

STAFF STUDY No. 9



# Federal Tax Revenues at Potential Output, 1960 and 1970

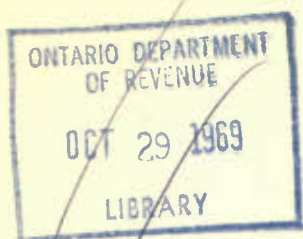
*by* D. J. Daly



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*prepared for the  
Economic Council of Canada*



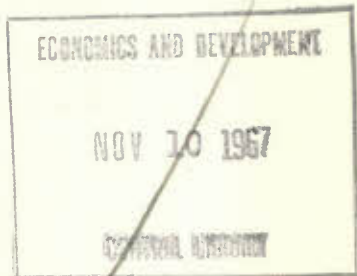


FEDERAL TAX REVENUES AT POTENTIAL OUTPUT

1960 AND 1970

by

D. J. Daly



Staff Study No. 9

Economic Council of Canada

December 1964



This is one of a series of technical studies which have been prepared as background papers for the First Annual Review of the Economic Council of Canada. Although these studies are published under the auspices of the Economic Council, the views expressed in each case are those of the authors themselves. At the end of this Study is a list of additional studies which are being published separately and are available from the Queen's Printer, Ottawa.



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## FEDERAL TAX REVENUES AT POTENTIAL OUTPUT, 1960 AND 1970

This study considers the levels of federal tax revenues which would be generated by existing tax rates if the economy were operating at potential output. Potential output is defined and measured in an Economic Council of Canada staff study which sets forth the levels of output attainable under high standards of performance in the economy as regards employment and productivity advances.<sup>1/</sup>

### I - FEDERAL REVENUE SOURCES

The major sources of federal revenues are summarized here as a necessary background for the analysis contained in this paper. The personal income tax is now the most important single revenue source. In 1950 this tax yielded \$654 million and contributed only about 20 per cent of federal revenues. By 1953, however, its yield exceeded the corporation profits tax for the first time and its revenue importance has since tended to grow consistently. By 1963 it yielded \$2.2 billion, about 30 per cent of total revenues. The corporation profits tax, on the other hand, has declined in relative importance since the early 1950's, in part because of the sluggish growth of corporate profits. In 1963, its yield was about \$1.4 billion, less than 20 per cent of the total. The indirect taxes continue to be of importance, although they no longer dominate the revenue picture as they did before the Second World War. The manufacturers' sales tax and customs import duties are the most important of the indirect taxes, although the excise taxes on liquor and tobacco should also be noted. The levels and percentage contributions of the main sources of federal government revenues are shown in Table 1.

Table 1  
Federal Government Revenues,  
Totals and Percentage Distribution, 1963

	Millions of Dollars	Per cent
Direct taxes, persons	2,193	30.6
Direct taxes, corporations	1,353	18.9
Withholding taxes	128	1.7
Indirect taxes, of which	2,450	34.3
Customs import duties	(577)	(8.0)
Excise taxes	(1,462)	(20.4)
Other	(411)	(5.9)
Investment income	497	7.0
Employer and employee contributions to social insurance and govt. pension funds	533	7.4
Total Revenue	7,154	100.0

Source: Dominion Bureau of Statistics, National Accounts, 1963, pp. 47 and 49.

<sup>1/</sup> B.J. Drabble, Potential Output, 1946 to 1970, Staff Study No. 2, Economic Council of Canada, Queen's Printer, Ottawa, 1964.

## II - EFFECTS OF UNDERUTILIZATION ON REVENUES IN 1960

When the economy operates at less than potential, the short-fall does not impinge uniformly on all incomes and expenditures. Some incomes and expenditures are affected much more than others especially corporate profits and merchandise imports. For example, during the four post-war recessions corporate profits fell 17 per cent on average and merchandise imports fell 8 per cent from the cyclical peak levels, while GNP actually went up fractionally. In such periods, there has been a particularly pronounced impact on production and employment in the commodity-producing industries, including machinery and equipment, consumer durables and some industrial materials; on the other hand, employment in service industries and among white collar occupations has tended to continue to grow relatively steadily.

This varying impact of recessions has very important implications for federal revenues, since the major tax sources correspond closely to the most sensitive areas of income and expenditure. About 85 per cent of federal taxes can be closely related to various statistical income and expenditure series in the National Accounts. Taxes on corporate profits, the customs import duties and the personal income tax are obvious illustrations. The manufacturers' sales tax moves more closely in line with manufacturing shipments than with retail sales, since the tax is levied on the manufacturer. On the other hand, many of the areas of relatively stable growth, such as expenditures on services, purchases of food, and depreciation, are all exempt from tax levies.

According to the staff study Potential Output, 1946 to 1970 by B.J. Drabble,<sup>1/</sup> potential output in the nonagricultural sector in 1960 would have been about 8.8 per cent higher than the level actually achieved. About half of this additional output would have arisen as a result of higher employment, and the other half because of higher real output per person employed. The first half of Table 2 summarizes some material from the study on potential output referred to above. The second half indicates the effects on federal government revenues which would have emerged at potential output, at the 1960 level of prices. The percentage increases in the major tax revenues are far more dramatic than the potential increase in the output of the non-agricultural sector. The corresponding increases in sales tax and personal income tax yields would have been about one eighth; customs duties collections would have been more than one fifth higher; and corporate profits collections more than one third

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<sup>1/</sup> op. cit., p.



greater. In the aggregate, a level of real output in the nonagricultural sector 8.8 per cent higher than actually occurred would have been reflected in an increase in taxes of about 18.0 per cent in current prices (a percentage increase more than twice as large).<sup>1/</sup> Thus, at potential in 1960, federal revenues would have been about \$7.5 billion, instead of the \$6.4 billion which was actually collected.

Table 2  
Major Economic Aggregates and Federal Tax Sources,  
Actual and Potential, 1960

	Actual	Per cent Increase to Potential
<u>Major Economic Aggregates</u>		
Total nonagricultural economy, GDP (1949 \$ millions)	21,543	8.8
Total employment (thousands)	6,074	3.8
Income per person (1949 \$)	3,891	4.8
	Millions of dollars	
<u>Major Federal Taxes</u>		
Personal income tax col- lections at the source	1,608	13.8
Corporation profits tax	1,266	39.6
Customs import duties	515	24.3
Sales tax (gross of refunds)	1,047	12.4
Total federal revenue	6,426	18.0

Source: B.J. Drabble, op. cit.; and Appendix.

Moreover, if unemployment had been limited to the 3.0 per cent level assumed for potential output instead of the 7.0 per cent actually experienced, unemployment insurance payments would have been appreciably lower - say \$230 million rather than the \$482 million actually disbursed. If all other expenditures had been unchanged, instead of an actual budget deficit of \$251 million on a National Accounts basis there would have been a budget surplus of about \$1.1 billion at potential output.

It should be noted that all expenditures by federal government departments on construction and machinery and equipment are treated as current expenditures, both

<sup>1/</sup> For a fuller discussion of the reasons for this, and a summary of past experience which has been used to develop these relations see D.J. Daly, "Variability in Federal Tax Collections", Canadian Tax Journal, September-October 1964, reproduced as an Appendix to this study.



in the National Accounts and the budgetary accounts. In 1960 these amounted to \$354 million. This method of treating capital expenditures departs significantly from that used by private concerns and contributes to the existence and size of the government deficit.

Thus, if the economy had been operating at potential in 1960, the federal government would have received revenues sufficient to cover all current and capital expenditures and to provide a budget surplus almost equal to one fifth of total expenditures. However, if it had been considered desirable to increase taxes or reduce expenditures to balance the budget at the level of underutilization then present in the national economy, the effects of such action would have curtailed the levels of private demand even further.

### III - GROWTH OF FEDERAL REVENUES TO 1970 POTENTIAL

The previous section dealt with the levels of tax revenues under alternative short-term conditions. The main interest of the Economic Council's First Annual Review and the related staff studies, however, is in the achievement of potential output in the medium-term period. In this section, the possible levels of federal tax revenues, assuming expansion of the economy to potential output in 1970, will be developed. Over such a period, the changes in federal revenues move relatively more in line with changes in total income than is true of the shorter term situation. In more technical phraseology, the long-term elasticity of federal revenues is much lower than the short-term elasticity, with respect to changes in Gross National Product.

The basic estimates in the staff study at potential output to 1970 are in terms of 1949 dollars, and some allowance for price changes must, therefore, be made to translate these into current dollars as a basis for revenue estimates. From 1953 to 1963, the increase in the GNP implicit price index amounted to 2.0 per cent per year, during a period largely marked by persistent slack below potential. The same rate of price increase is assumed for the period ahead to 1970.<sup>1/</sup> Table 3 summarizes the basic estimates of growth rates in income from 1963 actual to 1970 potential in current dollars. These calculations indicate an increase of 67 per cent in total income and of 36 per cent in income per employed person from 1963 to 1970 potential. These are the basic assumptions underlying the subsequent revenue estimates and are consistent with

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<sup>1/</sup> This assumption corresponds with that set forth in the First Annual Review of the Economic Council of Canada, Economic Goals for Canada to 1970: Queen's Printer, Ottawa, 1965, Chapters Six and Nine.

the estimates in the First Annual Review of the Economic Council and with related analysis in other staff studies.

Table 3  
Growth Rates and Total Change,  
1963 Actual to 1970 Potential

	<u>Percentage Increase</u>	
	Average Annual	Total
Employment	3.0	23.2
GNP, (1949 dollars)	5.5	45.4
GNP implicit price index	2.0	14.9
GNP, current dollars	7.6	67.1
Income per employed person (current dollars)	4.5	35.6

Source: Based on data from B.J. Drabble, op. cit.

Over the longer run, once the economy has expanded to a level close to that of potential output, the rates of growth for the various components which make up the total of Gross National Product and Expenditure tend to be in line with the rate of growth for the economy as a whole. In other words, when periods of high employment are compared, the percentage composition of GNP is substantially similar in contrast to the shift in composition which occurs between stages of underutilization and high utilization. Consequently, the increase in many of the major tax sources over a long period is in line with the increase in GNP. The potential increase in GNP shown in Table 3 is over 60 per cent and indicates the over-all buoyancy in federal revenues that would emerge if the economy operated at close to potential in the years ahead.

The increase in personal income tax collections would be even more pronounced than in GNP. The reasons for this can be illustrated, having in mind the present exemptions and rates under the personal income tax. A married man with two dependants making \$4,600 has a taxable income (after personal exemptions) of \$2,000. For a 1 per cent increase in total income, his taxable income would increase by about 2 per cent, and his tax payable by over 3 per cent. This is not just a special case, but a typical one, since taxable income goes up more rapidly than basic income because of the minimum personal exemptions. The progressive rate structure contributes further to revenue increases. Given the assumptions in the previous tables, the increase in personal income tax yields at prevailing rates would be 76 per cent per person. Total

federal and provincial personal income tax collections would more than double in moving from 1963 actual to 1970 potential under these assumptions. At existing rates, federal and provincial collections would increase from \$2,487 million in 1963 to about \$5,250 million at 1970 potential income levels.

The present federal-provincial tax sharing arrangements, as adjusted in the early part of 1964, provide for a progressively higher abatement of federal personal income tax rates of up to 24 per cent by 1966-67 and an increase in the so-called provincial "standard tax" up to the same level in that year. Assuming these arrangements were continued unchanged until 1970, and the federal and provincial tax rates systems also remained essentially unchanged, about \$1,250 million of the total personal income tax revenue would accrue to the provinces at potential output in 1970.

Even if the yields of all other federal taxes were increased in step with the GNP - a very conservative assumption - revenues would increase by more than \$3.0 billion. This is a relative low estimate, since corporate profits and output in the commodity-producing industries would rise more rapidly than the GNP.

It should also be noted that the removal of the exemptions for building materials and for production machinery and equipment (other than that employed in fishing and agriculture) under the manufacturers' sales tax will be a further factor. This was estimated at \$360 million on a full-year basis in the 1963 federal budget, and would amount to a total of around \$600 to \$700 million by 1970 at potential output.<sup>1/</sup>

These steps are summarized in Table 4. The figures suggest an increase in federal revenues of about \$6.0 billion over the next seven years, an average increase of about \$800 million per year on the basis of the assumptions underlying the above calculations of potential economic growth.

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<sup>1/</sup> This estimate is based on the levels of private and public investment shown in Economic Council of Canada, op. cit., Table 26.

Table 4

Summary of Federal Revenue  
1963 Actual and 1970 Potential  
(Millions of current dollars)

	1963 (actual)	1970 (potential)
Federal and provincial personal income taxes	2,487	5,250
All other taxes and revenues	5,052	8,440
Total	7,154	13,690
Plus: Sales tax on construction materials and machinery		+ 670
Less: Provincial personal income taxes	<u>- 385</u>	<u>- 1,260</u>
Adjusted federal total	7,154	13,100

The increases in revenues envisaged are quite substantial. These estimates suggest that barring unforeseen major difficulties, the attainment of potential output would be reflected in ample federal tax revenues over the balance of the decade to meet increased expenditures under current commitments, and also to consider such alternatives as reducing federal tax rates (including, perhaps, some redesigning of the tax structure), undertaking new functions, making extensive changes in federal-provincial financial arrangements, or debt repayment.

#### IV - SUMMARY AND CONCLUSION

The analysis and evidence in this study of federal tax revenues at potential output (and the more detailed work underlying it) is that if the Canadian economy were operating at potential now or over the balance of the decade, the inflow of tax revenues at current tax rates would be impressively large. There are two principal reasons for this. First, when the Canadian economy is operating at less than potential output, the relatively most seriously depressed sectors of incomes and expenditures are essentially those comprising the tax base for about 85 per cent of federal revenues. Second, as personal income rises, personal income tax collections grow far more rapidly with a given structure of exemptions and rates.

The following figures summarize the large short-fall in tax yields when the economy is operating at substantially below its potential. They relate to the year

1960 - a year in which the actual volume of nonagricultural output is estimated to have been 8.8 per cent below potential. Federal revenues on a National Accounts basis for that year were \$6,411 million, and the federal budget deficit on the same basis amounted to \$251 million. If the economy had been operating at its potential level, federal revenues would have been about \$1.1 billion higher and unemployment insurance payments approximately \$250 million lower. If all other expenditures had remained unchanged, the federal government would have been experiencing a budget surplus of about \$1.1 billion, instead of a moderate deficit.

Regarding the medium-term period ahead, the Economic Council's First Annual Review shows average annual increases of 3.0 per cent in employment and 5.5 per cent in real output from the actual levels in 1963 to potential output by 1970. The average increase in prices for total output from 1953 to 1963 was 2.0 per cent per year, and the Review suggests that a continuation of such a relatively moderate rate of increase to 1970 would not be an unreasonable assumption. Under these conditions, the yields from the existing federal and provincial personal income tax rates would increase from \$2.5 billion in 1963 to about \$5.2 billion in 1970. Under the present federal-provincial tax sharing agreements, the amount of this revenue accruing to the provinces would total about \$1,250 million in 1970, and to the federal government about \$4.0 billion. Under these conditions, federal government revenues would amount to \$13.1 billion in 1970, about \$6 billion above the current revenues. This does not allow for the additional contribution income paid into the Canada Pension Plan which would be accumulating fairly rapidly in funded form by the end of the decade, but which would be earmarked for capital loans to the provinces.

The magnitudes of federal revenues suggested here are an indication of what would happen under conditions of rapid economic growth to the level of potential output. The indicated increase in federal revenues is far larger than committed increases in expenditures under existing programmes, or the new or changed programmes suggested in the MacPherson, Gill and Hall Royal Commission reports. These results would suggest that if the economy expands at the rates outlined to 1970, the federal government would have revenues to consider such alternatives as reducing federal tax rates (including any redesigning of the tax structure), undertaking new functions, making extensive changes in federal-provincial financial arrangements or debt repayment.

The following Appendix sets forth the author's recent article "Variability in Federal Tax Collections", which is reproduced with permission from the Canadian Tax

Journal, (September - October 1964, pp. 324-336). The article emphasizes the shorter term revenue changes over the business cycle, but also contains much of the evidence and analysis underlying the estimates of revenue at potential output in 1960 and 1970.



## Appendix

### VARIABILITY IN FEDERAL TAX COLLECTIONS

It is widely recognized that federal tax collections are influenced to a major extent by the level of economic activity. However, there is less awareness of the extent to which tax collections vary as the value of output fluctuates. More precise knowledge of the response is helpful for two reasons: first, it is necessary in any forecasts of federal tax collections; and second, it provides a basis for assessing the scope for automatic changes in revenue to off-set changes in private demand in the economy. During the post-war years one of the controversial points in the discussion of appropriate fiscal policies for the federal government has been the scope for built-in stabilizers. This article summarizes some Canadian results in this area and outlines the reasons for the behaviour of tax collections in the past, with special emphasis on the personal income tax. In later sections the variations in yield over the business cycle are discussed and an estimate of the degree of built-in stability in the federal tax structure is provided.

Past experience in both Canada and the United States indicates that there is considerably greater variability in federal tax collections than in gross national product over the shorter-term business cycle. Some indication of the magnitude

of this can be seen from Chart I which shows the changes in gross national product and federal tax collections in the United States for the post-war period. It is apparent from the chart that during periods of slackening economic activity during the post-war recessions (the shaded areas), there has been a considerably more pronounced drop in tax collections than in the economy. The "P" and "T" shown in this and later charts mark off the peaks and troughs in the business cycle. The revenue declines are particularly evident for the years 1954 and 1957-58, and again in early 1961. Comparable changes have taken place in Canada, but there are some advantages in using the United States figures for purposes of this illustration. For one thing, the cycles in the United States over the post-war period have been more marked than in Canada, and in addition there have been fewer changes in tax rates.<sup>1</sup>

It is also apparent that over the longer-term period changes in tax collections keep roughly in line with the increases in gross national product, if comparisons are made at about the same stage in the business cycle. From early 1948 to the end of 1963, for example, the increase in gross national product in the United States was about

<sup>1</sup> However, Wilfred Lewis has provided some estimates of U.S. tax collections at unchanged tax rates. See his "The Federal Sector in National Income Models", in *Models of Income Determination*, Princeton: Princeton University Press, 1964; and *Federal Fiscal Policy in the Post-war Recessions*, New York: The Brookings Institution, 1962.

139% and the increase in federal cash receipts was 142%, a very similar change.

What are the factors that explain this very high short-term cyclical sensitivity in tax collections, but over the longer-term rather similar rates of increase in tax collections and in total output? Basically these developments reflect two considerations: one is the changes in the tax base (the income and expenditure items on which taxes are levied) and the other is the tax structure. These two factors help to explain the changes over both the shorter and the longer-term pattern in income and taxes.

### Variability in Tax Base

One of the more important considerations in the variations which have been experienced in the past in federal tax collections is that a high proportion of the taxes is levied on items which fluctuate considerably over the shorter term business cycle. In Canada, for example, corporate profits and merchandise imports fluctuate very markedly as economic conditions change. This can be seen in Table 1, which gives the average cyclical amplitude for both expansions and contractions and over the full cycle in half a dozen major economic series, selected on the basis of their relevance to the Canadian tax system. "Amplitude" is a measure of the extent of

change in a series over the expansions and contractions of business cycles. These amplitudes are calculated by methods developed by the National Bureau of Economic Research in the United States. A calculation is made for each series of the percentage increase occurring during each post-war expansion and the percentage decrease in each recession; and these are then averaged to give an average change for the three or four business cycles for which data are available.

It is apparent from the table that during the mild recessions Canada has experienced, gross national product and personal income have not usually declined, but their rate of increase has become appreciably less than during expansions. For most other series, on the other hand, declines have typically occurred during recessions. In corporate profits, for example, the average decline in the three recessions has been about 17% and the average increase during expansions has been about 30%, so that the amplitude over a full cycle is about 47%. Marked declines in recessions and appreciable increases in expansions have also taken place in merchandise imports, where the amplitude over a full cycle is about 42%. For both of these series the cyclical amplitude is appreciably larger than for gross national product, which has an

Table 1  
AVERAGE CYCLICAL AMPLITUDE OF COMPREHENSIVE CANADIAN SERIES  
POST-WAR YEARS

Series	Period Covered	No. of Cycles	Average Reference Cycle Amplitude		
			Expansion	Contraction	Full Cycle
Gross National Product	1948-61	3½	23.4	0.6	22.8
Personal Income	1948-61	3½	21.4	3.0	18.4
Corporate Profits	1948-61	3½	30.1	-16.7	46.8
Merchandise Imports	1945-61	4	34.0	-7.8	41.8
Manufacturing Shipments	1949-61	3½	22.1	-2.5	24.6
Retail Sales	1946-61	4	18.6	-1.5	20.1

Source: Derived from published D.B.S. series, processed along the lines developed by the N.B.E.R. See W. C. Mitchell, *What Happens During Business Cycles*, Cambridge, Riverside Press, 1951, Table 31, pp. 256, 257 and 262.

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amplitude of only about 23%. Manufacturing shipments and retail sales have also declined during recessions, but the extent of the decline has been less pronounced, amounting to 2.5 and 1.5 respectively. (It should be noted that in the United States over the post-war

period and during the inter-war period, the differences in amplitudes of the comparable major aggregates have been even more pronounced, as the recessions have been more severe there than in Canada and sharper in the inter-war period than during the post-war period.)

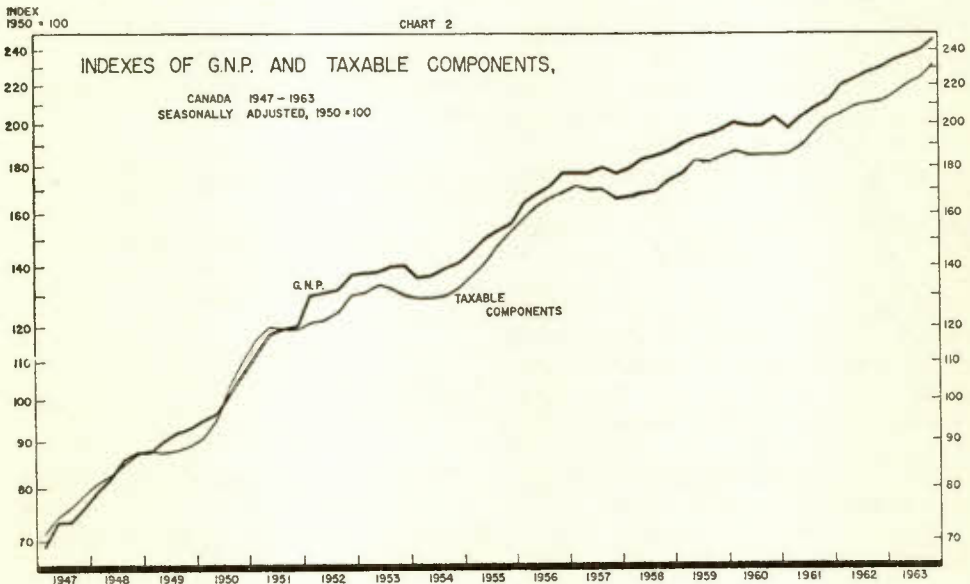
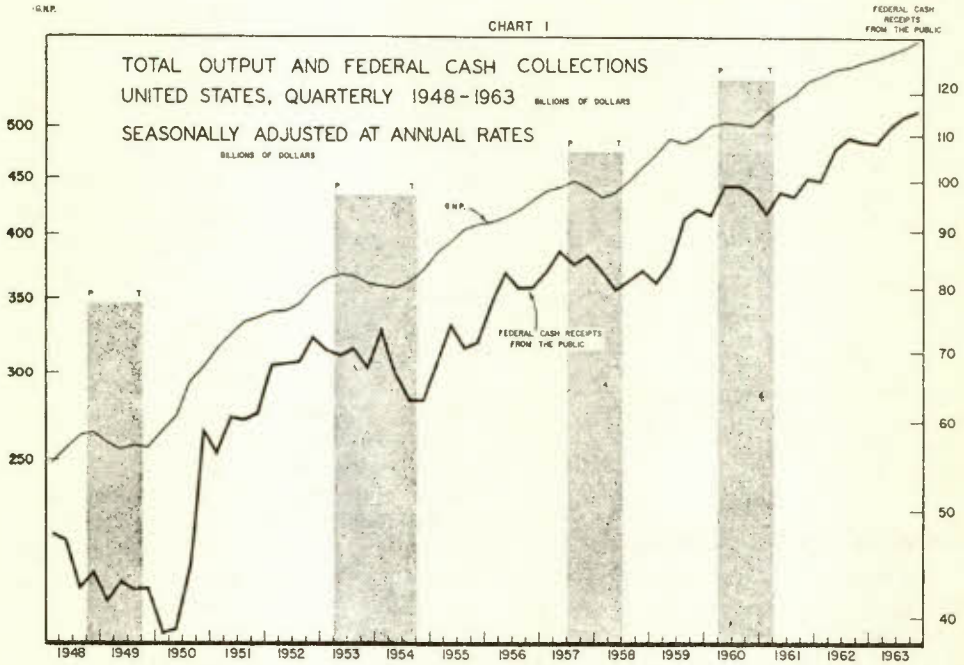




Chart 2 illustrates that the principal series constituting the bulk of the tax base in Canada have a greater amplitude over business cycles than G.N.P. These series have been combined together in the form of an index, using 1950 as a base period. Included are the series which affect personal income tax collections at the source, corporate profits tax collections, sales and other excise taxes, and customs import duties. These taxes account for about 85% of federal revenues, and their relative importance is shown later in Table 4. It can be seen that there is greater cyclical variability in the taxable items than there is in gross national product as a whole. Essentially this comes about because personal services undergo less variation over shorter-term cycles than other areas, and these are less heavily taxed. It is also apparent that the taxable categories of income and expenditure have grown more slowly than G.N.P. over this period.

### Variability in Tax Collections

We turn now to a consideration of how closely changes in tax collections correspond to changes in the various items on which taxes are levied. This can be seen in the accompanying Charts 3 and 4. In Chart 3A changes in labour income and personal income tax collections at the source are shown; the more pronounced declines in tax collections than in income when changes occur in economic activity are quite apparent there. This is most striking in 1957-58, but a similar tendency appears in 1953-54. Part of the declines in tax collections in 1953, 1955 and again in 1957 reflect changes in tax rates. (The abbreviation M.C.D. used in Charts 3 and 4 stands for "months of cyclical dominance" and refers to the short-term moving averages used to smooth out the more irregular series. The methods and the phrase month for cyclical dominance were developed by Julius Shiskin of the U.S. Bureau of the Census.) Labour income is one of the few series which

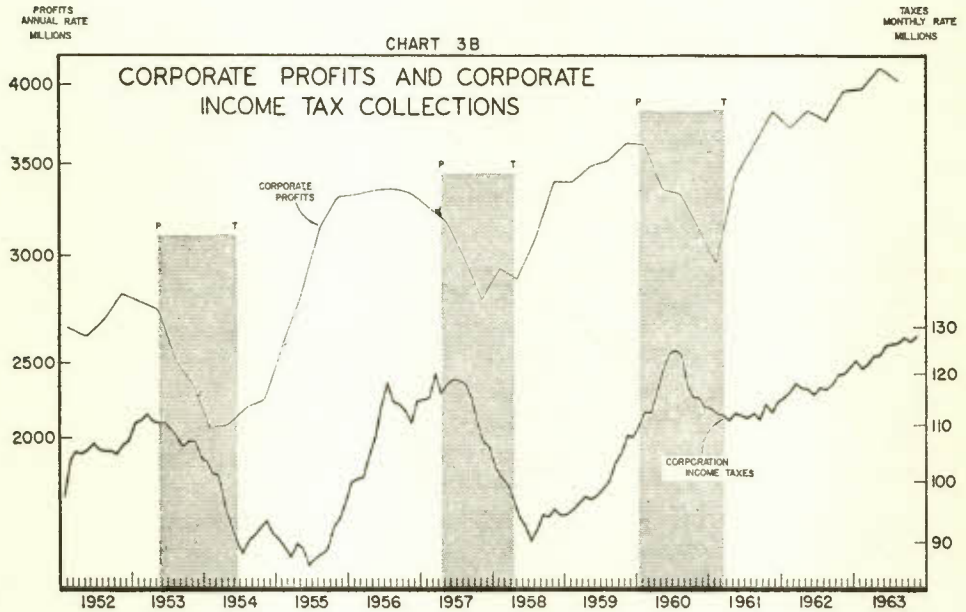
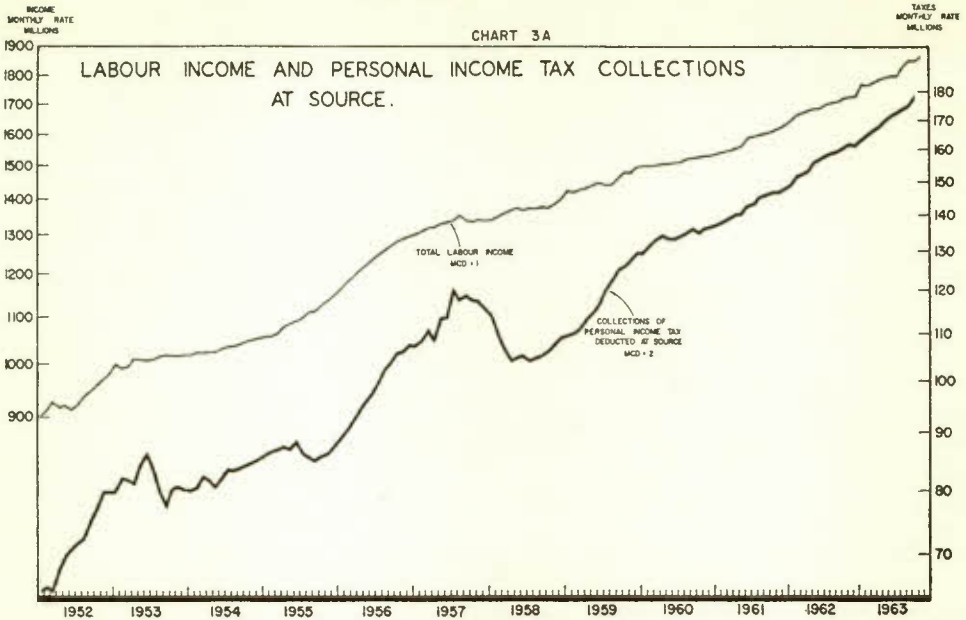
varies less than gross national product as a whole, so the greater volatility in personal income tax collections than in gross national product is an area that requires more consideration, and will be examined more fully in the following section.

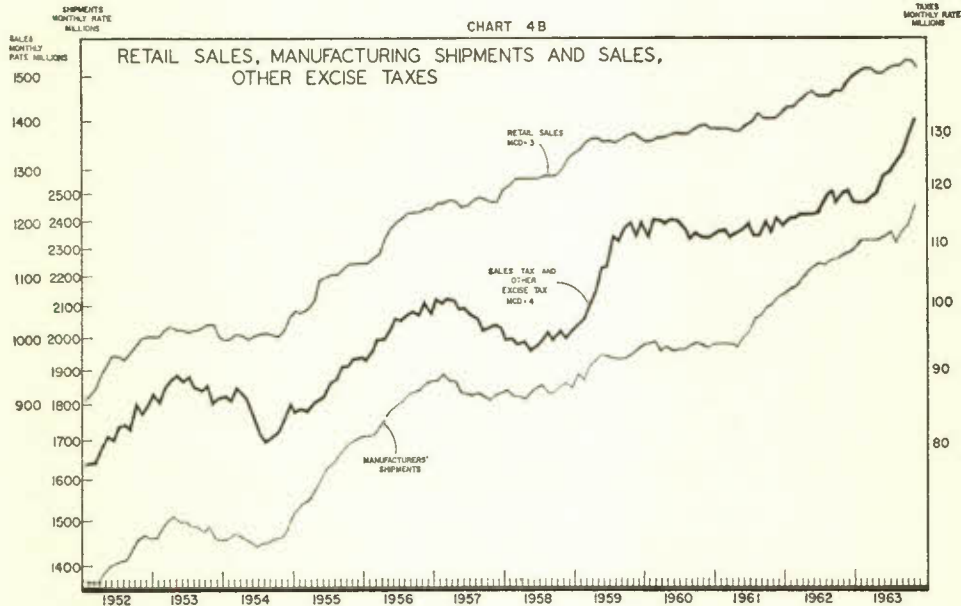
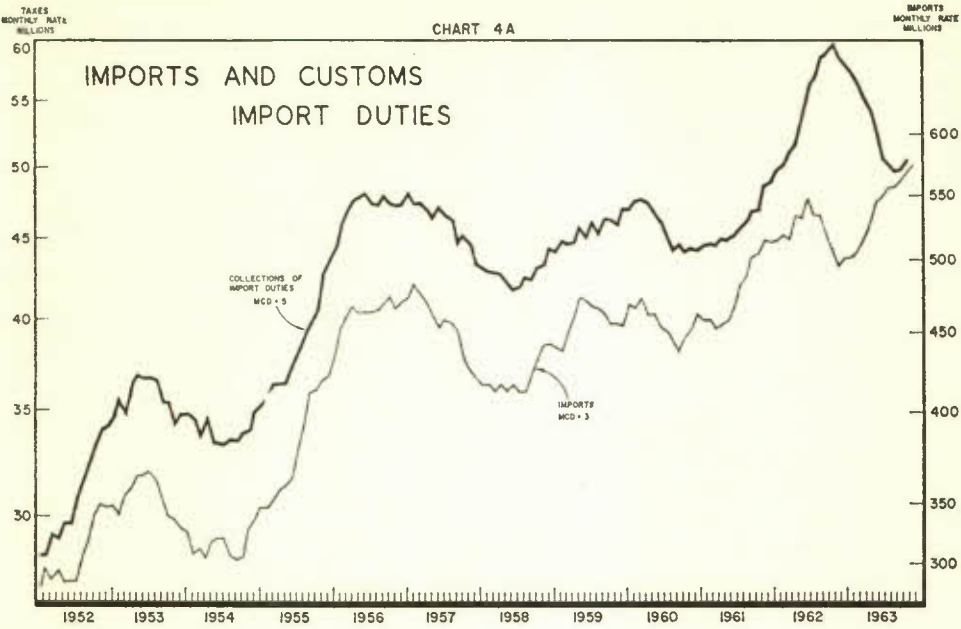
Chart 3B shows corporate profits and corporate profits tax collections. Corporate profits are one of the economic sectors which experience much greater volatility than the economy as a whole. Corporate profits tax collections reflect the same marked volatility as corporate profits, but it is apparent that the tax collections lag an appreciable time interval behind the income on which those taxes were levied. This comes about because of the legal requirements for tax payments, which permit current taxes to be paid either on the basis of corporate profits in the previous year, or on an estimate of profits for the current year. When corporate profits increase rapidly there is an advantage to the corporation to pay profits taxes on the basis of the lower level of the previous year, but eventually there is a catching-up period and the current liability must be discharged. The lag in corporate payments was reduced by a provision for accelerating payments announced in the budget of 1963, and corporate profits tax collections will be brought more in line with the timing in corporate profits.

Chart 4 shows the behaviour of some of the major federal commodity taxes. In the top panel one can see the movements in imports and the collections of import duties. Imports have a very pronounced cyclical volatility over the short-term business cycle in Canada, roughly as large as the variations in corporate profits. The chart shows the very similar timing and amplitude of imports and the corresponding import duties.

The behaviour of manufacturers' sales tax and other excise taxes can be seen in the bottom panel of Chart 4. The manufacturers' sales tax is levied on

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shipments at the manufacturers' level and it is apparent from the chart of these tax collections that they move much more in line with manufacturers' shipments than with retail sales. The greater volatility in manufacturers' shipments than in retail sales reflects the variation in inventory holdings at the wholesale and retail level.

This evidence indicates that federal tax collections move very much in line with the main items of the tax base and that a good part of the variability in federal tax collections reflects the greater volatility in the tax base than in gross national product.

At the same time, it is apparent that the changes in the main categories of income and expenditure which we have been outlining essentially reflect the short-term variability in the economy. The variations in these income and expenditure categories are much less pronounced when comparable stages of different business cycles are compared. For example corporate profits, labour

income, imports and manufacturers' shipments are all about the same proportion of gross national product near the peak of each business cycle. The taxable items show much more divergence from peak to trough in each cycle than they do from peak to peak of succeeding cycles.

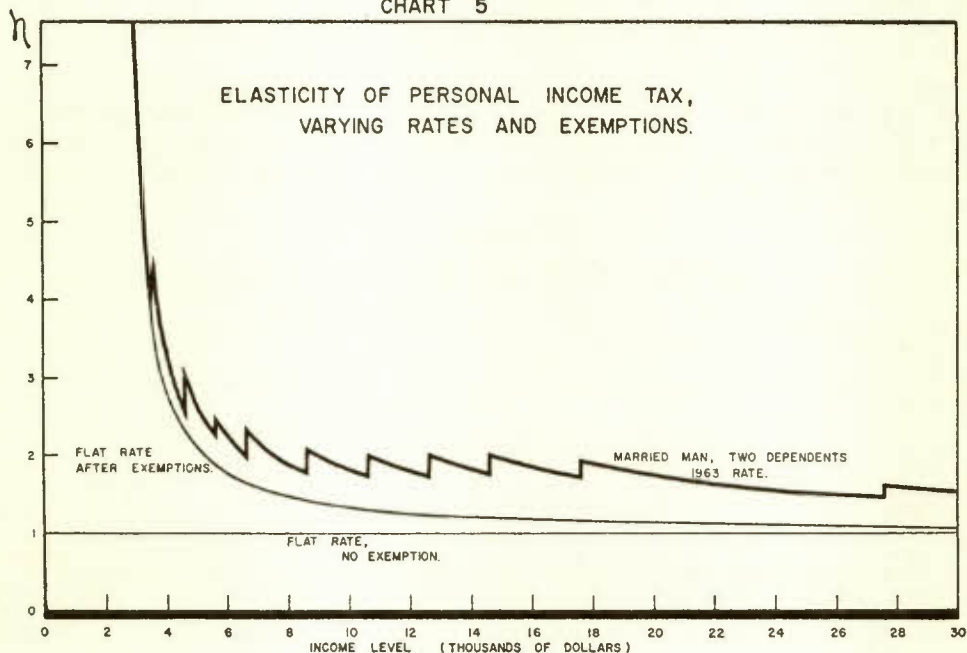
## The Personal Income Tax

### Individual Elasticity

It is very important to distinguish the different effects on personal income tax collections of a change in income associated with higher employment on the one hand and with an increase in *per capita* income on the other. The changes in tax collections are quite markedly different under these two situations.

Using the data for the past it is difficult to show the relative contribution of changes in employment and changes in *per capita* income on tax collections because the historical record reflects a combined influence of these two developments. In addition, the most nearly complete data on taxes and tax collec-

CHART 5



tions comes only on an annual basis from *Taxation Statistics*, and data for the full taxation year quite often blur the more pronounced changes which develop over the shorter-term business cycle and which are the topic of particular interest to us here. Furthermore, there have been a number of changes in tax rates over the period and some account must be taken of these changes.

The approach being followed here is first to develop the elasticity<sup>2</sup> for one individual from the present exemptions and rate structure; then to use the data on the distribution of taxation by income group to weight this information to provide an estimate of the elasticity for the economy as a whole.

Under our present income tax the amount of tax payable varies in relation to income. If a flat rate income tax were levied against total income, with no exemptions, that tax system would have an elasticity of one. This means that for each 5% or 10% change in income there is a comparable percentage change in the amount of tax, irrespective of what rate of taxation prevailed. Chart 5 which indicates elasticity at various income levels under three different types of income tax shows a flat rate tax as a straight line near the bottom of the chart—i.e., an elasticity of one at all income levels. When one con-

siders a flat rate tax after allowing for minimum personal exemptions for a married man with two dependants, the elasticity, as shown by the second line, is seen to drop sharply as taxable income rises. At an income of \$4,600 the elasticity is a little over 2 but at \$10,600 it is down to 1.32 and continues to fall and would eventually approach 1 as a limit at quite high levels of income.

The elasticity of the existing tax schedule is shown in the top line of Chart 5 with the saw-tooth pattern reflecting the changes in the marginal rates. Under the present graduated structure, elasticity starts off quite high, being in excess of 4 for the first \$1,000 of taxable income (equivalent to \$3,600 assessed income for the married man with two dependants). It stays between 1½ and 2½ for taxpayers with incomes from about \$5,600 up to \$32,600. At an income of about \$100,000 the elasticity has dropped to about 1.3. The distance between the top line and the second one indicates the degree to which the existing tax structure increases the elasticity over what it would be with a flat rate tax after the minimum personal exemptions. Chart 5 also shows that greater elasticity arises from personal exemptions than from the graduated rates and it indicates the degree of progression in the rate structure. However,

Table 2  
ELASTICITY AT DIFFERENT INCOME LEVELS  
MARRIED MAN — TWO DEPENDANTS

Assessed Income	Progressive Tax 1963 Rates	Flat Rate	Ratio, Progressive to Flat Rate Elasticity
\$ 4,600	3.13	2.29	1.36
6,600	2.38	1.65	1.44
10,600	2.02	1.32	1.53
15,600	1.91	1.20	1.59
27,600	1.55	1.10	1.41

<sup>2</sup> The elasticity of the tax schedule is a measure of the differential rates of change in tax yield and total income. Numerical estimates of this functional relationship for the personal income tax were obtained by dividing the marginal rate of tax by the average rate of tax on assessed income at various income levels. This method was developed by R. E. Slitor, "The Measurement of Progressivity and Built-in Flexibility", *Quarterly Journal of Economics*, LXII (Feb. 1948), pp. 309-313.

in the income ranges important in total revenues, the degree of progression does add appreciably to the elasticity of the tax structure as can be seen from Table 2, which gives the data for selected incomes covered by Chart 5. For the illustrative examples (which are typical), the progressive rate as compared to the flat rate increases elasticity between 36% and 60%.

#### Overall Elasticity

To go from the material in Chart 5 on the elasticity for one individual to the elasticity for the personal income tax as a whole, it is necessary to consider

the relative weights for the various ranges of elasticity. Table 3 shows the amount of total taxes collected in the various elasticity ranges in 1960. It can be seen there that the relative importance of the high elasticities is fairly small, with only about 2% of the taxes being collected from individuals within the range of elasticity of 5 or higher. In addition only about 5% of the tax is collected from individuals in the range where the elasticity is less than 1.5. Thus most of the elasticity in the total tax structure comes from individuals with an elasticity ranging between 1.5 and 2.5, with a further important group coming in the range between 2.5 and 5.0.

Table 3  
WEIGHTS FOR DIFFERENT ELASTICITIES  
Canada, 1960 Taxation Year

Range of Elasticity	Taxable Income Group	Per cent of Total Tax Collected in Range
Above 5.0	Under \$700	2.4
2.5 to 5.0	\$700 to \$3,000	32.0
1.5 to 2.5	\$3,000 to \$30,000	60.6
1.25 to 1.5	Above \$30,000	5.0
		100.0

Source: Based on data for Chart 5 and Department of National Revenue, 1962 *Taxation Statistics*, pp. 8 and 78-79.

These considerations help to explain why, with about a 1% change in *per capita* income, there is about a 2% change in total tax collections. This comes about because of the great number of taxpayers in the area of elasticity in the neighbourhood of 2. It should be noted that this comment refers only to the change in tax resulting from a change in *per capita* income. If the number of taxpayers in each taxable category were to increase by the same percentage, total taxes would increase in line with the increase in total employment. This would be reflected in an increase of only 1% in tax for a 1% increase in total income attributable entirely to higher employment, and not at all to higher *per capita* income.

Because of these factors there are appreciable changes in tax collections as the economy changes pace. During the minor recessions, as *per capita* income declines and some people only work part of the year, their taxes drop much more rapidly than their income. On the other hand, during periods of expansion coming out of business cycle recessions, *per capita* incomes increase and employees work a larger part of the year. This is reflected in much sharper increases in taxes paid than in the level of personal income. For example, when labour income increased 110% from early 1952 to the end of 1963, tax collections at the source under the personal income tax went up about 180%—a figure that would have been even larger



if all of this increase in the income had taken place from growth in *per capita* income.

### Illustration of Short-Term Variability

With this review of how federal tax collections have varied in the past, it might be helpful to show what might happen under differing economic conditions in the future. The greatest variability occurs during the recession phase, so this will be used in one part of the illustration. Suppose the Canadian economy is in the latter part of a short-cycle expansion, and one wants to consider the revenue implications of a moderate further advance of 10% in G.N.P. on the one hand or a moderate recession of 5% on the other. A recession of that order of severity would be sharper than has been experienced in Canada in the post-war period, but much less severe than the 1929-33 or 1937-38 declines. An increase in income of 10% is the

average increase over five quarters of the post-war expansions in Canada.

The comparable changes in federal revenues under the two assumptions can be seen from Table 4 which indicates the lack of symmetry in recessions and expansions. For a 5% decline in G.N.P., the comparable decline in federal tax collections would be about 15%; on the other hand, for a much larger increase in G.N.P. (a 10% increase compared to a 5% decline), the increase in federal revenues would be about 12½%. In such situations the expansion in the economy would be reflected to some extent in all the main taxable categories, but a recession would have a major impact on such sensitive categories as corporate profits and merchandise imports. It should be noted that the response of tax collections would be fairly quick. In the past, the only apparent lag has been in corporate profits tax collections, and this is being reduced.

Table 4

#### INDEX NUMBERS OF TAX YIELDS FOR ALTERNATIVE INCOME LEVELS

Tax Yields	Relative Levels of Gross National Product			Approximate Current Weights
	95	100	110	
Personal Income Tax .....	94	100	116	35
Corporate Profits Tax .....	66	100	113	20
Sales and other excise taxes .....	90	100	110	25
Customs import duties .....	80	100	115	10
Other tax revenues .....	96	100	104	10
Total Federal Taxes .....	85.0	100.0	112.5	100

Based on Table 1, and comparable data for more severe recessions in the United States. Personal income tax yields based on material in previous section.

Table 4 provides a measure of the elasticity of the tax system — that is the percentage change in taxes compared to the percentage change in income. For this example, the percentage difference

between the low and high income level is 15.8%, the difference in tax yields is 32.4%; the measure of elasticity is thus roughly 2.0.

This also provides a measure of the overall marginal tax rate.<sup>3</sup> In 1962 federal taxes averaged 17% of G.N.P. The marginal rate is the elasticity measure multiplied by the average rate, or, in this example, 2 times 17 or 34%. In other words the difference in tax collections associated with an income difference as set out in Table 3 would be about one-third of the difference in income!

Some comparisons can also be made with the 1920's in Canada. In 1929, the federal tax structure was dominated

by customs duties, which provided about one half of federal revenues, and other indirect taxes which produced a further 30%. Personal and corporation profits taxes were minor. However, the great volatility in merchandise imports contributed to an elasticity of federal revenues about the same as in 1962! The smaller relative size of federal taxes in relation to G.N.P. is reflected in a short-term marginal rate of about 13%, or about two-fifths of the current rate. These results are summarized in Table 5.

Table 5  
SUMMARY OF TAX STRUCTURE  
Canada 1929 and 1962

	1929	1962
1. Federal taxes (\$ million) . . . . .	399	6,907
2. Gross National Product at Market Prices (\$ million) . . .	6,134	40,401
3. Average tax rate to G.N.P. ( $1 \div 2$ ) . . . . .	6.5%	17.0%
4. Short-term elasticity . . . . .	2.0	2.0
5. Short-term marginal rate . . . . .	13%	34%

Sources: 1 and 2 from D.B.S. *National Accounts, Income and Expenditure*, various issues. 4 calculated as the percentage change in taxes relative to income from Table 4. Similar calculations were made for 1929. 5 is obtained from lines 3 and 4, as the marginal rate equals the average rate multiplied by elasticity, as pointed out in footnote 3.

### Long-term variability

It should be pointed out again that this discussion has emphasized short-term elasticities, which are much higher than the analogous long-term elasticities. Successive business cycle peaks a number of years apart do not exhibit the appreciable changes in corporate profits and imports compared to G.N.P.

that occur over short-cycle recessions. Although less work has been done on comparing long-term changes in the principal items which constitute the bulk of the tax base with changes in G.N.P., most items of income and expenditure are likely to move more in line with G.N.P. than has been the experience over the short cycle. Long term

<sup>3</sup> There has been much discussion of the relative merits of the marginal and the elasticity method of measuring the built-in stability of the federal tax structure. See R. A. Musgrave and M. H. Miller, "Built-in Flexibility", *American Economic Review*, Vol. 38, March 1948, pp. 122-128; R. E. Siltor, *op. cit.*, D. W. Lusher, "The Stabilizing Effectiveness of Budget Flexibility" in *Policies to Combat Depression*, (Princeton: N.B.E.R., 1956), pp. 123-145 and discussion; J. A. Pechman, "Yield of the Individual Income Tax During a Recession", in *Policies to Combat Depression*, pp. 123-145; Leo Cohen, "An Empirical Measurement of the Built-in Flexibility of the Individual Income Tax", *American Economic Review* XLIX, May 1959, pp. 532-541 and discussion by J. A. Pechman, pp. 552-555.

The author favours the use of the marginal method, but it should be noted that it is usually easy to go from one measure to the other, as elasticity is defined as the ratio of the marginal tax to the average tax. Evidence on any two of these permits the third to be obtained easily from the definition relating the three quantities.

increases in personal income per person, however, would move the income of the average taxpayer up. With present tax rates, personal income taxes per person would rise more rapidly than average income. It should be remembered from Chart 5 that appreciable increases in income per person would eventually lower the elasticity somewhat from current levels. This occurs as taxpayers move further away from the basic exemption levels where elasticity is very high, to higher income levels where the elasticity ranges are lower. Some lowering in the elasticity of the Canadian personal income tax has occurred in the past, and the elasticity for total tax collections was higher in the period from 1946 to 1953 than it has been for the last decade. A factor in the earlier period was the rapid increases in *per capita* income reflecting the price increases of that period. Estimates of long-term elasticity for Canada are now in the neighbourhood of 1.1 or 1.2, compared with the short-term estimates of 2.0 which have been developed here.

#### **Implications for Built-in Stability**

This material on tax yield variability shows the scope for automatic changes in tax collections to offset some of the changes in private demand. However, a full appraisal would require a more detailed discussion of the effects of taxes and government deficits on the economy

than can be included here. Although there is no clear agreement among economists on the key factors determining the level of income in the economy, many economists would emphasize the influence of business investment and government deficits on G.N.P. On this view, about one-third of a decline in business investment would be quickly offset by lower federal revenues and a larger federal deficit (Table 5, line 5). This would be an appreciable offset, and much larger than prevailed in the 1920's. In commenting on the United States situation, Professor Friedman states, "Indeed, I believe this is by far the most important change in recent years in the economic environment relevant to stabilization policy."<sup>4</sup>

It is hoped that the above discussion will provide a better understanding of the reasons for the past variability of federal revenues, and some indication of what could be expected in the future in the way of variations in tax collections in different circumstances, with the present tax structure, and material to appraise the secondary effects on the economy. It should be emphasized that primary attention has been given to the movements in revenues over the short-term business cycle. Changes in revenues would move much more in line with G.N.P. over the long-term than would be suggested by the short-term movements emphasized here.

<sup>4</sup> Milton Friedman, "Rejoinder" to Philip Neff, *American Economic Review*, XXXIV (Sept. 1949) p. 953.



### TECHNICAL STUDIES

The following is a list of technical studies which have been prepared as background papers for the First Annual Review of the Economic Council of Canada. They are being published separately and are available from the Queen's Printer, Ottawa. Although they are being published under the auspices of the Economic Council, the views expressed in them are those of the authors themselves.

#### Staff Studies

1. Population and Labour Force Projections to 1970, by Frank T. Denton, Yoshiko Kasahara and Sylvia Ostry.
2. Potential Output, 1946 to 1970, by B. J. Drabble.
3. An Analysis of Post-War Unemployment, by Frank T. Denton and Sylvia Ostry.
4. Housing Demand to 1970, by Wolfgang M. Illing.
5. Business Investment to 1970, by Derek A. White.
6. Special Survey of Longer Range Investment Outlook and Planning in Business, by B. A. Keys.
7. Canada and World Trade, by M. G. Clark.
8. Export Projections to 1970, by J. R. Downs.
9. Federal Tax Revenues at Potential Output, 1960 and 1970, by D. J. Daly.
10. National Saving at Potential Output to 1970, by Frank Wildgen.
11. Changes in Agriculture to 1970, by John Dawson.

#### Special Studies

1. Immigration and Emigration of Professional and Skilled Manpower During the Post-War Period, by Louis Parai.
2. A Survey of Labour Market Conditions, Windsor, Ontario, 1964: A Case Study, by G. R. Horne, W. J. Gillen and R. A. Helling.

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