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**BUDGETARY TRADE-OFFS AND CANADIAN DEFENCE SPENDING:
A QUESTION OF PRIORITIES**

by

NORMAND P. ZUCCO, B.A.

A thesis submitted to
The faculty of Graduate Studies and Research
in partial fulfilment of
the requirements for the degree of

Master of Arts

Norman Paterson School of International Affairs

**Carleton University
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Abstract

Through the development of various regression models, this thesis tests three hypotheses concerning the relationship between Canadian defence spending and three federal social spending areas: health, education and social welfare. An inverse relationship is hypothesized in each case, that is, an increase in defence expenditures is expected to result in a decrease in each of the three other spending areas. Using data from 1947 to 1984, several bivariate and multivariate models are presented, as well as a simultaneous model designed to measure direct and indirect impacts of defence on the three social expenditure categories. While initial results point to a direct positive relationship in the social welfare and health equations (an increase in defence would cause an increase in social welfare and health spending), and a slightly negative relationship in the equation for education (an increase in defence expenditure would result in a decrease in education spending), when indirect impacts are introduced, the overall relationships change directions. The total relationship between defence spending and social welfare spending (that is, when measuring simultaneously direct and indirect impacts), is negative and greater than one-to-one. The total relationship between defence and health spending, is also negative, though slighter. Only the education equation depicts the overall relationship as positive.

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à Mom et Dad

à Louise

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Tsekung asked about government, and Confucius replied: 'People must have sufficient to eat; there must be a sufficient army; and there must be confidence of the people in the ruler'. 'If you were forced to give up one of these three objectives, what would you go without first'? asked Tsekung.

quoted from
Charles P. Curtis,
The Practical Cogitator, 1950.

1. INTRODUCTION

THE ECONOMICS OF DEFENCE: A Review of the Literature

The tripartite view of the political responsibilities of governments has received much attention since Confucius' time. Adam Smith for example devotes an entire chapter to the subject in his famed *Wealth of Nations*. He writes:

...the sovereign has only three duties to attend to; three duties of great importance, indeed, but plain and intelligible to common understanding: I. the duty of protecting the society from the violence and invasion of the other independent societies; II. the duty of protecting, as far as possible, every member of the society from the injustice or oppression of every other member of it, or the duty of establishing an exact administration of justice; and III. the duty of erecting and maintaining certain public works and public institutions...¹

One hundred and ninety-five years after Adam Smith's observations, Walt Rostow echoed the tripartite view of the functions of government in an attempt to explore the growth of modern society. According to Rostow, governments face "an ever-shifting intermediate balance" between what he

¹ Adam Smith, *An Inquiry into the Nature and Causes of The Wealth of Nations* (Homewood, Illinois: Richard D. Irwin Inc., 1963), p.213.

labels the "eternal triangle of competing imperatives": security, welfare and constitutional order.²

Like many before him, Rostow recognizes the inherent conflicting pressures which each of the "three abiding tasks" exert on government. "There is a double balancing built into this view of the art of politics", he notes. "It is not only likely that the imperatives of security, welfare and constitutional order will clash among themselves, but each involves potential conflict and choice".³ In Rostow's view, judgement of a government is ultimately centred upon "the appropriateness of the sovereign's disposition in three directions: the balance it strikes in policy; the demand it makes of the people to carry out that policy; and the way it distributes the limited resources available to it among the three tasks".⁴

The "ever-shifting intermediate balances" which Rostow writes about have been topics of serious attention among policy analysts over the past two decades. In the late 1960s and early 1970s several studies argued that the

² Walt Rostow, *Politics and the Stages of Growth* (New York: Cambridge University Press, 1971), p.9-10.

³ Rostow, p. xi.

⁴ Rostow, p. 347.

balance between public priorities had permanently shifted in favour of social goals at the expense of defence spending. Studying the transformation and modernization of Gaullist France, Edward Morse concluded in a 1974 article, for example, that as "society became more highly industrialized and as new demands were placed on the government, the relative priority of security and administrative expenditures should be expected to fall, while other sorts of allocations should rise".⁵ Samuel Huntington echoed these views in 1975 adding that "the pattern of government activity which the Welfare Shift produced by the early 1970s could remain relatively stable for the immediate future".⁶

Furthermore, this reasoning seemed to find support in research into budgetary priorities. In their 1968 review article "The Dilemma of Rising Demand and Insufficient Resources" Harold and Margaret Sprout, for example, observed a priority shift in government spending from military services to social services, concluding that "[b]arring dire emergency, such as an all encompassing war, it is unrealistic...to expect any reversal of the priorities in

⁵ Edward Morse, *Foreign Policy and Interdependence in Gaullist France* (Princeton: Princeton University Press, 1974), p. 159.

⁶ Samuel P. Huntington, "The United States", in S.P. Huntington, M. Crozier and J. Watanuki (eds.), *The Crisis of Democracy* (New York: New York University Press, 1975), p. 74.

the foreseeable future".⁷ Ronald Inglehart's encompassing 1977 study showed that the priority of providing "strong defence forces" ranked last out of 12 goals for publics in ten European countries, below such aims as "a stable economy", "fighting crime", and providing "more beautiful cities".⁸ Observing "a shift from overwhelming emphasis on...security toward greater concern with the quality of life" Inglehart offers a simple conclusion which sums up well the predominant attitude among many social scientists at the time: "a Silent Revolution has been occurring that is gradually but fundamentally changing life throughout the Western world".⁹

By the mid-1970s, the average defence outlays of the western industrial nations, measured as a percentage of national output, had fallen to 2.7% from 4.0% twenty years earlier, a decline of over 32%. Between the early 1960s and mid 1970s these same countries increased spending on health,

⁷ W. Sprout and M. Sprout, "On the Dilemma of Declining Resources and Rising Demands", in *World Politics* 1968, vol. 20, p. 666.

⁸ R. Inglehart, *The Silent Revolution: changing values and political styles among Western publics* (Princeton: Princeton University Press, 1977) p. 49.

⁹ Inglehart, p. 363.

education and social welfare from 13.2% to 18.8% of Gross National Product, an increase of over 42%.¹⁰

In the late stages of the 1970s and early 1980s, however, developments began to run counter to the earlier predictions of a permanent defence-welfare shift. Evidence from the United States showed a five-fold surge between 1974 and 1980 in public support for increased defence spending,¹¹ as well as a constant dollar increase of 20.3% in American military expenditures between 1975 and 1982.¹² Furthermore, the trend was not limited to the United States; over the same period British, French, and Canadian defence efforts climbed by 18.4%, 27.2%, and 29.2% respectively,¹³

¹⁰ Reported, using OECD sources, in "A Squeeze On Welfare Around World", U.S. News & World Report (January 22, 1979), p.28.

¹¹ W. Schneider, "Conservatism, not Interventionism: Trends in Foreign Policy Opinion, 1974 - 1982", in K.A. Oye, R.J. Lieber, and D. Rothchild (eds.) *Eagle Defiant: United States Foreign policy in the 1980s* (Boston: Little, Brown and Co., 1983), p.35. See also, B. Russett, "Defence Expenditures and National Well-being", *American Political Science Review* (vol.76, 1983), p.83.

¹² International Institute for Strategic Studies, *The Military Balance 1984-85* (London: IISS, 1984), p.138.

¹³ *ibid.* The figures are based on the NATO definition of defence expenditures and official country-specific consumer price deflators. Throughout the thesis, however, all dollar conversions are based on the Gross Domestic Product Implicit Price Index (government current expenditure on goods and services). The use of different price indices will result in different constant dollar estimates.

representing a dramatic departure from the -24.4%, 4.6%, -4.7%, and -2.4% change each country respectively registered in the previous seven year period.¹⁴ To many, this shift in spending patterns and public attitudes signals a dangerous trend. As Richard Eichenberg notes in his article "The Expenditure and Revenue Effects of Defense Spending in the Federal Republic of Germany":

For supporters and clients of social programs, increasing international tensions and calls for higher defense spending raise the prospect of cuts in social programs. External requirements, they fear, may force a 'guns/butter' tradeoff to the detriment of the poor, the retired and other beneficiaries of social policies.¹⁵

These developments suggest that the welfare/defence balance has not settled, but rather remains a source of continued controversy and debate. As Gwyn Harries-Jenkins from the International Institute Strategic Studies notes:

Since the resources of society in the 1980s may continue to be severely limited and since financial constraints will reduce freedom of choice, the

¹⁴ Stockholm International Peace Research Institute, *World Armaments and Disarmament* (London: Taylor and Francis, 1975). Once again, NATO definitions are used, as are consumer price indices.

¹⁵ R.C. Eichenberg, "The Expenditure and Revenue Effects of Defence Spending in the Federal Republic of Germany", *Policy Science* (vol.16, 1984), p.392.

disagreement between those who advocate more defence spending and those who prefer more welfare spending is likely to continue over the next decade.¹⁶

In his recent book "The Rise and Fall of the Great Powers", Paul Kennedy writes that policy-makers "have to balance the spiralling cost of weaponry not only against productive investment but also against growing social requirements". Echoing the tripartite task of governing expressed by Smith and Rostow, Kennedy argues that

the feat demanded of most if not all governing bodies as the world heads toward the twenty-first century is a threefold one: simultaneously to provide military security...for its national interests, and to satisfy the socioeconomic needs of its citizenry, and to ensure sustained growth, this last being essential for the positive purposes of affording the required guns and butter at the present, and for the negative purpose of avoiding a relative economic decline which could hurt the people's military and economic security in the future.¹⁷

These concerns over policy directions have been reflected in a rather considerable literature examining the

¹⁶ G. Harries Jenkins (ed.), *Armed Forces and the Welfare Societies Challenges in the 1980s* (London: MacMillan Press Ltd., 1982), p.ix.

¹⁷ Paul Kennedy, *The Rise and Fall of the Great Powers: Economic Change and Military Conflict from 1500 to 2000* (New York: Random House, 1987), p.445-6.

defence/welfare question.¹⁸ Essentially two prevalent lines of theory have emerged. The first maintains not only that a large substitution effect occurs between defence spending and non-defence expenditures, but also that military spending is essentially corrosive to economic wellbeing.¹⁹ Arthur Burns, who served as the Chairman of the Council of Economic Advisors in the 1950s, advocated this view in 1971 writing that "the real costs of the defense sector consist not only of the civilian goods and services that are currently foregone on its account; it includes also an element of growth that could have been achieved through larger investment in human or business capital".²⁰ This view was echoed by Ruth Leger Sivard who argues in her book "World Military and Social Expenditure" that military spending "...drains investment and research resources, ... limits the potential for growth and innovation. On the civilian side, this means an economy less prepared to

¹⁸ This section of the chapter presents the main findings and conclusions from the literature. A more detailed assessment of the various studies and approaches will be presented later in the chapter.

¹⁹ See, for example, Lester Thorow, "How to Wreck the Economy", *New York Review of Books* (May 14, 1981); K.W. Rothschild, "Military Expenditure, Exports and Growth", *Kyklos* (vol.26, 1973), p.804 - 813; R.P. Smith, "The Demand for Military Expenditures", *Economic Journal* (vol.90, 1980), p.811- 820.

²⁰ A. Burns, "The defense sector and the American economy", in S. Melman (ed.) *The War Economy of the United States* (New York: St. Martin's Press, 1971), p.115.

compete in world markets, less able to provide its citizens with improved conditions of living".²¹ More recently, Howard Gold, in a United Nations report, argued that "the economic consequences of buying more weapons will be substantial. Jobs, investment and economic growth absolutely will be sacrificed. Technological progress will be distorted, and social programs aimed at decreasing human suffering will be cut".²²

Several studies have supported this reasoning. A recent article in the Journal of Peace Research which analyzed the economic effects of military spending in 17 OECD countries, for example, concluded that

when applying economic growth models to data which are both longitudinal and cross-sectional, the overall picture seems to be that military spending does not stimulate economic growth in the industrialized West, but rather the opposite. Thus conversion of military spending to areas that would stimulate investment is likely to increase economic growth in the developed countries.²³

²¹ Ruth Leger Sivard, *World Military and Social Expenditures, 1981* (Leesburg, Virginia: World Priorities, 1981), p.19.

²² H. Gold (ed.), *Making the Connection: Disarmament, Development and Economic Conversion* (New York: Non-Governmental Liaison Services, 1985), p.23.

²³ A. Cappelen, Nils Petter Gleditsh, and O. Bjerkholt,
(continued...)

Using time-series defence data from the United States, two University of Chicago researchers also found that defence expenditures dampened economic growth; Nardinelli and Ackerman concluded that "the effect of defense spending on net real GNP over the 1905-1973 period is clearly negative".²⁴ Similarly, Ron Smith and George Georgiou's 1983 study "Assessing the Effect of Military Expenditure on OECD Economies" found "strong evidence that in the OECD countries, military expenditure has depressed investment and that the technological spin-off from military expenditure is small".²⁵ Smith's earlier article, using data for 15 countries over a ten year period, 1960 to 1970, reported significant negative relationships between military expenditures, investment, employment and growth rates of GNP.²⁶

²³(...continued)

"Military Spending and Economic Growth in the OECD Countries", *Journal of Peace Research* (vol. 21, 1984), p.373.

²⁴ C. Nardinelli and G.B. Ackerman, "Defense Expenditures and the Survival of American Capitalism", *Armed Forces and Society* (vol.3, 1976), p.15.

²⁵ R.P. Smith and G. Georgiou, "Assessing the Effect of Military Expenditures on OECD Economies: A Survey", *Arms Control* (vol.4, 1983), p.15.

²⁶ R.P. Smith, "Military Expenditures and Capitalism", *Cambridge Journal of Economics* (vol.1, 1977), p.61 - 76.

In Canada, a study commissioned by the Canadian Union for Public Employees (CUPE) in 1986 suggested that defence spending generates significantly less employment than other types of government spending.²⁷ The study showed that expenditures of one billion dollars in 1983/84 by the Department of Defence generated 22,000 jobs; the same level of expenditures in road and highway construction, however, would have generated 37,000 jobs; in residential construction, 38,000 jobs; 51,000 jobs in hospital services; education and related services, 54,000 jobs; radio and TV broadcasting, 55,000 jobs; urban transit systems, 87,000 jobs; and 90,000 jobs in the post office.

Other researchers reiterated these findings. Anatol Szymanski hypothesized that "the greater the ratio of military spending to GNP, the greater should be the rate of growth in GNP/capita and the less the rate of unemployment"; yet after analyzing his sample of 18 countries he concluded that "military spending, instead of leading to economic growth, actually appears to be a cause of at least relative stagnation".²⁸ Similar conclusions were reached in the

²⁷ Toby Sanger, "Military Spending", CUPE Facts (January/ February, 1986).

²⁸ A. Szymanski, "Military spending and economic stagflation", *American Journal of Sociology* (vol.79, 1973), p.3 - 6.

study of OECD countries by the Labour Party Defence Study Group, which found that

where the rate of armaments is high (in particular Britain and the United States), the countries invest least, and in them, the annual growth rate is slowest; on the contrary, countries where defence expenditures are small (in particular Japan) there have been considerable resources for investment.²⁹

Correlating growth, exports and military spending for 14 OECD countries between 1956 and 1969, Rothschild argued that defence expenditures compete for resources which are used for the production of export goods and thus hamper export-led growth.³⁰

With regard to developing countries, Emil Benoit suggested in 1968 that "...if wise and effective transfer policies are adopted, the long-run civilian benefits of applying defense resources to civilian industries could be far in excess of what might be judged from the price set on these resources in defense areas".³¹ Faini, Annez and Taylor indicated that growth in military spending negatively affects the growth of investment and agricultural

²⁹ Labour Party Defence Study Group, *Sense about Defence* (London: Quartet, 1977).

³⁰ Rothschild, p.804 - 813.

³¹ E. Benoit, "The Monetary and Real Costs of National Defense", *American Economic Review* (vol.58, 1968), p.416.

production.³² These findings echoed the arguments of Alice Amsden, who claimed that "certainly the most elementary statistical analysis of the data ... on military burden and rates of growth in GNP per capita does not reveal any positive association between the two variables".³³ The same general conclusion was reached by David Lim, who used a Harrod-Domar type model for 54 less developed nations and concluded that "defense spending is detrimental to economic growth in developing countries".³⁴ In an input-output framework, Leontief and Duchin concluded that "virtually all economies are able to increase total output and per capita consumption as they progressively reduce their military spending...".³⁵

Lloyd Domas' 1981 article on the economic consequences of military spending in advanced industrialized countries argued that military spending was "non-productive" since it

³² R. Faini, P. Annez, and L. Taylor, "Defense Spending, Economic Structure and Growth: Evidence Among Countries and Over Time", *Economic Development and Cultural Change* (vol. 32, 1984), p.847 - 498.

³³ A.H. Amsden, "Kaldor's 'The Military in Development' --- A Comment", *World Development* (vol.5, 1977), p.757.

³⁴ D. Lim, "Another Look at Growth and Defense in Less Developed Countries", *Economic Development and Cultural Change* (vol.31, 1983), p.379.

³⁵ W. Leontief and Fay Duchin, *Military Spending: Fact and Figures, Worldwide Implications and Future Outlook* (New York: Oxford University Press, 1983), p.66.

did not contribute to the material standard of living. He writes that "the use of productive resources (labour, materials, capital, fuel, etc.) for non-productive purposes constitutes a drain on the validity and prosperity of any economy".³⁶

With regards to the possibility of trade-offs within government sector spending, researchers in this school of thought have found an exclusionary relationship between military spending and social services expenditures, caused primarily by a draining of political, technical and economic resources away from domestic programs in order to augment defence investments. In his early examination of tradeoffs, Bruce Russett found strong negative relationships between defence expenditures and government spending on health and education for the United States, France and the United Kingdom.³⁷ Using a simple bivariate time-series analysis covering the period 1950 to 1962, Frederick Pryor concluded in his 1968 study of Western market-economies and East Bloc countries that for Western countries

³⁶ L.T. Dumas, "Economic conversion, productivity efficiency and social welfare", *Peace Research Reviews*, (vol.7, 1981), p.17.

³⁷ Bruce Russett, "Who Pays for Defense?", *American Political Science Review* (vol. 63, 1969), p.412-426; also, Russett, *What Price Vigilance? The Burden of National Defense* (New Haven: Yale University Press, 1970).

... where defence expenditures are relatively more important, such as Canada, Greece, West Germany, the UK, and the USA, defence expenditures have a statistically significant substitution relationship with current governmental civilian expenditures...³⁸

Dabelko and McCormick assessed the impact of defence expenditures on education and public health spending, concluding that significant opportunity costs existed for a set of countries from 1950 to 1972 across different levels of economic development.³⁹ Peroff's study of tradeoffs between defence and three social policy areas (health, social welfare and housing) found similar patterns, although somewhat slighter.⁴⁰ Largely corroborating Russett's earlier study, Harold Wilensky's time-series analysis found a negative relationship between defence and welfare spending in sixteen industrialized nations.⁴¹

³⁸ F. Pryor, *Public Expenditures in Communist and Capitalist Nations* (London: George Allen and Urwin, 1968).

³⁹ D. Dabelko and J.M. McCormick, "Opportunity Cost of Defense: Some Cross-National Evidence", *Journal of Peace Research* (vol.14, 1977), p.145 - 154.

⁴⁰ K. Peroff, "The Warfare-Welfare Trade-off: Health, Public Aid and Housing", *Journal of Sociology and Social Welfare* (vol.4, 1977), p.366 - 381; see also K. Peroff and M. Podolak-Warren, "Does spending on Defense Cut Spending on Health? A Time-Series Analysis of the US Economy, 1929-1974", *British Journal of Political Science* (vol.9,1979), p.21 - 40.

⁴¹ H. Wilensky, *The Welfare State and Equality* (Berkeley: University of California Press, 1975).

Juxtaposed against these views are those of a second theoretical school who argue that defence expenditures play a significant role in capitalist society by countering under-consumption tendencies. Two diametrically opposed economic philosophies share this view. On one hand, the Marxist perspective postulates that capitalist economies "generate unabsorbable surpluses which, in the absence of new markets, leads to crisis and disintegration" unless demand is somehow restored through state intervention.⁴² What is needed to sustain the economic system, they claim, is a form of economic activity that can draw investable resources away from competing capitalists and use them in an unproductive manner without adding to the capacity to produce greater output. Military expenditures, because of their absorptive capacity, are seen as a desirable instrument to increase demand.⁴³ John Treddenick summarizes the Marxist view in his recent article, writing that expenditures on defence

⁴² P.A. Baran, and P.M. Sweezy, *Monopoly Capital: an essay on the American economy and social order* (Harmondsworth: Pelican press, 1968); J. O'Connor, *The Fiscal crisis of the State* (New York: St. Martin's Press, 1973); Michael Kidron, *Western Capitalism Since the War* (London: Weindenfeld and Nicholson, 1972); E. Mandel, *Marxist Economic Theory* (New York: Monthly Review Press, 1968).

⁴³ J. Cypher, "Capitalist Planning and Military Expenditures", *Review of Radical Political Economy* (vol.6, 1974), p.1 - 19.

...do not interfere with the ability of capitalists to extract surplus from workers; they do not divert profitable enterprises to the government; they do divert resources away from capital accumulation and hence increase the rate of profit on existing capital; and they are continuously expandable as a result of rapid obsolescence arising from the intense technological competition. In the Marxian view, capitalist society is thus seen to be inherently militaristic; increasing military expenditures become necessary for its very survival.⁴⁴

The Keynesian perspective, on the other hand, begins with the basic proposition that recessions occur when aggregate demand within the economy falls short of productive capacity. Unlike the classical economic tradition which argues that complementary movements in interest rates, prices and wages affect saving tendencies and investment decisions in such a way as to leave the total level of spending unchanged, and thus, the economy in equilibrium at full employment,⁴⁵ Keynesians recognize the

⁴⁴ J.M. Treddenick, "The Arms Race and Military Keynesianism", Canadian Public Policy (vol.11, 1985), p.81.

⁴⁵ Unemployment would be resolved by the lowering of wages, making it profitable for firms to employ more people. Interest rate changes would play a complimentary role by ensuring that all income would ultimately be spent. If people decided, for example, to increase their level of savings more funds would be available for loans, and consequently interest rates could fall. The increase in investment which would result would offset the effects of lower consumption by individuals, leaving the total level of spending constant. If for some reason not all savings were
(continued...)

inherent short-run difficulty of the economy to reconcile, at full employment levels of income, desired withdrawals from income flows with desired injections. The result is an equilibrium which occurs at some point shy of full employment levels of income.⁴⁶ The solution, according to the Keynesian tradition, is to increase aggregate demand through government intervention in the form of either monetary, fiscal, or commercial policy, or a combination of all three. With regards to fiscal spending, it is most powerful when financed by deficit spending, since financing through increased taxation, which like saving is a withdrawal from income flow, would largely offset the effects of increased government spending. Furthermore,

⁴⁵(...continued)

borrowed for investment, prices would fall such that purchasing power would be sufficient. With prices adjusting to the reduced demand, consumption is quickly restored and the economy finds its equilibrium (where savings and investments are again equal) at full employment.

⁴⁶ The falling wage rates which the classical theory claimed would increase employment, would, Keynesians argue, merely decrease aggregate demand. In addition, interest rates are defined by Keynesians as the price individuals receive for exchanging their holdings of cash for less liquid forms of investment. Therefore if people increased their savings, this would not necessarily reduce interest rates and increase investments. Instead the total demand for goods might fall and therefore cause inventories to increase. Production would then fall and employment would decrease until savings were reduced to a level where equilibrium was re-established with investments. See, John Maynard Keynes, *The General Theory of Employment, Interest and Money* (New York: Harcourt, Brace & World, 1936); John Kenneth Galbraith, *Economics, Peace and Laughter* (New York: New American Library, 1971), p.44-60; also Treddenick, p.81.

conservatives prefer defence rather than welfare expenditures since the latter is thought to damage work incentives in the labour market and to compete unfairly with private enterprise.⁴⁷ As the Palme Commission on Disarmament and Security Issues wrote in 1982, "the Keynesian view of military spending is in large part a political one. Its premise is that increased military spending may be the only politically plausible way of increasing public demand; that conservative governments, in particular, will only increase deficits in the interest of national security".⁴⁸ Even Keynes himself argued that "vast-dissipation of resources in the production of arms" was the best way to increase aggregate demand in the economy, writing in 1940:

It is, it seems, politically impossible for a capitalist democracy to organize expenditures on the scale necessary to make the grand experiment which would prove my case -- except in war conditions.⁴⁹

⁴⁷ Russett, 1983, p.768; L. Griffin, M. Wallace and J. Devine, "The Political Economy of Military spending: Evidence from the United States" *Cambridge Journal of Economics* (vol.6, 1982), p.4.

⁴⁸ Olaf Palme et al., "Military Spending: The Economic and Social Consequences", *Challenge* (September/October, 1982), p.25.

⁴⁹ J.M. Keynes, "The United States and The Keynes Plan", *The New Republic* (29 July 1940).

Thus, defence expenditures are increased, buoying up total spending, and as Hitch and McKean note, "[t]he existence of this demand makes a deficiency of total demand less probable. Moreover, it facilitates the application of other anti-deflationary measures, like the injection of additional money into the economy".⁵⁰ In the end no opportunity cost is acknowledged between the two types of government expenditures because social spending is not viewed as an alternative way of using resources that would produce something as positively valued as that produced by military expenditures. Defence spending is defended on the basis of its stimulating economic effects, its job creation potential, and its technological stimulation based on scientific research and development.⁵¹ If this is

⁵⁰ C. Hitch and R. McKean, *The Economics of Defense Spending in the Nuclear Age* (Cambridge: Harvard University Press, 1961), p.69.

⁵¹ The notion of beneficial technological spin-offs from military research and development is not one which has gone unquestioned. The National Academy Of Engineering in the United States wrote in their 1974 publication that "with few exceptions the vast technology developed by federally funded programs since World War II has not resulted in widespread "spin-offs" of secondary or additional applications of practical products, processes and services that have made an impact on the nation's economic growth, industrial productivity, employment gains, and foreign trade", (National Academy of Engineering, *Technology Transfer and Utilization, Recommendations for Reducing the Emphasis and Correcting the Imbalance*, Washington, 1974). See also, R.B.DeGrasse, Jr., "The Military: Shortchanging the Economy," *Bulletin of the Atomic Scientists*, May 1984; H.Tuomi and R. Vayrynen, *Transnational Corporations*, (continued...)

challenged, then military spending can simply be justified in terms of enhanced national security. As Jenkin writes in his 1982 book, "cuts in defense have specific negative consequences in that they reduce the military power of the West, while increased welfare spending does not necessarily solve contemporary social problems".⁵²

Tracing the origins of this reasoning to the early post-World War two United States, Griffin, Wallace and Devine note that the crystallization of political forces at the time led to a 'centre Keynesian coalition' comprised of social spending advocates dedicated to Keynesian-style 'demand management', Cold War protagonists interested in Soviet containment, and elite businessmen committed to the expansion of monopoly capital. They write:

A compromise was reached within this 'centre' coalition during the late 1940s based on the agreement that, when technically and politically feasible, military expenditures -- not civilian spending -- could best address the goals of big business, organised labour, and political strategists. 'Military Keynesianism', i.e., the policy of using the defense budget as a counter-cyclical and economic growth device, then, was

⁵¹(...continued)

Armaments and Development: A Study of Transnational Military Production, International Transfer of Military Technology and Their Impacts on Development (Tampere, Finland: Tampere Peace Research Institute, 1980).

⁵² G.H. Jenkins, p.ix.

the chosen mechanism through which economic stabilization and stimulation and the protection of the capitalist world economy were to be insured.⁵³

Thus, despite his later misgivings regarding the long-term consequences of defence spending, Arthur Burns concluded in the face of short-term slack in the late 1950s U.S. economy that "unless some decisive governmental action were taken, and taken soon, we were heading for another dip..." and urgently recommending "that two steps be taken immediately: by loosening up credit and, where justifiable, increasing spending for national security".⁵⁴ This view was echoed years later by two American Secretaries of Defense: Harold Brown, who claimed before the U.S. Budget Committee in 1980 that "[military expenditures] are beneficial in the long term to the civilian economy", and Casper Weinberger who defined defense as the "ultimate social welfare program", and warned that massive unemployment could result from cuts in the military budget.⁵⁵ Canadians have heard

⁵³ Griffen et al., "The Political Economy of Military Spending: Evidence from the United States", *Cambridge Journal of Economics* (vol.6, 1982), p.4; see also F. Block, *The Origins of International Economic Disorder* (Berkeley: University of California Press, 1977).

⁵⁴ see, M. Nincic and T. Cusack, "The Political Economy of US Military Spending", *Journal of Peace Research* (vol.16, 1979), p.105.

⁵⁵ DeGrasse, 1983: 35; *New York Times*, "Greater Outlays on U.S. Arms Urged" (9 March 1982, section A18); *Washington* (continued...)

similar arguments from Prime Minister Mulroney, who argued in 1984 that re-equipment of our armed forces would "constitute a significant investment in jobs, economic development and the national security of our nation."⁵⁶

These views have found growing support in the tradeoff research literature. Emil Benoit's landmark study in 1973 which focused on forty-four developing countries during two overlapping time series, 1950-1965 and 1960-1965, seriously questioned the prevalent point of view of defence as an economic burden, stating that "the evidence pointed strongly to the conclusion that, whether or not defense activities [i.e., spending] had a favourable net effect on the growth in the sample countries, ...they had certainly not had an unfavourable one".⁵⁷ Ten years earlier, Otto Eckstein concluded that in the United States "the association between civilian spending and military spending is positive, not negative"⁵⁸, a view echoed in that same year by Roger

⁵⁵(...continued)
Post, "Cutting Defense Won't Solve Job Problem" (9 November 1982, section A16).

⁵⁶ Quoted in Ernie Regehr, *Arms Canada: The Deadly Business of Military Exports* (Toronto: James Lorimer & Company, 1987), p. 161.

⁵⁷ E. Benoit, *Defense and Economic Growth in Developing Countries* (Lexington, Mass.: D.C. Heath, 1973), p.101.

⁵⁸ Otto Eckstein, "Discussion", in *National Security: Political, Military, Economic Strategies in the Decades* (continued...)

Freeman's "National Security and Competing Costs" and William Campbell's "Assuring the Primacy of National Security".⁵⁹ In his later study Benoit more vigorously concluded that growth and defense spending were positively related in less developed nations, finding that "countries with a heavy defense burden generally had the most rapid rate of growth, and those with the lowest defense burden tended to show the lowest growth rates".⁶⁰

More recently, two studies have found the evidence of defense tradeoffs to be weak: Eichenberg's 1984 analysis of possible systematic tradeoffs in West German budgetary outputs concluded that "...defense tradeoffs do not emerge when controls for policy and political pressures are specified in analyses of civil spending"⁶¹; similarly, Domke, Eichenberg and Kelleher's study into the existence of tradeoffs for the U.S., U.K., West Germany and France found

⁵⁸(...continued)

Ahead, edited by D. Abshire and Richard V. Allen (New York: Praeger, 1963) p.1012.

⁵⁹ R.A. Freeman, "National Security and Competing Costs", in Abshire and Allen, p.804; W.G. Campbell, "Assuring the Primacy of National Security", in Abshire and Allen, p.964.

⁶⁰ E. Benoit, "Growth and Defense in Developing Countries", *Economic Development and Cultural Change* (vol.26, 1978), p.271.

⁶¹ Eichenberg, p.403.

that "...although there may be years when one increases and the other decreases, the pattern is not common enough to produce a significant negative relationship between the two spending categories".⁶²

Frederiksen and Looney conducted studies in 1982 and 1985, both times finding that increased defence spending fostered economic growth in countries which were less financially resource constrained.⁶³ In her analysis of Brazilian budgetary allocation, Margaret Daly Hayes found that "increased military spending accompanied substantial increases in spending for infrastructure development and aspects of this associated with greater central government activity, for example, industrial investment and direct government investment".⁶⁴ Barry Ames and Ed Goff discovered that military and educational expenditures were

⁶² Domke et al., "The Illusion of Choice: Defense and Welfare in Advanced Industrialized Democracies, 1948-1978", *American Political Science Review* (vol. 77, 1983), p.33.

⁶³ P.C. Frederiksen and Robert Looney, "Defense Expenditures and Economic Growth in Developing Countries", *Journal of Economic Development* (vol.7, 1982); and "Another Look at the Defense Spending and Development Hypothesis", *Defense Analysis* (vol.1, 1985).

⁶⁴ M. Daly Hayes, "Policy Consequences of Military Participation in Politics: An Analysis of Tradeoffs in Brazilian Federal Expenditures", *Comparative Public Policy*, edited by C. Liske, W. Loehr and J. McCamant (New York: Wiley, 1976), p.48-49.

positively related in Latin American countries,⁶⁵ while David Caputo's research into Australian, Swedish, U.K. and U.S. tradeoffs concluded that "health expenditures, regardless of national income conditions, are directly and positively affected by national defense expenditures".⁶⁶ Even Bruce Russett, who in earlier bivariate studies had found strong negative tradeoffs,⁶⁷ concluded, in a more encompassing multivariate study focusing on the effect of military spending on American health and educational expenditures, that no systematic tradeoffs could be found.⁶⁸

Several observations can be noted at this point with regard to the vast literature. First, the majority of research to date examines the trade-off relationships of either less developed nations or developed countries with large defence outlays, such as the United States, West Germany, France and the United Kingdom. Much fewer studies have been conducted for developed countries with relatively

⁶⁵ B.Ames and E. Goff, "Education and Defense Expenditures in Latin America: 1948-1968", in Liske et al., p.175-197.

⁶⁶ David A. Caputo, "New Perspectives on the Public Policy Implications of Defense and Welfare Expenditures in four Modern Democracies: 1950-1970", Policy Sciences (vol.6 1975), p.442.

⁶⁷ Russett, 1969, 1970.

⁶⁸ Russett, 1983.

smaller defence budgets, such as Canada, Sweden or Australia. While this is not surprising given the fact that tightly resource-constrained countries, and countries with large defence budgets would be expected to display the greatest tendencies for budgetary tradeoffs, it does leave a substantial gap upon which future research could concentrate. Second, a point must be made with regard to the underlying assumptions of some of the research. Studies which examined the economic impact (boost or burden) of defence spending often ask the less relevant research question, "Does defence spending damage investment?".⁶⁹ Many researchers fail to note that some, perhaps a substantial, part of military spending is investment, in the form of capital formation (tanks, military buildings, etc.) and, therefore, ignore the more vital question of whether defence is less investment intensive than other forms of government spending. Studies which examine the differential impact of military spending versus other uses of government resources may more accurately define the important issue.

The third observation reflects the fact that the results of the empirical research to date have not been

⁶⁹ see, for example, Gold, 1985; Cappelen et al., 1984; Smith and Georgiou, 1983; Labour Party Defence Study Group, 1977.

entirely consistent or conclusive. A review of the extensive literature can lead to greater confusion than enlightenment regarding the relationship between "guns and butter". Advocates of increased defence spending, as well as those calling for greater social expenditures, can find sufficient empirical work to support either of their arguments.

A number of factors have contributed to the varying results of the research. Problems with the availability and quality of data have been considerable. Deger and Smith, for example, found that the estimates of defence outlays made by the U.S. Arms Control and Disarmament Agency and by the Stockholm International Peace Research Institute could produce significantly different results.⁷⁰ Researchers have also quarrelled over the appropriate time perspective for defining expenditure variables.⁷¹ A number of studies have viewed tradeoffs from the perspective of long-term trends, defining the relevant data as ratios of total government expenditures or GNP. Others have used percentage changes in defence and civilian spending as the appropriate definition,

⁷⁰ S.Deger and Ron Smith, "Military Expenditure and Growth in Less Developed Countries", *Journal of Conflict Resolution* (vol.27, 1983), p.347-358; see also Michael Brzoska, "The Reporting of Military Expenditures", *Journal of Peace Research* (vol.18, 1981), p.261-275.

⁷¹ Eichenberg, 1984.

criticizing the use of ratios as contradicting the dominant theoretical view of budgeting as an incremental process.⁷² This criticism, however, may not be valid. Budgeting is indeed incremental but if it is also done in a larger "composition of expenditures" framework that takes into account many programs, then ratios may be a superior variable definition. An example is useful to illustrate the point. Assume that total spending in year 1 is \$100, and 15% is allocated to each of education and defence; therefore, \$15 is spent on education and \$15 on defence. In year 2, the total budget climbs to \$200, but there is also a one-to-one percentage trade-off such that education spending receives 10% and defence expenditures account for 20%. If we look at the individual program percentage changes both education and defence spending have increased: defence from \$15 to \$40, and education from \$15 to \$20. In terms of ratios or shares of the total spending, however, education has fallen from 15% to 10% while defence has climbed from 15% to 20%. The relative loss of education spending is not captured when the data is defined as percentage changes.⁷³

Differences over the use of country-specific longitudinal analysis and comparative cross-national

⁷² Russett, 1983; Eichenberg, 1984.

⁷³ see Peroff, p.369-370; Hayes, p.28.

research have also been evident. Griffin, Wallace and Devine have criticized the latter method, noting that "there may not even be a common linkage between economic fluctuations and military spending in all capitalist nations...[either] at the conceptual level (does military spending mean the same thing in Canada and the United States?) [or for] equation specification (are the functional forms of the variables the same? are the lag structures constant across nations?)".⁷⁴ Others have questioned the static nature of cross-national designs, citing their inability to determine temporal leads and lags, or to take account of possible reciprocal influences among the variables or over-time changes in empirical parameters.⁷⁵ Perhaps the greatest shortcoming of the literature is the tendency to neglect the simultaneous relationship between the set of equations being examined. Too often conclusions are based on direct relationships between variables in one equation, and ignore the indirect influences which variables in other equations of the system may have on the total impact of a variable.

⁷⁴ Griffen et al., p.12.

⁷⁵ Steve Chan, "The Impact of Defence Spending on Economic performance: A Survey of Evidence and Problems", *Orbis* (Summer, 1985), p.407.

Debates between the use of simple bivariate studies, more comprehensive multivariate studies and complex simultaneous models, over relevant time-frames, and country sample-size have all plagued efforts at a broad consensus.

This study is designed to draw upon and extend previous research on the defence/welfare tradeoff question by examining a country not as yet studied in terms of potential defence budgetary tradeoffs. Using Canada as a case study, a series of statistical models, ranging from simple bivariate to more encompassing simultaneous regression frameworks, will examine the possibility of tradeoffs between defence and non-defence spending in the Canadian federal allocation process. More specifically, the exercise will focus on the relationship between defence expenditures, as the independent or explanatory variable, and expenditures in three federal social spending categories- education, health, and social welfare - which serve as dependent variables. Although some models will differ in variable definition (from long run ratio trends to short-term percentages changes) and grow in theoretical complexity, in general the thesis will test the following three hypotheses:

- H1: Federal spending on education is negatively related to defence expenditures;
- H2: Federal spending on health is negatively related to defence expenditures;
- H3: Federal spending on social welfare is negatively related to defence expenditures;

Before embarking on this analysis, chapter two will review the expenditure patterns of each of the spending categories for the period from 1947 to 1984. This will allow for a simple bivariate test of variance to be conducted later in the chapter as well as the development and application of an expanded multivariate regression model. Chapter three will expand the model through the development of a simultaneous regression framework with three equations.

Finding out how much the military is costing or benefiting society is critical to any discussion of policy priorities. It must be an integral part of a larger debate not only on defence policy, but on the priorities we wish to follow in a country where poverty is lasting and widespread, and in a world where millions die every year from hunger, contaminated water, and treatable diseases. Unfortunately, Canada has witnessed very little serious research on the issue. Writing in 1985, John Treddenick from the Royal Military College felt that this "almost total" neglect may

reflect our modest status as a military power. Yet he added, "it is a policy focus whose time is long overdue, one undoubtedly forced by the pressure of events and one where interest of the public has overtaken the interests of the profession".⁷⁶ His call for urgent additional research is a wise one. In a complex and competitive environment, where financial resources are increasingly constrained and where social needs are greater than ever, priority-setting for a future agenda of action demands it.

⁷⁶ Treddenick, p.78.

**2. A QUESTION OF PRIORITIES:
DEFENCE TRADEOFFS IN A CANADIAN SETTING**

...it is clear that the additional resources required by our Armed Forces cannot come from higher deficits. Only two other means are available to obtain the funds required -- tax increases, and the reallocation of existing government expenditures. Because Canada now devotes a much smaller share of both government expenditures and gross national product to national defence than our western allies, a strong argument can be made that a measure of spending reallocation away from other government programs and departments in favour of defence is justified.

Thomas D'Aquino, president
Business Council on National Issues

...at a time when the media and the opposition quarrel over the government's inattention to NATO or to the buildup of Canadian armed forces...who bothers to stress the positive side of this record in comparison with the distorted priorities of other countries' expenditures.

John Sigler, professor
from "World Crisis 1975",
Behind the Headlines, vol.XXXIV, no.2

Canadians are accustomed to calls that defence spending in this country must increase substantially. We are often reminded of the fact that the proportion of our GNP devoted to defence ranks us at the bottom of NATO countries, just ahead of Luxembourg. Ranking nations in this way, however, can be misleading since it addresses the question of defence spending solely in terms of cost equity, equating security with higher military expenditures, and ignoring, among other things, the social and economic priorities of a country. As the Palme Commission on Disarmament and Security Issues notes in its report,

Economic cost itself is seen as the prime index of military effort. Spending more money on defense becomes an end in itself. The relative security efforts of allies and enemies are measured by the proportion of gross domestic product devoted to defense...The calculations required depend on widely and at present unavoidably imprecise comparisons of different countries' military establishment. Military security is counted in inputs (money), rather than in outputs of 'security'...⁷⁷

⁷⁷ Olaf Palme et al., p.7; see also, Treddenick, p.85, who argues that measuring military expenditures in terms of GNP "bears no relationship to either security preference or cost conditions." He adds: "What would appear to be more important in assessing a nation's contribution to the alliance is the absolute level of its military expenditures. By this measure Canada currently stands a respectable sixth among the nations of the alliance." There are advantages for military spending advocates, however, in using the GNP measuring-stick. As Ulrich Albrecht notes, "the computation (continued...)"

Nevertheless, the general response from a large number of Canadians in and out the defence community, has been to propose significant real increases in military expenditures.⁷⁸ The influential Business Council on National Issues, for example, calls for no less than six percent real growth per year in defence expenditures over a ten-year period. Claiming that defence has been "seriously undermined by over fifteen years of underfunding" the BCNI concludes that "substantial financial resources will be required to halt and reverse this unacceptable trend" and proposes a doubling of the share of government expenditures

⁷⁷(...continued)
of military spending as a percentage of GNP is much favoured by Western sources, for it suggests that there is nothing unreasonable in rich countries spending more on armed forces than poor countries" ("Appendix II: Researching Conversion: A review of the State of the Art", in U. Albrecht et al. (eds.), *A Short Research Guide on Arms and Armed Forces* (London: Croom Helm, 1978), p.67.

⁷⁸ Peter C. Newman, *True North Not Strong and Free* (Toronto: McClelland and Stewart, 1983); B. MacDonald, ed., *War in the Eighties: Men Against High Tech* (Toronto: Canadian Institute for Strategic Studies, 1983); R.B. Byers, "Defence 81: The Strategic Environment for Canada", in B. MacDonald, ed., *Parliament and Defence Policy: Preparedness or Procrastination?* (Toronto: Canadian Institute of Strategic Studies, 1982), p. 11-26; and, R.B. Byers, "Canadian Security and Defence: the Legacy and the Challenges", *Adelphi Papers* #214 (London: International Institute for Strategic Studies, winter 1986); Martin Shadwick, "Canada's Commitments to NATO: The Need for Rationalization", *Canadian Defence Quarterly* (Vol.15, no.1, 1985); J. Jockel and J. Sokolsky, "Emphasizing the Assets: A Proposal for the Restructuring of Canada's Military Contribution to NATO", *Canadian Defence Quarterly* (Vol.9, no.2, 1979).

accounted for by the defence envelope.⁷⁹ In its 1982 report the Senate Sub-Committee on National Defence agreed that Canadian defence efforts in the Alliance were, at best, minimal and "should be strengthened by the deployment of additional manpower, new equipment and other resources".⁸⁰ In 1983 the sub-committee concluded that

The current Canadian level of expenditure on defence does little more than buy the country the worst of both worlds. While the expenditures are large enough to represent a significant charge on the national exchequer, they are too small to produce worthwhile results.⁸¹

In their recent book, Joseph Jockel and Joel Sokolsky argue strongly for significant increases in Canadian defence spending, arguing that

Canada is today taking almost a free ride on the backs of its U.S. and European allies. In addition to the moral failings of such an approach, Canada is failing to pursue forthrightly, through the commitment of

⁷⁹ Thomas D'Aquino, "Paying the Bill: Canada's Share of NATO Requirement", in B. MacDonald (ed.), *Guns and Butter: Defence and the Canadian Economy* (Toronto: Canadian Institute of Strategic Studies, 1984), p.44-56; also Business Council on National Issues, *Canada's Defence Policy: Capabilities versus Commitments* (Ottawa: BCNI, 1984).

⁸⁰ Senate Sub-Committee on National Defence, *Manpower in Canada's Armed Forces* (Ottawa: Minister of Supply and Services, 1982).

⁸¹ Senate Sub-Committee on National Defence, *Canada's Maritime Defence* (Ottawa: Minister of Supply and Services, 1983), p.98.

conventional military forces commensurate with its resources, two of its own most fundamental interests: the deterrence of war, ...and the preservation of a free and prosperous Western Europe.⁸²

Increases in defence expenditures are largely justified, according to these arguments, in terms of commitments, needed capabilities, growing and changing threats, economic growth potential, employment creation, as well as more ambiguous notions such as prestige and influence. Largely left out of the debate is the possible displacement effects of larger defence spending on other government public expenditures. In the present and certainly future environment of increased fiscal constraint, any discussion concerning larger military outlays must take account of the effects of such actions on domestic economic and social priorities. Defence requirements cannot be examined in a policy vacuum, treated independent of larger societal needs and priorities. In short, we can no longer afford to ignore the long-term economic and social consequences of increased military expenditures. Nor can simple rhetoric concerning the economic effects of defence

⁸² J.T. Jockel and J.J. Sokolsky, *Canada and Collective Security: Odd Man Out* (New York: Praeger Press, 1986), p. 1-2.

spending be taken seriously.⁸³ In this chapter the possibility of defence tradeoffs in the Canadian economy will be examined through a series of econometric models. The focus will simply be on the tradeoff relationships, which are hypothesized to be negative, between defence spending and three social policy expenditures: health, education, and social welfare. While acceptance of the hypotheses may be important in terms of priority setting, the thesis will not answer many of the broader issues of the defence debate. Issues concerning the "right" amount of military spending, its impact on the economy, the relationship between security and higher defence expenditures or even the appropriateness of Canada's spending strategies towards our social problems, while closely related to this thesis, lie beyond its immediate scope. Before proceeding to the statistical analysis however, the paper will present in greater detail each of the policy areas, outlining their composition and importance in total federal government spending. In addition, the trends which have characterized federal spending in these

⁸³ A recent article in *Canadian Defence Quarterly* reviews Canadian defence resources for 1988-89, and compares them, using a GDP ratio, with the defence outlays of other NATO countries. John Willis from the Centre for International and Strategic Studies observes that "comparisons of this type...do serve to illustrate the comparatively unburdensome effect of defence spending on the Canadian economy..." See, John Willis, "Defence Spending 1988-89", *Canadian Defence Quarterly* (Summer 1988), p.49.

areas throughout the postwar period will be explored, as will the policy and expenditure environment within which each policy field has had to operate.

The Policy Fields

The policy-planning and expenditure framework within which government spending has operated has undergone significant changes over the past four decades. The 1950s and early 1960s were marked by a highly personalized style of selecting, developing and implementing policy. The structure of government which emerged was dominated by a number of strong departments such as Finance, Trade and Commerce, and External Affairs, led by powerful ministers. As Kirby, Kroeker and Teschke note in their article "The Impact of Public Policy-making Structure and Processes in Canada",

During this period no discernable policy-making structures emerged whose explicit purpose was to reconcile differing views or to assist in the selection of priorities for government action. The policy-making process, to the extent any existed, was informal and adhoc.⁸⁴

⁸⁴ M.J.L. Kirby, H.V. Kroeker and W.R. Teschke, "The Impact of Public Policy-making Structures and Processes in Canada", *Canadian Public Administration* (Fall, 1978), p.408.

By the mid-1960s, pressures within and outside of government precipitated reform aimed at improving efficiency and effectiveness in policy-making. The result was the creation of a more formalized cabinet committee system and the development of priority-setting and resources-allocations processes.⁸⁵ In 1969, the Canadian government adopted the Planning-Programming-Budgeting System (PPBS) which provided for a functional classification of government expenditures into eleven main areas. The PPBS explicitly recognized the need for a formal planning structure in light of limited resources and growing program demands. In its PPBS Guide, Treasury Board clearly stated that

...not only should departmental programs be viewed as competing with one another for a share of the total resources, each program should be viewed as competing with one another for a share of the total resources; each program should be viewed as competing with all other programs, belonging to the same or other departments.⁸⁶

In 1979, the Policy and Expenditure Management System (PEMS) brought about further changes in planning and decision-making processes within government.⁸⁷ The new

⁸⁵ Kirby et al., p. 412-413.

⁸⁶ Treasury Board, Planning-Programming-Budgeting Guide (Ottawa: Queen's Printer, 1969), p.9.

⁸⁷ see, Richard Van Loon, "Ottawa's Expenditure Process: Four Systems in Search of Coordination", in G. (continued...)

system introduced an expenditure plan which established spending levels, or envelopes, within the level of total government outlays, for ten policy sectors. The envelopes defined the resources that were available over time for a particular policy sector. For the 1983-84 Main Estimates, the Social Affairs envelope accounted for the largest share of total resources, over 41%, with Public Debt (19.8%), Economic Development (10.8%), Defence (8.9%) and Fiscal Arrangements (6.3%) envelopes covering the bulk of the remaining funds.⁸⁸

While policy field definitions used in the analysis throughout the thesis generally follow the breakdown outlined in the Main Estimates, a number of clarifications are necessary. The defence envelope is organized into eight activities, one for each of land, maritime, and air forces in Canada, another for forces in Europe, and one for each of Communications Services, Personnel Services, Material Support, and Policy Direction and Management Services. For the analysis presented in this paper this aggregate is supplemented by the NATO definition of military expenditure.

⁸⁷(...continued)

Bruce Doern, ed., *How Ottawa Spends 1983* (Toronto: James Lormier & Company, 1983).

⁸⁸ see, 1984-85 Main Estimates - Part III, Department of National Defence, p.17.

It includes military R&D, military aid in the budget of the donor country, cost of retirement pensions, paramilitary forces and of police when judged to be trained and equipped for military operations; it excludes civil defence and war pensions.

Health, education and social welfare spending are included in the Social Affairs envelope. Education spending includes transfers to the provinces for post-secondary education, and funds for Native education programs. Health expenditures take into account federal transfers to the provinces, funding for hospital care, and public health. The social welfare field includes a wide range of services. For the analysis throughout the paper, social welfare refers to Contributory Plans, such as Pension Plans and Old Age Security; Labour Force Plans, including Unemployment Insurance and Workman Compensation; Family Allowances and Social Welfare Assistance.

The policy areas of defence, health, education and social welfare have, since 1950, never accounted for less than 45% of total federal government expenditures, and in many years, have made up well over half of total spending. Table 2.1 below illustrates the breakdown of each category

as a percentage of total federal spending over the period under study.

Table 2.1: Federal Spending in Defence, Health, Education and Social Welfare as a Percentage of Total Federal Expenditures (Selected Years)

year	defence	health	education	social welfare
1947	10.9	0.4	0.7	17.5
1948	12.1	1.0	0.6	19.8
1950	20.9	1.4	0.6	20.1
1952	41.7	1.0	0.4	16.6
1954	38.1	1.2	0.5	17.6
1956	37.0	1.2	0.8	17.6
1958	28.2	2.1	1.1	19.5
1960	24.5	4.0	1.0	19.7
1962	24.2	5.7	3.7	20.9
1964	22.6	6.7	2.7	23.0
1966	18.1	5.2	4.4	21.5
1968	15.8	6.0	4.8	23.3
1970	13.7	8.6	5.7	26.8
1972	11.1	8.9	4.2	31.7
1974	9.9	8.0	3.6	32.7
1976	9.3	8.5	3.5	34.3
1978	9.5	8.0	4.6	33.0
1980	9.5	7.2	4.1	33.6
1982	9.1	5.4	3.3	34.8
1984	9.1	6.6	3.6	33.5

sources: see end of reference section

Spending Trends 1947-1984

After rather modest levels of military spending during the immediate postwar period, Canadians witnessed rapid increases in expenditures for defence throughout the late 1940s and early 1950s. As indicated in Table 2.2, the

Table 2.2: Canadian Defence Spending, 1947-1984
(millions \$s)

year	Total (current \$s)	Total (1981 constant \$s)
1947	227	2162
1948	236	1967
1950	495	3694
1952	1875	12019
1954	1771	10669
1956	1888	10261
1958	1740	8744
1960	1654	7765
1962	1810	8009
1964	1813	7586
1966	1766	6565
1968	1927	6318
1970	2086	5943
1972	2238	5595
1974	2862	5864
1976	3589	5724
1978	4662	6386
1980	5788	6555
1982	7802	6991
1984	9754	7917

sources: see end of reference section

level of defence spending peaked in 1953 following half a decade of dramatic rise.

Numerous factors and events throughout this relatively short time span contributed to decisions for large increases in military spending; growing East-West tensions, the start and rapid intensification of the cold war, the formation of the Atlantic Alliance, the outbreak of the Korean war, and the subsequent Canadian decision to deploy forces in Europe and in Korea, all pointed to a need for high levels of defence expenditures.

In 1954, however, a long period of slow military decline began, not turned around until the mid-1970s and the start of a period of significant, yet erratic, increases (see Figure 1). Again, a number of important factors contributed to this curtailment, not the least of which was Canadian uncertainty concerning its own security position in a time of rapid international change.⁸⁹ The focus of NATO strategic doctrine on the concept of massive retaliation and its emphasis on nuclear weapons forced Canada to question its own defence posture. The world was also growing more complex; the rise of China as a major power, the emergence of the Third World and the economic re-ordering that it

⁸⁹ Treddenick, p. 85-87.

Figure 1: Trends in Defence Spending, 1947-1984
(1981 constant, billions \$s)

required, and the rapid rise in regional conflicts, all led to increased uncertainty regarding Canadian defence policy. As John Treddenick notes, there existed "little incentive to expand or even maintain the comparatively large military structures which had been forged in the early 1950s. Rather there arose a somewhat desperate searching for new roles befitting a minor power".⁹⁰

At the same time, domestic attention had shifted away from military concerns to a greater pre-occupation with social programs. This was reflected, as Figure 2 demonstrates, in growing public expenditures for social programs. From 1954 to the mid-1970s, real expenditures for social welfare and health showed consistent and significant increases. While defence spending by 1984 was, in real terms, back to its early 1960s level, welfare and health spending had increased over three-fold from its 1967 mark. In fact, over the twenty-year period when the defence envelope diminished (1954-1974), only two decreases in real spending appear for health and welfare.

Federal educational spending also recorded real increases, although more erratic and for a shorter period of time. It was not until the mid-1970s that the pattern of

⁹⁰ Treddenick, p.86.

Figure 2: Trends in Federal Health, Education and Social Welfare Spending, 1947-1984
(1981 constant, billions \$s)

spending emphasis showed significant changes. Between 1975 and 1984 social welfare expenditures displayed slower annual growth rates, and actually decreased in two of the nine years. Only in the two years of serious economic recession (1982 and 1983) did welfare spending experience large increases (see Figure 2).

Health expenditures fared similarly, witnessing slower growth rates during most of the period and declining in five of those years. Educational spending decreased eight times in a 14 year span from 1970 to 1984.

Overall the trend in government spending indicates an emphasis toward defence expenditures until the mid-1950s, a shift away from defence and toward social spending for the following two decades, and since 1975, a less dramatic reversal toward slightly higher military spending and slower or negative growth rates for social categories of expenditures. At the same time, in only 13 years, about one-third of the sample period, did social welfare spending and defence spending move in opposite directions; health showed an inverse trend in 17 years, while education expenditures experienced opposite spending patterns compared to defence in 15 of the 38 years. Moreover in never more than five years do we witness an increase in defence

accompanied by a decrease in one or more of the alternative spending areas. All this may partially explain the reason why the question of defence tradeoffs in the Canadian economy is not widely researched: simply put, initial observation does not lead to the expected patterns of tradeoffs.

Table 2.3: Trends in Canadian Federal Health, Education and Social Welfare Spending, 1947-1984 (Selected Years) (1981 constant, millions \$s)

Year	Education	Social Welfare	Health
1947	133	3476	86
1948	100	3217	158
1950	97	3560	254
1952	122	4789	295
1954	133	4922	325
1956	212	4870	337
1958	327	6040	653
1960	305	6235	1254
1962	1217	6925	1881
1964	904	7711	2243
1966	1602	7792	1896
1968	1931	9351	2416
1970	2484	11644	3727
1972	2118	15953	4473
1974	2129	19344	4705
1976	2188	21152	5271
1978	3058	22184	5246
1980	2846	23240	4741
1982	2577	26858	4139
1984	3158	29126	5731

sources: see end of reference section

Tradeoffs in the Canadian Economy

Following the approaches dominant in the literature, the question of tradeoffs between defence spending and other government expenditure categories can be analyzed from either a long-term or short-term perspective. In the former case, variable definition focusing on expenditure ratios would be most appropriate since tradeoffs would appear as trends in the defence share of the federal budget that are inversely related to trends in health, education, and welfare spending shares. A short-term time perspective, however, would depict the allocation process as one which focuses upon adjustments at the margins; in this case, each year's spending envelope is viewed in terms of the previous year's allocation base. The relevant economic variables, defence, health, education and welfare expenditures would be expressed as annual percentage change.⁹¹

The data used to examine possible tradeoffs in the Canadian allocation process cover the period from 1947 to 1984 inclusive. The years 1939 to 1946 were omitted for two basic reasons. First, there is a lack of consistent,

⁹¹ A discussion on the various definitions used can be found in Domke et al., "The illusion of Choice: Defense and Welfare in Advanced Industrialized Democracies, 1948-1978", *American Political Science Review* (vol. 77, 1983).

reliable data for all the expenditure categories during the war period, mainly due to changing category definitions. Secondly, there was a fear that the abnormally high defence expenditures as a result of World War II could distort the findings for the entire period.

For each year the absolute value for the particular federal government spending category was obtained (sources are listed at the end of the reference section). To account for the distorting effects of inflation each figure was deflated using the GNE Implicit Price Index for 'Government Current Expenditure on Goods and Services'. This gave us expenditure values in constant 1981 dollars for the five spending categories over 38 years: defence, social welfare, health, education and total federal spending.⁹²

In order to analyze longterm tradeoffs each number was divided by the value for total federal spending in the particular year. The effect was to obtain longrun ratio trends in each of the spending areas, examples of which appear in Table 2.1 above.

⁹² A preferred option would have been to use separate deflators for the four categories of expenditures; however none were available over the relevant time period. Although the majority of trade-off studies use a single deflator, it is important to note its potential source of error.

The chosen method of analysis is regression using ordinary least squares.⁹³ The first model will be bivariate, simply examining the relationship between two variables: defence spending, which will be the independent variable (or explanatory variable), and one of either education, health or social welfare expenditures acting as the dependent variable, such that

$$Y_{ed}; hth; sw = f(X_d)$$

where

X_d = defence spending as a percentage of total expenditures;

Y_{ed} = education spending as a percentage of total expenditures;

Y_{hth} = health spending as a percentage of total expenditures;

Y_{sw} = social welfare spending as a percentage of total expenditures.

Economic theory does not specify the mathematical form (linear or non-linear) of the 'tradeoff' function. Following the literature's predominant depiction of the relationship as linear, we start with the simple mathematical form

$$Y = B_0 + B_1X + u \quad (1)$$

⁹³ For a discussion on the advantages of using this econometric method see, A. Koutsoyiannis, *Theory of Econometrics* (London: MacMillian Publishers Ltd., 1977), p.48.

where u is the error term or random disturbance term and the parameters of the tradeoff function are B_0 and B_1 . The influence of less important and/or unspecified factors is taken into account by the random term.⁹⁴ The particular focus throughout this study is on the B_1 parameter. Since it is impossible to obtain all values of X , Y and u in order to calculate the numerical values of B_0 and B_1 , a sample of observed values is specified and satisfactory estimates of the true parameters are obtained: b_0 and b_1 . This is done by fitting a regression line through the observations, which is considered an approximation of the true line. The true relationship between X and Y is given in equation (1) above. The true regression line, therefore, is

$$Y = B_0 + B_1X \quad (2)$$

the estimated relationship is

$$Y = b_0 + b_1X + e \quad (3)$$

and the estimated regression line is

$$Y^* = b_0 + b_1X \quad (4)$$

⁹⁴ see, A.C. Johnson, M.B. Johnson and R.C. Buse, *Econometrics: Basic and Applied* (New York: MacMillan Publishers, 1987), p.105-107.

where

- Y^* = estimated value of Y , given a specific value of X ;
- b_0 = estimate of the true intercept B_0 ;
- b_1 = estimate of the true parameter B_1 ;
- e = estimate of the true value of the random disturbance term u .

Unfortunately, there can be an infinite number of estimated regression lines from a given sample of observations, depending on the value of the constant intercept and the slope of the line. The question then becomes one of choosing the line which "best fits" the scatter of observations. This is done on the basis of the least square (LS) criterion, which states that the smaller the deviations from the estimated line, the better the fit of the line to the scatter of observed points. The LS criterion requires that the regression line be drawn (i.e., its parameters be chosen) in such a way as to minimize the sum of the squares of the observations' deviations from the line itself. The deviations of the variables from their mean can be expressed as a difference and noted as:

$$x = X - \bar{X} \quad \text{and} \quad y = Y - \bar{Y} \quad (5)$$

where $\bar{X}$ and $\bar{Y}$ represent mean values, that is, the sum of

all X or Y values divided by the number of observations ($\sum X/n$; $\sum Y/n$).

The difference between the observed and estimated value of the dependent variable can be denoted by

$$e = Y - Y^*$$

Substituting Y^* (recalling equation 4) we get:

$$e = Y - b_0 - b_1X \quad (6)$$

The least square criterion, therefore, takes the form

$$\begin{aligned} &\text{minimize } \sum e^2 \\ &= \text{minimize } \sum [Y - b_0 - b_1X]^2 \end{aligned} \quad (7)$$

where $\sum$ denotes summation. In order to find the value of b_0 and b_1 that makes equation (7) a minimum, the partial derivative of equation (7) with respect to the parameters must be set to zero.⁹⁵

⁹⁵ for more detailed explanations of econometric methods and theories see, R.C. Henshaw, "Testing Single-equation Least-squares Regression Models for Autocorrelated Disturbances", *Econometrica* (vol. 34, 1966), p. 646-660; J. Johnston, *Econometric Methods* (New York: McGraw-Hill Book Company, 1984); A. Koutsoyiannis, *Theory of* (continued...)

i) Partial derivative with respect to b_0 :

$$\begin{aligned} f'(\sum e^2) &= f'(\sum [Y - b_0 - b_1 X]^2) = 0 \\ \text{or} \quad 2 \sum (Y - b_0 - b_1 X) (-1) &= 0 \end{aligned}$$

Dividing by -2 leaves

$$\begin{aligned} \sum (Y - b_0 - b_1 X) &= 0 \\ \text{or} \quad \sum Y - nb_0 - b_1 \sum X &= 0 \end{aligned}$$

where

n = number of observations

$$\begin{aligned} b_0 &= \sum Y/n - b_1 \sum X/n \\ \text{or} \quad b_0 &= \bar{Y} - b_1 \bar{X} \end{aligned} \quad (8)$$

ii) Partial derivative with respect to b_1 :

$$\begin{aligned} f'(\sum e^2) &= f'(\sum [Y - b_0 - b_1 X]^2) = 0 \\ \text{or} \quad 2 \sum (Y - b_0 - b_1 X) (-X) &= 0 \end{aligned}$$

95(...continued)

Econometrics (London: MacMillian Publishers Ltd., 1977); Jon Stewart, Understanding Econometrics (London: Hutchinson & Co. Ltd., 1976), H.E. Doran, Single Equation Methods in Econometrics: Applied Regression Analysis (Armidale, NSW: University of New England, 1984); Takeshi Amemiya, Advanced Econometrics (Oxford: Basil Blackwell ltd., 1985). I draw on all these sources for the analysis presented throughout this chapter.

Dividing by -2 and rearranging the equation leaves us with:

$$\sum (XY) - \sum (b_0 X) - \sum (b_1 X^2) = 0 \quad (9)$$

Substituting equation 8 into equation 9, we get

$$\sum (XY) - \sum (Y^{\wedge} - b_1 X^{\wedge})(X) - \sum (b_1 X^2) = 0 \quad (10)$$

Multiplying through and isolating the b_1 value leaves the following:

$$\begin{aligned} \sum (XY) &= \sum XY^{\wedge} - b_1 \sum (XX^{\wedge}) + b_1 \sum (X^2) \\ \text{or } \sum (XY) - \sum XY^{\wedge} &= b_1 (\sum X^2 - \sum XX^{\wedge}) \end{aligned}$$

Recalling the definition of mean values, we get

$$\sum (XY) - \sum X (\sum Y/n) = b_1 [\sum X^2 - \sum X (\sum X/n)]$$

Applying the usual summation rules which allow constant values to be moved in front of a summation sign

$$\sum (XY) - 1/n \sum Y \sum X = b_1 [\sum X^2 - 1/n (\sum X)^2]$$

Expanding the equation gives

$$\sum (XY) - 2/n (\sum Y \sum X) + 1/n (\sum X \sum Y) =$$

$$b_1 [\sum X^2 - 2/n (\sum X)^2 + 1/n (\sum X)^2]$$

$$\text{or } \sum XY - \sum Y/n \sum X - \sum X/n \sum Y + n (\sum X/n \sum Y/n) = \\ b_1 [\sum X^2 - 2(\sum X/n)(\sum X) + \sum (X/n)^2]$$

$$\text{or } \sum XY - Y^{\wedge} \sum X - X^{\wedge} \sum Y + n(X^{\wedge} Y^{\wedge}) = \\ b_1 [\sum X^2 - 2 X^{\wedge} X + nX^{\wedge 2}]$$

Equation 5 above allows simplification of the terms, such that

$$\sum (xy) = b_1 (\sum x^2)$$

$$\text{and thus } b_1 = \sum (xy) / \sum x^2 \quad (11)$$

Equations 8 and 11 represent "normal" equations for Ordinary Least Squares (OLS), that is, they allow for calculation of the parameters. The result is a rather simple system of equations based on deviations of the variables from their means. Since our preoccupation in this study is with the value of b_1 , we concentrate on that parameter. The value of the estimated b_1 will be, by definition, BLUE, that is, the Best, Linear, Unbiased Estimate obtainable.⁹⁶ This means that b_1 will (a) have the smallest variance as compared with any other estimate

⁹⁶ see Johnston, p.171-174; Koutsoyiannis, p.109-116.

obtained from other econometric methods; (b) it is a linear function of the sample observations; and (c) it will converge to the true value of the parameter as the number of observations in the sample increase.

The functional relationships expressed in equation (1) can be written in terms of estimated equations which, in this case, are simple linear regressions:

$$Y_{ed} = b_0 + b_1 X_d + e$$

$$Y_{hth} = b_0 + b_1 X_d + e$$

$$Y_{sw} = b_0 + b_1 X_d + e$$

Each spending category is expressed as a percentage of total federal government expenditures. The first task is to question the linearity assumption of each equation. The possibility of a curvilinear relationship must be examined for two reasons. Firstly, OLS analysis would be less than optimal under conditions where the relationships are non-linear. Secondly, a non-linear relationship between two variables suggests that the size of the trade-off may vary as the independent variables share of the budget changes. A

linear model would assume that the marginal effect of the independent variable is constant.⁹⁷

A non-linear function can be estimated by OLS if the variables undergo suitable transformation before the estimation of the parameters.⁹⁸ Since economic theory does not indicate the appropriate transformation of variables, a variety of logarithmic transformation were attempted. The transformation which demonstrated the "best fit" and which was statistically significant was chosen. If the linear relationship displayed that best estimation, then it was assumed that the function was indeed linear. In the case of the education equation the linear model was chosen, while the social welfare and health equation used a log-log specification, where the natural logarithm (denoted by "ln") is taken on both sides of the equation:

$$Y_{ed} = b_0 + b_1 X_d + e$$

$$\ln Y_{hth} = \ln b_0 + b_1 \ln X_d + e$$

$$\ln Y_{sw} = \ln b_0 + b_1 \ln X_d + e$$

⁹⁷ The question of non-linear trade-offs is not one often examined in the existing literature. Exceptions can be found in Joel G. Verner, "Budgetary Trade-offs between Education and Defense in Latin America: A Research Note", *The Journal of Developing Areas* (October 1983), p. 77-92; also Kathleen Peroff and Margaret Podolak-Warren, "Does Spending on Defence Cut Spending on Health? A Time-Series Analysis of the U.S. Economy, 1929-1974", *British Journal of Political Science* (January 1979), p.21-39.

⁹⁸ see, Johnson, Johnson and Buse, p.231-255.

The results of applying OLS analysis to the data are presented in Table 2.4. For each equation the b_1 parameter, the equation's adjusted r^2 value (denoted r^{2*}) and the tests of significance are given. The b_1 parameter, or the slope or derivative of the equation, gives, for the linear function, the change in the dependent variable which results when the independent variable increases by one unit; on the other hand, the slope or derivative of the non-linear equations is given by the term $b_1 Y/X$.⁹⁹ The adjusted r^2 is the square of the correlation coefficient or sometimes called the coefficient of determination. It shows the proportion of the variation in the dependent variable which is explained by variations in the independent variable, and can also be a measure of the 'goodness of fit' of the estimated line to the sample observations.¹⁰⁰

Recall that the original hypotheses stated that an inverse relationship was expected between defence spending and the alternative expenditure categories studied. A

⁹⁹ The linear equation is in the form $Y = b_0 + b_1X$; the derivative is simply $f_X(Y) = b_1$. The non-linear equation is in the form $\ln Y = \ln b_0 + b_1 \ln X$; exponentially, the equation can be re-written as $Y = b_0 X^{b_1}$. The derivative of this function is $f_X(Y) = b_0 b_1 X^{b_1-1} = (b_0 b_1 X^{b_1-1})(X/X) = (b_0 b_1 X^{b_1})/X = b_1 Y/X$.

¹⁰⁰ Koutsoyiannis, p.69.

Table 2.4: Results of OLS Analysis

	Defence (b_1)	t-test	r^2 *	F-statistic	DW
Education	-0.12*	-7.00	.57*	48.99	.429
Health	-1.13*	-6.78	.56*	45.99	.183
Soc.welfare	-0.46*	-16.27	.88*	264.65	.535

DW = durbin-watson test for autocorrelation

* indicates statistical significance at the 5% level

negative sign is thus expected before the defence parameter to indicate a tradeoff relationship.

Simple bivariate regression indicates a highly significant inverse relationship between defence spending and each of the alternative categories. Considering the fact that no other explanatory variables have been introduced, the adjusted r^2 value is surprisingly high, ranging from 56% to 88% of the variance explained by changes in defence spending. More importantly, the negative values

of the parameter support the hypotheses. The analysis suggests that a one percent increase in defence spending as a percentage of total expenditures would result in a 0.12% decrease in education spending. Using the formula b_1Y/X for non-linear functions¹⁰¹, 0.29% and 0.59% decreases would be experienced in each of health and social welfare spending respectively. To translate this into dollars and cents, we can use current 1984 figures as a base: defence spending increases of 1% to \$9.85 billion (an increase of about \$97 million) would result in decreases to education spending in the order of \$5 million; health would fall by \$20 million and social welfare by \$260 million.

While the model's results are satisfactory in terms of supporting the hypotheses, the model itself suffers from a number of deficiencies. First, by using time-series ratios as the focus of analysis for longrun tradeoffs, the risk of autocorrelation is high. Autocorrelation refers to the relationship between successive values of the same variable, and its existence counters one of the main assumptions governing OLS models. The Durbin-Watson test for autocorrelation (see Table 2.4) indicates serious serial correlation, affecting the variance of both the estimated

¹⁰¹ The computations are based on sample means of 19.4% for defence, 25.0% for social welfare and 5.0% for health spending.

parameter and the random term.¹⁰² The second shortcoming of the model is the absence of other explanatory variables in the equations themselves. There can be no doubt that simple bivariate analysis does not fully reflect the allocation choices of decision-makers.

Fortunately, both serious deficiencies can be overcome. To solve the problem of autocorrelation, the appropriate corrective procedure is to obtain an estimate of the autocorrelation coefficient, denoted by ρ , and to apply OLS to a set of transformed data. The method used to estimate ρ is the Cochrane-Orcutt iterative method¹⁰³ which involves a gradual convergence to the estimated autocorrelation coefficient. Using the b_0 and b_1 estimates obtained when OLS was applied to the original data, the first-round residuals can be computed using equation (6):

$$e = Y - b_0 - b_1X \quad (6 \text{ repeated})$$

The value of ρ can then be obtained using the given formula:

¹⁰² see Koutsogiannis, p.200-232; Johnston, p. 304-330.

¹⁰³ D. Cochrane, and G.H. Orcutt, "Application of Least-squares Regressions to Relationships containing Autocorrelated Error terms", *Journal of the American Statistical Society* (vol. 44, 1949), p. 32-49.

$$\theta = \frac{\sum e_t e_{t-1}}{\sum e_{t-1}^2}$$

Given our generalized equation:

$$Y = b_0 + b_1 X + e$$

the θ is used to transform the variables:¹⁰⁴

$$Y^* = Y_t - \theta Y_{t-1}$$

$$X^* = X_t - \theta X_{t-1}$$

$$b_0^* = b_0(1-\theta)$$

$$e^* = e_t - \theta e_{t-1}$$

Applying OLS to the new transformed model will yield second-round estimates, which are used to compute second-round residuals and a second-round estimate of θ . This iterative process continues until the value of θ converges and the equation passes the test of zero autocorrelation; this will, in the end, create safer conditions for hypothesis testing.

Applying the Cochrane-Orcutt method to our three specific equations yields the following:

¹⁰⁴ see Koutsoyiannis, p.203; Johnston, p. 304; E.J. Kane, *Economic Statistics and Econometrics* (Harper International, 1968), p.366.

$$\begin{aligned}
 Y_{ed}^* &= b_0^* + b_1 X_d^* + e^* \\
 \ln Y_{hth}^* &= \ln b_0^* + b_1 \ln X_d^* + e^* \\
 \ln Y_{sw}^* &= \ln b_0^* + b_1 \ln X_d^* + e^*
 \end{aligned}$$

and the results are presented in Table 2.5.

As in the OLS regression analysis, the results when controlling for autocorrelation support the hypotheses of tradeoffs in the Canadian economy. Only in the equation for education does the model perform poorly and thus, lead to the rejection of the hypothesis; health and social welfare expenditures continue to display significant negative relationships with defence spending. The non-linear formula would indicate a drop of 0.13% in health expenditures and a 0.57% fall in social welfare spending if defence allocations were to increase by 1%. While the health equation displays a drop in its r^2 value, the social welfare function has a stable value for its adjusted coefficient of determination. In both cases the coefficient remains statistically significant at the 5% level.

To expand the model beyond the simple bivariate analysis, the single equation systems are redefined into multivariate formulae. In this case the dependent variable,

Table 2.5: Results of the Cochrane-Orcutt estimation

	Defence (b_1)	t-test	r^2 *	F-statistic	DW
Education	-0.03	-0.84	.00	0.72	2.14
Health	-0.52*	-2.86	.20*	8.20	1.80
Soc.welfare	-0.44*	-14.78	.86*	218.54	1.92

DW = durbin-watson test for autocorrelation

* indicates statistical significance at the 5% level

say health, will have three explanatory variables: defence, and the two other spending areas, education and social welfare. The idea here is to examine, on a preliminary basis, whether other kinds of tradeoffs occur between the specific areas of the federal budget under investigation. Is it possible, for example, that increased defence spending would result in a tradeoff between education and health expenditure? Health spending may remain stable, but at the expense of education spending. The multivariate equations are:

$$Y_{ed}^* = b_0^* + b_1 X_d^* + b_2 X_{hth}^* + b_3 X_{sw}^* + e^*$$

$$\ln Y_{hth}^* = \ln b_0^* + b_1 \ln X_d^* + b_3 \ln X_{sw}^* + b_4 \ln X_{ed}^* + e^*$$

$$\ln Y_{sw}^* = \ln b_0^* + b_1 \ln X_d^* + b_2 \ln X_{hth}^* + b_4 \ln X_{ed}^* + e^*$$

The results of the multivariate analysis are presented in table 2.6. It should be noted that inclusion of additional independent variables will increase the value of r^2 . Once again the adjusted multiple correlation coefficient (r^{2*}) is used to account for this effect.

The fit of the multivariate models is very good, as indicated in the significant and quite high values of the adjusted r^2 . The results show that while social welfare spending remain negatively related to defence expenditures, health spending tends to be positively related to defence. The defence parameter for the health equation, however, is not statistically significant. Education displays a negative b_1 value, but also fails the significance test. In terms of our original hypotheses, only one of the three equations support the view of tradeoffs. With regard to the relationship between health, education, and social welfare, no evidence of negative trade-offs was found; most of the parameters were positive although not statistically significant (the exception was the relationship between

health, as the independent variable, and education). The Durbin-Watson values suggest the continued existence of

Table 2.6: Results of the multivariate analysis

	Defence (b ₁)	Health (b ₂)	SW (b ₃)	Education (b ₄)	r ² *	DW
Education	-0.03	0.52*	-0.03	----	.82*	.94
Health	0.17	----	0.73	0.76	.90*	.87
Soc. welfare	-0.38*	0.08	----	-0.01	.90*	.55

DW = durbin-watson test for autocorrelation

* indicates statistical significance at the 5% level

serial correlation and therefore, the Cochrane-Orcutt method will be applied to the multivariate equations. Table 2.7 shows the results of using a multivariate analysis which controls for autocorrelation, thus overcoming the two earlier deficiencies of bivariate OLS.

The findings continue to indicate the strong fit of the overall equations; the adjusted r^2 values reveal a significant amount of variance explained. The relationship between defence and two of the spending areas, social welfare and health, is statistically significant and negative, upholding the tradeoff views expressed in the original hypotheses. A 1% increase in defence spending would result in decreases of 0.13% and 0.58% in health and social welfare expenditures respectively.

Education and defence expenditures, however, do not demonstrate a negative tradeoff relationship, although the coefficient does not hold at the chosen significance level. With regards to the relationship between the three civil expenditures, the results show only two significant coefficients, both positive, and both times between health and education.

The evidence presented to this point suggests that economic tradeoffs are relevant in the Canadian allocation process. When controlling for autocorrelation in a multivariate framework, both spending categories of social welfare and health displayed, in the long-run, significant negative tradeoff relationships with expenditures on defence. By "longterm tradeoffs" we mean that a negative

relationship exists between trends in the defence share of government spending and other federal spending areas. The

Table 2.7: Results of the multivariate analysis using the Cochrane-Orcutt method

	Defence (b ₁)	Health (b ₂)	SW (b ₃)	Education (b ₄)	r ² *	DW
Education	-0.04	0.25*	0.00	----	0.31*	2.08
Health	-0.49*	----	0.24	0.20*	0.68*	1.71
Soc. welfare	-0.45*	0.01	----	0.02	0.86*	1.95

* indicates statistical significance at the 5% level

coefficients presented in Table 2.7, therefore, lead to the acceptance of two of the three original hypotheses. These conclusions, however, cannot be extended to the possibility of tradeoffs in the short-term. In order to capture possible short-run tradeoffs it is necessary to redefine our data as annual real growth rates (see Table 2.8).

As noted earlier in the chapter, casting the tradeoff question in terms of yearly rates of change suggests that

**Table 2.8: Expenditure Categories: Real Annual Growth Rates
Selected Years (in percentages)**

year	Defence	Health	Education	Social Welfare
1948	-9.0	84.7	-25.0	-7.5
1950	28.1	12.9	4.3	3.2
1952	46.8	4.6	- 4.5	30.9
1954	-13.4	6.2	6.0	0.7
1956	-3.0	1.7	45.8	-1.8
1958	-7.7	103.4	34.1	11.3
1960	-2.6	13.8	- 8.9	1.8
1962	2.7	13.0	184.8	7.0
1964	2.8	5.8	1.8	7.4
1966	-1.1	11.3	38.6	4.1
1968	-7.7	12.2	22.3	4.0
1970	3.6	20.2	28.9	21.8
1972	-2.3	3.8	-8.8	18.8
1974	4.6	3.5	-0.6	9.9
1976	1.8	5.4	3.3	0.7
1978	5.3	14.6	7.7	1.8
1980	8.8	- 5.2	- 4.4	7.2
1982	11.2	-12.7	- 3.6	16.1
1984	6.3	9.4	4.8	1.4

sources: see end of reference section

the size of each year's spending envelope depends on the size of the previous year's expenditure base. The assumption is that short-term tradeoffs occur at the

margins, responding to incremental yearly changes rather than total budgets.

The problem of serial correlation was evident when using OLS regression, and thus, the Cochrane-Orcutt method of estimation was employed. Although the same four regression techniques employed in the previous analysis were used to study short-term tradeoffs (ie., bivariate and multivariate OLS, bivariate and multivariate Cochrane-Orcutt),¹⁰⁵ Table 2.9 only displays the results of multivariate analysis when controlling for autocorrelation.

Unlike the longterm tradeoff analysis, the regression model for short-run tradeoffs performs extremely poorly. None of the coefficients are very large, only one displays the hypothesized negative relationship, and none prove to be close to statistical significance. Our original hypotheses are therefore rejected for the three equations.¹⁰⁶

¹⁰⁵ The functional form of each equation was linear. Because negative percentage changes were possible, log transformation of the health and social welfare equations could not be used.

¹⁰⁶ None of the other regression techniques employed offered significantly different results from the one shown in Table 2.9. Few of the relationships were within the stated acceptance level, and none showed serious negative trade-offs. In the introductory chapter, I noted that variable definition in terms of percentage changes may not be appropriate. I am not surprised by the poor results.

The results to this point lead to two generalizations. First, while in the short-run no economic tradeoff is evident between defence spending on one hand and social welfare, health, and education spending on the other, there is evidence of budgetary tradeoffs in the long-run. Results show that, in terms of total federal expenditures, a one percent increase in defence spending would lead to a 0.13% and 0.58% decrease in federal health and welfare spending respectively.

Table 2.9: Results of the multivariate analysis using the Cochrane-Orcutt method

	Defence (b ₁)	Health (b ₂)	SW (b ₃)	Education (b ₄)	r ² *
Education	0.06	0.15	-0.33	----	0.08
Health	0.04	----	0.16	0.04	0.08
Social welfare	0.05	0.03	----	0.01	0.05

* indicates statistical significance at the 5% level

Using 1984 spending levels to illustrate the dollar impact, a \$97 million increase in defence (ie. 1%), would in the long-run force a \$10 million cutback in health expenditure and a \$208 million cutback in social welfare spending.

Secondly, the differing results obtained not only between the long-run and short-run analysis but between the various regression techniques, suggest that it is imperative to use the econometric model and variable definition which is most theoretically and methodologically sound.

In this chapter the gradual progression of the models allowed for the elimination of two serious concerns: autocorrelation and simple two-variable analysis. Two caveats remain. The first is the problem of multicollinearity.¹⁰⁷ The application of least squares implies that the explanatory variables are not linearly correlated, that is, that no linear relationship is present between independent variables. The existence of some degree of intercorrelation between the explanatory variables may impair both the accuracy and stability of the parameter estimates. As multicollinearity is inherent in almost all

¹⁰⁷ see, Semoon Chang, *Practitioners' Guide to Econometrics* (Lanham, MD: University Press of America, 1984), p.59 - 67.

economic relationships, it can be expected to have existed in the above analysis. In fact, if the variables displayed no intercorrelation (ie., they were orthogonal), the parameters estimated by bivariate and multivariate would be the same.¹⁰⁸ Since this was not the case in our analysis, it can be concluded that a degree of intercorrelation is present.

The second caveat pertains to the complexity of governmental decision-making and resource allocation in modern society. Simply put, single equation systems such as those specified above fail to capture the complex influences which have an impact, directly or indirectly, upon government spending decisions. The aging of the Canadian population, for example, may influence future health spending, which in turn may affect defence expenditures, which may cause changes to social welfare spending. A similar argument can be made concerning education spending and school enrolment patterns.

To capture, at least partially, the effects of these two caveats it becomes useful to develop more complex models. In the next chapter simultaneous equations models

¹⁰⁸ A.S. Goldberger, *Econometric Theory* (New York: Wiley Press, 1964).

are developed in an effort to address the methodological difficulties of econometric model-building as well as to better reflect the realities of the federal government allocation process.

3. TRADE-OFFS ANALYSIS USING SIMULTANEOUS EQUATION MODELS

Despite the modifications applied in the last chapter, there is still substantial divergence between the statistical model developed in chapter two and the complex workings of the budgetary forces in the allocation process. No single model can capture all the pressures and influences which operate when deciding funding levels of government programs. Our concern to this point, however, has been exclusively with models suitable for partial analysis, designed to explain the behaviour of a single endogenous variable. In the last set of equations presented in chapter two, all dependent variables were endogenous while all explanatory or independent variables were exogenous. In reality, the economic relationship is almost certain to operate in a system of equations where independent variables are endogenous to the system. That is, the independent variables in one equation may be dependent variables elsewhere within the system of equations. Thus, while no statistical model can reflect the complexities of funding decisions, there is considerable room to improve upon the regression analysis performed in the previous chapter. It should be noted that the large majority of studies into budgetary trade-offs fail to properly address the simultaneity relationship between the

equations, and are content with the results of partial analysis. The limited use of simultaneous models in the literature poses one of the major short-comings of existing research. In the name of simplicity, such areas as indirect impacts and intermediate relations have been largely ignored.

In this chapter, an expanded model of three equations will be developed, with each equation inter-linked such that one variable can simultaneously affect several equations. The four key variables of the previous chapter (defence, health, education, social welfare) are supplemented with a series of additional variables in order to better explain their relationships. It is impossible, and indeed not desirable, to include all the variables which operate within the system. Continual introduction of additional variables adds to the complexity of the model and increases significantly the data requirements and eventual computations. Thus only four or five important variables are included in a relationship, with the remaining influences of the excluded variables left to be absorbed by the error term.¹⁰⁹

¹⁰⁹ Furthermore, the model developed in this chapter does not include "macropolitical data", or hard-to-measure variables often referred to as "indicators". Devise "indicators" are used to introduce political, institutional (continued...)

Before building the econometric model, it is necessary to build the theoretical groundwork of the various relationships we intend to examine. It is clear that the specification of our econometric model will depend upon this theoretical construction. To gain additional information about the factors determining the specified dependent variable, we turn to general economic theory as well as existing literature in the particular fields. Often, however, general assumptions must be made with regard to possible relationships since economic theory or the existing literature do not always specify the interactive behaviour between specific variables.

Social Welfare

The focus of the first equation is the relationship between military spending and social welfare expenditures by the federal government. To explore the possible determinants of social welfare spending, it is important to

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and physical factors which do not have readily available or computable measures (eg. intensity of conflict, political ideology, degree of democracy, etc.). The use of indicators in regression analysis is not prevalent in trade-off studies. However it does offer an obvious area for future research. For more on Politometrics, see Ted Robert Gurr, *Politometrics: An introduction to Quantitative Macropolitics* (New Jersey: Prentice-Hall, 1972); Gordon Hilton, *Intermediate Politometrics* (New York: Columbia University Press, 1976).

examine the various components of the federal spending envelope. The social welfare envelope encompasses a variety of assistance and support programs such as old age security, Canada pension plan, family allowances and welfare assistance. One of the largest and most volatile components is unemployment insurance. In periods of high unemployment, up to 31% of the entire federal social welfare envelope has been accounted for by unemployment insurance payments. Chart 3.1 below depicts the annual unemployment rate, the corresponding number of people unemployed, and the share which federal unemployment insurance payments consumes from the total social welfare envelope. The dollar amount of payments has increased substantially over the period as demographic trends, such as the growing presence of women in the labour force, and the labour force induction of a large baby boom generation, have taken hold. The implication is that the level of joblessness in the country, because of its effect on unemployment insurance payments, may be an important factor influencing the required social welfare spending level.¹¹⁰ The anticipated relationship between the variables is positive, suggesting that rising unemployment levels lead to increased requirements for insurance payments.

¹¹⁰ see K.G. Banting, *The Welfare State and Canadian Federalism* (Kingston/Montreal: McGill-Queen's University Press, 1987).

**CHART 3.1: Unemployment rate and U.I. Payments
Selected Years, 1955 - 1984**

Year	unemployment rate (%)	U.I payments as % of S.W. envelope	Number of Unemployed(000s)
1955	4.4	7.9	245
1960	7.0	12.6	446
1965	3.9	7.7	280
1970	5.7	18.5	476
1976	7.1	26.1	726
1978	8.3	27.5	908
1980	7.5	22.1	865
1982	11.0	31.9	1314
1984	11.3	27.8	1399

source: see end of reference section

Closely linked with the number of Canadians unemployed and the level of unemployment insurance payments is the general state of the economy. In times of prosperity, the unemployment level decreases, the number of people in poverty generally decreases, and government revenues increase allowing them to augment spending. During economic slow-downs the number of unemployed rises, leading to

increased demands on the unemployment insurance system, while other programs are strained as the number of people living below the poverty line rises and addition welfare assistance is demanded.¹¹¹ A variable depicting the state of the economy should therefore be included in the specification, and the relationship between it and the dependent variable is expected to be negative (as the economy worsens, the level of social welfare expenditures increases).

The equation for social welfare depicts as independent variables the national unemployment rate, expressed in terms of annual changes, and the percentage change in the Canadian gross national product (GNP). The latter is a proxy variable used to measure the state of the economy. In addition, the three variables of major interest are included, namely health, education, and defence. The previous model would lead to expectations of a negative relationship between social welfare spending and defence expenditures, but no strong positive or negative relationship between social welfare and health or education spending.

¹¹¹ see, Ernie Lightman, "The Major Issues in Canadian Social Policy", *Perception* (September/October, 1982), p.32-34; Richard Deaton, "Unemployment: Canada's Malignant Social Pathology", *Perception* (Spring/Summer, 1983), p. 14-19.

Health

Over the past four decades two significant changes have occurred in the financial cost-sharing arrangements for health services. The first is the gradual and dramatic shift from private to governmental responsibility for health resources. With the establishment in 1957 of the Hospital Insurance and Diagnostic Services Act, which provided public hospital services at the national level, government involvement in health began to increase. The shift continued with the introduction nine years later of the Medical Care Act and the universal provision of a medical care insurance program. The public sector share of total health expenditures rose dramatically during this time, from approximately 43% in 1961 to over 70% by the early 1970s.

The second major factor in health resource allocation has been the shift towards greater provincial involvement. In the early 1960s, the federal share of government spending on health was over 40%. By 1984, this had shrunk to approximately 23%. In contrast, by 1984, the provincial governments' share of total health expenditures had risen substantially, to over 70% from 55% in 1963.¹¹²

¹¹² see, Gilles Grenier, "Health Care Costs in Canada: Past and Future Trends", in F. Vaillancourt (research (continued...))

It is possible, therefore, that federal allocations in health are related to the level of expenditures at the provincial level. Our model will measure the relationship by introducing aggregate provincial government health spending as an independent variable.

Accompanying the shift in financial responsibility for health care has been a dramatic rise in the overall cost of health care. Health economists point to several factors to explain the escalating costs. Many contend that the growth in public insurance coverage is partially to blame, as it has given greater access to a large portion of the population who previously were unable to meet high costs. Simply stated, increased numbers of patients needing and receiving care has resulted in higher health care expenditures. Some health economists have also argued that the greater ability to secure health care caused by public insurance coverage, leads to greater individual consumption and thus higher aggregate costs. As Campbell recently wrote in his "Economics and Politics of Health", "costs reimbursed by third parties do not restrain consumer demand as do

112(...continued)
coordinator), *Income Security and Economic Security in Canada* (Ottawa: Minister of Supply and Services, 1985), p. 251-282.

prices in the normal marketplace...".¹¹³ Adds Alain Enthoven in a 1982 article, "third party reimbursement leaves the consumer with, at most, a weak financial incentive to question the need for or value of services or to seek out a less costly provider or style of care".¹¹⁴ These arguments are closely linked to the notion that public health insurance increases the services offered to low-income groups, and that this group tends to use more services than higher-income groups. The association between health insurance coverage and higher medical care costs through over-utilization is not, however, accepted by all health economists. Some argue that the problem is not over-utilization by insured individuals but rather the under-utilization by those who are not insured. An early study done by Beck in 1973, which examined the effects of the introduction of universal medical care in Saskatchewan in 1962, suggested that low income families used less medical services, and those used were less expensive, than those used by higher income groups.¹¹⁵

¹¹³ R. Ricardo-Campbell, *The Economics and Politics of Health* (Chapel Hill: University of North Carolina, 1982), p.4.

¹¹⁴ Alain Enthoven, "National Health Insurance", in R.D. Luke and J.C. Bauer (ed.), *Issues in Health Economics* (Rockville, Maryland: Aspen Systems Corp., 1982), p.510.

¹¹⁵ R.G. Beck, "Economic Class and Access to Physician Services Under Medical Care Insurance", *International Journal of Health Services* (Fall, 1973), p.341-355; see (continued...)

2

OF/DE

2

MICRO
MEASUREMENT SYSTEMS

Demographic changes have also played an important role in determining the level of funding required for health care. Canada's population has been steadily aging over the past four decades. In 1984, 10.2% of Canadians were over 65 years of age, compared to only 7.3% in 1947. This rise is due in large part to technological breakthroughs which have allowed for both an extension of life, as well as the prevention of early death; in addition fertility rates have declined steadily over the past forty years. As the average age of the Canadian population rises, the demand for medical care also increases because older people, on the average, need more medical care.¹¹⁶ The gradual aging of the

¹¹⁵(...continued)

also, R.W. Broyles et al., "The Use of Physician Services under a National Health Insurance Scheme: An Examination of the Canada Health Survey", *Medical Care* (vol.21, no.11, 1983), p.1037-1054; J.L. Siemiatycki and L. Richardson, "Equality in Medical Care under National Health Insurance in Montreal", *New England Journal of Medicine* (vol.303, no.1, 1980), p. 10-15.

¹¹⁶ see, J.A. Boulet and G. Grenier, "Health Expenditures in Canada and the Impact of Demographic Changes on Future Government Insurance Program Expenditures", *Discussion Paper 123* (Ottawa: Economic Council of Canada, 1978). A closely linked factor is the fact that, over the past four decades, the range of health services has expanded considerably. Health care over the years has evolved from a narrowly-defined group of services aimed at preventing and curing physical illness, to a more comprehensive concept concerned with among other things, specialty services for the elderly.

population, therefore, is often identified as a major cause of increased health care expenditures.¹¹⁷

The life-saving or extending technologies themselves are often seen as contributing to the rapid increase in health costs and, consequently, health expenditures. There is a tendency in the health care system to bias the allocation and use of resources toward newer, more sophisticated technologies which require higher capital expenditures and operating costs. One study of hospital costs in the United States suggests that about 75 percent of the rise in hospital costs relative to the general economy can be attributed to increases in labour and non-labour inputs per patient day.¹¹⁸ A recent report by the Task Force on the Allocation of Health Care Resources states that "the introduction of new technologies has caused an annual percentage increase, in real costs, of between one and three

¹¹⁷ see, Monique Begin, "The Unladylike Business of Growing Old in Canada", *Proceedings: Canadian Conference on Social Development 1978* (Ottawa: Canadian Council on Social Development, 1978), p.3-20; "The Aging of the Canadian People: A Round Table Discussion", *Perceptions* (September/October, 1978), p.16-20.

¹¹⁸ John B. McKinley (ed.), *Issues in Hospital Administration* (Cambridge: MIT Press, 1982), p.xi.

percent of the total health expenditures per year over the past decade".¹¹⁹

Many of these factors which explain the rapid escalation in health costs are difficult to express in terms of econometric modelling. The technological imperative of the industry, for example, does not easily lend itself to a defined measurable variable or proxy variable. The effect of universal insurance coverage would require a difficult specification.¹²⁰ Only one variable is therefore chosen for the equation. The effect of an aging population will be studied by introducing the percentage of Canadians over 65 years of age as a variable. The relationship is expected to be positive, with health costs increasing as the overall population ages.

Another factor which may play a considerable role in determining the level of funding for health care by the federal government is the level of the federal deficit. In order to limit overall expenditures, governments have

¹¹⁹ Task Force on the Allocation of Health Care Resources, *Health: A Need for Redirection* (Toronto: Canadian Medical Association, 1984).

¹²⁰ A possible solution would be the introduction of a dummy variable. This would be difficult however given that piecemeal coverage was introduced at different times across the country.

increasingly targeted social spending in general, and cost-sharing programs in particular, as areas where expenditures could be curtailed.¹²¹ Therefore, the level of the deficit/surplus in a given year is introduced to the health equation. A positive relationship is anticipated, which would indicate that as the deficit increases (becomes more negative), health spending would decrease (become less positive).

Education

Some of the factors which have influenced spending trends in social welfare and health care have also strongly effected the expenditure levels for education. Over the past forty years, two phenomena have been experienced. The first is a considerable rise in enrolment at the post-secondary level. The post-war baby boom, a broadening of secondary school curriculum which has resulted in a higher student retention rate, greater accessibility to university, and the creation of community colleges which offer a greater diversity of courses at lower costs, have contributed to the increase in post-secondary students. In addition to these institutional and demographic factors, the

¹²¹ Michel Bergeron, *Social Spending in Canada: Trends and Options* (Ottawa: Canadian Council on Social Development, 1979); also, E. Lightman, p.33.

"great dream of upward social mobility" which is attached to a diploma or degree has increased the pressure on students to attend university or college and on governments to offer greater accessibility. As Wisenthal writes in his conference paper on educational priorities, "the Canadian public has developed a set of expectations which can only be met by the provision of more opportunity for education beyond the secondary school level".¹²²

The second vital trend in Canadian education over the past four decades is the decline in elementary and secondary school enrolment caused by decreasing fertility rates. Fertility rates began to decline rapidly in the early 1960s, slowing down somewhat during the past decade. By 1985, the total fertility rate was less than 1.7 children per woman.¹²³

The effect of these factors on federal education spending is introduced through an independent variable

¹²² M. Wisenthal, "The Threat of Increasing Numbers and Costs in Post-Secondary Education", in J.A. Riffel and E. Mikl (eds.), *Social Goals, Educational Priorities, and Dollars: Planning Education in the Seventies* (Edmonton: Human Resources Research Council, 1970), p.23.

¹²³ S.B. Seward, "Demographic Changes, the Canadian Economy and the Role of Immigration", in S.B. Seward (ed.), *The Future of Social Welfare Systems in Canada and the United Kingdom* (Ottawa: The Institute for Research on Public Policy, 1987), p.231-246.

measuring the change in student enrolment at all levels of education. The relationship is expected to be direct, suggesting that an increase in the number of students will require a higher level of spending to support them.

Financial responsibility for education has not experienced the dramatic shift witnessed in the area of health care. The federal government has increased its share from approximately 5% in the early 1950s to its present level of about 10%. Over the past 25 years, however, the federal share has been relatively stable at that level. Much of the spending shift in education has occurred between the provincial and municipal governments. Municipalities have gradually decreased their share of the total education budget from 45% in 1950 to slightly over 16% in 1984, while the provinces have increased their share from 40% to over 66% in the same period. The education equation therefore contains a variable to measure the effect of education spending by municipal and provincial governments on federal expenditures. It also introduces a deficit/surplus variable to examine the effect on education spending of a high federal government deficit. As in the health equation, the relationship is expected to be positive.

The specification of our model can be summarized as follows:

$$SW = a_0 + a_1Hth + a_2Educ + a_3Def + a_4Unemp + a_5GNP + u_1 \quad (3.1)$$

$$Hth = b_0 + b_1Def + b_2SW + b_3SEN + b_4PH + b_5D/S + u_2 \quad (3.2)$$

$$Educ = c_0 + c_1Def + c_2SW + c_3Std + c_4OEduc + c_5D/S + u_3 \quad (3.3)$$

where:

SW = federal social welfare expenditures as a percentage of GNP;

Hth = federal health expenditures as a percentage of GNP;

Educ = federal education expenditures as a percentage of GNP;

Def = federal defence expenditures as a percentage of GNP;

SEN = the annual percentage change in the number of Canadians over 65 years old;

PH = provincial expenditures on health as a percentage of GNP;

Unemp = the annual percentage change in the national unemployment rate;

GNP = the annual percentage change in the GNP;

D/S = the budget deficit /surplus as a percentage of GNP;

Std = the annual percentage change in the number of full-time students enrolled at all levels of education;

OEduc = provincial and municipal educational expenditures as a percentage of GNP;

The model is complete in that it contains three independent equations and three endogenous variables. It is necessary, however, to examine the model for proper identification. An equation is identified when it is in a unique statistical form, enabling unique estimates of its parameters to be subsequently made from the sample data ¹²⁴.

In other words, there can be no other equation in the system which, standing alone or formed through algebraic manipulation of any other equation, contains the same variables as the equation in question. Conversely, an under-identified equation results in estimates which may relate to any individual or mixture of equations. The test for identification consist of two conditions: rank and order. Since we are estimating using an simultaneous equations model, identification of the entire system requires that not only must the model be complete, but each equation in the system must be identified.

The first condition for identification is the order condition which simply states that "for an equation to be identified the total number of variables excluded from it but included in other equations must be at least as great as

¹²⁴ see, T. Amemiya, *Advanced Econometrics* (Oxford: Basil Blackwell Ltd., 1985), p.228-244; also, Koutsoyiannis, p.346.

the number of equations of the system less one".¹²⁵
Symbolically, the order condition can be expressed as

$$(K - M) \geq (G - 1)$$

where

K = number of total variables in the model

M = number of variables included in a particular equation

G = total number of equations

The second condition for identification, the rank condition, is more difficult to trace. This second condition states that "in a system of G equations any particular equation is identified if and only if it is possible to construct at least one non-zero determinant of order (G - 1) from the coefficients of the variables excluded from that particular equation but contained in the other equations of the model".¹²⁶

The structural model outlined above can be rewritten as:

$$\begin{aligned} 0 = & -SW + a_0 + a_1Hth + a_2Educ + a_3Def \\ & + a_4Unemp + a_5GNP + u_1 \end{aligned} \quad (3.4)$$

¹²⁵ Koutsoyiannis, p.352.

¹²⁶ Koutsoyiannis, p.353.

$$0 = -Hth + b_0 + b_1Def + b_2SW + b_3SEN + b_4PH + b_5D/S + u_2 \quad (3.5)$$

$$0 = -Educ + c_0 + c_1Def + c_2SW + c_3Std + c_4OEduc + c_5D/S + u_3 \quad (3.6)$$

Ignoring the random disturbances and the constant intercepts, the table of the coefficients is as follows:

Equations	Variables										
	SW	Hth	Educ	Def	Un	GNP	Sen	PH	D/S	Std	OEduc
3.4	-1	a1	a2	a3	a4	a5	0	0	0	0	0
3.5	b2	-1	0	b ₁	0	0	b3	b4	b5	0	0
3.6	c2	0	-1	c1	0	0	0	0	c5	c3	c4

To identify the social welfare equation the two criteria are applied.

1. Order condition: $(K - M) \geq (G - 1)$

There are eleven variables in the model ($K = 11$) and three equations ($G = 3$). The social welfare equation contains six variables ($M = 6$).

$$(K - M) = 5 \text{ and } (G - 1) = 2$$

Therefore, $(K - M) \geq (G - 1)$, and the order condition for identification is satisfied.

2. Rank condition

If the parameter of all variables excluded from the social welfare equation are presented in a matrix, the result is as follows:

$$\begin{bmatrix} b_3 & b_4 & b_5 & 0 & 0 \\ 0 & 0 & c_5 & c_3 & c_4 \end{bmatrix}$$

From this table a number of non-zero determinants of order $(G - 1) = 2$ can be calculated; only one is necessary, therefore:

$$D = \begin{bmatrix} b_4 & b_5 \\ 0 & c_5 \end{bmatrix} = (b_4)(c_5) - (0)(b_5) = b_4c_5$$

The value of the determinant is non-zero, provided that b_4c_5 does not equal zero.

Both the rank and order conditions have been satisfied and thus the social welfare equation of the model is identified. Since in the order condition it is the

inequality sign that holds, this first function is over-identified.

The order conditions for the health and education equations also display over-identification. In each case

$$(K - M) \geq (G - 1)$$

since $K = 11$, $M = 6$, and $G = 3$.

The rank condition for the health equation yields the following matrix

$$\begin{bmatrix} a2 & a4 & a5 & 0 & 0 \\ -1 & 0 & 0 & c3 & c4 \end{bmatrix}$$

while the education matrix is

$$\begin{bmatrix} a1 & a4 & a5 & 0 & 0 \\ -1 & 0 & 0 & b3 & b4 \end{bmatrix}$$

In each case a non-zero determinant can be calculated from the matrices. Thus the entire model is identified and estimation can proceed using the three-stage least square method.

Structural equations only identify the direct relationships between variables: the parameter a_3 , for example, measures the direct effect of a change in military spending on social welfare expenditures. The total effect, which takes into account the interdependencies among the jointly dependent endogenous variables, can only be measured by examining the set of parameters derived from the reduced form of the model. To obtain the reduced form of the structural equations the endogenous variables of equations 3.1, 3.2 and 3.3 above are expressed as a function of the predetermined variables. Thus the social welfare equation, can be rewritten as:¹²⁷

$$SW = a_1 Hth + a_2 Educ + a_3 Def + a_4 Unemp + a_5 GNP \quad (3.7)$$

Substituting equation 3.5 and 3.6 into equation 3.4, we obtain:

$$\begin{aligned} SW = & a_1 (b_1 Def + b_2 SW + b_3 SEN + b_4 PH + b_5 D/S) + \\ & a_2 (c_1 Def + c_2 SW + c_3 Std + c_4 OEduc + c_5 D/S) + \\ & a_3 Def + a_4 Unemp + a_5 GNP \end{aligned}$$

¹²⁷ In order to simplify the mathematical calculations for the reduced-form equations, the constant and the disturbance terms have been omitted. Execution of three-stage least square regression, however, included the constant term.

Multiplying through and then collecting like terms leaves the following relationship:

$$\begin{aligned} SW - a_1b_1 SW - a_2c_2 SW = & Def(a_1b_1 + a_2c_1 + a_3) + a_1b_3 SEN \\ & + a_1b_4 PH + D/S(a_1b_5 + a_2c_5) + \\ & a_2c_3 Std + a_2c_4 OEduc + a_4 Unemp \\ & + a_5 GNP \end{aligned}$$

The parameter of concern for this particular equation is the one which measures the full effect of defence spending on social welfare expenditures, that is

$$SW = \frac{a_1b_1 + a_2c_1 + a_3}{1 - a_1b_2 - a_2c_2} Def \quad (3.8)$$

Similarly, the reduced form of the health equation can be determined by starting with equation 3.2 and ignoring the constant and disturbance terms:

$$Hth = b_1Def + b_2SW + b_3SEN + b_4PH + b_5D/S \quad (3.9)$$

Substituting equation 3.8 into equation 3.9 gives

$$Hth = b_1Def + b_2\left(\frac{a_1b_1 + a_2c_1 + a_3}{1 - a_1b_2 - a_2c_2}\right) Def + b_3SEN + b_4PH + b_5D/S$$

If the defence term is isolated, the equation becomes

$$Hth = b_1 Def + \frac{a_1 b_1 b_2 + a_2 c_1 b_2 + a_3 b_2}{1 - a_1 b_2 - a_2 c_2} Def$$

or

$$Hth = \frac{b_1 - a_1 b_2 b_1 - a_2 c_2 b_1 + a_1 b_1 b_2 + a_2 c_1 b_2 + a_3 b_2}{1 - a_1 b_2 - a_2 c_2} Def$$

or

$$Hth = \frac{b_1 - a_2 c_2 b_1 + a_2 c_1 b_2 + a_3 b_2}{1 - a_1 b_2 - a_2 c_2} Def$$

or

$$Hth = \frac{b_1 - a_2(b_1 c_2 - b_2 c_1) + a_3 b_2}{1 - a_1 b_2 - a_2 c_2} Def$$

The education equation begins with a repeat of equation 3.3 without the constant and disturbance terms:

$$Educ = c_1 Def + c_2 SW + c_3 Std + c_4 OEduc + c_5 D/S \quad (3.10)$$

Substituting equation 3.8 into equation 3.10 gives

$$Educ = c_1 Def + c_2 \left(\frac{a_1 b_1 + a_2 c_1 + a_3}{1 - a_1 b_2 - a_2 c_2} \right) Def + c_3 Std + c_4 OE + c_5 D/S$$

If the defence term is isolated, the equation becomes

$$\text{Educ} = c_1 \text{Def} + \frac{a_1 b_1 c_2 + a_2 c_1 c_2 + a_3 c_2}{1 - a_1 b_2 - a_2 c_2} \text{Def}$$

or

$$\text{Educ} = \frac{c_1 - a_1 b_2 c_1 - a_2 c_2 c_1 + a_1 b_1 c_2 + a_2 c_1 c_2 + a_3 c_2}{1 - a_1 b_2 - a_2 c_2} \text{Def}$$

or

$$\text{Educ} = \frac{c_1 - a_1 b_2 c_1 + a_1 b_1 c_2 + a_3 c_2}{1 - a_1 b_2 - a_2 c_2} \text{Def}$$

or

$$\text{Educ} = \frac{c_1 - a_1 (b_2 c_1 - b_1 c_2) + a_3 c_2}{1 - a_1 b_2 - a_2 c_2} \text{Def}$$

Application of three-stage least-square regression leads to the following estimations:

$$\begin{array}{ccccccccc} \text{SW} & = & 9.60 & \text{Hth} & - & 10.24 & \text{Educ} & + & .29 & \text{Def} & + & .04 & \text{Unemp} & - & .13 & \text{GNP} \\ & & (1.95) & & & (-1.15) & & & (1.56) & & & (2.11) & & & (-.92) \end{array}$$

$$\begin{array}{ccccccccc} \text{Hth} & = & .08 & \text{Def} & + & .18 & \text{SW} & - & .002 & \text{SEN} & + & .42 & \text{PH} & + & .17 & \text{D/S} \\ & & (1.29) & & & (.67) & & & (-1.16) & & & (4.41) & & & (2.11) \end{array}$$

$$\begin{array}{ccccccccc} \text{Educ} & = & -.02 & \text{Def} & - & .04 & \text{SW} & - & .003 & \text{Std} & + & .17 & \text{OEduc} & - & .03 & \text{D/S} \\ & & (-3.87) & & & (-3.01) & & & (-0.56) & & & (13.77) & & & (-3.52) \end{array}$$

The t - statistic for each parameter appears in brackets below the corresponding estimate. All absolute t - statistics over 1.7 are significant at the 5% level, while those between 1.3 and 1.7 are significant at the 10% level. Examination of the Durbin-Watson statistics reveal that autocorrelation was not a problem for the equations at the 1% level.

The conclusion based on these estimates is that no direct negative trade-off appears to exist between defence and social welfare spending, as well as between defence and health expenditures. The relationship between education and defence spending is inverse, although the size of the impact is small at -.02 percent. Defence spending appears to actually increase the level of funding for social welfare and health. A one percent rise in defence spending would result in increases of 0.29% in social welfare spending and 0.08% in health expenditures. Using the 1984 dollar base for illustration, these results suggest that an increase in defence spending of 1% or \$97 million, would increase spending for social welfare and health by \$104 million and \$6 million, respectively, while education expenditures would fall by \$800,000. Relating the results to the original hypotheses, only one of the three statements are supported by the analysis.

The other variables which formed the theoretical framework for each equation suggest that not all relationships behaved as anticipated. The relationship between social welfare expenditures and unemployment rates is positive as predicted, suggesting that as unemployment increases, the level of government spending in social welfare increases. Similarly, the predicted negative relationship between social welfare and GNP appears, implying that expenditures are effected by the state of the economy.

Two of the three additional variables in the equation for health expenditures did not, however, perform as expected. A positive relationship was expected between federal health spending and the number of Canadians over the age of sixty-five. The analysis, however, suggests that the aging of the population does not represent added pressure on the federal health spending envelope. It is quite possible that demand pressures due to population aging is felt at the provincial level where the bulk of government health spending occurs. The relationship between the federal contribution to health expenditures and that of the provinces was expected to be inverse; the analysis depicts the relationship as a positive one, where increases at the federal level are matched by the provinces. The

relationship between health expenditures and the federal deficit, however, was, as expected, positive. The model suggest that a higher deficit will result in lower health expenditures.¹²⁸

We had hypothesised that federal education expenditures would be directly related to number of students enroled at elementary, secondary and post-secondary levels. The analysis, however, indicates that the annual changes in enrolment levels have very little impact on federal education spending. Similarly, the expected inverse relationship between education spending by the federal government and expenditures by other levels of government did not materialize. Unlike health expenditures, education spending was negatively related to the deficit/surplus variable, suggesting that as the deficit increases, education spending will also increase.

Our major concern, as previously stated, is with the question of defence trade-offs. The analysis to this point suggests that no such trade-offs occur, and in fact, the

¹²⁸ Deficits have been expressed as negative values, while surpluses are depicted as positive values. Therefore a direct relationship between health spending and the deficit/surplus variable means that as the deficit increases (becomes more negative), health expenditures decreases (becomes more negative).

relationship between defence spending and what might be labelled federal government social spending is for the most part positive. It should be noted, however, that the analysis deals with direct impacts only. The total effect of military spending on each of the dependent variables can only be obtained by examining the multiplier derived through the reduced-forms of each equation. Therefore, the total effect of defence spending on social welfare is calculated as such:¹²⁹

$$\begin{aligned}
 d(SW)/d(Def) &= \frac{a_1b_1 + a_2c_1 + a_3}{1 - a_1b_2 - a_2c_2} \\
 &= \frac{(9.60)(0.08) + (-10.24)(-0.02) + (0.29)}{1 - (9.60)(0.18) - (-10.24)(-0.04)} \\
 &= \frac{1.33}{-1.21} \\
 &= -1.10
 \end{aligned}$$

Calculations using the reduced-equations for health and education spending yield the following multipliers:

$$d(Hth)/d(Def) = \frac{b_1 - a_2(b_1c_2 - b_2c_1) + a_3b_2}{1 - a_1b_2 - a_2c_2}$$

¹²⁹ The calculations were performed to five decimal places. For presentation purposes, numbers have been rounded off to two decimals.

$$= \frac{(0.08) + 10.24\{(0.08)(-0.04) - (0.18)(0.02)\} + (0.29)(0.18)}{1 - (9.60)(0.18) - (-10.24)(-0.04)}$$

$$= \frac{0.15}{-1.21}$$

$$= -0.13$$

and

$$d(\text{Educ})/d(\text{Def}) = \frac{c_1 - a_1(b_2c_1 - b_1c_2) + a_3c_2}{1 - a_1b_2 - a_2c_2}$$

$$= \frac{(-0.02) - 9.60\{(0.18)(-0.02) - (0.08)(-0.04)\} + (0.29)(0.18)}{1 - (9.60)(0.18) - (-10.24)(-0.04)}$$

$$= \frac{-0.03}{-1.21}$$

$$= 0.02$$

The results of examining the total impact of defence expenditures on the three social spending areas offers strikingly different conclusions. It would seem that the direct consequences of defence spending are more than offset by the indirect impacts. A one-percent increase in military spending as a proportion of aggregate output would reduce federal social welfare and health expenditures by 1.10 percent and 0.13 percent respectively when all interdependent variables are taken into account. Education spending displays a positive relationship with defence expenditures, although it is slight, at 0.02 percent.

Again, the 1984 dollar base can be used for illustration purposes. An increase in defence spending of 1% or \$97 million, will result in longterm negative trade-offs of \$395 million in social welfare spending, and \$9 million in health expenditures. Education spending on the other hand will increase by \$775,000. The results, which confirm the findings of chapter two's multivariate analysis, support two of the three original hypotheses which predicted negative relationships between defence expenditures and the three dependent variables.

CONCLUSION: DEFENCE BUDGETARY TRADEOFFS IN THE CANADIAN ECONOMY

The thesis was centred upon three hypotheses regarding the relationship between Canadian defence spending on the one hand, and federal health, education and social welfare expenditures on the other. In all cases, defence was depicted as the independent variable with the alternative social spending area depicted as the dependent term. The hypotheses tested were:

- H1: Federal spending on education is negatively related to defence expenditures;
- H2: Federal spending on health is negatively related to defence expenditures;
- H3: Federal spending on social welfare is negatively related to defence expenditures;

A review of the existing literature on defence tradeoffs did not lead to any predictable relationship between the variables, but did expose the diversity of techniques used to examine tradeoffs. In general two schools of thought emerge. The first concludes that defence spending acts as a burden on the general economy, dampening growth and investment rates, while at the same time drawing resources away from social programs. A second group emerges with different conclusions, arguing that defence

spending stimulates economic activity, and provides job creation and technological stimulation in a variety of sectors across the economy. With regard to social spending, these researchers point to a positive relationship with defence expenditures.

The contradictory results of the various studies emphasize the sensitivity of econometric modelling to slight changes in conceptualization and data definitions. Substantial differences were observed in the conclusions of simple bivariate studies, more comprehensive multivariate studies and complex simultaneous models. Debates over relevant time-frames, country sample-sizes, and proper variable definition all lead to diverse results. Data collection and consistency also proved to be a problem, as results differed in several studies simply because different data sources were utilized.

This thesis essentially presented a progression of econometric models, from bivariate specification to simultaneous regressions to test the three hypotheses. In effect this progression reflected the range of models used in the literature. The overwhelming majority of the research studies completed to date stop short of examining simultaneous relationships, and even more rarely look at

indirect impacts of the independent variables. This study, therefore, used the existing studies as a starting base, and attempted to extend beyond much of the research presently available.

The first set of equations examined the possibility of longterm tradeoffs, by defining the data (consistent with the literature) in terms of ratios. The regression technique used was single-equation ordinary least-squares. The results in all cases led to the acceptance of two of the three hypotheses, although the strength of the relationships differed slightly. When correcting for problems of autocorrelation, both bivariate and multivariate analyses showed significant negative tradeoffs between defence spending and each of social welfare and health expenditures. Education expenditures also displayed a negative coefficient, but the value was not statistically significant at the stated level.

When the same set of equations were used to examine short-term tradeoffs (by defining the data in terms of annual growth rates), the results did not show any evidence of a negative or positive relationship between the variables. None of the parameters displayed statistical significance and the overall equations did not have high

adjusted r^2 values. Therefore all three hypotheses were rejected. This was not unexpected as the use of percentage changes as the variable definition was not seen as providing an accurate assessment of the budgeting process.

The thesis then examined the tradeoff question through a simultaneous regression model consisting of three equations. When direct impacts were measured, only the relationship between education and defence spending proved to support the hypotheses. Both social welfare and health expenditures showed a positive relationship with defence. When indirect effects were introduced, however, the total relationships reversed. Social welfare and health displayed negative co-efficients, while education was positively related. These results supported the findings of the multivariate analysis completed earlier.

The thesis therefore accepts the hypotheses regarding social welfare and health, but rejects the education hypothesis. Furthermore, the results show that a one percent increase in defence expenditures will negatively effect health spending by 0.13 percent and, perhaps most alarming given the relative size of the envelope, social welfare spending by 1.10 percent.

The policy implications of these results are simple, but significant. At question are the priorities which as a country we wish to pursue in an economic environment governed by financial constraints and increased demands. While the results presented in this thesis may be only a small factor in the larger equation of priority setting, it does point to a clear and simple conclusion: an exclusionary relationship exists between defence spending on one hand, and social welfare and health expenditures on the other, and, therefore, the longterm implication of higher defence spending is that certain social programs will suffer. In light of these findings, and against a background of lasting, widespread poverty and suffering in this country, it would be wise for those inside and out of government calling for increased funding of the military to consider the consequence of such action on the social and economic priorities of the country.

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