

## **Economic Impact of a Military Base on Its Surrounding Economy: The Case of CFB Esquimalt, Victoria, British Columbia**

J. J. M. Rioux and J. A. Schofield  
Department of Economics  
University of Victoria  
Victoria, British Columbia V8W 3P5

The economic influence of military bases on their host communities has been a relatively neglected subject in Canada. An early study by the Nova Scotia government (Nova Scotia 1967) and two reports by the Operational Research and Analysis Establishment (Lafleur 1974; McRoberts 1974) are examples of the limited Canadian literature on the subject. Yet the economic impact of military bases has become a salient issue with the proposed closure of Canadian Forces Base (CFB) Summerside, Prince Edward Island, and six other bases as announced in the March 1989 federal budget statement. Moreover, base closures have occurred recently in other countries, and future closures may be anticipated as East-West tensions lessen.

This analysis will estimate the economic impact of the normal operations of the regular force at CFB Esquimalt in Victoria on its host community, the Capital Regional District (CRD) of British Columbia. Impact is identified in terms of both income generated (for fiscal year 1986-87) and employment created in the region (as of June 1987). The analysis uses a method of estimation that appears to provide a more comprehensive measure of impact than is achieved with some other methods often used when local input-output tables based on census surveys of establishments are not available. The analysis is characterized by development of income and employment multipliers associated with injections of spending into the CRD economy through the base.

---

The authors are indebted to S. MacDonald, anonymous referees, and the editor of this journal for useful comments on drafts of this paper.

Certain previous studies of military base impact employed a more rudimentary framework of analysis than is used here. Some merely estimated the direct impact of military spending on the local economy (Thompson 1962; McRoberts 1974), abstracting from indirect and induced effects stemming from multiplier processes generated by the direct (or initial) injection of spending.<sup>1</sup> Other studies approximated multiplier effects by use of a simple economic base multiplier (Terner 1965; Callan 1967; Erickson 1977) that fails to take into account the specific spending patterns at the installation under analysis and thus could distort first-round spending impact. Still other studies borrowed multiplier values estimated elsewhere for other purposes (Nova Scotia 1967; Lafleur 1974). Although we were unable to base our analysis on the most satisfactory basis for multiplier estimation—survey-based local input-output tables—we were able to use a survey of base spending patterns to gauge first-round impact. Also, the analysis takes into account indirect and induced expenditure multiplier effects and avoids the need to rely on multiplier values generated elsewhere.

To estimate the first-round spending impact in studies of major facilities (for example, universities, power stations, military bases), it is important to identify the spending behaviour specific to the operation in question because such behaviour is likely to differ from that in the community at large. In particular, it is important to identify the propensity to spend locally out of factor incomes paid at the facility, the propensity to make local purchases for operating purposes (as well as for capital construction if the impact of a new development is under consideration), and the sectoral distribution of local expenditures. In this respect, impact analyses of major institutions and installations are somewhat different from the usual multiplier analyses of the impact of an autonomous change in final demand.

In the remainder of this paper, a description of the organizational and demographic structure of CFB Esquimalt and the main features of the CRD economy is followed by an outline of the income and employment multiplier models employed in the study, an estimation of these models, and a summation of the impact of the base on the regional economy.

1. Indirect effects are represented by forward and backward production linkages. Induced effects represent the Keynesian income multiplier effects of induced consumption spending (and induced investment and export spending if these elements of expenditure are endogenized) resulting from the initial injection of spending.

## Background

CFB Esquimalt is the largest military base in British Columbia; it supports some 79 units and detachments. In 1966, during the integration phase of the Canadian Forces, a number of separate sites were amalgamated in administrative terms into CFB Esquimalt. Of the 5,240 members of the regular force at CFB Esquimalt as of June 1987, 79.8 percent were non-commissioned members (NCMs) and 20.2 percent were officers; 2,482 civilians also worked at the base.

CFB Esquimalt is the home port of two squadrons of destroyers, one replenishment ship, and numerous smaller vessels. Thus, at any one time a significant number of military personnel are posted to ships. Indeed, of the total military personnel assigned to the base in June 1987, 36.2 percent of NCMs and 3.6 percent of officers were posted to ships.

The Capital Regional District comprises the southern tip of Vancouver Island and the Gulf Islands, which lie between Vancouver Island and the mainland. The total land area of the CRD is 937 square miles, composed of seven municipalities, some unorganized territories, and Indian reserves. The population of the CRD in 1986 was 262,000.

The main source of income in the CRD is the service sector, which supports 83.5 percent of regional employment (1981 Census), with government being the largest employer, followed by retailing, health and welfare services, and education. Manufacturing and construction industries account for about 14 percent of total employment and primary industry (agriculture, forestry, and fishing) for only some 2.5 percent. Total employment in 1986 was approximately 100,000.

## Income and Employment Multiplier Models

To gauge the full impact of the normal operations of the military base on the CRD economy, it is necessary to assess the multiplier effects of spending and employment associated directly with the base—in principle, by linking base spending and employment to income and employment multipliers estimated from input-output data. Using this method, it is possible to capture the forward and backward production linkages of the base as well as the induced effects of the spending multiplier (to the extent that final demand sectors are endogenized in the input coefficient table). Moreover, input-output multipliers are computed separately for each sector of the economy so that economy-wide impacts of economic perturbations can be estimated according to the sector in which they occur.

In the absence of input-output tables for many local economies (and given the cost of creating such tables), three broad alternative approaches have been used for estimating local multipliers. In the first approach, short-cut techniques are utilized for estimating input-output coefficients. These range from various non-survey methods (such as use of national coefficients at the local level) to attempts to estimate multipliers on the basis of local purchase coefficients (the proportion of sector demand satisfied locally—see, for example, Drake 1976; Stevens and Trainer 1976). Because the reliability of short-cut input-output techniques remains questionable (Park et al. 1981), it is arguable whether such techniques have a necessary advantage over the method used in this analysis.

The second approach to local multiplier estimation is to estimate Keynesian expenditure multipliers either by an armchair approximation based on published statistics (see Archibald 1967; Brown et al. 1967) or by use of some survey together with published statistics (see, for example, Greig 1971; Brownrigg 1973; McGuire 1983; Glasson et al. 1988). This approach takes only partial account, if any, of the so-called indirect, as opposed to induced, multiplier effects of expenditure injections—that is, the production linkage effects measurable by input-output analysis—and does not usually produce multipliers disaggregated by sector.

The third approach is to use the economic base multiplier, estimated as the ratio of total regional income or employment to income or employment in the basic (or export) sector. Census surveys of local firms to determine functional characteristics, geographic sources of revenue, and residential patterns of employees generate multiplier estimates in which investigators have strong confidence (Gibson and Worden 1981; Mulligan and Gibson 1984b). Cost, however, remains a constraint on the value of this approach in large local economies. As a result, basic sector income and employment are often estimated using as short-cuts either minimum requirements or location quotient techniques (see below) or the sample survey method. In principle, the base approach captures both indirect and induced multiplier effects, and, although aggregate multipliers are usually developed, disaggregated sectoral multipliers can be generated if survey data are used (see, for example, Mulligan and Gibson 1984a).<sup>2</sup>

In our analysis, the multiplier is akin to one developed for evaluating the impact of a university on a local economy (Wilson and Raymond 1973; Wilson 1977). The multiplier uses (1) sector-specific information generated by a questionnaire survey of first-round local

2. At least for one set of communities, sectoral base multiplier estimates compare favourably with survey-based input-output multipliers (Mulligan and Gibson 1984a).

spending through the military base, and (2) economic base analysis. This method would appear to be appropriate for assessing the local impact of a major facility in situations in which the local area is too large for use of census survey-based input-output or economic base analysis. It produces a more precise evaluation of impact than that produced by simply applying a generalized multiplier value (of the input-output Keynesian or economic base type) to military base spending without taking into account immediate leakages from the local income stream. At the same time, the method goes beyond Keynesian and economic base methods that typically abstract from sectoral spending detail. It also goes beyond the Keynesian approach in terms of incorporating both indirect and induced spending effects. Moreover, there is evidence (Gibson and Worden 1981), to the extent that the minimum requirements procedure is used, that the method may be superior to economic base analysis that relies on the sample survey approach. Finally, as indicated earlier, it is not clear that short-cut input-output techniques have an advantage over the method used in this analysis.

### Income Multiplier

The income multiplier is derived from the following expression which defines the impact of an injection of spending into the local economy as the sum of additional local income created at each round of the expenditure multiplier process:

$$Y = X + m_1 X + m_1 m_2 X + m_1 m_2^2 X + \dots + m_1 m_2^n X + \dots \quad (1)$$

where  $Y$  is the income impact on the local economy;  
 $X$  is the initial spending injection that accrues as income in the local economy;  
 $m_1$  is the proportion of  $X$  that materializes at the first round of spending as local value added;  
 $m_2$  is the average propensity to consume locally—that is, the value corresponding to  $m_1$  at subsequent rounds of spending in the local economy as a whole; and  
 $m_1$  is  $\sum a_i b_i$ , in which  $a_i$  is the proportion of total unit-related spending that remains in the local economy at the first round of spending for each of  $i$  categories of expenditure and  $b_i$  is the local value added in each category of expenditure.

It follows from equation (1) that

$$Y = X(1 - m_2 + m_1)/(1 - m_2) \quad (2)$$

so that the income multiplier is

$$(K = Y/X) = (1 - m_2 + m_1)/(1 - m_2) \quad (3)$$

As defined here, the multiplicand ( $X$ ) excludes initial expenditures that never accrue as local income. Thus, in our analysis immediate leakages out of the base procurement budget into imported commodities are excluded from the multiplicand.<sup>3</sup> The above multiplier formulation also does not take into account the possibility of induced investment spending or repercussive spending effects generated from "export" sales or tax payments to outside jurisdictions. These possibilities are not considered material to the current context. Finally, if  $m_1 = m_2$ , the multiplier is defined as  $1/(1 - m_2)$ , the simplest version of the standard multiplier (assuming that average and marginal propensities to consume locally are equal).

### Employment Multiplier

In terms of income, a non-basic sector multiplier ( $K_{nb}$ ) can be defined as the total multiplier ( $K$ ) minus unity (Wilson and Raymond 1973). Similarly, in terms of employment a non-basic sector multiplier ( $K_{enb}$ ) can be defined as the total multiplier ( $K_c$ ) minus one so that

$$K_c = K_{enb} + 1 \quad (4)$$

The non-basic sector employment multiplier may be approximated as

$$K_{enb} = K_{nb}(W_b/W_{nb}) \quad (5)$$

where  $W_b$  is the mean labour income per period in the unit under analysis, and  $W_{nb}$  is the mean labour income per period in the local economy. Thus,

$$K_c = K_{nb}(W_b/W_{nb}) + 1 \quad (6)$$

## Multiplier Estimation

### Income Multiplier

Estimation of the income multiplier requires values for the proportions  $m_1 (= \sum_{i=1}^n a_i)$  and  $m_2$ . These are estimated below to be 0.30 and 0.53-0.65,

3. The multiplicand is defined as the military base budget net of procurement imports plus grants paid to municipalities on behalf of the base in lieu of local property taxes (see note 5).

respectively, so that the range of values for the income multiplier is 1.64-1.86.

To estimate the proportion ( $m_1$ ) of the initial spending injection ( $X$ ) remaining in the local economy at the first round of spending for each of  $i$  categories of expenditure ( $a_i$ ), base spending is disaggregated into four elements: (1) the base procurement budget, (2) expenditures by civilian personnel, (3) expenditures by military personnel, and (4) grants paid to local municipalities in lieu of local property taxes (GILT).<sup>4</sup> Expenditures in these four areas are then distributed over  $i$  sectors of the local economy, after deducting from the military base budget immediate leakages from the local economy into purchases outside the CRD, savings, and federal and provincial income taxes (including social insurance deductions).<sup>5</sup> Results are displayed in the first five columns of Table 1.

Dollars injected into local industries from the military base procurement budget of \$35.3 million (1986-87) are shown in column (1) of Table 1. The sectoral allocation of procurement spending as well as the separation of local and non-local spending through the procurement budget is based on a census of cheque registers for 1985-86 (1986-87 registers did not include sectoral "resource codes" for identifying the industry in which an expenditure was made). This procedure assumes that the proportionate distribution of expenditures across industries and the split between local and non-local spending were the same in 1985-86 and 1986-87.

To estimate the annual sectoral distribution of local purchases by civilian and military personnel (columns (2) and (3) of Table 1), we distributed 1,000 questionnaires to a 13 percent sample of military base personnel during the months of July and August 1987. The questionnaire was designed to determine typical monthly spending patterns within the CRD out of take-home household income less savings. The sample was stratified by rank, sex, and posting for military personnel and by sex and classification for civilian personnel. The survey was distributed through military base units, in accordance with sample stratification requirements. Thus, only units with 15 or more members received questionnaires as too great a loss of precision in the stratification of the sample would have occurred in the smaller units. Only those ships in port or close to Victoria were included in the survey because of the difficulty and time delays involved in communi-

4. Grants-in-lieu-of-taxes are included in military base spending because the existence of the base accounts for their injection into the local economy.  
5. Multipliers are underestimated to the extent that (1) the local economy receives reinjections of spending out of the proceeds of saving and taxes, and (2) purchases outside the CRD augment non-local incomes, which in turn increase "export" demand for local commodities (see the subsection "Income Multiplier").

TABLE 1 Computation of  $m_1$

Sector	Local Spending (\$)				Total (\$)	$a_i$	$b_i$	$(6) \times (7)$
	Annual Procurement Budget	Annual Personnel Expenditures		Annual GILT				
		Civ. (2)	Mil. (3)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
<i>Manuf. industry</i>								
Food & bev.	916,857				916,857	0.003841	0.512741	0.001969
Misc. semi-durables	165,739				165,739	0.006694	1.000000	0.006694
Furn. & fixtures	52,896				52,896	0.00222	1.000000	0.00222
Printg. & pub.	404,747				404,747	0.001696	0.750639	0.001273
Primary metals	5,995				5,995	0.00025	0.630852	0.00015
Metal fabricating	208,056				208,056	0.000872	0.959014	0.000835
Machinery ind.	6,700				6,700	0.00028	0.852127	0.00023
Transportation equip.	3,879				3,879	0.00016	0.905997	0.00014
Elec. pdts.	6,700				6,700	0.00028	0.984112	0.00027
Non-metallic minerals	2,468				2,468	0.00010	0.642714	0.00006
Petrol. & coal pdts.	91,686				91,686	0.00384	0.411777	0.00157
<i>Construction</i>	2,010,032				2,010,032	0.008420	0.822980	0.006929
<i>Transportation, commerce &amp; storage</i>	136,231	563,704	749,286		1,449,221	0.006071	0.550194	0.003340
<i>Utilities</i>	305,492				305,492	0.001280	0.212554	0.000272
<i>Wholesale trade</i>	3,949,536				3,949,536	0.016545	0.604688	0.010004
<i>Retail trade</i>	1,698,554	16,532,807	31,160,529		49,391,890	0.206908	0.704999	0.145870
<i>Finance, ins., real estate</i>	95,979	17,044,102	32,698,807		49,838,888	0.208780	0.209431	0.043275
<i>Communications, business, personal services</i>								
Commissioned services	109,318				109,318	0.021394	0.498367	0.010662
Accommodation & food	2,645,887	1,602,494	3,395,247		5,107,059	0.011084	0.746498	0.008273
Bus. mgmt.	735,208	2,786,305	5,970,456		9,492,169	0.039764	0.562564	0.022369
Other								
Non-comm. services								
Education & rel. serv.	1,376,495				1,376,495	0.005766	0.793428	0.004575
<i>Public admin. &amp; defence</i>	162,213	1,722,271	948,171	4,677,946	7,510,601	0.031463	0.732739	0.023053
<i>Special sectors</i>								
Water & heating oil	1,885,739				1,885,739	0.015589	0.408621	0.006370
Charities	421,542				421,542	0.003317	0.818091	0.002714
Other expenditures	1,519,759				1,519,759	0.013187	0.691361	0.009117
						Total = 0.597384		$m_1 = 0.302507$

Notes: The figures in col (5) are obtained by summing cols. (1), (2), (3), and (4) by industry. In col. (6)  $a_i$  is obtained by dividing the respective totals in col. (5) by the sum of the gross pay of base personnel, the base procurement budget net of imports, and GILT (52,387,143,988). Only the industries affected by the expenditures emanating from the base are included in this table.  $a_i$  = local proportion of total spending;  $b_i$  = local proportion of value added.

- Only categories of expenditure that affected the local economy were included. For example, "electricity" was not considered because all payments in this category are made outside the CRD.
- This procedure underestimates local value added to the extent that non-labour income remains within the local economy; it overestimates local value added to the extent that labour commutes into the CRD for employment. The latter is not an important factor.

cating with other ships. Within each stratum, respondents were chosen in alphabetical order from unit rolls (REMARS). The response rate in terms of usable questionnaires was 30.4 percent.

Respondents were asked to report their monthly household income after taxes and other deductions and to allocate this sum for a typical (or average) month to the following categories of expenditure: water and heating; cable television; rent (excluding rent for on-base quarters); payments to financial institutions for insurance, mortgage, and other loan payments; retail store spending according to type (for example, spending on food for home consumption, footwear and clothing, tobacco and alcoholic beverages, personal services); amusement and recreation (movies, theatrical and staged entertainment, sports activities, and other activities such as vacation trips); eating and drinking establishments; charities (including churches); other expenditures.<sup>6</sup> Respondents also were asked to indicate how much they paid in property taxes in the most recent year, whether they lived outside the CRD, and what amount in each of the foregoing expenditure categories was typically spent inside the CRD. On the basis of the above information it was possible to complete columns (2) and (3) of Table 1.

After adding grants-in-lieu-of taxes (GILT) for 1986-87 in column (4), the estimated total annual military base expenditures inside the local economy can then be shown by sector in column (5) and as proportions ( $a_i$ ) of the initial spending injection in column (6). The sum of column (6) shows that 60 percent of the initial injection is estimated to materialize in the first round as local spending.

To estimate  $m_1$ , it is necessary to multiply column (6) by column (7), the local value added created by expenditure in each sector. Following Wilson (1977), the payroll-to-sales ratio (PSR) in each sector is used as a proxy for local value added.<sup>7</sup> Payroll by sector is estimated from provincial average weekly earnings by sector (Statistics Canada 1986) and employment data (Statistics Canada 1984). Sales by sector are estimated on the basis of the distribution of the provincial gross domestic product (GDP) by industry for the Province of British Columbia (British Columbia 1986a, 1986b). Provincial GDP is allocated to the CRD on the basis of the proportion of the provincial population in the CRD. Use of GDP as a proxy for sales underestimates the value of sales.

Finally, estimates of  $a_i b_i$  are shown in column (8) of Table 1: the estimate of  $m_1 = \Sigma a_i b_i$  is estimated at 0.30. To the extent that non-labour income is part of local value added, the estimate of  $m_1$  (and thus the size of the multiplier) is biased downward. But, to the extent that local GDP underestimates local sales, the payroll-to-sales ratio,  $m_1$ , and the multiplier are overstated.

The value of  $m_2$ , which measures the proportion of each dollar of consumption paid to local factors of production in subsequent rounds of the multiplier process, is estimated using the economic base method. If it is assumed that employment is proportional to income, the proportion of income spent locally is equal to the ratio of non-basic (or service) employment (NBE) to total employment (TE). If it also is assumed that average and marginal propensities to spend locally are equal, the simple multiplier becomes

$$TE/BE = 1/(1 - NBE/TE) \quad (7)$$

where BE is basic (or exogenous) employment. Thus, the ratio NBE/TE is used as the estimate of  $m_2$ . In this formulation the multiplier captures both indirect and induced multiplier effects.

Two widely used methods are employed to give a range estimate of the non-basic ratio NBE/TE: the minimum requirements (MR) and the location quotient (LQ) methods. Using the MR method, basic (or export) employment in industry  $i$  in area  $j$  is represented as  $(e_{ij} - e_{im})E_j$ , where  $e_{ij}$  is the proportion of area employment in industry  $i$ ,  $e_{im}$  is the proportion of area employment in industry  $i$  in the area with the lowest such proportion (the minimum requirement assumed necessary to service the local market), and  $E_j$  is the employment in area  $j$ . In other words, employment above the minimum requirement is considered to be export employment. Thus, the ratio NBE/TE in area  $j$  equals  $1 - (e_{ij} - e_{im})$ . Using the LQ method, LQ equals  $(e_{ij}/e_{im})$ , where  $e_{ij}$  is as defined above and  $e_{im}$  is the proportion of national employment (or employment in some benchmark economy other than the national economy) in industry  $i$ . To the extent that LQ is greater than one, it is assumed that industry  $i$  serves the export market. Thus,  $(e_{ij} - e_{im})E_j$  represents export employment, and NBE/TE equals  $1 - (e_{ij} - e_{im})$ . Clearly, the MR method gives a lower estimate of the multiplier than the LQ method because the value of  $m_2 = NBE/TE$  is lower as estimated by the MR method, given that  $e_{im}$  is less than  $e_{in}$ .

Following Moore (1975), Erickson (1977), and Moore and Jacobsen (1984), the ratio NBE/TE, measured from the MR method, is assumed to be such that

$$NBE/TE = \alpha + \beta (\log_{10} P) \quad (8)$$

where  $P$  is the population size of the community. The procedure is to estimate equation (8) from a cross-section of cities grouped into size classes and to determine  $m_2$  for the CRD by inserting CRD population into the fitted equation. Using the data given in the Appendix—employment data disaggregated into 15 sectors—the following equation is obtained by application of the OLS method with a correction for autocorrelation (Cochrane-Orcutt method):

$$NBE/TE = -0.41762 + 0.17654 [\log_{10} P] \quad R^2 = 0.85 \quad (9) \\ (-2.1287) \quad (4.5592)$$

where the statistics in parentheses are  $t$ -values. Then, the value of  $m_2$  for the CRD is equal to  $-0.41762 + 0.17654 [5.3683] = 0.53$ .

Based on the LQ method applied to employment data disaggregated at the three-digit Standard Industrial Classification (SIC) level—and following Isserman (1977), all federal government, hotel, tourist, and motel employment is assigned to exogenous employment—export employment is estimated to be 34,593 so that  $m_2 = 1 - 34,593/100,000 = 0.65$ .

### Employment Multiplier

To estimate the employment multiplier, estimates of the mean labour income both at the military base and in the service sector of the CRD are needed. Mean annual gross earnings at the military base are computed as \$25,646 (1984 dollars), and mean annual personal income in the service sector of the CRD is \$19,192 (1984 dollars) as provided by the CRD information office and based on Revenue Canada returns. Since the latter figure measures total income (including pension income, investment income, and the like), and the former measures only employment income, the value of the employment multiplier is underestimated.

On the basis of the foregoing values, the employment multiplier ( $K_e$ ) derived from the income multiplier based on the MR method is  $K_e = 0.64 (25,646/19,192) + 1 = 1.86$ . Using the LQ method as the basis of estimating the income multiplier, the upper-bound value for the employment multiplier is  $K_e = 0.86 (25,646/19,192) + 1 = 2.15$ .

### Military Base Impact on the CRD Economy

The total initial annual amount of spending through the military base that accrues as local income ( $X$ ) comprises the gross pay of military base personnel, the military base procurement budget net of imports, and grants-in-lieu-of-taxes. This sum excludes expenditures on major

capital projects. For fiscal year 1986-87 the total was \$238.7 million (see notes to Table 1). With an income multiplier of 1.64, this means that the normal operations of the regular force at the military base in 1986-87 are estimated to have generated approximately \$391.5 million in income retained in the CRD economy. Incremental local income created outside the defence sector is estimated to be \$172.5 million, or \$391.5 million less \$219.0 million (gross pay of military base personnel). Using the upper-bound income multiplier estimate of 1.86, the effect on total regional income and regional income outside the defence sector amounts to \$440 million and \$225 million, respectively.

In terms of employment impact, the estimated employment multiplier range of 1.86-2.15 implies that on top of the 7,722 jobs at the military base as of June 1987, another 6,600-8,900 existed outside the defence sector, for a total impact on regional employment of approximately 14,400-16,600 jobs.

### Conclusions and Implications

Using a multiplier model that distinguishes between spending behaviour in the unit under analysis (the military base) and in the community at large, it is estimated that the normal operations of the regular force at CFB Esquimalt generated between \$391.5 million and \$440 million (fiscal year 1986-87) in income for the local economy of the CRD. These estimates are based on income multiplier values of 1.64 (the more likely value) and 1.86 (an upper-bound estimate) as applied to an initial spending injection defined as aggregate base expenditures less procurement imports plus grants paid to local municipalities in lieu of taxes. Estimates of annual local income generated outside the defence sector are \$172.5-\$225 million.

Based on employment multiplier estimates of 1.86-2.15, the total employment impact of the military base is estimated to be 14,400-16,600 jobs (as of June 1987), or an incremental impact outside the defence sector of approximately 6,600-8,900 jobs. These latter estimates imply that some 14.4 percent of total employment in the regional economy (16.6 percent at the upper bound) is attributable to the existence of the military base.

As with the results of most multiplier studies, the results of this study should be interpreted with caution. In the absence of a current input-output table (or at least an economic base study) based on a detailed survey, considerable approximation is inevitable.<sup>8</sup> The

8. Together with aspects of approximation identified earlier in the body of the analysis, the method employed does not fine-tune for certain factors found to

approach adopted here, however, does have the merit of distinguishing between spending patterns in the unit under analysis and in the community at large, specifically in terms of the propensity to spend locally and the sectoral distribution of local spending. Estimated multipliers also incorporate indirect as well as induced multiplier effects. Moreover, ranges of multiplier values are generated so as not to give the impression of spurious precision. On the basis of judgement, we prefer to think that the lower ends of the ranges are more realistic, with the upper-bound values representing limits unlikely to be exceeded. This position is consistent with the finding that the minimum requirements method that yields the lower-bound values is perhaps the most reliable of short-cut economic base methods (Gibson and Worden 1981).

Even accepting the approximate nature of the estimates, it is clear from the order of magnitude of the results that the military base exerts a major influence on its surrounding economy. This influence would be even greater if capital spending at the base and the effect on the regional economy of visits to the base by foreign ships were taken into account. This study has not, however, addressed the possibility that the base may impose costs, at least for some people, as well as benefits on the local economy. Relevant here, for example, might be such items as forgone land development values at the sites of the base and negative intangible effects (such as visits by ships carrying nuclear weapons) associated with naval operations.

Finally, it is necessary to caution against the simplistic application of the multiplier values estimated in this study to cases of base impact elsewhere or to impact analyses involving other types of facilities. Clearly, every facility and every community has its own particular spending characteristics. In the case of military bases, for example, local impact will depend on base operations and the size of the community to which the base is connected (in the sense of the ability of the local economy to service the base and to provide goods and services for local residents). Thus, it would be inappropriate, except as a very rough indication, to use the findings of this study as a basis for estimating the impact of closing CFB Summerside or other bases in Canada or elsewhere. Nevertheless, the method appears to provide a tractable approach for use in situations involving military

influence estimated impact values elsewhere. Examples include adjustments for federal tax revenues raised locally and recycled into the local economy as part of base funding itself (Moore 1974), transfer payments received by individuals in the area, wage variability among and within employment sectors, and out-commuters who live in the locality but earn their income outside (Gibson and Worden 1981). In this study, however, the first and last of these examples are insignificant.

bases or other major local facilities where census survey-based input-output or economic base multipliers are unavailable.

## References

- Archibald, G. C. 1967. "Regional Multiplier Effects in the UK", *Oxford Economic Papers*, 19(1):22-45.
- British Columbia Ministry of Economic Development. 1986a. *British Columbia Regional Index*. Vancouver: Mitchell Press.
- . 1986b. *Economic Accounts 1971-84*. Victoria: Queen's Printer.
- Brown, A. J., H. Lind, and J. Bowers. 1967. "The Green Paper on the Development Areas", *National Institute Economic Review*, 40:33.
- Brownrigg, M. 1973. "The Economic Impact of a New University", *Scottish Journal of Political Economy*, 20(2):123-139.
- Callan, P. C. 1967. "The Economic Impact of Fort Detrich on Frederic, Maryland", M.A. thesis, University of Maryland, College Park.
- Drake, R. L. 1976. "A Short-cut to Estimates of Regional Input-Output Multipliers: Methodology and Evaluation", *International Regional Science Review*, 1(2):1-17.
- Erickson, R. A. 1977. "Sub-regional Impact Multipliers: Income Spread Effects from a Major Defense Installation", *Economic Geography*, 53(3):283-294.
- Gibson, L. J., and M. A. Worden. 1981. "Estimating the Economic Base Multiplier: A Test of Alternative Procedures", *Economic Geography*, 57(1):146-159.
- Glasson, J., D. Van De Wea, and B. Barrett. 1988. "A Local Income and Employment Multiplier Analysis of a Proposed Nuclear Power Station at Hinkley Point in Somerset", *Urban Studies*, 24(3):248-261.
- Greig, M. A. 1971. "The Regional Income and Employment Effects of a Pulp and Paper Mill", *Scottish Journal of Political Economy*, 18(1):31-48.
- Isserman, M. 1977. "The Location Quotient Approach to Estimating Regional Economic Impacts", *Journal of the American Institute of Planners*, 43(1):33-41.
- Lafleur, L. M. 1974. *The Economic Impact of CFB Cornwallis on its Micro-Environment*, Report No. R38. Ottawa: Operational Research and Analysis Establishment.
- McGuire, A. 1983. "The Regional Income and Employment Impacts of Nuclear Power Stations", *Scottish Journal of Political Economy*, 30(4):264-274.
- McRoberts, B. G. 1974. *The Military Base and the Community—An Economic Analysis*, Report No. R45. Ottawa: Operational Research and Analysis Establishment.
- Moore, C. L. 1974. "The Impact of Public Institutions on Regional Income: Upstate Medical Centre as a Case in Point", *Economic Geography*, 50(2):124-129.
- . 1975. "A New Look at the Minimum Requirements Approach to Regional Economic Analysis", *Economic Geography*, 51(4):350-356.
- Moore, C. L., and M. Jacobsen. 1984. "Minimum Requirements and Regional Economics", *Economic Geography*, 60(3):225-237.
- Mulligan, G. F., and L. J. Gibson. 1984a. "A Note on Sectoral Multipliers in Small Communities", *Growth and Change*, 15(4):3-7.
- . 1984b. "Regression Estimates of Economic Base Multipliers for Small Communities", *Economic Geography*, 60(3):225-237.
- Nova Scotia. 1967. *A Study of the Economic Impact of C.F.B. Cornwallis on the Surrounding Communities*. Halifax: Economics and Development Division, Department of Trade and Industry.
- Park, S-H, M. Mohtadi, and A. Kubursi. 1981. "Errors in Regional Non-Survey Input-Output Models: Analytical and Simulation Results", *Journal of Regional Science*, 21(3):321-387.
- Statistics Canada. 1984. *1981 Census of Canada*, Cat. Nos. 93-961 to 93-972. Ottawa: Queen's Printer.
- . 1986. *Employment, Earnings and Hours*, Cat. 72-002. Ottawa: Queen's Printer.
- Stevens, B. H., and G. H. Trainer. 1976. "The Generation of Error in Regional Input-Output Impact Models", Regional Science Research Institute Working Paper A1-76, Amherst, Massachusetts.
- Terner, I. D. 1965. "The Economic Impact of a Military Installation on the Surrounding Area: A Case Study of Fort Devens and Ayer, Massachusetts", M.A. thesis, Harvard Graduate School of Design, Cambridge, Massachusetts.
- Thompson, C. B. 1962. "An Economic Appraisal of Donaldson Air Force Base upon Greenville, South Carolina", M.S. thesis, Clemson University, Clemson, South Carolina.
- Wilson, J. H. 1977. "Impact Analysis and Multiplier Specification", *Growth and Change*, 8(3):42-46.
- Wilson, J. H., and R. Raymond. 1973. "The Economic Impact of a University upon the Local Community", *Annals of Regional Science*, 7(2):130-143.

## Appendix: Data for Computation of $m_2$ Using the Minimum Requirements Method

City Class	Number of Cities	Median Population	Minimum Employment (as % of total)
1	3	2,828,349	71.59
2	3	657,057	55.10
3	3	576,075	54.20
4	13	164,313	60.87
5	11	88,330	56.14
6	14	58,924	49.01
7	20	34,411	45.55
8	18	24,026	34.53
9	17	16,866	24.52
10	26	13,528	29.92
11	25	11,353	23.86

Source: Statistics Canada. 1984. *1981 Census of Canada*. Cat. Nos. 93-961 to 93-972. Ottawa: Queen's Printer.