulation returns to capital in this sector is down to one tenth of that in the basecase. Durable goods industries totally dominate the investment scene. 11 out of 15 raw material firms close down in the 80's and this fact helps somewhat to keep up sector profitability. Most of labor migrates to the engineering sector. In 1968, 22.7 and 36.2% of those employed in industry worked in RAW and DUR respectively. Twenty years later only 4.2% remains with RAW, whereas 78.3% earns their living in the durable goods producing sector.

When relative prices are pivoted more strongly against raw material producers after the temporary profit bonanza in 1973/74 (C-series), the allocation process is disturbed. The redistribution of real resources is not carried out quite as smoothly as in the slow pivoting, (B-series), and this shows most clearly in profitability development, the general level of inflation and the external balance of the country. The restructuring of industry in the generous fiscal case does the most damage to overall profitability (see Table 2), and allocation results, in terms of output, are dismal compared to the other fiscal alternatives (see Figure 4). 12 out of 15 firms in the raw material sector close down. In the tight fiscal case, insufficient investment and capital equipment create, in the first decade, a general run for labor, driving wages and domestic prices sky high. A prolonged profit depression in industry starts due to deteriorating export margins.[1] The economy is on its way back to normal profits and a restored external balance towards the end of the 20 year simulation but at a price level some 40 percent above that in the tight fiscal and/or the base reference case.

c. Micro level

All experiments described in this article were carried out on a model-setting containing 30 real and 30 synthetic firms, equally divided on the four industrial markets. Consolidated accounts of all firms added up to sector national accounts data. We will now take a closer look at these micro-units in the raw materials production and engineering industries.

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[1] This could have been countered with a devaluation and more inflation, at least temporarily.

Figures 8 and 9 show the profitability outcome in two C-simulations on a firm-by-firm basis, namely the one with a tight fiscal policy throughout and the one with a change to a generous policy after six years.

Increased foreign competition (through price-pivoting) led to a decreasing RAW-sector in both experiments. The two scatter-diagrams show only firms that managed to escape bankruptcy. The number of RAW-firms has been reduced to one third.

Returns to total capital 1968 and 1979 have been plotted in Figure 8 for the remaining firms under the two schemes. The arrows indicate the direction of the shift, with the head pointing at the "easy fiscal policy" observation. In general, firms exhibiting a low rate of return in the first case tend to stay at that low level also after the change has taken place (the bottom-left part of the diagram). They seem however (with a couple of exceptions) to be heading upwards. The opposite behavior can be said to hold for the initially highly profitable firms. Their rates of return decline.

This fits our original hypothesis that highly profitable firms increase their investments because of fiscal stimulus, to the extent that they drive down before tax rates of return on the margin. Firms on the edge of ruin, on the other hand, were able to consolidate their positions by contracting output and slowing down investment. The scatter furthermore leaves the impression that good or bad "luck", in terms of profits, seem to stay with firms for a long time in the model, as in reality. The scatter stays rather close to the 45°-line.

Figure 9 reflects the changed relation between before- and after-tax rate of return on net worth in the two experiments. Again, the arrow-heads point in the direction of generous fiscal policy observations.

All firms experience higher after-tax returns as a consequence of tax stimulus. However, the most striking feature is the clustering of firms into two separate groups with entirely different performance characteristics. Almost all high-profit units lower their before-tax rate of return as a result of the more generous depreciation rules, while the low-profit units do the reverse. In fact, we are presented with an explanation to the drop in profitability in engineering industries observed in Figure 8.

The reason is, of course, a combination of reduced slack and a contraction of output growth to a relatively more efficient and profitable production range of the firms as a result of more competition. Part of this is reflected in a movement of labor out of raw material firms into expanding engineering firms. We think that this final conclusion illustrates one important feature of the growth process, namely that growth itself affects factor prices so that they tilt against the growing firms. Endogenous factor price feed back so to speak operates as a "growth cost factor" that increases faster than proportionally to growth. It is then also easy to see that artificial price wedges (like taxes and subsidies) can easily reinforce that mechanism, slowing down both the resource allocation process and growth, through increasing the cost of growth.

These results finally suggest strongly that one needs the dynamic representation of a market economy with endogenous factor prices and structural change of the micro to macro model to conceptualize, think about and quantify these mechanisms.

Figure 3A. Investments in Total Manufacturing, 1968-1987

Index 100 = Reference base case

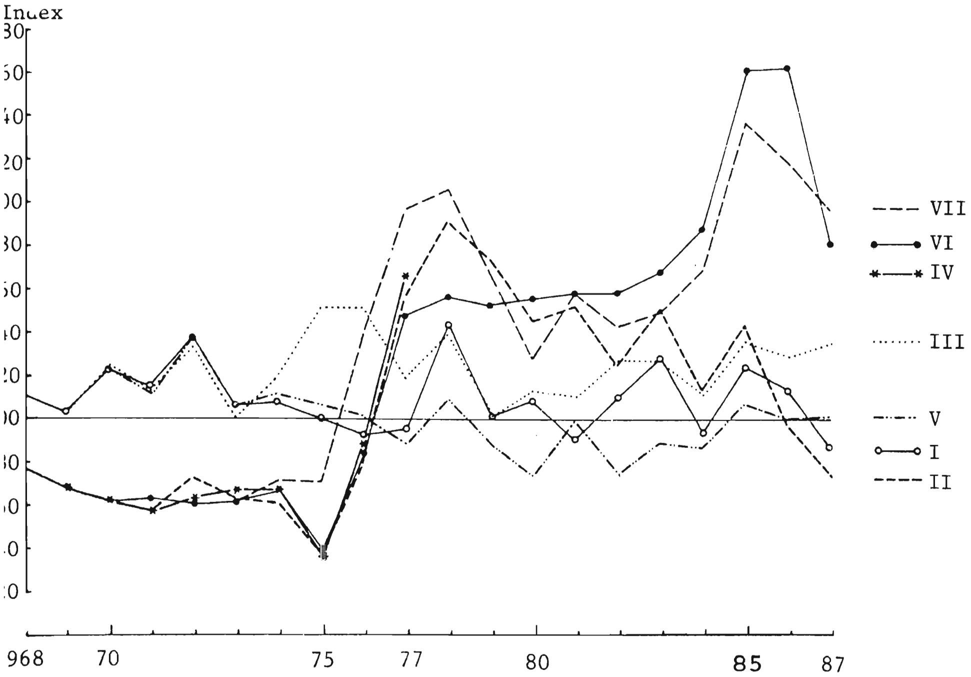
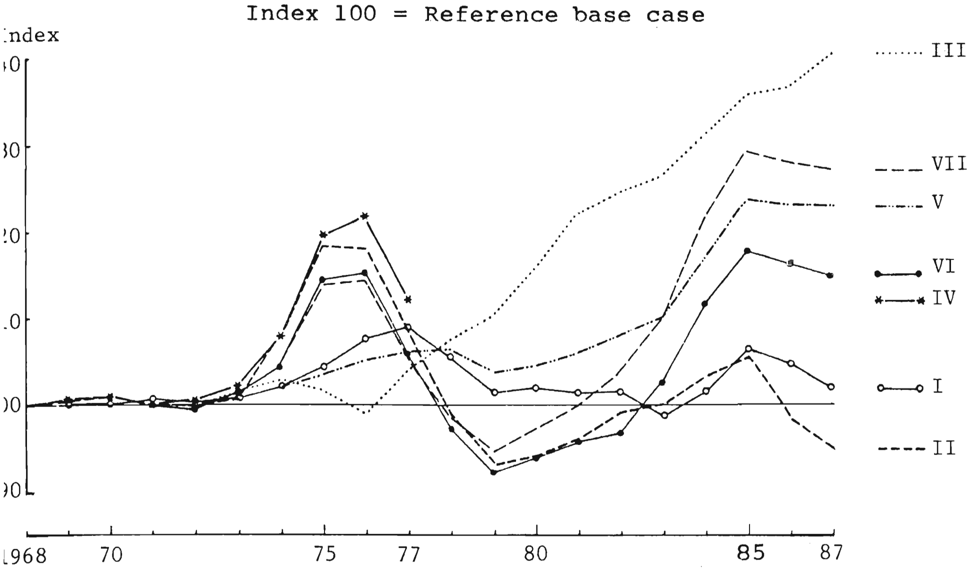


Figure 3B. Private Consumption, 1968-1987

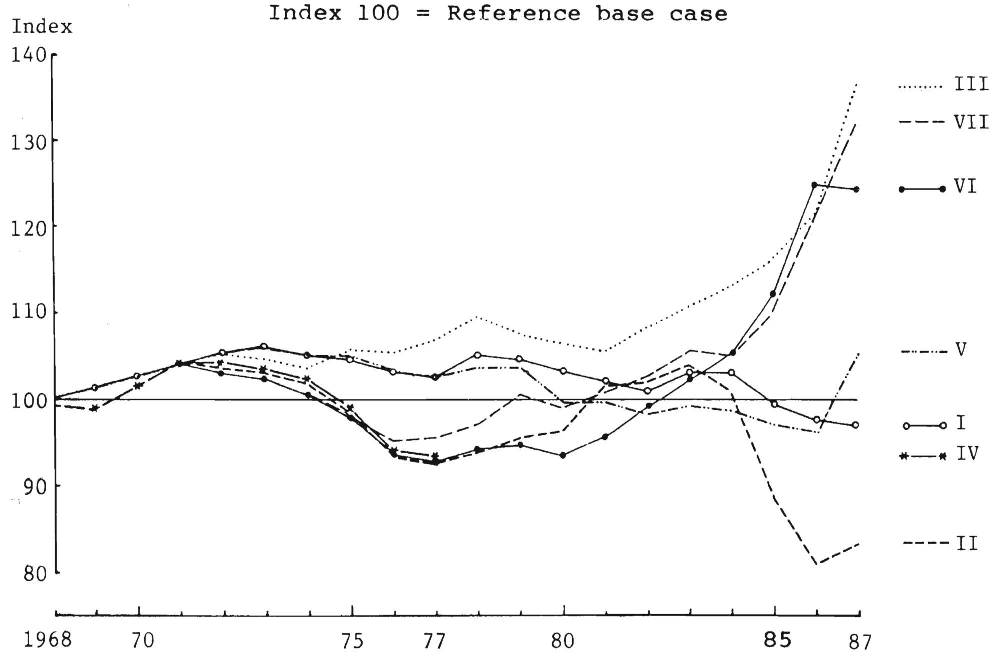
Index 100 = Reference base case



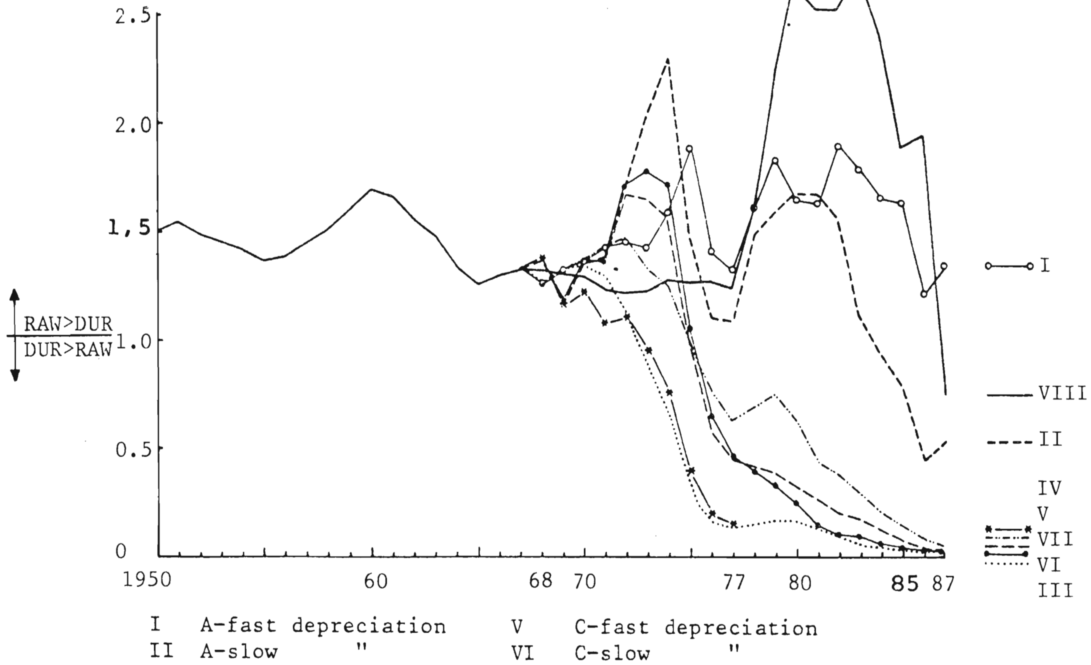
I	A-fast depreciation	V	C-fast depreciation
II	A-slow "	VI	C-slow "
III	B-fast "	VII	C-slow → fast "
IV	B-slow "		

Figure 4. Total Manufacturing Output, 1968-1987

Index 100 = Reference base case



Figures 5A. Ratio of Investments in Raw Materials Production (RAW) and in Engineering (DUR), 1950-1987



I A-fast depreciation
II A-slow "
III B-fast "
IV B-slow "
V C-fast depreciation
VI C-slow "
VII C-slow → fast "
VIII Real + ref.

Figure 5B. Employment in Engineering (DUR) in percent of Total Manufacturing Employment, 1950-1987

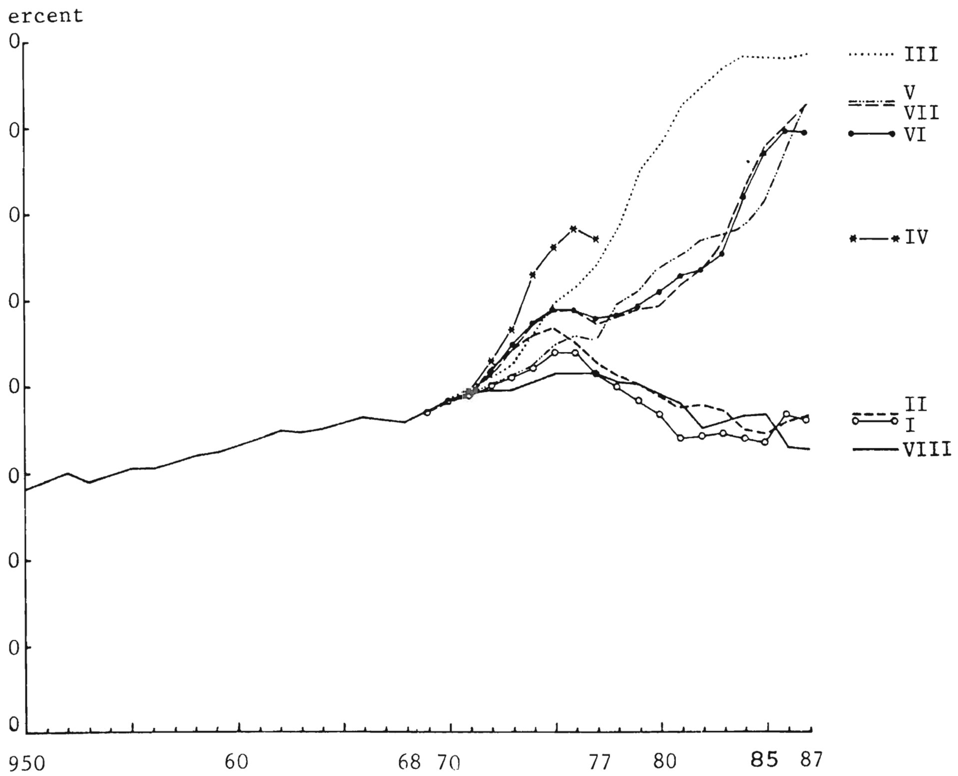
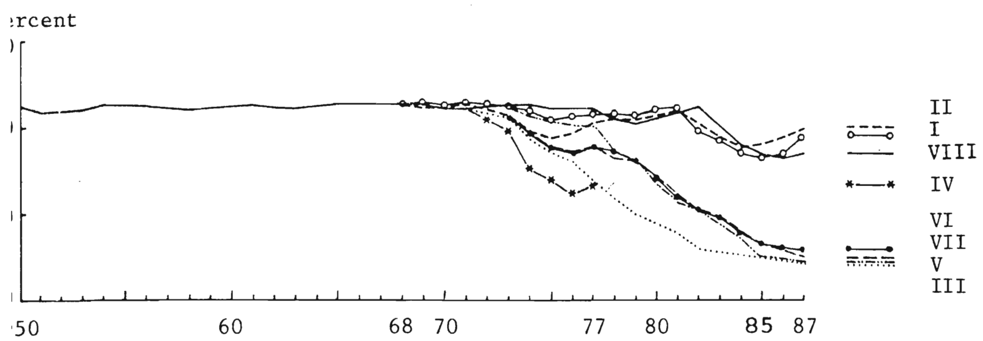


Figure 5C. Employment in Raw Materials Production (RAW) in percent of Total Manufacturing Employment, 1950-1987



I	A-fast depreciation	V	C-fast depreciation
II	A-slow "	VI	C-slow "
III	B-fast "	VII	C-slow → fast "
IV	B-slow "	VIII	Real + ref.

Figure 5D. Operating Profits in Engineering (DUR) in percent of Profits in Total Manufacturing, 1950-1987

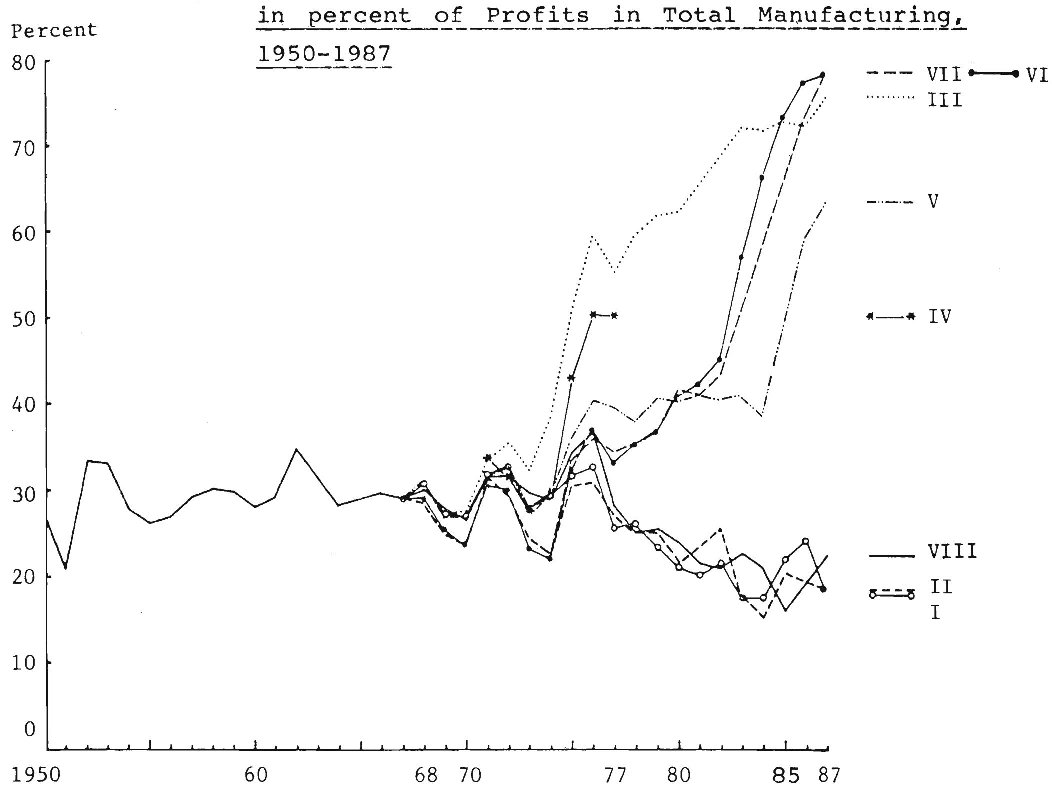
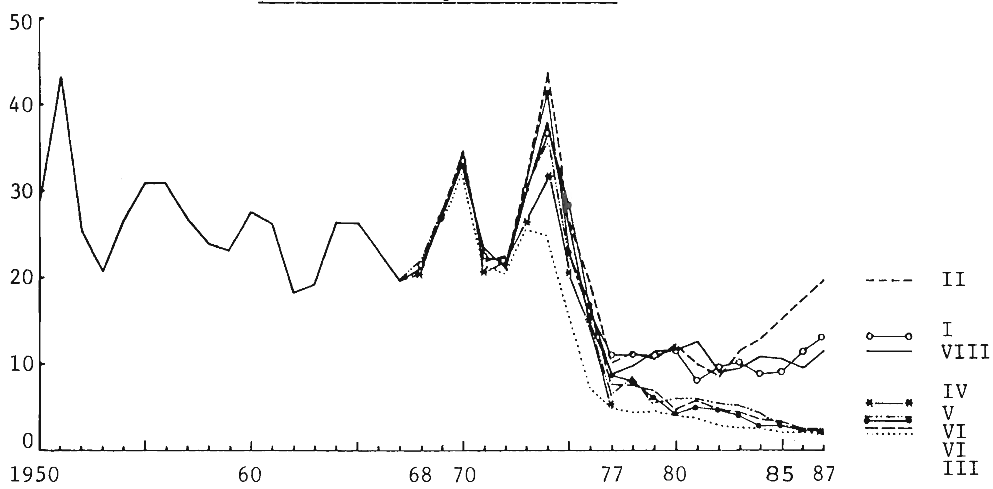


Figure 5E. Operating Profits in Raw Materials Production (RAW) in percent of Profits in Total Manufacturing, 1950-1987



I	A-fast depreciation	V	C-fast depreciation
II	A-slow "	VI	C-slow "
III	B-fast "	VII	C-slow → fast "
IV	B-slow "	VIII	Real + ref.

Figure 5F. Value Added in Engineering (DUR) in percent of Value Added in Total Manufacturing, 1950-1987

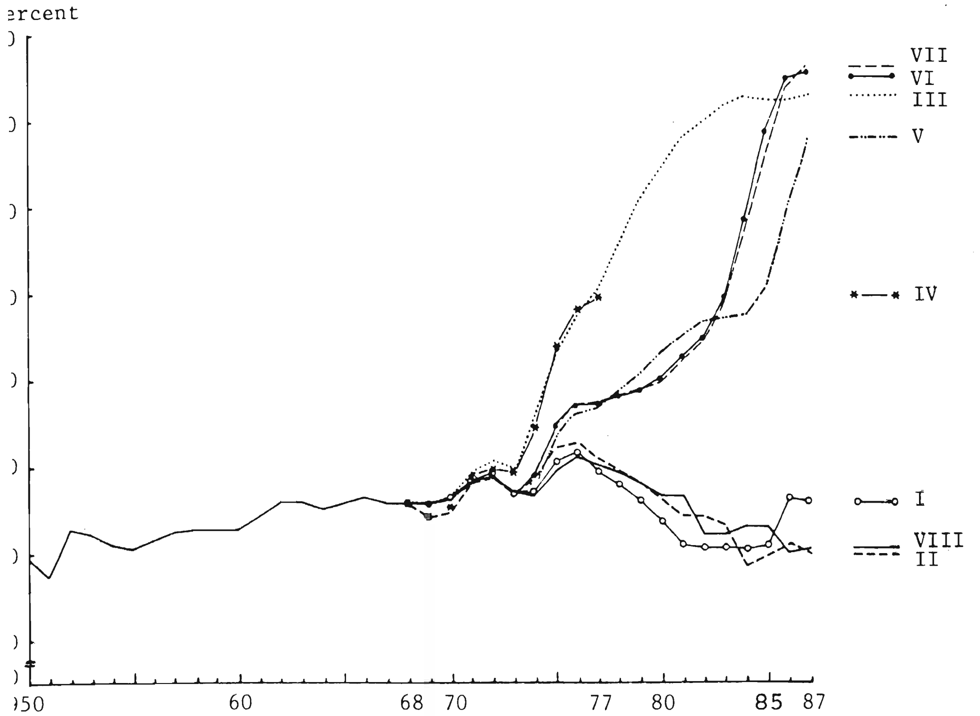
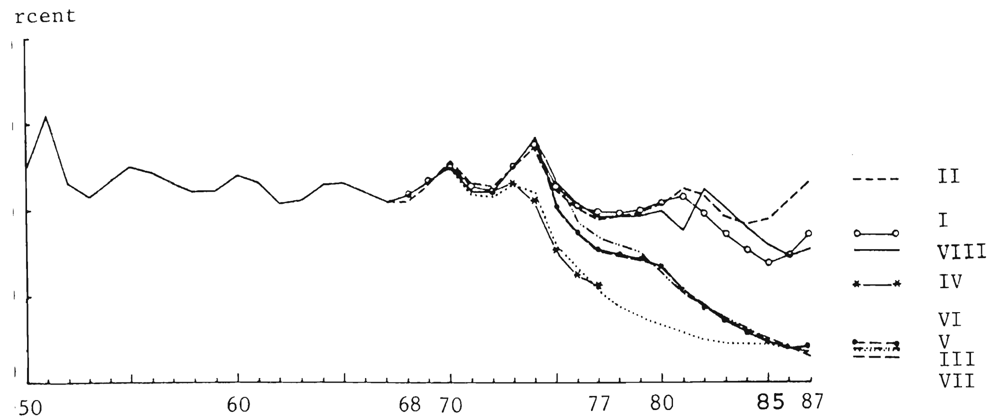


Figure 5G. Value Added in Raw Materials Production (RAW) in percent of Value Added in Total Manufacturing, 1950-1987



I	A-fast depreciation	V	C-fast depreciation
II	A-slow "	VI	C-slow "
III	B-fast "	VII	C-slow → fast "
IV	B-slow "	VIII	Real + ref.

Figure 6A. Rate of Return on Total Assets before Tax, 1968-1987. Total Manufacturing
Index 100 = Reference base case

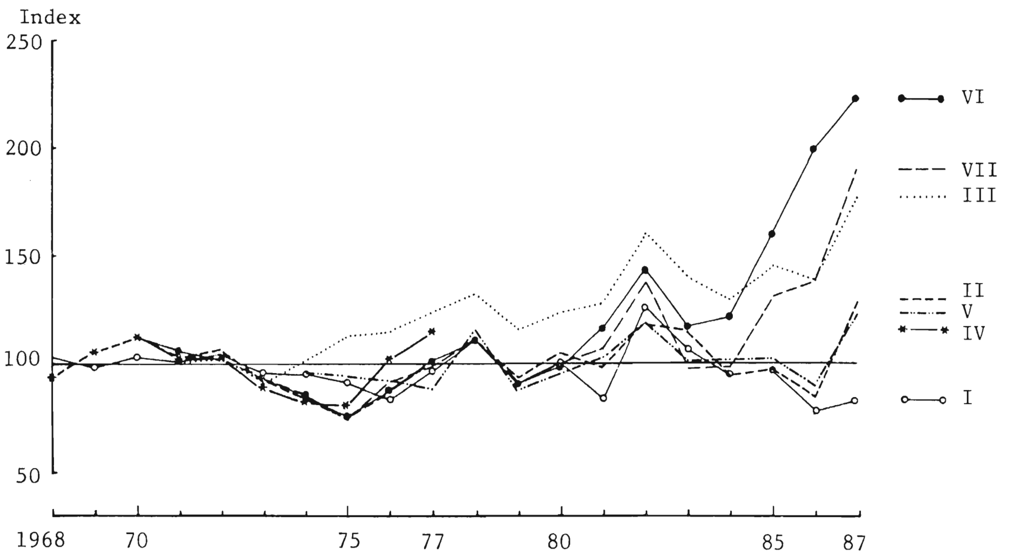
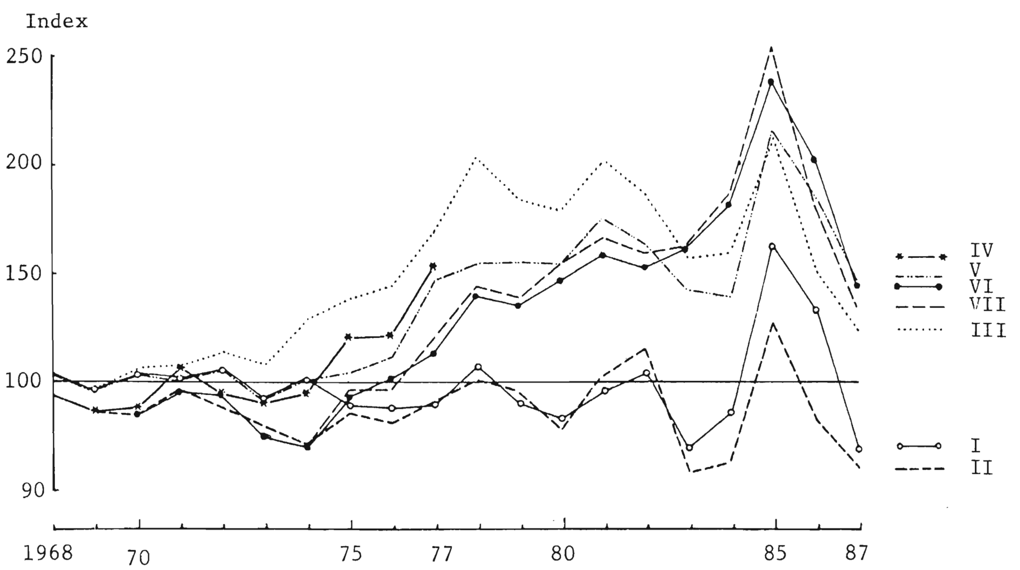


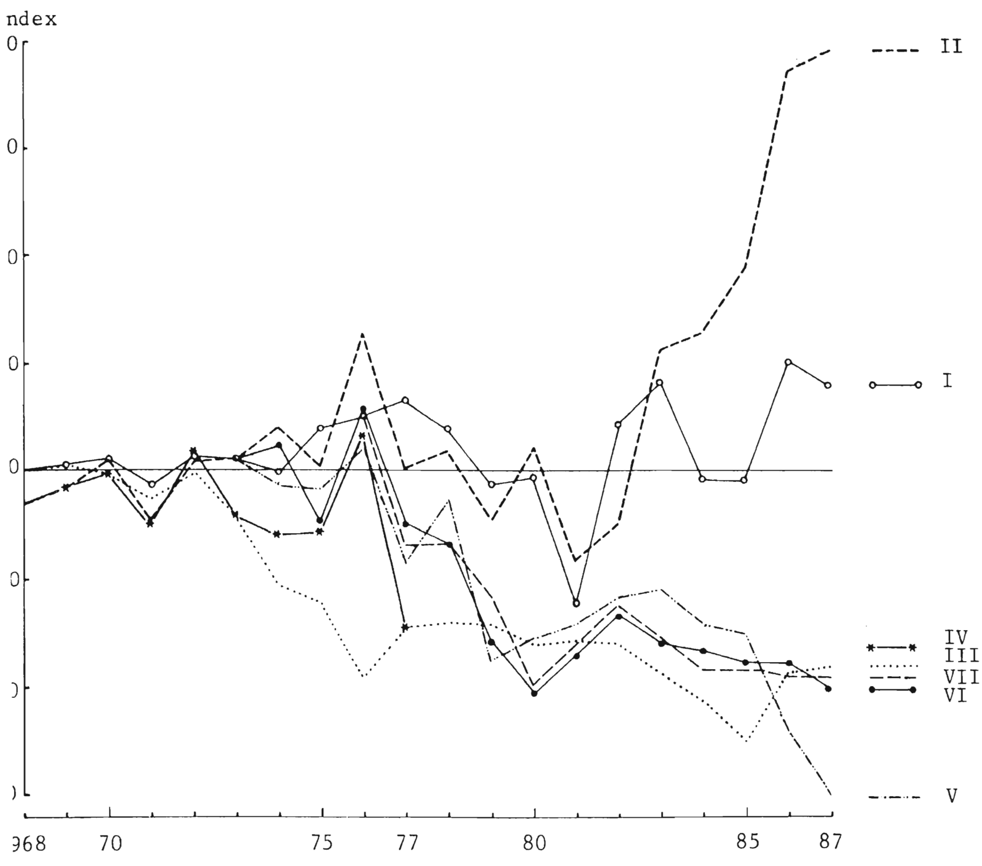
Figure 6B. Rate of Return on Total Assets before Tax, 1968-1987. Engineering (DUR) in Relation to Total Manufacturing
Index 100 = Reference base case



I	A-fast depreciation	V	C-fast depreciation
II	A-slow "	VI	C-slow "
III	B-fast "	VII	C-slow → fast "
IV	B-slow "		

Figure 6C. Rate of Return to Total Assets before Tax, 1968-1987. Raw Materials Production (RAW) in Relation to Total Manufacturing

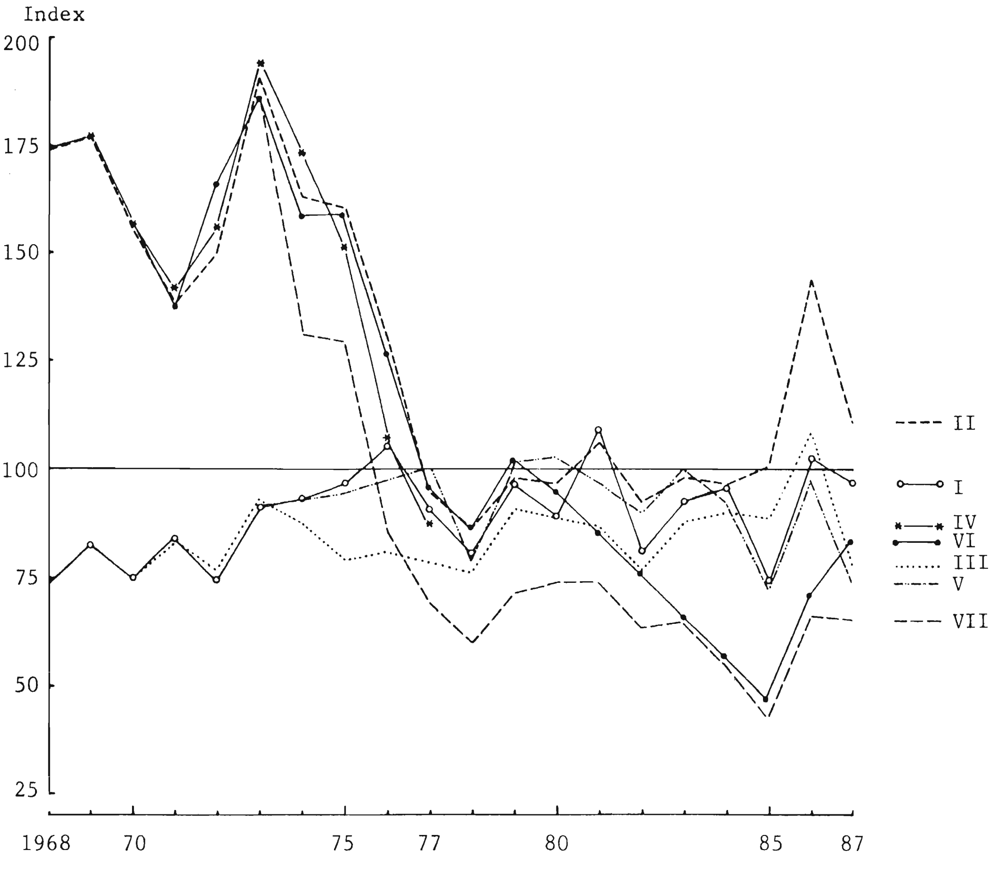
Index 100 = Reference base case



I A-fast depreciation
II A-slow "
III B-fast "
IV B-slow "
V C-fast depreciation
VI C-slow "
VII C-slow → fast "

Figure 7. <u>Effective Rate of Taxation[a] in Total Manufacturing, 1968-1987</u>

Index 100 = Reference base case



I A-fast depreciation
II A-slow "
III B-fast "
IV B-slow "
V C-fast depreciation
VI C-slow "
VII C-slow → fast "

[a] Effective rate of taxation = Tax bill paid/Operating profits - Calculated depreciation charges.

Figure 8. Rate of Return to total capital before tax
Percent

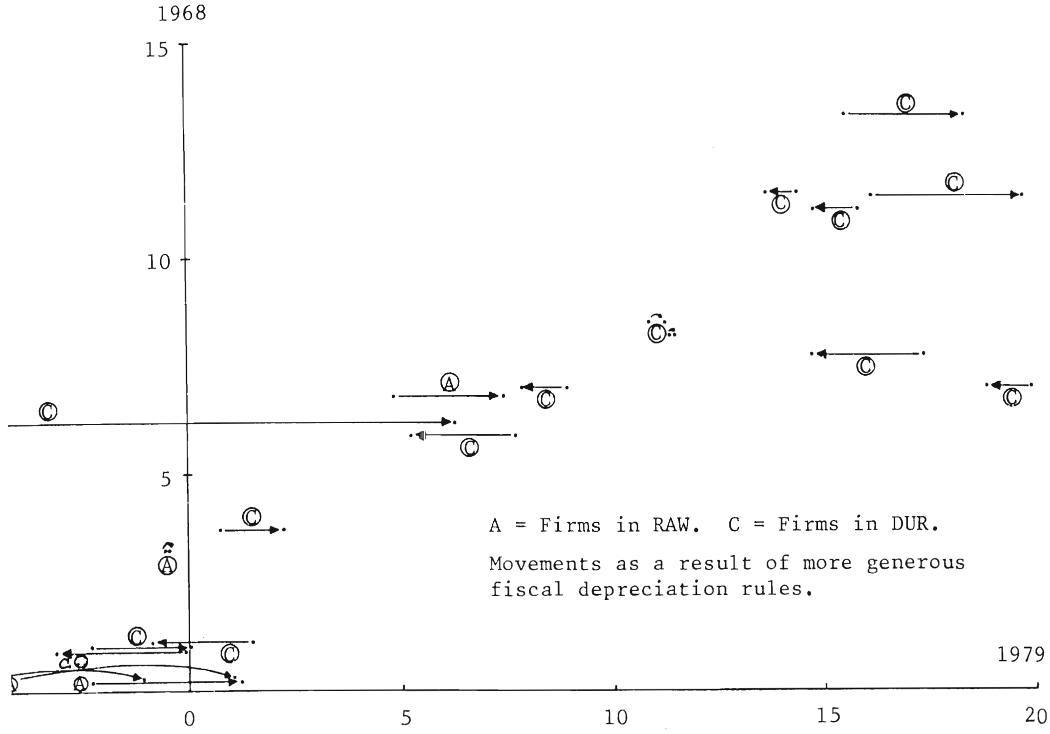
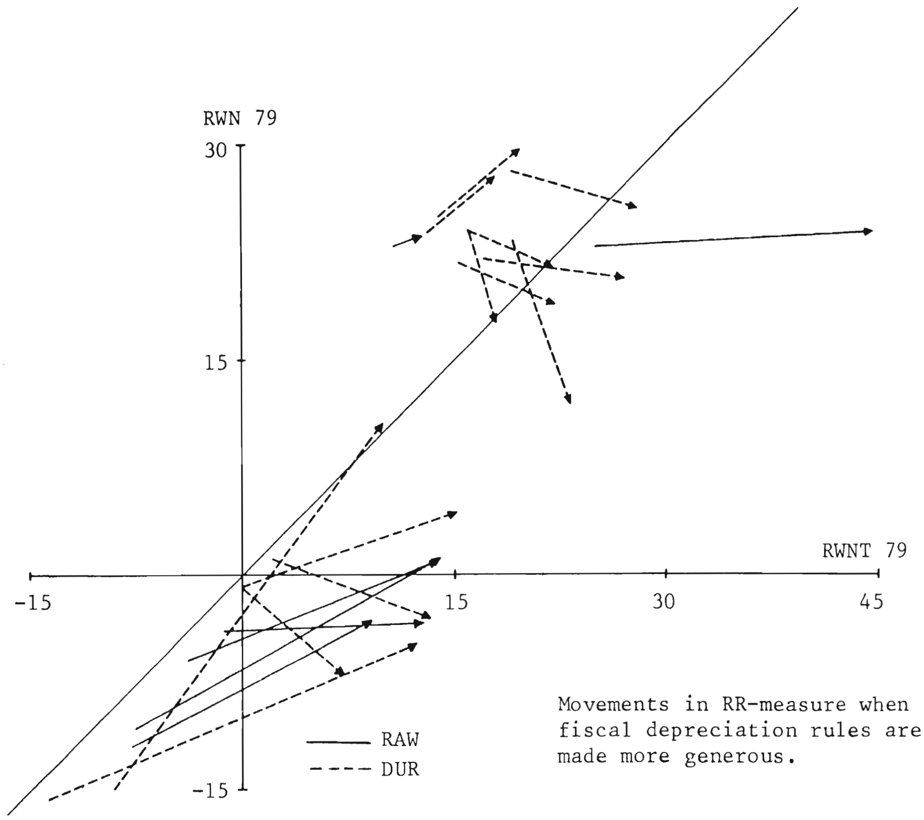


Figure 9. Rate of Return on Net Worth before (RWN) and after(RWNT) Tax 1979
Percent



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