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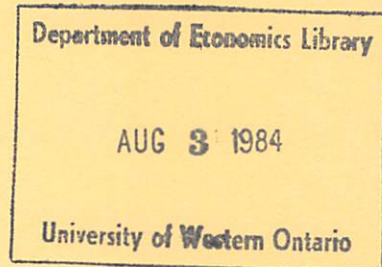
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REGRESSION OR PROGRESSION: THE TAXING QUESTION

OF INCIDENCE ANALYSIS

John Whalley

This paper contains preliminary findings from research work
still in progress and should not be quoted without prior
approval of the author.

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REGRESSION OR PROGRESSION: THE TAXING QUESTION OF

INCIDENCE ANALYSIS[1]

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Abstract

In recent years thinking on broad directions for tax reform has been influenced by the perception that the tax system does little to redistribute income. This view can be largely traced to the results of a number of tax incidence calculations which allocate taxes among income groups using detailed annual data and a range of assumptions as to how various taxes are or are not shifted. While the key role of incidence assumptions in these calculations has been recognized for some time, only limited attention has been given to the implicit modelling involved. Beyond issues with sales and excise taxes recently raised by Browning, the treatment of savings, whether capital income bears taxes (including part of personal taxes), and the treatment of human capital are identified here as also quantitatively important. Depending on the treatment adopted for each, the tax system can appear as sharply progressive or regressive. When combined with variations in results which follow from the choice of income concept, these issues suggest that considerably more ambiguity may exist as to what realistic tax burdens from these exercises are than has hitherto been recognized. Many of the issues raised suggest using a different approach to incidence analysis and later sections discuss recent attempts to develop new research directions, especially as regards lifetime incidence.

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I   Introduction

Who bears the burden of taxes? In recent years the perception that public financiers have developed as to the redistributive effects of the tax system is based primarily on numerical calculations of annual tax incidence.[1] While it is widely agreed that net redistribution involving expenditures and taxes may be of more interest than tax incidence alone, and that lifetime rather than annual incidence calculations may be more appropriate, these calculations have been influential in framing tax reform initiatives. The policy significance of these calculations rather than their rationale in terms of economic theory provides the main motivation for the discussion in this paper.

As usually summarized in public finance texts, the major finding from these studies is that the tax system does very little to redistribute income. This paper argues that if annual incidence calculations are to be relied on for policy analysis there may well be more uncertainty as to the redistributive impacts of the tax system than has hitherto been recognized. The treatment of sales and excise taxes raised by Browning (1978) and Browning and Johnson (1980) is only one of a number of complicating issues which can be introduced into these calculations. Depending on the treatment adopted for each, and the way they interact, the tax system can appear as either sharply progressive or regressive. Many of the problems raised are endemic to all attempts to produce annual rather than lifetime incidence

calculations. Results from a recent attempt by Davies, St-Hilaire, and Whalley (1984) along these lines are summarized in a concluding section.

II   Tax_Incidence_Calculations_Based_on_Annual_Data

Annual tax incidence calculations focus on five key tax groups; income, corporate, sales and excise, property, and social security.[2] Each is treated as having sources side and/or uses side effects.[3] Three main income sources bear the burden of taxes; capital income, labour income, and transfers. In annual data, transfers are heavily concentrated in the lower tail of the income distribution, and capital income in the upper tail due to the presence of retirees. Labour income is closest of the three series to being proportional to income. Depending upon whether a tax is allocated on the sources side to capital income, labour income, transfers, or to income in general, a progressive or regressive effect can result.

On the uses side the key feature is differential savings rates by income range. Since around 40 percent of household savings are concentrated in the top 10 percent of the income distribution, taxes which are treated as being borne according to consumption produce regressive incidence effects.[4]

Incidence estimates for whole tax systems are based on a separate calculation for each tax by income range. In combination, these yield an average total tax rate for each income range. Redistribution from the tax system is evaluated by examining the pattern of average tax rates.

An especially important set of calculations are those by
Pechman and Okner (1974) who use a detailed merged data file of
approximately 87,000 1966 U.S. income tax returns and 30,000
households in the Survey of Economic Opportunity data file.
Alternative incidence calculations are reported reflecting
different shifting assumptions. They conclude that regressive and
progressive taxes in the tax system roughly offset each other and
suggest that this finding is little affected by the choice of
variant in the calculation.

This Pechman-Okner conclusion, referred to here as the
Proportionality Hypothesis, is widely quoted and has been a major
element in tax reform debate in the U.S. This same theme also
appears in other studies. Musgrave and Musgrave (1980), for
instance, use a set of assumptions close to Pechman-Okner's least
progressive variant along with a different data set and arrive at
similar conclusions.

In work on Canada, Gillespie (1980) takes a somewhat
different approach in that he stresses net fiscal incidence (the
value of benefits by income range from government expenditures,
less taxes) rather that simply tax incidence. In his tax incidence
analysis he largely limits himself to a single set of shifting
assumptions and importantly uses a different income concept
from Pechman-Okner. He reaches the conclusion that the tax system
is "regressive over the poorest 36 percent of all family units and
mildly regressive over the upper income classes" (p. 170). The
exclusion of transfers in the income concept is a major factor in
explaining these results.

In more recent work, the Proportionality Hypotheses has been strongly criticized, most notably by Browning (1978) and Browning and Johnson (1978). The main difference relative to Pechman-Okner lies in their treatment of sales and excise taxes and in the income concept they use.5 Browning and Johnson argue that uses side effects due to different savings rates by income largely disappear when savings out of lifetime rather than annual income are considered. They therefore only consider the sources side effects of indirect taxes, pointing out that since transfers are largely indexed for changes in the price level only factor incomes can bear their burden. The concentration of transfers in the lower tail of the income distribution, and savings in the upper tail means that sales and excises are significantly progressive rather than regressive in Pechman-Okner. This change is enough to produce a pattern of average total tax rates which is progressive.

This Browning-Johnson argument stresses how crucial the shifting assumptions used in the incidence literature are to an understanding of incidence results. In Table 1. the key assumptions used in these calculations are summarized, along with an indication as to which produce progressive or regressive incidence results.

As can be seen from Table 1, the major areas of disagreement centre on the corporate, property, and sales and excise taxes. The income tax is uniformally treated as paid by income recipients and is progressive due to increasing average tax rates. Social security and related contributions are treated predominantly as a

Table 1

Literature Incidence Assumptions

Incidence Pattern	Most Progressive	Most Regressive	Taxes and Shifting Assumptions	Gillespie's Basic Case[3]	P/O Most Redistributive Case[2]	P/O Least Redistributive Case[2]	B/J Competitive Case[1]	B/J Alternative Case[1]
P			A) Individual Income Tax: (not shifted) allocated to taxpayers according to income taxes paid	✓	✓	✓	✓	✓
			B) Corporation Income Tax:					
P			- to capital income in general				✓	
P	✓		- 1/2 to capital income in general; 1/2 to dividends (stockholders)		✓			
A		✓	- 1/2 to capital income in general; 1/2 to total consumption			✓		
P			- 1/2 to capital income in general; 1/2 to factor income					✓
A			- 1/2 to dividend income; 1/2 to total consumption.	✓				
			C) Property Taxes:					
			i) on land					
P			- to capital income in general		✓		✓	
P			- to landowners			✓		
P	✓		- to capital owners	✓				
P		✓	- 1/2 to capital income in general; 1/2 to factor income.					✓
			ii) on structures and improvements					
P	✓		- to capital income in general		✓		✓	
R		✓	- to shelter and consumption	✓		✓		
P			- 1/2 to capital income in general; 1/2 to factor income.					✓
			D) Sales and Excises					
R		✓	- to consumers of taxed goods	✓	✓	✓		
P	✓		- to factor income				✓	✓
			E) Social Security					
			i) on employees					
A			- to employee compensation	✓	✓	✓	✓	✓
			ii) on employers					
A			- to employee compensation	✓	✓		✓	
A		✓	- 1/2 to employee compensation; 1/2 to consumption			✓		
P	✓		- 1/2 to employee compensation; 1/2 to factor income.					✓

1. B/J refers to Browning and Johnson (1979).

2. P/O refers to Pechman and Okner (1974).

3. Gillespie refers to Gillespie (1980).

Note: The first column of the table indicates whether a particular shifting assumption results in a progresive (P), regressive (R) or ambiguous (A) pattern; ambiguous being when two opposite patterns occur across income classes.

payroll tax on labour and, outside of the lower tail of the income distribution, are regressive due to the ceilings on contributions. Corporate and property taxes are regressive if treated as shifted "forward" to consumers, but progressive if assumed shifted "backwards" to recipients of capital income.[6] Corporate taxes are even more progressive if assumed borne by capital income specific to taxed industries rather than capital income in general, because of light tax treatment of widely held housing capital. In some literature, this motivates the use of dividends rather than all capital income (which includes dividends) as a more progressive distributive series for allocating corporate taxes. Sales and excise taxes are regressive if borne by consumers, and progressive if borne by recipients of factor incomes.

III Incidence Analyses Using 1972 Canadian Data

The role of shifting assumptions in tax incidence calculations based on annual data is discussed in later sections in which a series of alternative calculations for Canada are reported. These are all based on a microconsistent demand, production, and tax data set for Canada for 1972, originally constructed for general equilibrium tax policy modelling (St-Hilaire and Whalley [1983]). This data is used to reproduce the main features of the literature incidence calculations referred to above. Alternative shifting assumptions are then adopted and different implicit models used to demonstrate the sensitivity of incidence conclusions.

Table 2 reports income and outlay data by household income range and highlights some of the more important features of these data as they relate to the distributive series used in annual incidence analysis. Capital income is heavily concentrated in the top tail of the income distribution. Transfers as a fraction of income are considerably higher in the lower income ranges (as stressed by Browning and Johnson). The factor intensity of non-transfer income is higher in favour of capital income in the lower income ranges, reflecting the presence of retirees. Savings are concentrated in the top tail of the income distribution. Data are also reported on income fully taxable by income range, and income tax payments by income range.

Incidence calculations have been made using this data, (Table 3) for five different cases corresponding to shifting assumptions and income concepts used in various literature calculations. Under the Pechman-Okner most progressive incidence assumptions (the first panel of Table 3), there is some progressivity in average tax rates which rise from 23 percent to 34 percent, but in the least progressive variant (the second panel of Table 3) tax rates only rise from 27 to 29 percent. In both cases, the income tax is progressive while the sales and excise taxes are regressive. The major change between these cases lies in the treatment of the corporate and property taxes, both of which change from progressive to regressive. This reflects the difference between forward shifting to consumers, and backward shifting to capital income.

The Gillespie central case calculations use a measure of

Table 2

Key Distributive Series for Tax Incidence Analysis

(data for Canadian Households, on a per household basis, in 1972 dollars)[1]

Income[2] Classes	Percentage of Households (%)	Total Income	Labour Income	Capital Income[3]	Transfer Income	Total Expenditure	Net Savings	Income Fully Taxable
Under $6500	16.6	4496.5	599.4	576.2	3320.9	5199.1	-775.6	4239.2
6500 - 7500	7.1	6934.9	2814.5	1196.1	2924.3	6921.6	-302.1	6558.4
7500 - 8500	6.9	7893.5	4357.6	1170.9	2365.0	7721.2	-389.8	7478.8
8500 - 10000	8.0	9135.1	6506.3	1033.4	1595.4	8358.7	-104.2	8671.9
10000 - 11500	8.9	10936.2	8109.6	1459.6	1367.0	9832.8	-94.5	10376.4
11500 - 13000	8.6	12251.0	9569.0	1362.0	1320.1	10228.5	497.5	11556.3
13000 - 14500	8.5	13611.6	11054.3	1462.6	1094.7	11102.8	652.2	12796.7
14500 - 16000	7.3	15208.8	12526.1	1571.1	1111.6	11672.0	1282.8	14284.9
16000 - 18500	5.6	17419.8	13651.1	2656.1	1112.5	12988.8	1751.5	16279.9
18500 - 21000	4.6	19360.6	15374.3	2792.7	1193.7	14663.0	1781.3	18145.5
21000 - 25000	9.3	22133.2	17873.8	3224.8	1034.6	14785.9	3571.4	20547.5
25000 & Over	8.6	44510.6	27075.1	16301.6	1133.9	21204.1	15903.3	37296.4

[1]Based on data reported in St-Hilaire and Whalley [1983].

[2]These are gross of income taxes and include transfers.

[3]Includes imputed rents and retained earnings of corporations.

[4]Excludes unassessed capital income and takes into account the special treatment of dividends and capital gains income.

Table 3

Alternative Incidence Calculations Using Incidence Assumptions and Income Concepts Prominent in the Literature

(Income ranges for Canadian Households in 1972 dollars; all tax rates are in percentages)

Income Classes	Under $ 6,500	6,500-7,500	7,500-8,500	8,500-10,000	10,000-11,500	11,500-16,000	16,000-25,000	25,000 and over
Pechman and Okner's Most Progressive Assumptions								
Personal Income Tax	1.4	3.7	5.7	7.9	9.0	11.4	13.4	12.5
Corporate Income Tax	2.6	3.0	2.7	2.1	2.1	1.7	2.4	7.5
Property Tax	2.5	3.3	2.8	2.2	2.6	2.1	2.9	6.6
Sales and Excises	13.9	12.3	12.1	11.7	11.5	10.4	9.2	5.6
Social Security	2.3	3.8	5.0	4.6	3.9	3.5	2.6	1.7
Production Tax	.2	.1	.1	.2	.2	.2	.2	.1
TOTAL ALL TAXES	22.9	26.1	28.4	28.6	29.3	29.4	30.7	33.9
Pechman and Okner's Least Progressive Assumptions								
Personal Income Tax	1.3	3.6	5.6	7.7	8.8	11.1	13.2	13.2
Corporate Income Tax	4.1	4.0	3.8	3.3	3.5	3.1	3.2	4.6
Property Tax	5.8	6.7	5.9	4.6	3.9	3.5	3.2	3.0
Sales and Excises	13.6	12.0	11.8	11.4	11.3	10.1	9.1	5.9
Social Security	2.6	3.5	4.4	4.1	3.6	3.3	2.7	1.9
Production Tax	.2	.1	.1	.1	.2	.2	.2	.1
TOTAL ALL TAXES	27.6	30.0	31.6	31.3	31.4	31.3	31.5	28.9
Gillespie's Central Case Assumptions Using "Bread Income"								
Personal Income Tax	5.8	7.5	9.8	11.3	12.1	14.5	16.6	15.9
Corporate Income Tax	18.8	7.9	6.4	4.7	4.2	3.5	3.4	6.8
Property Tax	25.9	14.1	10.3	6.8	5.4	4.6	4.0	3.7
Sales and Excises	59.6	25.3	20.7	16.8	15.6	13.3	11.4	7.2
Social Security	9.7	7.8	8.5	6.6	5.2	4.5	3.3	2.1
Production Tax	1.0	.3	.2	.2	.3	.3	.2	.1
TOTAL ALL TAXES	120.8	62.9	55.8	46.4	42.8	40.7	38.9	35.8
Browning and Johnson's Competitive Assumptions								
Personal Income Tax	1.4	3.8	5.8	7.9	8.9	11.3	13.2	12.5
Corporate Income Tax	2.7	3.4	2.9	2.2	2.6	2.1	2.9	6.5
Property Tax	2.7	3.4	2.9	2.2	2.6	2.1	2.9	6.6
Sales and Excises	3.5	6.6	7.7	8.7	9.1	9.4	9.7	10.0
Social Security	2.4	3.9	5.1	4.6	3.9	3.5	2.6	1.6
Production Tax	.1	.1	.1	.2	.2	.2	.2	.2
TOTAL ALL TAXES	12.8	21.2	24.4	25.8	27.3	28.6	31.4	37.4
Browning and Johnson's Alternative Assumptions								
Personal Income Tax	1.5	3.8	5.8	7.8	8.9	11.1	13.1	12.8
Corporate Income Tax	2.1	3.0	3.0	2.8	3.1	2.9	3.4	5.4
Property Tax	2.1	3.1	3.0	2.9	3.1	2.9	3.4	5.4
Sales and Excises	2.0	6.6	7.7	8.7	9.1	9.5	9.7	10.0
Social Security	3.4	3.4	4.3	4.0	3.5	3.3	2.7	2.1
Production Tax	.1	.1	.1	.2	.2	.2	.2	.2
TOTAL ALL TAXES	11.2	19.9	23.9	26.4	27.9	29.9	32.4	35.8

broad income which excludes transfers, and produces a regressive
pattern of tax rates for the bottom tail of the income
distribution. The only progressive tax is the income tax.

The Browning and Johnson competitive assumptions are similar
to the Pechman-Okner most progressive variant, with the notable
exception of sales and excises. In their competitive case,
average total tax rates by income range are progressive,
increasing from 12 to 37 percent. Browning and Johnson's
alternative assumptions incorporate a degree of forward shifting
of corporate and property taxes, which implies that their burden
falls fully on all factor incomes since transfers are assumed
indexed. Their conclusion that the tax system is progressive is
largely unaltered.

To show the sensitivity of incidence results both to the
shifting assumptions chosen, and the concept of income used later
sections examine a number of variations around a single set of
central case assumptions to show how the tax system can be to
appear as either progressive or regressive. The assumptions used
in this central variant are deliberately kept simple to highlight
this sensitivity issue. The individual income tax is assumed borne
by income recipients with no uses side effects. Capital income is
assumed to bear the burden of corporate and property taxes,
irrespective of in which industries capital is used; an assumption
of a long-run equilibrium situation with intersectorally mobile
capital. Sales and excise taxes are borne on the uses side in
proportion to taxed consumption. Social security taxes are borne
by labour income.

The incidence results implied by these assumptions are reported in Table 4. Total tax rates increase from 27.5 percent to 43 percent, showing a mild degree of progression intermediate to the two Pechman-Okner cases reported earlier. Income tax rates reflect average tax rates by income range and are progressive. Incidence of the corporate and property taxes reflects the capital income distribution. Increasing savings rates by income range produce a regressive pattern sales and excise tax rates. Because of ceilings on annual contributions for social security taxes tax rates beyond the lowest income ranges are regressive.

IV   Making the Incidence Calculation Progressive

Because an implicit rather than explicit model is used in incidence analysis based on annual data, the choice of shifting assumptions to a large extent determines the conclusion. Unfortunately this is the case, irrespective of how carefully the data work is done, or how elaborate or detailed the original data sources. This and the following section illustrates how it is possible to change shifting assumptions to alternately produce substantial progressivity or regressivity.

A number of arguments can be used to make the tax system appear more progressive. The central case variant reported earlier has three progressive and two regressive taxes. To make the tax system more progressive, one has to find justifications for increasing the progressivity of existing progressive taxes and curtailing the regressivity of other taxes.

Table 5 reports a sequence of modifications to the central

Table 4

1972 Tax Incidence in Canada Using Central Case Assumptions and Income Concept[1]

Average Tax Rates

1972 Household

Income Classes	Personal Income Tax	Corporate Income Tax	Property Tax	Sales & Excises	Social Security	Production Tax	Total (All Taxes)
Under $6500	1.6	3.3	3.3	16.3	2.6	.3	27.5
6500 - 7500	4.5	4.2	4.2	15.0	4.6	.2	32.7
7500 - 8500	7.0	3.6	3.6	14.8	6.1	.2	35.4
8500 - 10000	9.5	2.8	2.8	14.2	5.6	.2	35.0
10000 - 11500	10.8	3.2	3.2	13.9	4.7	.3	36.1
11500 - 13000	12.3	2.7	2.7	12.8	4.5	.3	35.3
13000 - 14500	13.5	2.6	2.6	12.5	4.2	.2	35.6
14500 - 16000	14.7	2.5	2.5	11.9	3.9	.2	35.7
16000 - 18500	15.2	3.6	3.7	11.5	3.6	.2	37.8
18500 - 21000	14.9	3.4	3.5	11.9	3.2	.2	37.1
21000 - 25000	16.9	3.4	3.5	10.4	2.9	.2	37.4
25000 & Over	16.5	8.4	8.4	7.4	2.2	.1	43.0

[1]Income is gross of income tax, gross of transfers with a further adjustment for the tax treatment of imputed housing income (see Section VI).

Table 5

Modifications to the Central Case Incidence Calculation (Table 4)

Each Making the Tax System Appear More Progressive

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1972 Household Incomes					Total tax rates: alternative cases						
under $6500	27.5	27.5	27.5	27.5	27.5	25.9	14.5	14.4	14.4	14.3	11.6
6500 - 7500	32.7	32.7	32.7	32.7	32.7	32.2	25.2	25.3	25.3	24.2	19.6
7500 - 8500	35.4	35.4	35.4	35.4	35.4	34.9	29.6	29.7	29.7	29.1	23.0
8500 - 10000	35.0	34.9	34.9	34.9	34.9	34.9	31.5	31.6	31.6	31.0	25.5
10000 - 11500	36.1	36.1	36.1	36.1	36.1	36.0	33.4	33.3	33.3	32.2	27.5
11500 - 13000	35.3	36.0	36.6	37.0	36.3	37.0	35.2	35.6	35.9	34.8	30.3
13000 - 14500	35.6	36.5	37.2	37.6	36.8	37.6	36.5	36.9	37.3	36.2	32.0
14500 - 16000	35.7	37.2	38.4	39.2	37.7	39.2	38.4	39.1	39.9	38.8	35.0
16000 - 18500	37.8	39.8	41.2	42.2	40.2	42.2	41.7	42.6	43.6	41.9	38.3
18500 - 21000	37.1	38.9	40.2	41.1	39.3	41.1	40.4	41.2	42.1	40.7	37.4
21000 - 25000	37.4	41.0	43.0	44.5	40.9	44.5	44.8	46.5	48.2	47.3	44.4
25000 & over	43.0	52.5	56.2	59.5	50.1	59.5	61.4	65.7	69.9	72.8	70.6

Case descriptions

(1) Central variant

(2) Adding future income taxes on savers.

(3) Adding future capital taxes on savers to case 2.

(4) Adding future sales and excise on savers to case 3.

(5) Future corporate and sales only, no future income taxes case 4 - case 2.

(6) Refunding future sales taxes to current dissavers, but keeping future taxes on savers as in case 4.

(7) Adding future capital and income taxes to Case 1 with Browning's adjustment for current period sales and excise taxes (no future sales taxes appear).[1]

(8) Case 7 plus inflation taxes on savers (tax on 1/2 of inflation).[1]

(9) Case 7 plus inflation taxes on savers (tax on full inflation).

(10) Case 9 with allocation of corporate taxes using dividends rather than capital income.

(11) Case 10 with social security removed (benefit related tax).

[1]The 1972 inflation rate of 5% is used, along with the 1972 long-term bond rate of 7% as the gross of tax nominal interest rate.

variant whose combined effect is to produce sharp progressivity in the incidence calculation for the whole tax system. Moving from column 1 to column 11 changes the range of average tax rates from 27.5 to 43 percent (the central variant), to 11 to 70 percent. Column 11 implies such sharp progressivity that one might easily conclude that the tax system is significantly redistributive. While some of these modifications are clearly contentious, and a series of changes have been made all of which combine to jointly increase the progression in the incidence calculation, the main point of sensitivity in these calculations nonetheless stands.

The justification for this sequence of adjustments is as follows. Beginning with the central variant (Table 4) in column 1, I first of all note that savers are treated as lightly taxed in the Pechman-Okner calculations because they do not pay indirect taxes today on their savings. However, savings today imply taxes tomorrow as dissaving occurs. The implicit model which underlies the Pechman-Okner calculations is a one-period general equilibrium model in which two factors of production--capital and labour--are transformed into consumption goods and capital goods. Consumption is taxed while capital goods are not since they are bought by producers.

This implicit model can, however, be reformulated as one in which capital and labour inputs are transformed into current and future consumption. Future consumption is acquired through the purchase of capital goods today. The significance of this reformulation is that since capital goods bought today yield a consumption stream savers should no longer be treated as lightly

taxed because of the future taxes they pay when they dissave. In
fact, quite the opposite is true since a number of future taxes
now have to be taken into account. These additional taxes are
therefore included in the annual incidence calculation
reoresenting future taxes on today's savers.[7]

Future income taxes should be included since savings generate
a taxable future income stream. This calculation, however, should
take into account 'sheltered' savings operating through housing,
pensions, and tax shelters. I make the strong assumotion that due
to the tax treatment of shelters, owner-occupied housing, and
pensions, only one-half of savings generates a fully taxable
income stream. Savings is therefore treated as the purchase of an
annuity paying a oeroetual future consumotion stream, and the
resulting future income taxes on savers are added into the annual
incidence calculation. This change is incorporated in moving from
column 1 to column 2, and it produces a slight increase in average
total tax rates for the uoper portion of the income distribution.

However, savings generate a future income stream which is
also partially taxable under other caoital income taxes (coroorate
and property). I therefore also add future caoital income taxes
on savers in addition to the future income taxes in moving to
column 3 from column 2. This further increases the degree of
orogression in total tax rates. Future sales and excise taxes
should also be taken into account. Adding these further increases
the degree of progression (column 4).

In column 5 the escalation of orogression is relaxed a lttle
by noting that with compelte sheltering of savings no future

income taxes need be taken into account. This produces smaller future taxes for the high income ranges relative to column 4. Column 6, however, takes into account the substantial current period dissaving by households in the bottom income ranges. If a household dissaves today, then it will have to save in the future in order to pay off the debts accumulated, or make good the decline in its net worth. It therefore seems appropriate to give these households a rebate of sales and excise taxes in the future because of dissaving today, which lowers the tax rate in the bottom income ranges, and further increases progression.

Column 7 involves a different adjustment which limits future taxes to those on capital income and personal income taxes as in Case 3, but Browning's indexation adjustment for sales taxes is now included. Since Browning ignores uses side effects in allocating sales and excise taxes to factor incomes, it is inappropriate to also include future sales taxes on savers as an element increasing the degree of progression. As in Browning's work, this indexation argument produces further progression from the sources side.

Column 8 incorporates the feature that future taxes on savers involve taxes on inflationary rather than real capital gains. There is significant disagreement in the literature as to the appropriate treatment of inflation in this case, depending upon whether or not a `tax modified' Fisher equation holds. Two calculations are made, one with taxation on one-half of the inflation premium in asset returns (column 8), and one with full taxation on this inflation premium (column 9). Taxation of

one-half of the inflationary return to savers follows from capital gains taxes on nominal rather than real returns at one-half rates, as is current law in Canada.8 However, if an equilibrium asset pricing condition holds in real terms across all financial (non-housing) assets, nominal returns on other assets adjust to compensate for additional taxes on inflation. Taxation of the whole inflationary return might be justified by the argument that due to the demand for liquidity money and bonds are substitutes rather than the more usual assumption that money and real capital are substitutes.

Two final steps are taken in moving to column 11. In column 10 corporate taxes are allocated using the distribution of dividends rather than capital income. As noted in the earlier section this slightly increases the progression in corporate tax rates. In column 11 social security contributors, the final regressive tax, are removed on the grounds that they are benefit-related, with contributions offsetting benefits received over the lifetime. Column 11 can be interpreted as the contribution of the tax system to net fiscal incidence where social security is a benefit-related tax which nets out on the expenditure and tax sides.

While clearly constructed so as to produce marked progression in the incidence calculation, column 11 provides a fundamentally different perception of the redistributive impact of the tax system compared to either the Pechman-Okner or Browning-Johnson calculations. It obviously raises the issue as to exactly how redistributive the tax system is.

V   Making the Tax System Regressive

In contrast to the preceding section, it is possible to make incidence calculations in which the tax system instead appears significantly regressive. A number of different arguments are first discussed under which capital does not bear the burden of any taxes, including personal taxes on capital income. The issue of the treatment of human capital in incidence calculations is then raised. If capital cannot bear the burden of taxes and is defined to include human capital, incidence analysis can produce tax rate profiles which are highly regressive.

First are the assumptions under which capital does not bear the burden of capital taxes, including personal taxes on capital income. One argument is that of forward shifting of taxes on capital income, discussed by Pechman-Okner, Musgrave and others. While this argument is usually limited to portions of the corporate and property taxes, and does not have as wide support as was the case 10-15 years ago, I nonetheless use this as one possible justification for this position. An alternative argument, which would apply to small countries like Canada, is based on the assumption that the economy being analyzed is a small open price-taking economy and is a taker of rental rates on world capital markets. Domestic taxes on capital simply change the gross-of-tax rate of return on capital, leaving the net-of-tax rate unchanged. Capital income does not bear any of the domestic tax burden.[9]

A third justification would be the argument underlying

Gordon's (1981) analysis of the corporate tax. Under this view, equilibrium conditions across capital assets imply that with a close to zero real rate of return on bonds the majority of the perceived real rate of return on equity must be a risk premium. The corporate tax on equity returns thus becomes co-insurance between government and corporations. Taxes on capital become largely benefit-related and, in effect, disappear in a net fiscal incidence calculation.

A final argument is based on the assumption of elastic capital supply through time. This has been stressed by Feldstein (1974) who argues that in a comparison between steady states with elastic factor supplies, a taxed factor will not bear the burden of taxes. In the case of capital, this has a similar effect to the small open economy situation by reversing the inelastic capital supply assumption in a static fixed factor model. The transition between steady states, however, can be an important complicating feature.

The impact on incidence calculations of each of these arguments that capital does not bear the burden of taxes is reported in Table 6. These reduce the mild progression of the central variant, although not to the extent which accompanies the redefinition of capital income to include the return to human capital (considered below in Table 7).

Case 1 in Table 6 repeats the central variant from Table 4. Case 2 considers the risk argument advanced above. Case 3 has forward shifting of the corporate and property taxes. In case 4 the Ballentine argument weakening the forward shifting is

Table 6

Incidence Calculations Under Assumptions that Capital Income Does Not Bear the Burden of Taxes

				Total Tax Rates: alternative cases			
1972 Household Income Classes	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Under $6500	27.5	24.3	34.1	30.8	30.5	32.2	31.5	32.4
6500 - 7500	32.7	29.1	37.9	35.9	33.5	34.7	33.4	34.1
7500 - 8500	35.4	32.7	41.1	39.1	37.7	38.8	38.1	39.0
8500 - 10000	35.0	32.9	40.9	39.3	39.5	40.7	40.8	41.9
10000 - 11500	36.1	33.5	40.3	38.8	39.4	40.4	40.3	41.2
11500 - 13000	35.3	33.1	39.5	38.6	39.8	41.0	41.4	42.3
13000 - 14500	35.6	33.6	39.7	38.8	40.4	41.6	42.2	43.0
14500 - 16000	35.7	33.7	39.5	39.0	40.8	42.0	42.6	43.4
16000 - 18500	37.8	34.7	39.2	38.9	40.1	40.5	40.8	41.3
18500 - 21000	37.1	34.1	39.0	38.6	39.8	40.4	40.7	41.3
21000 - 25000	37.4	34.3	38.3	38.8	40.1	40.6	41.1	41.5
25000 & Over	43.0	35.3	33.2	25.7	33.4	30.7	30.3	28.2

Case Descriptions

(1) Central Variant (Table 4).

(2) Risk Premium Case: Both capital and taxes on capital are removed from the calculation.

(3) Forward shifting of the corporate and property taxes (on structures and improvements).

(4) Same as (3) with Ballentine's case: 26% of the corporate tax is shifted to savers.

(5) Capital does not bear the burden of the corporate and property taxes: labour and transfers bear these taxes.

(6) Same as (5) plus income tax on capital income (in proportion to share of total income).

(7) Same as (6): in this case income tax on capital income is derived by applying average marginal tax rate on capital income to assessed capital income.

(8) Same as (7): in this case the average marginal tax rate on capital income is applied to total capital income.

considered.[10] In column 5 the assumption is made that capital does not bear the burden of the corporate and property taxes using the small open economy assumption. In this case labour and transfers bear the burden of these taxes. Column 6 includes a portion of the personal income tax as taxes on capital income. Columns 7 and 8 use alternative procedures where average marginal tax rates on capital income, firstly on assessed income and then on total capital income, are used in the incidence calculation.

All of these cases involve a different treatment of taxes on capital income from the central variant in Table 4 and in each the change in assumption is made only with respect to column 1. Outside of case 6, changes are not made cumulatively (as in Table 7). While the impacts are not pronounced, these modifications all produce a more regressive average rate pattern than in column 1, and the tax system moves closer to proportionality.

Sharp changes towards marked regressivity in the incidence pattern occur when, in addition to capital income not bearing taxes, the measurement of capital income is also questioned. Capital income is defined in the Pechman-Okner and Browning-Johnson calculations in a similar (though not identical manner) to the national accounts. Included are interest, dividends, retained earnings and rent, with wages and salaries being the measure of labour income. However, much of the recent labour economics literature stresses human capital as an integral part in the process of capital formation, and if this is recognized these factor income measures should correspondingly change.

Recent human capital theory assumes that, ex ante,

households possess a single composite factor of production,

lifetime resources, with no distinction made between labour and

capital. The older-style view of human capital, represented in the

work of Schultz (1962), stresses the concepts of endowed and

improved labour with improvements to endowed labour occurring

through on-the-job training and schooling. The original Schultz

calculation had an approximate economy-wide ratio of two to one

for the U.S. for improved to endowed labour. A more recent

estimate for Canada by Havrylyshyn (1979) puts this ratio at

approximately three to one.

To dramatize the significance of this issue in incidence

calculations, the Schultz formulation has been adopted and a ratio

assumed of 3:1 for improved to endowed labour. It is further

assumed that capital, which now includes improved labour, does not

bear the burden of any taxes. Human and non-human capital are

treated as perfect substitutes in portfolio decision making by

savers, and earn the same rate of return.[11] Only unimproved

labour and transfers bear tax burdens in the no indexation case;

only unimproved labour bears the burden where indexation (as

defined by Browning) occurs.

Table 7 reports the effects on the central variant incidence

calculation from Table 4. The ratio of improved to endowed labour

income is assumed to vary by income range in two alternative

ways. One is that the ratio is the same for all wage and salary

earners; the other is that unimproved labour income is the same

dollar amount per wage earner for all income ranges. For the no

Table 7

Incidence Calculations in Which the Measurement of Capital Income is Altered to Include Human Capital

1972 Household Income classes	Total tax rates: alternative cases [1]				
	(1)	(2)	(3)	(4)	(5)
under $6500	27.5	83.5	99.8	19.9	29.9
6500 - 7500	32.7	59.2	70.1	27.9	37.7
7500 - 8500	35.4	53.5	62.2	35.4	45.2
8500 - 10000	35.0	45.4	51.2	41.0	49.9
10000 - 11500	36.1	40.8	44.1	41.4	47.3
11500 - 13000	35.3	40.0	42.2	42.8	47.3
13000 - 14500	35.6	38.4	38.9	44.1	46.6
14500 - 16000	35.7	38.2	38.0	44.8	46.3
16000 - 18500	37.8	35.8	35.1	42.6	43.3
18500 - 21000	37.1	35.6	34.6	42.7	43.1
21000 - 25000	37.4	34.5	31.1	43.2	39.8
25000 & over	43.0	22.2	15.9	29.7	21.0

Case Descriptions

(1) Central variant (Table 4).

(2) Human Capital Case: Unimproved labour income assumed proportional to labour income, capital income does not bear the burden of capital taxes and the portion of the income tax allocated to capital.

(3) Same as 2; unimproved labour income is the same for each wage earner.

(4) Same as 2; capital income and transfers do not bear the burden of taxes since transfers are indexed.

(5) Same as 3; capital income and transfers do not bear the burden of taxes since transfers are indexed.

[1] In all cases tax rates are on a net of factor tax, net of direct tax basis; thus the 99.8 percent tax rate on the lowest income group in column 3 implies a sharply lower rate on a gross basis.

indexation case, these assumptions correspond to columns 2 and 3 of Table 9, for the indexation case to columns 4 and 5 of the same table.

These calculations indicate a significantly more regressive average tax rate pattern than for the central variant, especially in column 3 where sharp regressivity is obtained. As in Table 5, indexing transfers significantly reduces the regressivity of the tax system since transfers are heavily concentrated in the bottom tail of the income distribution. This is reflected in columns 4 and 5 of Table 7 where the regressivity of columns 2 and 3 is sharply reduced. However, the main effect remains; namely, that sharp regressivity can be produced through an alternative set of incidence assumptions.[12]

These calculations present a contrast to those of the preceding section. Results in the two sections indicate that significantly wider confidence ranges need to be used in interpreting incidence calculations than has been thought to be the case in the past. The natural corollary is that many issues of implicit theorizing need to be settled before we can interpret further incidence calculations.

VI   The Income Measure and Tax Incidence

While the shifting assumptions used are perhaps the most crucial part of any incidence calculation, the income measure is also very important. This issue is discussed in some detail in this section.

In the central variant (Table 4) income is gross of

transfers, gross of personal income taxes, but net of all other taxes. An adjustment has also been made to the value of imputed income from owner-occupied housing which has been grossed up by the household marginal tax rate. The main reason for using this particular income concept is the desire to use an income measure which does not change as shifting assumptions vary. Following the general equilibrium tax literature, the concept of 'observed' is used rather than 'original' income (as stressed by Pechman and Okner, and Browning and Johnson).

It is well known that the income concept used affects incidence calculations and to emphasize this point, calculations using alternative income bases are reported in Table 8. In all these cases the shifting assumptions remain the same as in Table 4 (the central variant); only the tax base used in calculating total tax rates changes. If income net of all taxes is used, the tax system appears more progressive with average rates increasing from 28 to 51 percent. If income net of transfers (similar to the Gillespie income measure) is used, the tax system appears sharply regressive with average rates falling from 99 to 44 percent. On the other hand, if income gross of all taxes is used (similar to the income measure used by Browning and Johnson and by Pechman and Okner), average tax rates increase from 22 to 34 percent. Finally, average total tax rates have been calculated on an annual consumption base, which advocates of consumption tax might consider more defensible than using income. To implement this, consumption has been grossed up by the amount of annual taxes paid, and the tax system appears to be significantly more

Table 8

Impact of Different Income Measures and Tax Bases on Incidence Calculations

Total Tax Rates: Central Variant Incidence Assumptions Used in Each Case

1972 Household Income Classes	Central Variant (Table 4)	Using Income Net of all Taxes	Using Income Net of Transfers	Using Income Gross of all Taxes	Using Consumption Gross of all Taxes
Under $6500	27.5	27.9	99.0	21.8	20.8
6500 - 7500	32.7	34.2	55.8	25.5	26.7
7500 - 8500	35.4	38.1	50.2	27.6	28.8
8500 - 10000	35.0	38.7	42.3	27.9	30.0
10000 - 11500	36.1	40.5	41.2	28.8	31.0
11500 - 13000	35.3	40.3	39.5	28.7	32.0
13000 - 14500	35.6	41.2	38.7	29.2	32.8
14500 - 16000	35.7	41.8	38.5	29.5	34.1
16000 - 18500	37.8	44.6	40.4	30.9	36.1
18500 - 21000	37.1	43.6	39.5	30.4	35.4
21000 - 25000	37.4	45.0	39.2	31.0	38.4
25000 & Over	43.0	51.5	44.2	34.0	50.0

progressive than in the central variant.

The choice of income concept in literature calculations is thus an important issue since the perceived redistribution through the tax system can be significantly affected. As already noted the Gillespie tax incidence calculations use a 'broad' income concept, although in Gillespie's calculations of net fiscal incidence (benefits less taxes) a different income measure is emphasized. Broad income excludes transfers, and is measured essentially as capital income (gross of unshifted corporate taxes) plus labour income (gross of backward shifted employers' share of social security taxes), gross of income taxes. Adjusted broad income, used in Gillespie's net fiscal incidence calculations, adds in the value of government benefits and transfers received, but subtracts total taxes allocated by income range.

In Pechman-Okner, the income measure is motivated by a concern to calculate household income in a counterfactual situation that has no tax system in operation. Tax rates so calculated are intended to reflect the portion of 'original' income households surrender through the tax system. Thus, gross of tax capital, labour, and transfer incomes by household are used, with a reallocation of all other taxes including sales and excise taxes. In the most redistributive variant, one-half of corporate taxes are added back into dividends by income range, and one-half of corporate and all of the property taxes are added into capital (property) income. Pechman and Okner use the same gross-up rate in their tax calculations for all income ranges even though the portfolio composition of capital (and its tax treatment) differs

by income range. Sales and excise taxes are also added back in by income range using the same average rate for all households, even though the tax is treated as regressive. In the least redistributive variant, the forward shifted taxes are reallocated using the same approach as with sales and excise taxes. One-half of corporate taxes, property taxes on structures and improvements, and one-half of the employer's social security contributions are treated as "indirect business taxes", and are reallocated along with sales and excise taxes.

A similar procedure to that used by Pechman and Okner is employed by Browning and Johnson. The major difference is how taxes are added back in, because of the use of different shifting assumptions and the definition of the income base.[18] As with Pechman and Okner, Browning and Johnson use an average rate across all capital income for all income ranges in calculating the corporate and property tax addition to net of tax incomes. The sales and excise taxes are added back into incomes using the average tax rate over all factor incomes (gross of factor taxes), with the gross up applied to factor incomes by income range (in contrast to Pechman and Okner who gross up total income).

The choice among these income measures has a considerable impact on the perception of redistribution from the tax system. The gross of tax income measures used by Pechman-Okner and Browning-Johnson imply an income definition which changes as shifting assumptions change. Thus, in performing sensitivity analyses it is difficult to separate out the effects of changes in incidence assumptions from changes in the income base, since the

calculated average tax rate profile is all that is reported.
Calculations performed with the 1972 Canadian data (but not
reported here) suggest that a significant portion of the
sensitivity that Pechman and Okner report between their most and
least redistributive variants comes from the change in the income
concept rather than simply from the reallocation of taxes by
income range as incidence assumptions change.

A further point is that the gross-up procedure used by
Pechman-Okner and Browning-Johnson in their implicit general
equilibrium model is not consistent with the 'market factor price'
approach to the choice of units of capital and labour services
used by Harberger (1962). This same units convention also
underlies much of the applied general equilibrium tax analysis
which has become more prominent in the last few years (see Shoven
and Whalley [1984]).

Under this approach, units of factor services are defined
with reference to the net of tax market price for an assumed
homogeneous factor. With intersectorally mobile capital, the
assumption is that there is a market price for capital services
determined after all industry discrimination in factor use is
taken into account, since sellers of factors require the same
factor reward wherever the factors they own are used. The amount
of capital services which can generate a return of one dollar net
of all taxes in all possible uses is the amount of capital
services taken to be one unit; this units convention yields a
market price of one dollar.

The implication of all this for incidence calculations is

that in reallocating taxes to factor incomes one has to be careful
to reallocate taxes according to the use of factors.   For
instance, capital services used in home ownership are differently
taxed from capital services used in manufacturing, and grossing up
by a single gross-up tax rate for all capital income can
substantially misestimate capital income by income range if
housing capital is heavily owned by one group of households and
non-housing capital by another.   Equally, with differential tax
treatment across assets, such as with tax free state and municipal
bonds in the U.S. whose tax treatment is capitalized into market
yields, one can be mislead by using a single gross up tax rate.

Because of the gross-up problem, and also the need I feel to
have an income measure which is unchanged as incidence assumptions
are varied, a different income measure has been used in the
central variant calculation from either Pechman and Okner, or
Browning and Johnson.   This includes factor incomes net of all
factor taxes but involves no reallocation of sales and excise
taxes as in other incidence studies. Income measures the net of
tax budget constraint of households in an equilibrium situation in
the presence of existing taxes.

A problem with this approach, noted in the applied general
equilibrium tax literature, is discrimination on the supply side
of factor markets which occurs through different personal marginal
tax rates.   A way of partly correcting for this is to measure
households incomes gross of personal taxes, but with some further
adjustments for asset discrimination in personal taxes (e.g.,
housing versus non-housing capital income). The income measure

used here follows this approach and is net of factor tax, adjusted factor incomes, plus transfers.

Average tax rates computed using this income base do not have the interpretation sought by Pechman-Okner and Browning-Johnson of the fraction of purchasing power a household surrenders to the tax system, since incomes no longer correspond to 'original' income. This income measure also produces a more progressive tax rate profile than an 'original' income concept. The attraction of using this concept of 'observed' rather than 'original' income is its invariance to alternative shifting assumptions.

VII   Towards_Lifetime_Tax_Incidence

In the discussion thus far, the somewhat pessimistic picture has been painted that alternative and seemingly defensible assumptions exist under which the incidence effects of the tax system assessed using annual data can be made to appear alternately progressive or regressive. The key issues arise with the treatment of savings and human capital. To my mind this highlights a need for lifetime rather than annual incidence calculations. There is, however, surprisingly little discussion in the literature as to how lifetime and annual tax incidence may differ.

There are a number of ways in which these incidence calculations will diverge. In a no-bequest life cycle model, capital income, a key component in annual incidence calculations, is not part of lifetime resources. Capital income as such does not exist, does not bear the burden of taxes, and is not part of

the lifetime income base.

In addition, if all households face similar lifetime earnings profiles, or if the tax treatment of differential earnings streams which result from varying educational experience produces compensating wage differentials, a presumption would exist for the tax system being proportional to lifetime incomes if no lifetime uses side effects arise. Thus, annual incidence calculations can be highly misleading simply because people move through lifetime profiles which produce high incomes during the peak of working life. Data currently available suggest that the size distribution of lifetime income is significantly more equal than the size distribution of annual incomes. In a recent thesis, Blomqvist (1981) calculates that nearly one-half of inequality in annual incomes disappears when examining lifetime incomes, a conclusion which is implicitly supported by the work of Mincer (1974) and Lillard (1977) on inequality in earnings.

Another difference arises through the effects of transfers over the lifetime. Transfers include old-age support and education-financing, particularly for post-secondary education. Depending on the year chosen, these can account for approximately 50 percent of transfers to persons on a national accounts basis. It is therefore likely that over the lifetime these transfers are less heavily concentrated in the bottom tail as in the annual income distribution. Such a change would weaken the significance of the indexation issue stressed by Browning.

A further interesting issue arises with the differing periodicity of various taxes over the lifetime. Taxes on labour

income are paid until retirement, but taxes are paid on consumption until death. This would suggest that even if lifetime income profiles reflect the inequality of the distribution of skills, the relative weights on taxes which appear in annual incidence calculations need not be the same in lifetime incidence calculations.

Yet another point concerns the uses side argument for regressivity of sales and excise taxes in annual incidence calculations. If lifetime incidence is viewed on a similar basis to annual incidence, and sources and uses side effects examined, the sources side would involve three components of lifetime resources; human capital (discounted present value of lifetime labour income), inheritances, and the discounted present value of lifetime transfers. There would also be uses side effects from differences in lifetime expenditure patterns by range of lifetime income. The uses side argument for regressivity with sales and excise taxes could re-emerge for a lifetime incidence calculation using the Kotlikoff and Summers (1981) finding that most saving over the lifetime is for bequest purposes, if it is also true that lifetime savings rates increase by range of lifetime income. On the other hand, 'dynastic' the incidence which treats families as ongoing entities would remove such a uses side effect.

The tax incidence literature has many statements to the effect that it would be more satisfactory to analyse tax incidence in a lifetime context if it were possible. It has generally been believed until recently that due to data and other problems, such calculations were next to impossible to perform. As a result,

redistributive tax policy judgements have continued to be based on annual tax incidence studies despite the reservations many have about their usefulness.

However, a set of lifetime tax incidence calculations for Canada have recently been produced by Davies, St-Hilaire and Whalley (DSW) (1984), which, while not without problems, are nonetheless relevant to the discussion here. These calculations use a simulation model of life cycle saving and bequest behaviour for a representative sample of Canadian households due to Davies (1979). To generate some of the distributive series required is an incidence calculation. As in the annual incidence calculations, each component of the tax system is allocated to households, now grouped by lifetime rather than annual income and different distributive series are used relative to annual incidence calculations.

The data used by DSW come partly from the 1971 Statistics Canada Survey of Consumer Finances (SCF), and partly from the Davies life cycle simulation model. The SCF data are used to construct synthetic longitudinal lifetime profiles of earnings, transfers and income tax payments for a sample of 500 households in each of 11 age groups (20-24 to 70-74). Households are linked across age groups using a procedure which reproduces the degree of earnings mobility implicit in Lillard's (1977) study of inequality in annual and lifetime earnings in the U.S. A simulation of patterns of mortality and bequests produce a size distribution of net inheritances across the households which is fed into the life cycle savings model along with the rest of the model data. The

model generates lifetime paths of consumption and investment income by household generating the distributive series required for the lifetime incidence calculation.

A set of standard competitive incidence assumptions adapted to the lifetime context is used to determine tax burden in their central case: the income tax is assumed to be borne by income recipients; corporate and property taxes by recipients of investment income over the lifetime (deferred consumption); social security taxes by earnings recipients; and sales and excise taxes in proportion to lifetime consumption. The key distributive series on the sources side are discounted lifetime earnings, inheritances and transfers. These series provide the gross of tax lifetime income base. Capital income, so important in annual calculations, does not appear. On the uses side, two rather than one key series (as in annual calculations) appear: lifetime consumption and lifetime investment income.

The central case lifetime incidence results produced by DSW are reported in Table 9. These results suggest that under standard competitive assumptions lifetime incidence calculations produce mild progression in tax rates across most household deciles. This is a similar result to the central variant annual incidence calculation in Table 4. Also, as the authors point out there is considerably less variation in incidence patterns across taxes in the lifetime calculation.

Lifetime income taxes, while progressive, are less so than in annual calculations; sales and excise are less regressive; social security is initially less progressive and subsequently less

Table 9

Central Case Lifetime Incidence Calculation by DSW[1]

Average Tax Rates for Canadian Households by Decile

Deciles Ranked by Lifetime Resources

	First (lowest)	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Ninth	Tenth (highest)	All deciles
Corporate Income Tax	2.2	2.9	2.6	3.0	2.9	3.3	3.3	4.1	3.4	5.1	3.6
Property Tax	2.4	3.1	2.8	3.3	3.2	3.6	3.6	4.5	3.7	5.6	3.9
Sales & Excises	15.0	14.3	14.1	13.9	13.8	13.5	13.6	13.3	13.2	12.4	13.5
Social Security	3.9	4.0	3.9	4.0	3.8	3.8	3.6	3.6	3.4	2.8	3.6
Personal Income Tax	7.3	11.3	12.5	13.5	14.5	15.1	15.7	16.7	17.7	20.5	15.8
All Taxes	30.9	35.5	35.9	37.7	38.1	39.3	39.8	42.2	41.3	46.5	40.2

[1]Source: Davies, St. Hilaire, and Whalley (1984)

regressive by income range, and corporate and property taxes are less progressive (especially at the top end). This reflects the absence of extremes of inequality in the underlying lifetime distributive series, and means that changes in incidence assumptions have less impact on lifetime, than on annual incidence results.

This relative robustness of lifetime calculations is confirmed by DSW in their calculations of lifetime tax incidence under alternative incidence assumptions. Under non-competitive assumptions where corporate and property taxes are treated as partially forward shifted and are allocated one-half to consumption and one-half to lifetime investment income, overall progressivity of the tax system hardly changes at all. Adapting the Browning indexation argument to the lifetime context also produces relatively little change in the incidence pattern.

The main implications from the DSW calculations is that there may be a stronger basis than from annual incidence calculations for the conclusion that the incidence of the overall tax system is mildly progressive. On the other hand, since inequality over the lifetime appears to be considerably smaller than in annual data there seem to be less grounds for concern that the tax system does not do more to redistribute income, especially if the social costs of redistribution through induced inefficiencies are high.

VIII Other Issues

In addition to annual and lifetime incidence which have been discussed in preceeding sections, there are a number of other

dimensions to incidence analysis that are beginning to appear in more recent literature.

Benefit-Related Taxes

An important issue in assessing tax incidence is the link to the expenditure side of government activity. If taxes merely finance benefits received by the person paying the tax then the net incidence effect is zero. While this issue is discussed in the incidence literature the main focus in the past has been on the combined effects of all taxes and all expenditures. Increasingly, however, arguments are being made that individual taxes are benefit related and can thus be ignored in any attempt to analyze tax incidence.

In previous sections the 'benefit-related' argument has been used to alternately remove social security and corporate taxes from tax incidence calculations to support the progression and regression positions. There are, however, literature arguments currently circulating as to why three of the five major components of the tax system considered in tax incidence studies are benefit-related. The argument with social security has already been made, and a similar issue with corporate taxes has been raised appealing to the Gordon risk argument. A further argument arises with the property tax where a treatment as a system of financing charges for local government expenditures meeting local preferences would suggest a benefit-related approach. This would also remove the property tax from a net fiscal incidence calculation.

Some indication as to the significance of this issue, can be

guaged from the incidence calculations reported in St-Hilaire and Whalley (1982). When benefit-related taxes are removed, an incidence pattern a little closer to proportionality is obtained, but the impacts on the overall incidence picture are small.

General Equilibrium Incidence Analysis

A further issue in incidence analysis is the role of numerical general equilibrium calculations. Difficulties in choosing between shifting assumptions in incidence calculations suggests not only a need for lifetime incidence, but also an explicit general equilibrium model in which production, demand, and elasticity paramaters are explicitly represented.

In building an explicit general equilibrium model, the 'arbitrariness' of shifting assumptions is, to some extent, replaced by the 'arbitrariness' of choice of elasticities and model form. On the other hand, general equilibrium models have the virtue that they explicitly specify both the model and the parameter values, and also take into account the deadweight loss of the tax system in calculating incidence.

To my knowledge, only one of the general equilibrium tax models thus far constructed has been used to make an incidence calculation for the whole tax system. Using their model of the U.K. economy and tax-subsidy system, Piggott and Whalley (Table 7.8, forthcoming) estimate the gain to the top decile from replacing the 1973 UK tax and subsidy system by a yield preserving neutral tax to be in the region of 20-25 percent of disposable income, while the loss to the bottom decile would be similar. Direct cash transfers remain unchanged in this calculation. While

there are many features of this model which can be queried, this
does indicate further possible qualifications to the conclusion
that the incidence of taxes is proportional using annual data.
Lifetime applied general equilibrium incidence calculations have
not, to my knowledge, been made.

International Dimensions of Tax Incidence

Earlier sections have indicated how the assumption of a
small open economy in which capital is internationally mobile can
change the tax incidence calculation, due to the inability of
internationally mobile capital to bear taxes in a small country.
There are, however, a number of other international dimensions to
tax incidence not usually raised in the incidence literature, but
potentially equally important.

A key issue concerns the potential for transfers of tax
revenues between jurisdictions and therefore the ability of even
small countries to have their taxes borne by foreigners. For
instance, with a foreign tax credit in the U.S. and corporate tax
rates in Canada at, or below, the U.S. corporate tax rate, taxes
on foreign controlled companies in Canada are effectively paid by
U.S. residents through a transfer from the U.S. to the Canadian
Treasury. In analysis of the incidence of this tax in Canada it
is misplaced to treat it all paid by Canadian residents.

In contrast, for large economies, the ability to export taxes
may mean that foreign countries bear the burden of a portion of
domestic taxes through impacts on the terms of trade. This
argument has been made by both Whalley (1980) and Ballentine and
Thirsk (1981), and to the extent that this is true national

incidence calculations may need to be modified.

Interregional Tax Incidence

Another dimension of tax incidence relatively little explored, but potentially important in Canada, is interregional tax incidence. Most interregional tax incidence analyses simply take the national framework for incidence analysis and make separate incidence calculations by region. Thus differences in tax rate profiles across regions reflect regional differences in income sources and differences in savings or expenditures on various products. There are, however, several tax features which suggest that regional dimensions of tax incidence are potentially important because of the way particular industries concentrated in certain regions are treated for tax purposes.

One very clear case arises with the manufactures sales tax which taxes an industry heavily located in Central Canada and also taxes manufacturing imports. When this is combined with the manufacturing processing incentive (the reduction in the corporate tax rate for manufacturing industry) the net effect in output markets is much the same as a tariff. The interregional effects of the tariff have been extensively discussed in Canada, and similar effects through the tax system may be present.

Intergenerational Incidence

A futher neglected area concerns intergenerational incidence, the way in which taxes are borne by one generation relative to another. As yet, these questions are little explored in numerical incidence analyses, but are potentially very important. As has been pointed out repeatedly over the last few

years, the presence of unfunded or underfunded public pension
liabilities when demographic shocks are encountered can result in
large intergenerational transfers. In turn, the intergenerational
redistribution elements accompanying changes in tax policies such
as a switch from an income to a consumption tax, need to be more
extensively studied and are potentially large.

Defining Taxes in Incidence Analysis

Another issue is that incidence studies concentrate only
on those elements of the tax system which generate cash receipts
for government. A broader view of what constitutes the tax system
suggests other revenue sources should perhaps be incorporated. The
inflation tax implicitly collected by government as a tax on money
holdings is a good example. In addition taxes which governments
exact through unanticipated increases in the inflation rate and a
reduction of the real value of government debt outstanding is also
a further potentially significant source of redistribution.
Neither of these elements enter conventional incidence analyses.

Furthermore, there are taxes only collected implicitly from
individuals, which should nonetheless be treated as part of the
tax system. A clear case arises with state and municipal bonds in
tax incidence calculations in the U.S. Because individuals holding
these bonds pay no taxes, they are treated in incidence
calculations as facing a zero tax rate on this income source. In
fact, these indiviuals implicitly pay a tax in the form of a lower
coupon return on the bond which they own. The benefit of the tax
treatment accrue not to individuals but to municipalities who are
able to issue bonds at lower interest rates. Implicit tax

revenues for U.S. states and municipalities appear as lowered
financing costs in meeting their expenditure obligations.

The Equity-Efficiency Trade Off

Thus far in discussing incidence has made no explicit
reference to efficiency, and yet all incidence calculations have
to be seen as part of the evaluation of the broader
equity-efficiency trade off implicit in government intervention on
both the tax and expenditure sides. Interestingly, on this issue
there seems to be a substantial reevaluation of perceptions
underway. For many years efficiency costs of taxes were regarded
as small but in recent literature efficiency costs have increased
substantially, especially so at the margin. Indeed in a recent
piece by Browning and Johnson (1984) the argument is made that
because redistribution involves raising taxes from those in the
highest income ranges, there are larger distorting costs
associated with raising these revenues than is true on average for
the whole economy. In their analysis, more equity has a very high
cost in terms of efficiency. If this is so, evaluations of tax
incidence have a special role to play in tax reform debate, and no
doubt in future literature the wider context of all incidence
calculations will be more widely discussed.

It seems fitting to close with some comments on the broader
methodological implications of the view of incidence calculations
offered here. To many economists raised in the post war positivist
tradition, the apparent inability to provide a definitive answer
as to the incidence of the tax system may seem troubling. After

all, if economics is a science much the same as in natural
sciences, why is it so difficult to test alternative hypotheses
and determine appropriate values for key parameters?

For my own part, I do not find this situation as troublesome
as I might a few years ago since I view it as reflective of the
newly emerging recognition of what the state of empiricism in
economics actually is. This experience in the tax incidence area,
has parallels in the other areas of economic policy making with
which I have been associated (such as efficiency analysis of
taxes, trade policy, and choice of development strategies). A few
key assumptions are crucial for the conclusions, but remain
untested (and may even be untestable). Data is sparse and of poor
quality. The range of issues and number of plausible hypothesis
grows more quickly than empirical evidence indicating which of the
hypotheses is more reasonable. And beneath all of this is the
policy process, which requires decisions. The need for someone to
make difficult judgemental calls is simultaneously inescapable,
and problematical. I therefore see tax incidence calculations as
continuing to tax the minds and energies of public finance
economists for some years to come. Simultaneously I view activity
of this form as an integral part of a healthy policy process,
since even if policy debates remain unresolved in any definite
sense, they at least take place on a higher level.

ENDNOTES

1 See Gillespie (1980), Pechman and Okner (1974),

  Musgrave, Case and Leonard (1974) and Browning (1978).

2 Resource taxes do not figure prominently, partly because

  many of these calculations are for economies other than

  Canada, and partly because the data used for Canadian

  calculations refers to years which preceded the recent

  growth in importance in resource taxes.

3 Sources and uses sides effects refer to assumptions that a

  tax is borne partly or fully by one or more sources of

  income (capital income, labour income, and transfers), or is

  borne by households according to their use of income

  (savings and expenditure patterns). A particular tax can

  have both uses and sources effects. In the literature the

  terms "shifting assumptions", "incidence assumptions", and

  "sources and uses sides effects" all refer to the

  assumptions made which determine the allocation of tax

  burdens. These terms are used interchangeably here.

4 This is the case with Pechman and Okner's treatment of sales

  and excise taxes. A number of quantitatively less important

  uses side effects also occur, such as with excise taxes on

  alcohol and tobacco.

5 The difference relative to Pechman and Okner is what is

  included in transfers. This is discussed in more detail

  later. See also Meerman (1980).

6 An argument by Ballentine (1981) complicates the implication

that forward shifting produces regressive incidence impacts
as in the Pechman-Okner and Gillespie calculations. Since
forward shifted taxes fall on capital goods as well as
consumption goods, savers bear some of the burden of forward
shifted taxes. In Ballentine's study, around 26 percent of
forward shifted taxes are borne by savers and this
significantly reduces the regressivity of the tax system
calculated under forward shifting assumptions.

7 There is an issue of double counting raised by this
procedure, since one can argue that some of the taxes paid
today should be treated as borne by yesterday's savers and
removed from the calculation. If the implicit model is as
described above, no double counting arises since capital
inputs used today can bear the burden of todays taxes on the
sources side, and consumption tomorrow can bear future tax
burdens on the uses side. An overlapping generations
formulation would, however, confront this double counting
issue. To correct for this, it would be necessary to remove
a portion of taxes borne by recipients of capital income
since capital income accrues to yesterday's savers. While
such an adjustment would reduce the progressivity of the tax
system, it would not have the same impacts as adding in
additional taxes on savers since savings is more heavily
concentrated in the top tail of the income distribution than
is capital income.

8 Although this is now modified by the existence of the ISIP,
under which only one half of real rather than nominal

capital gains is taxed, using a three-year sliding average calculation. Interest costs associated with investments in such plans are not deductible.

9 This argument is more complex if the capital exporting country has a foreign tax credit. In this case the foreign country bears the burden of any taxes up to the foreign tax rate. Only domestic increases in taxes above the foreign tax rate will result in the gross of tax return to capital rising to leave net of tax returns to foreign investors unchanged.

10 See endnote 6.

11 It is possible, however, to construct a three factor model involving human capital, non-human capital, and unimproved labour in which the two types of capital are imperfect substitutes in production. With a fixed endowment of human capital in the short run and internationally mobile non-human capital, the conclusion that only unimproved labour bears the tax burden would no longer hold.

12 There are further adjustments which could also be made to enhance regressivity, one being to utilize a uses side adjustment on leisure operating against high marginal income tax brackets in the allocation of income taxes on labour income.

13 The measure of transfers used in Browning is substantially broadened to include transfers in kind. Meerman (1980) discusses the impact of this on incidence results.

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