

THE ECONOMIC IMPACT OF CFB ESQUIMALT UPON THE CAPITAL
REGIONAL DISTRICT, BRITISH COLUMBIA

by

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The economic impact of CFB Esquimalt upon the Capital
Regional District, British Columbia

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ABSTRACT

The present project proposes a more sophisticated model than previously employed in Canada for the study of the economic impact of a military base. The model is applied to the specific case of **the normal operations of the regular force at CFB Esquimalt during the fiscal year 1986-87**. It provides a framework for the analysis of the income and the employment impact on the Capital Regional District, B.C.

Specifically, an income multiplier (K_3) is estimated for CFB Esquimalt. K_3 is formulated such that the first round propensities to spend locally out of spending infusions at the economic unit being studied are distinguished from these propensities at subsequent rounds in the community at large. K_3 is an amalgam of two other multipliers (K_1 and K_2) which assume, in different ways, that the propensities to spend locally out of incremental income are the same for the particular economic unit and for its host community. The value of K_3 is estimated at 1.85 using the minimum requirements technique. Using the alternative location quotient technique, an upper bound value of 2.14 is estimated.

The total gross injection of spending by the base into the regional economy is \$258.89 million for 1986-87. Multiplying this value by K_3 yields an estimated total impact in terms of regional income generated outside of the defence sector in the order of \$220 million. The upper bound estimate of this impact is approximately \$295 million.

Finally, K_3 is converted into an employment multiplier to find the effect on regional employment. The estimated value of the employment multiplier is 2.14 with an upper bound value of 2.52. It is estimated that the economic activities under investigation create approximately 16500 jobs (7722 at the base and around 8800 elsewhere in the

region). The upper bound estimate of the employment impact is found to be no more than 19460 jobs.

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DEDICATION

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A mes parents et ma soeur, pour avoir été loin de vous pendant la rédaction de ce long projet.

CHAPTER 1. INTRODUCTION

The economic impact of military spending, both at the macro and micro level, has been the focus of intense research, especially in the United States. This is understandable when we look at the amount of resources devoted to the defence sector in that country (7.2% of the GNP in 1982). However, the situation is quite different in Canada where very few impact studies have been conducted. This reflects a more general neglect of defence economics in this country. Indeed, "Defence is not a subject which has fired the creative energies of Canadian economists" [110, p.1]. For example, in the first fifteen years of the existence of the Canadian Economic Association, not a single paper on defence was presented at the annual meetings, nor was any article published in the Canadian Journal of Economics. By contrast, three papers related to defence were presented at the 1982 annual meeting of the American Economic Association alone [110, p.1 of footnotes].

The study of the influence of military bases on their host communities has also been a subject of neglect in Canada. An early study of the Nova Scotia government [99] and two reports [105, 109] produced by the Operational Research and Analysis Establishment essentially form the

background literature on the matter in a Canadian context. A feature of these studies, however, is that they use the concept of the regional multiplier only to a very small extent. This project is different in that it emphasizes the importance of developing a specific multiplier for the purpose of evaluating the economic impact of **the normal operations of the regular force at CFB Esquimalt upon the Capital Regional District (CRD)**. The impact is in terms of income generated in the region and of total effect on regional employment.

This thesis is divided into nine chapters. The first is, of course, the introduction which addresses the question to be answered. The second is a description of the base (its activities, size and location) and of the local economy. The third chapter is a review of the literature on income and employment multipliers as well as alternative techniques for conducting impact studies. The methodology to be used and the specification of the multiplier models are covered in the fourth chapter. The fifth chapter explains the procedures for estimating the models. The sixth chapter contains the empirical estimation of the multipliers. The seventh chapter outlines the impact of CFB Esquimalt on the CRD economy. Finally, a summary and conclusion constitutes

the eighth chapter. Details of the empirical analysis are provided in appendices.

CHAPTER 2. BACKGROUND TO THE STUDY: THE CAPITAL REGIONAL DISTRICT AND CFB ESQUIMALT.

2.1 The Capital Regional District

The Capital Regional District (CRD) covers the southern tip of Vancouver Island with a total land area of 937 square miles. The core region is bordered by the Outer Gulf Islands and the Saltspring Electoral Areas on its northern boundary and the Sooke Electoral Area on its western boundary (see map in appendix A). Table 1 shows the municipalities and electoral areas included in the CRD along with their respective populations.

As figure 1 indicates, the main source of income comes from service industries. Of the eight largest employers in the CRD, six are part of the tertiary sector. The three levels of government are the largest employers in the area providing close to 22025 jobs (according to the 1981 census data) or 20% of the regional employment. The retail trade sector is very important. It is in part supported by the considerable number of retirees located in the region and the tourist industry. Retail trade also provides approximately 14565 jobs or 13% of total employment in the CRD. The health and welfare services industry ranks third in

	1986 interim census
Esquimalt	15734
Oak Bay	16918
Saanich	82301
Victoria	65366
SUB-TOTAL	180319
Central Saanich (C)	11923
North Saanich	7192
Sidney	8915
Union/Cole Bay Indian Reserve	(A)163
SUB-TOTAL	(A)28193
Colwood	11400
Metchosin	3645
Langford	-
View Royal (C)	(B)21396
Becher Bay Indian Reserve	(A) -
Sooke Electoral Area	(A)8107
SUB-TOTAL	44548
TOTAL VICTORIA METRO. AREA	253060
Salt Spring Electoral Area	-
Outer Gulf Island Elect. Area	(A)8993
TOTAL CRD	261993

Table 1. CRD population - 1986

- NOTES: (A) Contains one or more incompletely enumerated Indian Reserves
 (B) Interim census counts are unavailable for these electoral areas
 (C) Includes Indian Reserves

SOURCE: Trends, Capital Regional District Regional Information Office, May 1987, p.5

terms of the number of employees. In 1981, about 11410 persons were working in this industry which represented 10% of total regional employment. The fourth most important employer is the education related services industry with a labour force in the order of 8190 (7.5% of total employment). The size of the tourist industry is reflected in the importance of the accommodation and food services industry which employed around 8010 people in 1981 (7.3% of employment in the CRD). Finally, the financial sector has the eighth largest labour force with close to 6260 persons or almost 6% of the total employment.

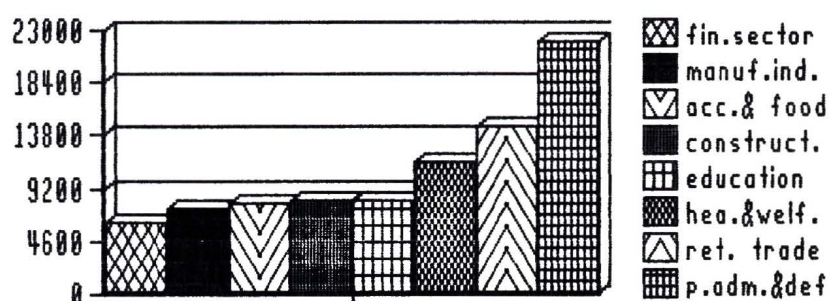


Figure 1. Largest employers in CRD (1981)

In the secondary sector, manufacturing and construction industries draw the attention. Manufacturing as a whole provided 7530 jobs in 1981 (6.9% of total). It, therefore, ranked seventh. It had, in 1982, a payroll in excess of 120 million dollars and a total value added of

more than 203 million dollars.² Within this industry, wood products, food & beverages and transportation equipment were the largest employers. The fifth most important employer is, according to the 1981 figures, the construction industry. It employed approximately 8075 workers which is equal to 7.4% of the total employment in the CRD.

The primary sector is also present in the CRD although it only represents about 2.4% of regional employment. In this sector, agriculture, with around 1090 jobs (1% of total), and forestry, with approximately 1050 jobs (1% of total), are predominant.

2.2 Canadian Forces Base Esquimalt

CFB Esquimalt is the largest military base in British Columbia. It supports some 79 units and detachments in the region. In 1966, during the integration phase of the Canadian Forces, the sites known locally as Albert Head, Belmont Park, Colwood, the Dockyard, Mary Hill, Naden, Nanaimo, Nanoose, Rocky Point, Royal Roads and Work Point Barracks were amalgamated into CFB Esquimalt (see map in appendix B).

Albert Head and Mary Hill, both located southwest of

Victoria and Esquimalt, are used as training areas by the Regular and Militia units.

Belmont Park, situated northeast of the Royal Roads Military College and southwest of the Colwood site, is a Married Quarters area for the military personnel of the base and of the ships attached to Esquimalt.

The Colwood site is located on the western side of Esquimalt Harbour approximately 8 km northeast of the Dockyard. It is the base of the Fleet Diving Unit (Pacific) as well as a Nuclear, Biological and Chemical Warfare School and a general storage area.

The Dockyard occupies the eastern side of the entrance of Esquimalt Harbour. It is about 5 km northeast of Victoria and 1 km west of Naden. The Dockyard has basically kept the same function it has had for most of its history. It is used for the maintenance, repair and provision of services to the ships of Maritime Forces Pacific and other auxiliary vessels. Moreover, the Defence Research Establishment (Pacific) and the Maritime Forces Pacific Headquarters are located there.

Naden is situated on the eastern shore of Esquimalt

Harbour. It is about 5 km northwest of Victoria and is mainly employed as a barracks, instructional and administrative site.

Nanaimo was selected during the 1960's for the establishment of the Regional Emergency Government Headquarters (REGHQ) which was built to provide emergency government facilities capable of operating in a post-nuclear exchange environment. The REGHQ is co-located with 740 Communication Squadron and is a detachment of CFB Esquimalt providing support services to CFMETR in Nanoose.

The Canadian Forces Maritime Experimental Test Range (CFMETR) is located at Nanoose which is approximately 130 km north of Esquimalt and 25 km northwest of Nanaimo. CFMETR is jointly used by the Canadian Forces and the US Navy for torpedo testing.

Rocky Point is situated southwest of Victoria on an isolated peninsula close to Parry Bay and Pedder Bay. It is the home of Canadian Forces Ammunition Depot Rocky Point.

Royal Roads is one of the three Canadian military colleges and occupies an area west of the Dockyard. It is a

degree-granting institution for the formation of Canadian Forces officers belonging to any of the three elements.

Finally, Work Point Barracks is the home of the third Princess Patricia's Canadian Light Infantry battalion (3 PPCLI). It is located on the west shore of the entrance to Victoria Harbour and is approximately 2 km east of the Dockyard.

According to the demographic information obtained from the National Defence Headquarters in Ottawa, there were 5240 members of the Regular Force at CFB Esquimalt as of June 12th 1987.² Also, there were 2482 civilians working at the base (in the CRD) during the summer of 1987 based on the data provided by the Base Civilian Personnel Officer.

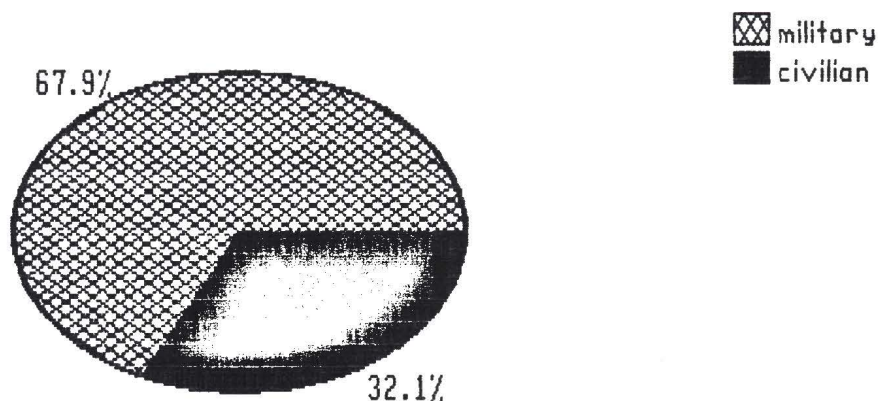


Figure 2. Military and civilian personnel

Figure 2 illustrates the breakdown of the base personnel between civilian and military people.

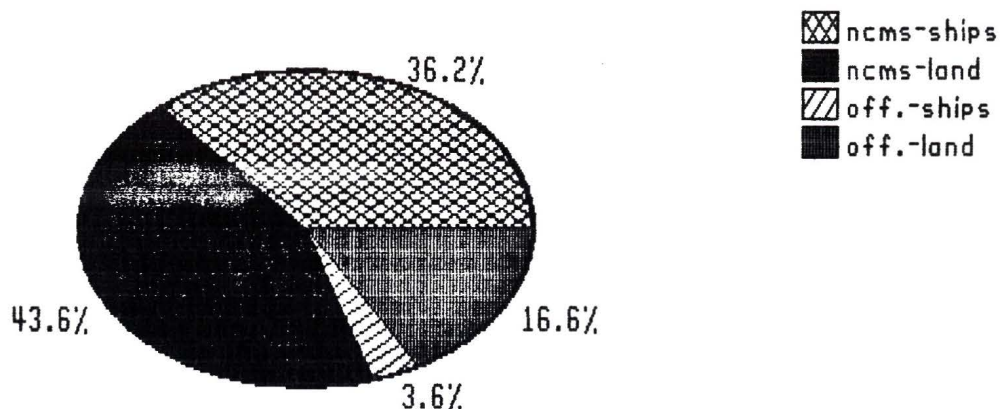


Figure 3. Military personnel-ships postings vs land postings

CFB Esquimalt is the port of 2 squadrons of destroyers, 1 replenishment ship and numerous smaller vessels. There is, therefore, a significant number of persons posted to ships as depicted by figure 3. Indeed, 36.2% of total military personnel is composed of Non-Commissioned Members (NCM's) posted to ships and 3.6% by officers posted to ships. Figure 3 also shows that NCM's as a whole represent 79.8% of the military personnel and officers, 20.2%.

CHAPTER 3. SURVEY OF THE LITERATURE

This chapter reviews the concepts of income and employment multipliers, and outlines different types of income (or employment) multipliers as well as examples of these in impact studies. It also surveys studies of the impact of military installations.

3.1 The concept of the income multiplier

The basic concept of the income multiplier is straightforward. For the national economy, the income multiplier is the change in national income divided by the injection of spending into the economy that causes the change. The total change in income is equal to the injection times the multiplier. In the case of a regional economy, estimation is usually more difficult as a result of a lack of readily available data. Also, the value of the multiplier is lower because leakages from the spending stream (in particular into imports) are higher at the regional than the national level.

Another problem is the proper definition of the income multiplier. In fact, there is an inability among economists "to agree on a definition of income multipliers" [1, p.71].

Archer [1] points out two main schools of thought: the "orthodox" school (with its subgroup) and the "unorthodox" school.

The "orthodox" school considers the income multiplier to be "the ratio of the total income generated within the study area to the direct income created by the initial autonomous injection" [1, p.71]. A subgroup of the "orthodox" school argues that the income multiplier is "the ratio of the total income generated to the amount of the initial injection which remains within the study area after direct leakages" [1, p.71]. Finally, the "unorthodox" school measures the income multiplier as "the ratio of total income generated to a unit of the initial injection" [1, p.71].

It is to be noted that each of these multiplier concepts defines a multiplier which, when applied to its respective multiplicand, gives a value for incremental regional income generated over and above the value of the initial injection. Archer might have added a fourth category of multiplier (the type estimated in this thesis) that, when used in conjunction with a gross injection of funds into a regional economy, yields an estimate of total regional income created (inclusive of the injection).

The derivation of income multipliers has been a fertile field of study for regional economists. They have developed models for a wide range of activities such as tourism ([1], [12], [67], [107], [111]), university spending ([9], [57], [85]), a pulp and paper mill [30], newly established firms [14] and large public institutions ([22], [56]) among others. The consensus view is that it is not reasonable to assume that every activity which brings "foreign" funds into a region should be assessed with the same multiplier. Wilson is clear on this point and argues that "analysts involved in economic impact studies should use multipliers that are specific to the economic activity being evaluated" [76, p.42]. This provides the rationale for the current thesis.

3.2 The concept of the employment multiplier

The impact of an economic activity can also be appraised in terms of the number of jobs it sustains in the region. The principle of the employment multiplier is similar to that of the income multiplier. The creation of new jobs leads to a further expansion in employment so that the total increase is equal to a multiple of the initial augmentation. Although income and employment multipliers are closely related, they may differ considerably, particularly if the "wages paid to workers in new project-related jobs

differ significantly from those prevailing in the local economy" [20, p.127] and if there is "significant excess capacity and underemployment" [20, p.127] in the region.

Income and employment multipliers are related as follows. Suppose that the income multiplier of a region is 1.5 and that the average gross wage is \$15 000 per annum in the region and \$20 000 per annum in the project. Then, the secondary income produced by the spending of the \$20 000 will be \$10 000 ($\$20\,000 \times .5$). This newly-generated income will support 0.67 jobs in the community ($\$10\,000 / \$15\,000$). The employment multiplier is therefore equal to 1.67. In this case, the employment multiplier is larger than the income multiplier because the wage prevailing in the project is higher than in the community. The opposite would also hold true if the divergence in wages were reversed.

The estimation of employment multipliers has been undertaken with respect to many different types of activities; for example, university spending ([9], [76], [78]), operations of a pulp and paper mill [30], military expenditures [66], and tourism ([107], [111]).

3.3 Alternative methodologies for impact studies

Three techniques are commonly used to evaluate the income or employment multiplier, namely: input-output, economic base and Keynesian methods. This section examines each technique in turn.

3.3.1 The input-output multiplier

The input-output multiplier is widely used and is known to provide "the most comprehensive measure of indirect and induced effects" [52, p.81]. Input-output models have several advantages: "a general equilibrium approach, neutrality and adaptability [...], and [...] they can be implemented" [93, p.184].

But they also have drawbacks. Firstly, the analyst has to make an expensive investment in terms of time and money in order to obtain the necessary data. This means that input-output tables cannot be computed very often. Secondly, the data limitations at the regional level imply that it may be difficult to get precise coefficients. Thirdly, input-output tables are inferior for the analysis of the effects of competitive forces between regions because they cannot handle substitution effects very well. Finally, the

analyst cannot adapt the tables to deal with the dynamics of structural change (he can only do it by assumption).

One example of an input-output income multiplier [52] for industry i is:

$$K^{\cdot}_i = h^{\cdot}_i / v^{\cdot}_i \quad i = 1, \dots, n \quad (1)$$

where h^{\cdot}_i = the household row entry of the i th industry in the Leontief inverse matrix $(I - A)^{-1}$ with households endogenous.

v^{\cdot}_i = the direct income coefficient of the i th regional industry.

The input-output multiplier has been applied to the study of the impact of university spending [46], of the steel industry [35] and of an arms reduction [42] among other activities. In this thesis, the input-output approach is not employed. Instead, multipliers developed draw on the methodologies of economic base and Keynesian multiplier analyses outlined below.

3.3.2 The economic base multiplier

The economic base multiplier is the oldest and least complicated tool developed to evaluate the impact of exogenous income on a region's economy. It is based on the

argument that "Export markets are considered the prime mover of the local economy" [96, p.13].

The regional economy is divided into a non-basic or service sector and a basic or export sector. The former is then represented as a function of the latter. It is assumed that "over the long run the proportion of basic and non-basic jobs will remain about the same" [96, p.13].

This multiplier is traditionally specified as an employment multiplier:

$$E_t = E_b + E_{nb} \quad (2)$$

$$M = E_t / E_b \quad (3)$$

$$M = E_t / (E_t - E_{nb}) \quad (4)$$

$$M = (E_t / E_t) / [(E_t / E_t) - (E_{nb} / E_t)] \quad (5)$$

$$M = 1 / [(1 - (E_{nb} / E_t))] \quad (6)$$

where M = economic base multiplier

E_t = total regional employment

E_b = basic employment

E_{nb} = non-basic employment

Regional economists are divided on the issue of the usefulness of the economic base model. Some of them have written off this technique as worthless. For instance, Richardson argues that "the one-way causal dependence of the economic base framework is unconvincing" [64, p.12]. He also

considers to be a problem the fact that use of the model assumes that excess capacity exists in the region. Lastly, the actual estimates of the multiplier can vary widely depending on the alternative procedures (e.g. direct measurements such as commodity and money flows and surveying of the local economy; or indirect measures such as location quotient and minimum requirements techniques) used at each step of the computation.³ Lewis estimated an employment multiplier and found that "the estimates range[d] from less than unity under the minimum requirements approach to over five in a location quotients case" [45, p.68]. He concluded by saying that "base theory per se with its emphasis on an artificial dichotomy between export and non-export activities can be largely dismissed from consideration" [45, p.68].

On the other hand, some scholars think that the use of economic base models can be justified in certain circumstances and on cost-effectiveness grounds. For example, McNicoll concluded that "although less accurate [than input-output methods], the practical application of Keynesian and economic base techniques can still be justified in terms of cost effectiveness" [52, p.87]. Moreover, concerns about the dependence of the multiplier on the existence of spare capacity and on estimation procedures

used apply to all multipliers, whether or not they are of the economic base type.

The economic base multiplier has been used in many impact studies which cannot all be identified here. However, some examples include the impact of university spending ([47], [57], [76], [78]) a major defense installation ([22], [66], [103], [117]), a medical center [56] and a new industry [26].

3.3.3 The Keynesian multiplier

The Keynesian regional income multiplier is analagous to the Keynesian multiplier used at the macroeconomic level. The only variation is in the substitution of regional values in the macroeconomic version. One example of a Keynesian multiplier is derived below⁴:

$$Y_{\text{r}} = C_{\text{r}} + I_{\text{r}} + G_{\text{r}} - T_{1\text{r}} + X_{\text{r}} - M_{\text{r}} \quad (7)$$

$$C = \bar{C} + c(Y - T_{\text{a}} + B) - c_2(Y - T_{\text{a}} + B) \quad (8)$$

$$I = \bar{I} \quad (9)$$

$$G = \bar{G} \quad (10)$$

$$T_1 = t_1(C) \quad (11)$$

$$X = \bar{X} \quad (12)$$

$$M = \bar{M} + mY \quad (13)$$

$$B = -b(Y) \quad (14)$$

$$T_a = \bar{T}_a + t_a(Y) \quad (15)$$

where z = region z

Y = regional income

C = consumption expenditure by the resident population of region z

I = investment

G = government spending on goods and services

T_1 = indirect taxes (on goods and services)

X = regional exports

M = regional imports by the industrial, commercial and service sectors of the regional economy

B = government benefits (e.g. unemployment benefit, National Assistance, etc.) which vary negatively with Y

T_a = direct tax + National Insurance contributions, etc.

c = marginal propensity to consume

c_s = proportion of c which is spent outside the region

b = the marginal propensity to receive government benefits

m = the marginal propensity to import

t_1 = indirect tax rate on goods and services

t_a = direct tax rate on income

It does not go unnoticed that import leakages are taken into account in two different ways. First, with c_s which

allows the model to account for the proportion of consumer expenditures spent outside the region. Second, with m which measures the proportion of the purchases of the industrial, commercial and service sectors made outside the region.

Equation (16) is obtained by substituting equations (8) to (15) into (7):

$$Y = \frac{c(Y - t_a Y - bY) - c_s(Y - t_a Y - bY) - t_{1c}(Y - t_a Y - bY) - mY + E}{(16)}$$

where E = all elements of autonomous expenditures

The effect on income (ΔY) of the injection of an extra unit of autonomous expenditure (ΔE) can be derived from (17):

$$\Delta Y = \frac{c\Delta(Y - t_a Y - bY) - c_s\Delta(Y - t_a Y - bY) - t_{1c}\Delta(Y - t_a Y - bY) - m\Delta Y + \Delta E}{(17)}$$

Dividing (17) by ΔY yields:

$$1 = \frac{c(1 - t_a - b) - c_s(1 - t_a - b) - t_{1c}(1 - t_a - b) - m + \Delta E/\Delta Y}{(18)}$$

Hence,

$$1 = (c - c_s - t_{1c})(1 - t_a - b) - m + \Delta E/\Delta Y \quad (19)$$

$$\Delta Y/\Delta E = 1 / [1 - (c - c_s - t_{1c})(1 - t_a - b) + m] \quad (20)$$

Therefore, the multiplier (K) = $\Delta Y / \Delta E$ is given as:

$$K = 1 / [1 - (c - c_s - t_{1c})(1 - t_a - b) + m] \quad (21)$$

This instantaneous multiplier shows that the impact of

a spending injection is dependent on the marginal propensity to spend locally. It is, however, criticised by Archer [1]. According to him, it is too broadly based because "Each form of exogenous injection is assumed to have the same multiplier effects upon the recipient economy" [1, p.73]. He thinks that the initial round of spending should be divided into its multiple elements so that each of these can be studied separately. Also, the internal economic structure of the region should be broken down to allow for a closer investigation. Moreover, as Black [5] emphasises, a more complete formulation of the multiplier could endogenise both investment spending and trade repercussions.

Some examples of the application of the Keynesian regional multiplier relate to a pulp and paper mill [30], a new firm [14], a new university [9], several types of industries and sizes of plants [44] and tourist expenditures [67].

3.4 Economic impact of military installations

In this section, the literature on the economic impact of military bases is surveyed before specifying a model for estimating the economic impact of CFB Esquimalt on the CRD.

In general, the existence of military installations is taken for granted by host communities until the military authorities announce their closure. It is then that these communities realize that the closure may be harmful to the economy of the region.

There has been a lot of research done in the United States to find out the impact of military bases on their surrounding areas. This can easily be explained by the fact that in the period 1961-69 alone, "over 950 defense installations were identified for closure, cutback, or inactivation. Approximately sixty major defense bases were included in these closure announcements" [89, p.ix]. There was therefore a great interest among the general public about this issue as host communities were fighting to keep the bases open since they sometimes represented the largest single regional employers.

The impact studies of military bases that were available to the author usually employed a simple framework of analysis. Some made use of a simple economic base multiplier of the type outlined above ([22], [103], [117]). Some borrowed an already-existing multiplier ([99], [105]). Finally, some were only concerned with the direct impact and did not use any multiplier at all ([109], [119]).

The present thesis is a departure from the above studies in that it uses a more sophisticated multiplier than the simple economic base multiplier, it adapts the multiplier to the specific case of CFB Esquimalt and it provides a framework for the analysis of both the income and the employment impact.

CHAPTER 4. SPECIFICATION OF THE MULTIPLIER MODELS

In this chapter, the models, which consist of an income and an employment multiplier, are developed and reviewed in detail.

4.1 The income multiplier

To obtain a true picture of the impact of the normal operations of the regular force at CFB Esquimalt on the CRD, one must try to assess its total impact and not just its direct contribution to regional income. To do this, the use of an income multiplier is required.

The military base is similar in some aspects to establishments like universities and large public institutions. It is a nonprofit economic unit, it exports a service outside the region and it is funded by an external source, namely the federal government.

In his paper "Impact analysis and multiplier specification", Wilson [76] introduces a multiplier for the study of the impact of a university. Its main feature is that it is composed of two parts. The first part takes into account the particular spending pattern of the university

and the second, the spending traits of the community hosting the university. This is, therefore, a flexible multiplier which can be employed every time one suspects that the spending characteristics of the economic unit under study are different from the ones of the region at large.

Such a multiplier seems appropriate for our purpose because there are good reasons to believe that a dissimilarity in spending patterns may exist between the base and the CRD. For example, the high proportion of procurement expenditures leaking out of the region and distinctive features of the social and economic character of military personnel can contribute to this dissimilarity.

Wilson's multiplier (K_3) integrates two multipliers (K_1 and K_2) as shown below:

$$K_1 = 1 / (1 - m_1) \quad (22)$$

$$\text{where } m_1 = \sum_{i=1}^n a_i b_i$$

a_i = the percentage of the economic unit-related spending staying in the region for each category (i) of expenditures

b_i = an estimate of the local value added in each category

$$K_2 = 1 / (1 - m_2) \quad (23)$$

where $m_2 = p c$

p = proportion of a dollar of consumption expenditure which remains in the community as local factor payments

c = marginal propensity of households to consume

K_3 is derived from the following expression:

$$Y = X + m_1X + m_1m_2X + m_1m_2^2X + m_1m_2^3X + \dots + m_1m_2^nX \quad (24)$$

where Y = total impact on regional income

X = initial injection

$$Y = X [1 + m_1 + m_1m_2 + m_1m_2^2 + \dots + m_1m_2^n] \quad (25)$$

$$= X [1 + m_1 (1 + m_2 + m_2^2 + \dots + m_2^n)] \quad (26)$$

$$= X \{ 1 + m_1 [1 / (1 - m_2)] \} \quad (27)$$

$$= X \{ 1 + [m_1 / (1 - m_2)] \} \quad (28)$$

$$= X [(1 - m_2 + m_1) / (1 - m_2)] \quad (29)$$

Therefore,

$$Y / X = K_3 = [(1 - m_2 + m_1) / (1 - m_2)] \quad (30)$$

K_3 , which grew out of a discussion between Moore, Sufrin and Wilson [79], is formulated such that the first round effects of the economic unit being studied and the subsequent round effects in the community are taken into account. The rationale is that the effect of the injection on regional income will depend on the characteristics of the economic unit under investigation during the first round and

on the characteristics of the community in subsequent rounds. In other words, once the money is injected by the spending unit, only K_2 matters.

How close will K_3 be to K_1 and K_2 ? It will obviously depend on m_1 and m_2 . For instance, a low value for m_1 will make K_3 small (given m_2). We can see by looking at the expression of K_3 that it approaches 1 as m_1 gets closer to 0. On the other hand, if m_1 approaches 1, K_3 gets closer to $(K_2 + 1)$.

Thus, if there is a very high degree of leakage in the spending pattern of the base (i.e. if m_1 is very small), the multiplier effect will be small and the total impact will mainly depend on the spending characteristics of the CRD. Conversely, if there is practically no leakage associated with the expenditures of the base, the multiplier effect will be at its maximum given K_2 . In our case, the explicit assumption about the difference between the spending pattern of the base and the community ensures that we do not make the mistake of taking for granted an equality between these two when there might not be one.

It is also of interest to find out whether K_3 is more sensitive to m_1 or m_2 . Wilson performed a sensitivity

analysis and concluded that " K_3 is more sensitive to m_2 if m_1 is greater than $(1 - m_2)$, and more sensitive to m_1 if m_1 is less than $(1 - m_2)$ " [76, p.43].

K_3 is not a complete Keynesian nor an economic base multiplier but rather, a mix of the two. K_2 is estimated in terms of economic base analysis while the estimation of K_1 incorporates the savings, tax and import leakages captured explicitly by a Keynesian multiplier. The weaknesses of the economic base model were reviewed previously. However, a cautious use of it can be warranted in terms of cost and tractability. Finally, sensitivity analysis can be applied to the key parameters in order to present a range of multiplier estimates as a way of dealing with the uncertainty surrounding actual values.

Alternative multiplier formulations are not chosen on the following grounds. The input-output multiplier requires too great an investment in terms of time and money. An interregional multiplier does not seem necessary because of the small size of the region used here (i.e. the CRD). This is also what is believed by Brownrigg:

[..], for the smaller region affected by the normal project, the repercussions from its rising level of imports on the level of income and imports of other regions, with the resultant feedback in the form of increased exports of its

goods to those regions, are not likely to be significant [10, p.283].

This point of view is also shared by Archer who adds that there is probably no need to incorporate a term for induced investment in the multiplier because "Previous studies have shown, [...], that, in the case of small regions, additional allowances for induced exports and induced investment add less than $\frac{1}{2}$ p in £ 1 to the value of the multiplier" [1, p.72]. Moreover, it is less critical to take the induced investment into account when a region is not enjoying a state of full employment. Since Victoria is presently experiencing a state of spare capacity reflected in an unemployment rate of 9.8% (second quarter of 1987)², it is reasonable to assume that the inclusion of an induced investment term in the multiplier would not affect it in a significant way.

4.2 The employment multiplier

The employment multiplier can be derived from the income multiplier. A simple method for converting the income multiplier into an employment multiplier has been proposed by Wilson and Raymond [78]. It consists of introducing a non-basic sector multiplier (M_{NB}) so that:

$$M_e = M_{NB} + 1 \text{ or} \quad (31)$$

$$M_{nb} = M_t - 1$$

where M_t = total multiplier

This can be applied to the employment multiplier:

$$M_{tm} = M_{nbm} + 1 \text{ or} \quad (32)$$

$$M_{nbm} = M_{tm} - 1$$

where M_{tm} = total employment multiplier which is equal to the ratio of total employment to basic employment

M_{nbm} = non-basic sector employment multiplier

This last expression gives the number of jobs in the non-basic sector that will be created by an increase of one job in the basic sector.

M_{nbm} is equal to the non-basic sector income multiplier (M_{nby}) times the ratio of average income in the military base sector to average income in the non-basic sector:

$$M_{nbm} = M_{nby} (\text{ave. } Y_b / \text{ave. } Y_{nb}) \quad (33)$$

$$M_{nby} = M_{ty} - 1 \quad (34)$$

where M_{ty} = total income multiplier (which would already be calculated)

It is clear that M_{ty} will be different from M_{tm} if "average income in the service sector does not equal average income in the export sector" [78, p.138].

CHAPTER 5. PROCEDURES FOR ESTIMATING THE MODELS

This chapter outlines the details of the procedures followed to estimate the base and the community related multipliers (K_1 and K_2 respectively) as well as the employment multiplier.

5.1 The estimation of K_1

K_1 is the multiplier related to the military base. It uses data specific to the base spending patterns and, again, is expressed as:

$$K_1 = 1 / (1 - m_1) \quad (35)$$

again where $m_1 = \sum_{i=1}^n a_i b_i$

a_i = percentage of total base-related spending remaining in the CRD for each of i categories of expenditure

b_i = local value added in each category as estimated by the payroll-to-sales ratio.

The estimation of a for each of i categories of expenditure is broken down into three parts: expenditures of the military personnel, of the civilian personnel and the base procurement budget. Sections 5.1.1 to 5.1.4 below describe procedures used for estimating K_1 .

5.1.1 The survey^e

A 13% sample survey comprising 1000 questionnaires was conducted during the months of July and August 1987. Its purpose was to gather information on the spending patterns of the base personnel in order to determine the proportion of disposable income remaining in the CRD and flowing into different local industries.

Members of the military population of the base were stratified by rank, sex and posting. The civilian population was stratified by sex and classification. Only the largest units (i.e. fifteen members or more) were selected to receive questionnaires. In the case of the ships, only those which were in port or close to Victoria were chosen because of the difficulty and the length of time involved in communicating with far away ships.

The number of questionnaires that had to be filled in by each stratum was calculated and this formed the basis of the distribution. For example, if 6% of the base population was composed of male corporals not posted to ships, then this stratum received 6% of the questionnaires. Each unit obtained a certain amount of questionnaires according to the

proportion of their members that were in each stratum. For instance, a unit that had many male corporals not posted to ships was given more questionnaires assigned to this stratum than a unit that had few of these people.

A package, containing the proper amount of questionnaires, a letter for the unit commanding officer requesting his permission to use his personnel in the survey, and an instruction sheet, was sent to the designated units. Within each unit, respondents were randomly chosen. The random selection was as follows: first, for a specific stratum, the distributors were asked to distribute the questionnaires to the first respondents appearing on the REMAR of their unit, starting at the top of that list (a REMAR is a nominal roll which includes the name, the rank and other information about the members of a unit). Second, if a potential respondent could not fill out the questionnaire, the distributor was asked to skip that person and go the next one having the same rank (or classification) and sex.

The questionnaire was constructed along the lines of questionnaires used in previous studies of military bases ([103], [117]) but was modified to make it compatible with the methodology of the present project.

It was realised that the questionnaire required some effort on the part of the respondents. Moreover, long and difficult mail questionnaires have great chances of getting a low response rate. For these reasons, the questionnaire was designed to be as easy as possible to complete without compromising the quality and the usefulness of the answers in a critical way.

The percentage of usable questionnaires was 30.4% (see section 6.2.1).

5.1.2 The expenditures of the military and civilian households

In the first portion of the questionnaire, the respondents were guided through to compute the "total net household income less savings" which represented the total amount of money at the disposal of their household for consumption expenditures.

The expenditures were broken down into eleven categories. Only those categories that affected the local economy were included in this list. For example, the item "electricity" was not taken into consideration because all

payments for this category are made outside of the CRD (in Vancouver) and, hence, are leaving the regional income stream.

These eleven categories were: water & heating oil, cable TV, rent, payments to financial institutions, retail stores, personal services, amusement and recreation, eating & drinking places, charities, property taxes, and other expenditures. The respondents were asked to give information on the average monthly amount spent in each category as well as how much of that amount was spent inside the CRD.

5.1.3 The base procurement budget

The base had an operating budget of \$35 263 714 in the fiscal year 1986-87. However, not all of this amount was spent in the region and in the same industries. In order to find the impact on the regional economy, the proportion of the budget staying in the CRD had to be calculated. Also, the percentage of that money flowing into the different industries affected had to be estimated.

The base procurement budget is organised by resource codes. A resource code is a number assigned to a specific expenditure item. For example, the resource code of the item

"repair of office furniture" is 06205. The percentage of each resource code remaining in the region can be determined by looking at every transaction reported in the cheque registers. The latter give information on the cost of the transaction, the pertinent resource code, the name and the address of the supplier. So by looking at the address, it is possible to know whether the payment has been made locally and which resource code is affected.

There is a slight problem with the cheque registers of 1986-87. They do not include the resource code because a new computer system has been introduced which does not keep this information. However, the cheque registers of 1985-86 were used and the results for that year employed as proxies for 1986-87.

Every supplier was assigned to an industry. This enabled the computation of the amount in each resource code going into the particular industries. Then, by summing over the entire budget, the total expenditures in each industry were found. It was necessary to transfer these findings for the fiscal year 1985-86 to the fiscal year under study. This was accomplished by determining the percentage of the total budget going into each industry, and applying these percentages to the fiscal year 1986-87.

5.1.4 The payroll-to-sales ratio (PSR)

An estimate of the local value added in each industry affected by the activities of the base was needed to compute the estimated value of K_1 . For the present study, the payroll-to-sales ratio is used as a proxy for this information.

The numerator of this ratio is simply the annual payroll of the industry. The denominator was estimated from the information contained in the British Columbia Economic Accounts on the provincial GDP by industry. The portion of the GDP accruing to the CRD is estimated on the basis of the proportion of the provincial population located in the CRD.

5.1.5 The computation of m_1

The amount of money spent by the base and its personnel in each regional industry was calculated and then divided by the total base spending. The total base spending is the sum of the total expenditures of the base personnel (including imports), the entire base procurement budget and the grants in lieu of taxes. The result is the percentage of total base related spending made in each local

industry. This percentage was multiplied by the PSR of the respective industry. After that, this product was summed over all industries to obtain m_1 which, once substituted in the equation (23 or 31), yields K_1 .

5.2 The estimation of K_2

The multiplier K_2 is based on the characteristics of the community and is estimated with the economic base method:

$$K_2 = 1 / (1 - m_2) \quad (36)$$

again where $m_2 = p c$

p = the proportion of a dollar of consumption expenditure which remains in the region as local factor payments

c = the marginal propensity of households to consume

The term " $p c$ " is therefore equal to the proportion of each dollar of consumption which is paid to local factors of production at subsequent rounds of the multiplier process. The assumption is that the average equals the marginal propensity to consume. The reason $p c$ is estimated using the economic base method is because of the lack of data on all factors of production. However, the availability of employment data allows us to determine labour's share of local consumption spending. Moreover, "We assume that the

portion of the labour force employed in providing locally consumed goods and services is about the same for all other factors" [57, p.39]. This calculation produces a base service ratio which is substituted for p_c in the expression of K_2 .

The weaknesses of the economic base analysis have already been discussed. In order to use this method with caution, a sensitivity analysis is performed on the value of K_2 . To do so, m_2 is estimated with two methods: the minimum requirements technique and the location quotient. The range of values obtained for m_2 gives a range of estimates for K_2 and, hence, for K_3 as well.

5.2.1 The minimum requirements technique (MRT)

The first method used for estimating m_2 is the minimum requirements technique. Export employment in industry z is represented by:

$$(e_{z\text{ CRD}} - e_{z\text{ m}})E_{\text{tot CRD}} \quad (37)$$

where $e_{z\text{ m}}$ = proportion of area employment in industry z in the area with the smallest such proportion

$e_{z\text{ CRD}}$ = proportion of employment in CRD in industry z

$E_{\text{tot CRD}}$ = total employment in CRD

This smallest proportion is assumed to be the minimum necessary to satisfy the local demand of the region. The employment over and above that proportion in other regions is considered to be export employment.

Ullman and Dacey [73] were responsible for the original work on the minimum requirements technique. Their work was updated by Moore [54] who also extended the technique to regional economic impact analysis.

The approach which is utilised here is the one Erickson [22] employed in his study of the impact of a major defense installation. The ratio of non-basic (or service) to total employment, E_b , is estimated as:

$$\hat{E}_b = \alpha + \beta (\log_{10} P) \quad (38)$$

where P = population size of the community

The parameters are estimated as:

$$E_{b1} = \alpha_1 + \beta_1 (\log_{10} P_1) \quad (39)$$

where E_{b1} = the observed percentage minimum employment in the i th population class

P_1 = the median population of the i th population class

This relationship can be evaluated using the ordinary least squares regression procedure.

The multiplier is obtained by substituting the estimated percentage minimum employment in the expression:

$$K_z = 1 / (1 - \hat{E}_b) \quad (40)$$

5.2.2 The location quotient technique (LQ)

The location quotient is defined as being the ratio of the proportion of employment in area y in industry z to the proportion of national employment (or employment in a "benchmark economy") in industry z . If this ratio is greater than one, it is assumed that industry z is in the basic sector.

For the purpose of this study, the following formula is employed:

$$LQ = (E_z \text{ CRD} / E_{\text{tot}} \text{ CRD}) / (E_z \text{ Can} / E_{\text{tot}} \text{ Can}) \quad (41)$$

where LQ = location quotient

$E_z \text{ CRD}$ = employment in industry z in CRD⁷

$E_z \text{ Can}$ = employment in industry z in Canada

$E_{\text{tot}} \text{ Can}$ = total employment in Canada

For those industries serving the export market (i.e. having a value for LQ greater than one), the export employment can be estimated with the following expression:

$$(e_z \text{ CRD} - e_z \text{ Can})E_{\text{tot}} \text{ CRD} \quad (42)$$

where $e_{z, Can}$ = the proportion of national employment in industry z

Isserman [38] showed that the accuracy of the multiplier could be greatly improved by using more disaggregated data and by assigning to the exogenous sector all federal government, hotel, tourist and motel employment. In keeping with this, the three-digit level of disaggregation of the Standard Industrial Classification is used* and, as suggested by Isserman, the above employment sectors are considered as exogenous.

The rationale behind the latter modification is that "a more accurate description of the multiplier is not the ratio of total to export employment, but the ratio of total to exogenous employment (the latter includes export employment)" [38, p.36].

5.2.3 Underlying assumptions of the location quotient and the minimum requirements techniques.

Theoretically, the MRT and the LQ techniques are based on the same consumption and production homogeneity assumptions.

The basic assumption is that the proportion of local

activity for local use is equal to that of the benchmark economy (in the case of the LQ) or of other regions (in the case of the MRT). The implication of this assumption is that the propensity to consume as well as consumption patterns are the same in all areas. With regard to consumption patterns, Greytak pointed out that "in some areas such relationships may not be found for many products have a distinctly local character" [31, p.388].

Furthermore, consumption of capital goods, intermediate products and raw materials are also assumed to be similar. This implies that production functions and factor productivities are equivalent in all areas.

The MRT and LQ techniques also assume complete homogeneity of products within each industry. As a result, the share of regional exports activity depends on the particular industrial breakdown (e.g. the Standard Industrial Classification) and is therefore susceptible to the drawbacks of that classification.

Finally, the above techniques assume that consumers are primarily concerned with minimising transport costs in choosing among various supply sources. The implication of this assumption is that "for any commodity, so long as

local requirements do not exceed local supply, the requirements will be met by local produce and that no product will be exported until all local requirements are satisfied" [31, p.388].

It is important to note at this point that even if all of the above assumptions are respected, the LQ technique, by its very nature, will underestimate exports in each industry by an amount equal to the region's imports of that activity. Consequently, "By understating exports, net, as opposed to gross, use of average ratios overstates the size of the foreign trade multiplier" [31, p.388].

Therefore, the multiplier estimated with the MRT can be expected to be lower than the value obtained with the LQ because the former is based on minimum rather than average requirements and, hence, will give a closer estimate of gross exports from the region. It is gross exports that are relevant for multiplier estimation purposes.

5.3 The estimation of the employment multiplier

In order to estimate the employment multiplier, the average personal income of the base and the average personal income of the CRD have to be evaluated. The average gross

pay of the base personnel (both military and civilian) is employed as a proxy for the average personal income of the base. The main drawbacks of this proxy are that it is estimated from the median monthly gross pay rate by rank, and more importantly, it does not include investment income, pension income, etc. On the other hand, the average personal income of the CRD is obtained from the data published by Revenue Canada and, hence, is composed of total income and not just employment income.

Since the figure for the CRD includes a broader definition of income than the figure of the base, the value of the employment multiplier is underestimated. However, the unemployment rate in the CRD tends to reduce the size of the employment multiplier [20, p.127]. So the exact effect of the problems outlined here is difficult to appraise. This should be kept in mind when using the empirical estimate of this multiplier.

CHAPTER 6. EMPIRICAL ESTIMATION OF THE MULTIPLIERS

In this chapter, empirical estimates of the multiplier models are computed after the adjustments of the data have been discussed.

6.1 Adjustments of the data

The data used in the present study were the most recent obtainable at the time of collection. The year 1986 was the reference point and some of the data came from that year. However, it was sometimes unavoidable that data from previous periods had to be used because of the unavailability of 1986 figures. The latter were always adjusted to reflect, as much as possible, the situation of the reference year.⁹

6.2 The base-related multiplier (K_1)

As described in section 4.1, the income multiplier K_3 is a combination of two other multipliers (K_1 and K_2). The appraisal of the base-related multiplier (K_1) involves the estimation of two components, namely a_1 and b_1 . The next section deals with the computation of a_1 while section 6.2.2 presents the calculation of b_1 .

	ANNUAL BUDGET	ANNUAL PERSONNEL EXPEND.		ANNUAL GILT	TOTAL		PSR	column 6 X column 7
	\$ 1	CIVILIAN	MILITARY	\$ 4	\$ 5	a ₁	b ₁	column 7 %
		\$ 2	\$ 3			% 6		
MANUFACTURING IND.:								
food & beverages	916857				916857	0.00508	0.512741	0.002605
misc. semi-durables	165739				165739	0.000918	1	0.000918
furniture & fixtures	52896				52896	0.000293	1	0.000293
printing and publishing	404747				404747	0.002242	0.750639	0.001683
primary metals	5995				5995	0.000033	0.630852	0.00002
metal fabricating	208056				208056	0.001152	0.959014	0.001105
machinery industries	6700				6700	0.000037	0.852127	0.000031
transportation equ.	3879				3879	0.000021	0.905997	0.000019
electrical products	6700				6700	0.000037	0.984112	0.000036
non-metallic minerals	2468				2468	0.000013	0.642714	0.000008
petroleum and coal prod.	91686				91686	0.000508	0.411177	0.000208
CONSTRUCTION	2010032				2010032	0.011138	0.82298	0.009166
TRANSP., COMM. & STORAGE UTILITIES	136231	563704.1	749286		1449221	0.00803	0.550194	0.004418
WHOLESALE TRADE	305492				305492	0.001692	0.212554	0.000359
RETAIL TRADE	3949536				3949536	0.021886	0.604688	0.013234
FIN., INS. & REAL ESTATE	1698554	16532807	31160529		49391890	0.273701	0.704999	0.192959
COMM., BUS., PERS. SERV. COMM. SERV.	95979	17044102	32698007		49838888	0.276178	0.209431	0.05784
accomm. & food serv.	109318	1602494	3395247		5107059	0.0283	0.498367	0.014103
bus. management serv.	2645887				2645887	0.014662	0.746498	0.010945
other comm. serv.	735208	2786505	5970456		9492169	0.0526	0.562564	0.02959
NON-COMM. SERV.								
education & rel. serv.	1376495				1376495	0.007627	0.793428	0.006052
PUBLIC ADMIN. & DEFENCE	162213	1722271	948171.9	4677946	7510601	0.041619	0.732739	0.030496
SPECIAL CASES								
water & heating oil		1885739	1835682		3721421	0.020622	0.408621	0.008426
charities		421542.6	370189.3		791731.9	0.004387	0.818091	0.003589
other expenditures		1519759	1628083		3147842	0.017443	0.691361	0.012059
					total =	0.79023	m ₁ =	0.400175

Table 2. Computation of m₁

Notes: i) The figures in column 5 are obtained by summing columns 1, 2, 3 and 4 by industry.

ii) The percentages in column 6 are obtained by dividing the corresponding number in column 5 by the total base spending (i.e the sum of the total expenditures of the base personnel, the entire base procurement budget and the

grants in lieu of taxes). The total base spending was estimated to be around \$180 458 716 in 1986-87.

iii) Only the industries affected by the expenditures emanating from the base are included.

6.2.1 Computation of a_1 (the percentage of total base-related spending staying in the region for each category (i) of expenditures)

In order to obtain a figure for a_1 , the amounts of money flowing into local industries through the base procurement budget, base personnel expenditures and the GILT have to be estimated.

Following the methodology explained in section 5.1.3, the amounts injected into local industries by the base procurement budget are shown in the first column of table 2.

The survey was an essential tool of data collection for this project. Its objectives was to gather information about the spending patterns of the civilian and the military personnel. The response rate was fairly good in comparison to similar surveys conducted in previous studies. The percentage of usable questionnaires was 30.4% which compares favourably with Wilson's percentages. Indeed, in his evaluation of the impact of the University of Tulsa on that

city's economy, Wilson obtained a proportion of 31% for the staff and 11% for the students [76, p.45]. Callan and Turner made use of an analogous questionnaire in their study of the impact of a military base. Their proportion of usable questionnaires was 56% [103, p.45] and 40% [117, p.44], respectively.¹⁰

The spending patterns of the civilian personnel are displayed in tables 18, 19 and 20 of appendix G. As well, these monthly figures are converted to annual numbers and reported in column 2 of table 2.

The results of the survey with regard to military personnel spending patterns are summarised in table 21 in appendix H.¹¹ The annual amounts are included in column 3 of table 2.

Finally, the annual amount paid in the form of grants in lieu of taxes (GILT) is displayed in column 4 of table 2.

Table 2 shows the computation of the total base-related spending remaining in the CRD for every category of expenditures (a_1). These percentages are indicated in column 6.

6.2.2 Computation of b_1 (the payroll-to-sales ratios)

The first step in computing the payroll-to-sales ratios consisted in evaluating the regional GDP of the industries in question¹². This yielded the sales portion of the ratio (see column 1 of table 22 of appendix I).

The second step was to estimate the payroll (as shown in column 4 of table 22 in appendix I) of the pertinent industries. This was accomplished by multiplying the employment level in each industry (in column 2 of table 22) by an estimate of workers' earnings in that industry. The latter can be found in column 3 of table 22.

The payroll-to-sales ratios (PSR) obtained are displayed in column 5 of table 22 and column 7 of table 2. After the final calculation was performed, it appeared that the proxies used gave rise to some problems with the estimated values of the PSR as some of them were greater than unity. It is theoretically impossible for these values to be greater than unity since this would mean that these industries have payrolls that exceed their sales (i.e. all the value added would be produced by labour only and these firms would be losing money). If some of the estimates of

the PSR are too high, some may be too low so that the end result may not be affected in a dramatic way. In the face of this difficulty, the PSR figures were constrained to unity.

6.2.3 Computation of K_1

K_1 can be estimated using the information contained in table 2. As explained in section 5.1.5, the numbers in column 8 came out of the product of the percentage of total base related spending made locally for each category of expenditures and the PSR's. The sum of that column gives the value of m_1 which, when substituted in the equation, yields a multiplier of 1.67:

$$K_1 = 1 / (1 - .40) = 1.67 \quad (43)$$

6.3 The community-related multiplier (K_2)

As outlined in section 5.2, K_2 was estimated with the minimum requirements (MRT) and location quotient (LQ) techniques.

6.3.1 The minimum requirements technique

The results of this approach are summarised in table 3. The figures in columns 3 and 4 were used to evaluate the parameters α and β of equation 34. The ordinary least squares regression procedure was employed and the regression was corrected for autocorrelation using the Cochrane-Orcutt procedure. Equation 34 is reproduced here along with the regression results (t-values in parantheses).

$$\begin{aligned}\hat{E}_b &= \alpha + \beta (\log_{10}P) && (44) \\ &= -0.41762 + 0.17654 (5.3683) \\ &\quad (-2.1287) \quad (4.5592) \\ \hat{E}_b &= 0.53 \\ R^2 &= 0.85\end{aligned}$$

The estimated percentage minimum employment for the CRD is 0.53. This value is substituted for m_2 in the equation of K_2 to provide an estimate of 2.13 for the multiplier of the community. This figure for m_2 is used in conjunction with the value of m_1 previously obtained to get K_3 .

It is interesting to compare the MRT results of this project with other studies which applied the same technique. For example, if the parameters of Ullman and Dacey [73] are employed to estimate K_2 , the latter would be equal to 1.92. If the estimators of Erickson [22] are used, K_2 for the CRD

would be 2.46. Moore's values would yield a multiplier of 2.34 [54] and 2.16 [55]. Therefore, the figure for K_2 obtained here (2.13) is of the same order of magnitude as values estimated by other analysts for similar regions.

	nb. of cities 1	median population 2	\log_{10} of median pop. 3	minimum employment 4
Class 1	3	2828349	6.4515	71.59%
Class 2	3	657057	5.8176	55.10%
Class 3	3	576075	5.7605	54.20%
Class 4	13	164313	5.2157	60.87%
Class 5	11	88330	4.9461	56.14%
Class 6	14	58924	4.7703	49.01%
Class 7	20	34411	4.5367	45.55%
Class 8	18	24026	4.3807	34.53%
Class 9	17	16866	4.2270	24.52%
Class 10	26	13528	4.1312	29.92%
Class 11	25	11353	4.0551	23.86%

Table 3. Results of the MRT by city classes

6.3.2 The location quotient technique

The location quotient was also chosen as an estimation technique to provide an upper bound for the value of K_2 and consequently, K_3 . The results are reported here.

export employment = 21420

Adjustments:

employment in accommodation & food industry = 2248

employment in camping grounds = 27

employment in defence = 7722

employment in federal government offices^{1,3} = 3178

exogenous employment = 34595

Computation:

$$\begin{aligned} K_2 &= \text{Total employment} / \text{exogenous employment} \\ &= 100\ 000 / 34593 \\ &= 2.9 \end{aligned}$$

This means that, although K_2 is probably close to 2, it is highly unlikely that it surpasses 2.9 knowing that the LQ is expected to exaggerate the value of the multiplier (see section 5.2.3).

6.4 The amalgamated income multiplier (K_3)

With both m_1 and m_2 now estimated, K_3 is simply obtained by substituting their values into the following equation:

$$\begin{aligned} K_3 &= (1 - m_2 + m_1) / (1 - m_2) && (22) \\ &= (1 - 0.53 + 0.40) / (1 - 0.53) \\ &= 1.85 \end{aligned}$$

So K_3 is taken to be 1.85 using the MRT to estimate m_2 . With the LQ, m_2 rises to 0.65 which gives an upper bound for K_3 of 2.14.

In the presentation of the methodology, it was pointed

out that the use of K_3 was appropriate when K_1 and K_2 (i.e. m_1 and m_2) were expected to differ. It appears that the hybridization of K_3 was necessary in our case because the propensity for base related expenditures to leak out of the region is 0.60 (1 - 0.40) as opposed to 0.47 (1 - 0.53) in the case of the local economy.

6.5 Conversion of K_3 into an employment multiplier

As outlined in section 4.3, K_3 can be transformed into an employment multiplier. The average annual personal income in the military base sector is computed as \$25646 (1984 dollars) in appendix L. The average annual personal income of the community which, in this case is the average personal income in the service sector, is \$19192 (1984 dollars). The latter figure was obtained from the CRD information office.

The conversion of K_3 into an employment multiplier is performed in the following way:

$$M_{nbm} = M_{nby} (\text{ave } Y_b / \text{ave } Y_{nb}) \quad (45)$$

$$M_{nby} = 1.85 - 1 = 0.85$$

$$\begin{aligned} M_{nbm} &= 0.85 (25646 / 19192) \\ &= 1.14 \end{aligned}$$

$$M_{tm} = M_{nbm} + 1 \quad (46)$$

$$= 1.14 + 1$$

$$= 2.14$$

The discrepancy between the employment multiplier and the income multiplier is due to the substantial difference between "ave Y_b " and "ave Y_{nb} ".

An upper bound value for the employment multiplier can be calculated using the upper bound K_3 . (For simplicity, the same subscripts are employed).

$$M_{nbm} = M_{nby} (\text{ave } Y_b / \text{ave } Y_{nb}) \quad (45)$$

$$M_{nby} = 2.14 - 1 = 1.14$$

$$M_{nbm} = 1.14 (25646 / 19192)$$

$$= 1.52$$

$$M_{tm} = M_{nbm} + 1 \quad (46)$$

$$= 1.52 + 1$$

$$= 2.52$$

This new value for the employment multiplier (2.52) must be interpreted with caution. As with the case of the upper bound K_3 , it represents a ceiling value above which the true value of the employment multiplier is unlikely to lie.

CHAPTER 7. IMPACT OF CFB ESQUIMALT ON THE CRD ECONOMY

This chapter shows the computation of the total gross injection of funds by CFB Esquimalt into the CRD economy for the fiscal year 1986-87. The value of this injection is used as the multiplicand in the total income impact equation. This chapter also presents the impact of the base in terms of regional income and employment generated in the CRD.

7.1 Total gross injection into the CRD

The total gross injection into the CRD by the base is simply the sum of the gross pay of the base personnel, the entire base budget and the grants in lieu of taxes (GILT). The total gross injection is estimated to be approximately \$258.89 million dollars in the fiscal year 1986-87.¹⁴

7.2 Total regional income generated

With K_3 equal to 1.85 and a total gross injection of \$258.89 millions of dollars, the normal operations of the regular force at CFB Esquimalt during the fiscal year 1986-87 generated approximately \$478.95 million in regional income. However, one must deduct the initial injection in order to obtain an estimate of the income created outside of

the defence sector. The regional incremental income then becomes equal to \$220.06 million for the period under study.

Using the upper bound estimate of K_3 (2.14), the effect on total regional income and regional incremental income amounts to \$554.02 million and \$295.13 million, respectively. This means that, although the impact in terms of incremental income can be taken to be close to \$220 million, it is unlikely to be larger than \$295 million.

7.3 Total impact on regional employment

If the employment multiplier (2.14) is applied to the size of the labour force of the base, the total impact on regional employment amounts to 16525 jobs. That is, 8803 jobs are created in the CRD on top of the 7722 jobs already existing at CFB Esquimalt. This total impact represents close to 16.5% of the total employment in the region in 1986 (the total employment averaged 100 000 in 1986). The base has therefore a significant effect on the level of employment in the CRD.

If, as is perhaps unlikely, the employment multiplier is as high as 2.52, then the total impact on regional

employment climbs to 19459 jobs (19.5% of total regional employment in 1986) or 11737 jobs created outside the base.

The reader should keep in mind the assumptions discussed in section 5.2.3 regarding the LQ and the MRT. It can be safe to argue that not all of these assumptions are met in our case and, for that reason, the multiplier estimates should be interpreted with caution. As well, it is to be recognised that some approximation results from use of the survey and use of the payroll-to-sales ratio as a proxy for local value added (section 6.2.2).

CHAPTER 8. SUMMARY AND CONCLUSION

The estimated values of the multipliers derived in this thesis are displayed in table 4. As indicated earlier, the foregoing results are to be viewed with caution, given the various approximations involved in the estimation process.

The total gross injection was estimated at \$258.89 million. It is believed that the total impact in terms of incremental income in the CRD was probably around \$220 million in 1986-87 but not larger than \$295 million (using the upper bound for K_3).

Multiplier designation	Estimated values	
the base-related multiplier (K_1)	1.67	1.67
the community-related multiplier (K_2)	2.13	(2.90)
the amalgamated multiplier (K_3)	1.85	(2.14)
the employment multiplier	2.14	(2.52)

Table 4. Summary of multipliers values

Note: the values in parantheses are the upper bound estimates based on the LQ.

The estimate of the total impact on regional employment was around 16500 jobs (i.e. approximately 8800 jobs created in the local economy on top of the 7722 jobs already

existing at the base). The upper bound estimate of this impact was no more than 19460 jobs.

As outlined in the introduction, this project was intended to study the effect of the normal operations of the regular force at CFB Esquimalt on regional income and employment in the CRD. It was impossible, unfortunately, to look at other aspects of the impact of the base due to constraints on time and resources.

One important activity, in terms of "foreign" dollars injected into the region, is the present and future construction projects at the base. For instance, between 1987 and the year 2000, approximately \$300 million will be spent on the construction of new infrastructure for the base.²⁵ These undertakings are likely to have a non-negligible impact on the region. It would be interesting to develop a multiplier that would take into account the effect of immigrant construction workers (something along the line of Brownrigg's multiplier [10]) on the local community in order to assess the total impact of these expenditures.

The impact of reserve units was not considered here. Their impact on regional income and employment could be

analysed with the framework used in the present project by separating out the reserve units' impact on the procurement budget and identifying the net pay of the reserve personnel.

Another interesting source of exogenous income is the visits of foreign warships. In 1986, it was estimated that these spent some 167 days ashore in Victoria. The foreign sailors certainly have an impact on the regional economy, especially in such industries as accommodation and food, amusement and recreation, and so on. The problem here is to appraise their spending quantitatively. It is unlikely that a meaningful survey of their spending habits could be conducted.

The presence of military retirees is not an aspect that comes to mind immediately when assessing the impact of military expenditures. To the extent that the retirement income of these people is considered part of military spending, the concentration of retired servicemen in a region (like Victoria) can have a significant impact on the local community.

As estimated, the base appears to have a significant absolute impact on the economy of the Capital Regional District although the analysis does not say anything about

its relative impact. It would have been most interesting to contrast its influence with other large institutions in the area such as the provincial government offices, the University of Victoria or the Royal Jubilee Hospital.

Finally, it would be interesting to compute multipliers for different fiscal years to see if they vary over time [43].

This study has presented a new way of evaluating the economic impact of military bases. Its framework of analysis is an amalgam of other frameworks used to study the impact of different economic units. For example, the income multiplier was borrowed from the impact study of a university but was adapted to the specific case of the base. The unique nature of K_3 is an important aspect of the proposed approach which could easily be applied to other military bases without substantial expenditures in money and time.

It is hoped that the results outlined above will serve to clarify the impact of CFB Esquimalt on the CRD by providing some concrete evidence of the influence of the base on regional income and employment. While it is usually difficult to show the impact of a military installation in

terms of its contribution to such abstract ideas as "deterrence" or "national security", this thesis illustrates that it is feasible to demonstrate the impact in terms of "bread and butter" economic concepts.

¹ British Columbia Regional Index, Ministry of Economic Development, Mitchell Press Ltd, 1986, p.262.

² For more detail, see appendices C and D.

³ For a complete treatment of these alternatives, see Tiebout, Charles M., The community economic base study, Supplementary paper no.16, Committee for economic development, 1962, chap.5.

⁴ This expression of the Keynesian multiplier as presented by Archer is the instantaneous multiplier because it does not take into account i) any additional flows of exports induced by the increase in the income of other regions resulting from a rise in their exports to the region under study and, ii) any induced investment in the study region due to an increase in output there.

⁵ This information was obtained from the CRD information office in a private communication.

⁶ See appendix N for an example of the questionnaire.

⁷ The Census provides information on the employment of the Victoria Metropolitan Area, not the Capital Regional District per se. However, as displayed in table 1, there is not a large difference between the two so that results should not be affected severely if the former is assumed to be equal to the latter.

⁸ This three-digit level of disaggregation is the highest level available in the Census data of 1981.

⁹ See appendix M for more detail.

¹⁰ There were two main negative feedbacks about the questionnaire. Firstly, even though respondents were assured of the confidentiality of their answers, many did not want to disclose their spending patterns and income. Secondly, some thought it was difficult to fill in. Although every effort had been made to design a questionnaire as easy as possible to complete, it was recognised from the start that it required some time and effort on the part of respondents. Unfortunately, it was impossible to augment the facility of completion without compromising the usefulness of the information collected. This trade-off was inevitable.

¹¹ The "payments to financial institutions" category included all payments and not just interest payments. It would have been more appropriate to consider only the latter since they represent the income of the institution. For instance, a portion of a mortgage payment goes to pay for the capital of the loan (i.e the house itself) and another portion goes to pay the interest (which is the only portion kept by the financial institution as income). For the sake of making the questionnaire as easy as possible to fill in, this distinction was not made and it was assumed that all the payments went to pay for interest.

¹² See appendix J for more detail.

¹³ This information was obtained from the CRD information office. It represents a minimum as of 21 January 1987.

¹⁴ See appendix F for detailed computations

¹⁵ These figures were taken from an address of the Base Commander, Capt(N) Dzioba, in 1987.

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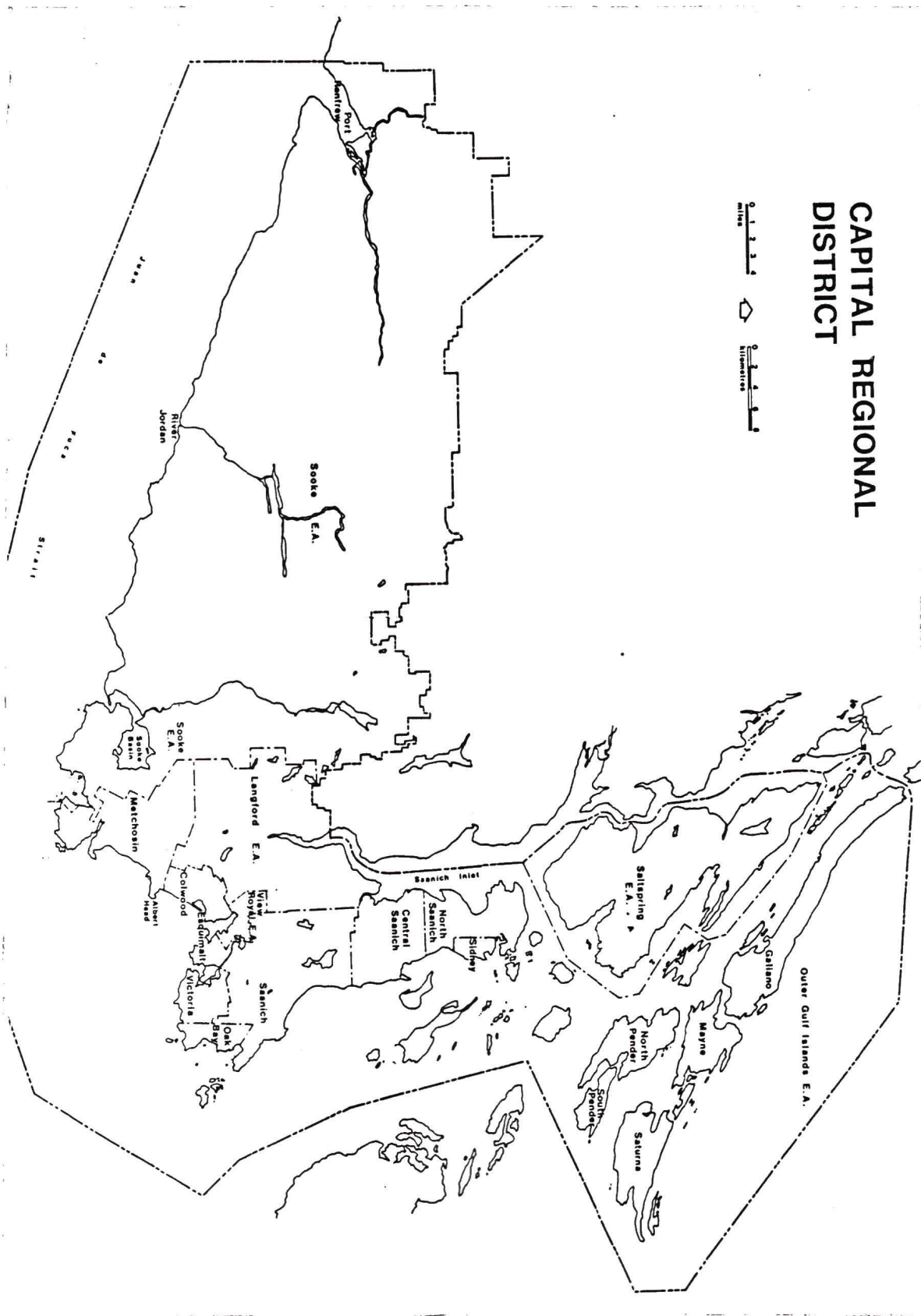
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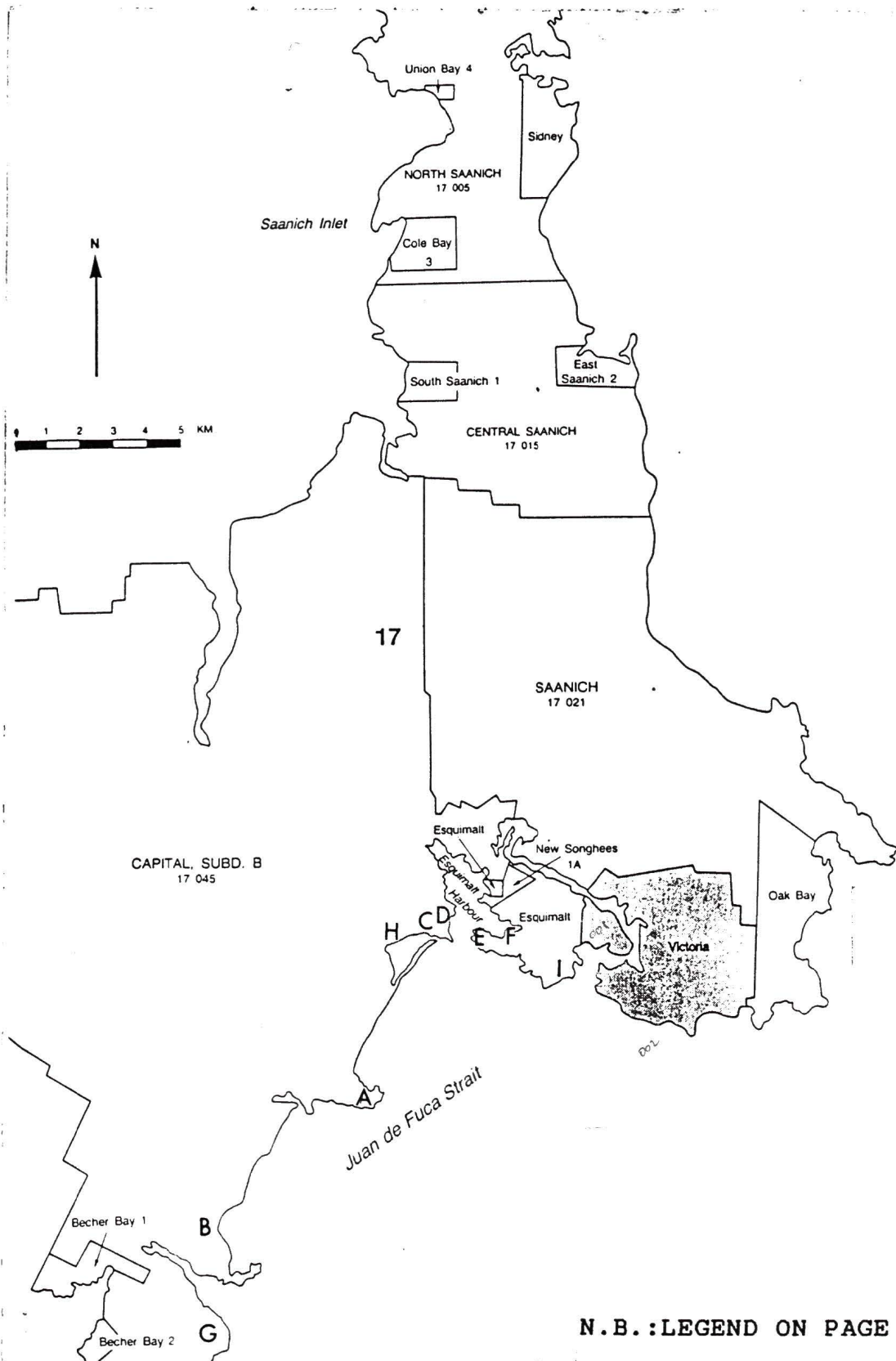
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Map of the Capital Regional District



Map of CFB Esquimalt



N.B.: LEGEND ON PAGE 81

Legend of CFB Esquimalt map

- A- Albert Head
- B- Mary Hill
- C- Belmont Park
- D- Colwood
- E- Dockyard
- F- Naden
- G- Rocky Point
- H- Royal Roads Military College
- I- Work Point

Source: Statistics Canada, Catalogue 99-907, April 1982,
Ottawa, p.32B.

Demographic structure: CFB Esquimalt

Following is the demographic information (as of June 12 1987) obtained from NDHQ Ottawa.

TOTAL	%	COL	%	LCOL	%	NAJ	%	CAPT	%	LT	%	SLT	%	OCDT	%
F 58	0.07	0	0.00	0	0.00	3	0.03	17	0.08	7	0.13	1	0.01	30	0.11
M 812	0.93	8	1.00	26	1.00	102	0.97	203	0.92	49	0.87	191	0.99	233	0.89
870	0.82	8	0.01	26	0.03	105	0.12	220	0.25	56	0.06	192	0.22	263	0.30

Table 5. Strength-officers not posted to ships

TOTAL	%	COL	%	LCOL	%	NAJ	%	CAPT	%	LT	%	SLT	%	OCDT	%
F 0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
M 188	1.00	1	1.00	9	1.00	23	1.00	100	1.00	48	1.00	6	1.00	1	1.00
188	0.18	1	0.01	9	0.05	23	0.12	100	0.53	48	0.26	6	0.03	1	0.01

Table 6. Strength-officers posted to ships

TOTAL	%	COL	%	LCOL	%	NAJ	%	CAPT	%	LT	%	SLT	%	OCDT	%
F 58	0.06	0	0.00	0	0.00	3	0.02	17	0.05	7	0.07	1	0.01	30	0.11
M 1000	0.94	9	1.00	35	1.00	125	0.98	303	0.95	97	0.93	197	0.99	234	0.89
1058	1.00	9	0.01	35	0.03	128	0.12	320	0.30	104	0.10	198	0.19	264	0.25

Table 7. Total strength-officers

TOTAL	%	CWO	%	NWO	%	WO	%	SGT	%	MCPL	%	CPL	%	PTBT	%	PTTB	%
F 133	0.06	0	0.00	1	0.01	5	0.03	22	0.07	21	0.07	46	0.09	18	0.10	20	0.03
M 2151	0.94	54	1.00	138	0.99	199	0.97	308	0.93	270	0.93	456	0.91	159	0.90	567	0.97
2284	0.55	54	0.02	139	0.06	204	0.09	330	0.14	291	0.13	502	0.22	177	0.08	587	0.26

Table 8. Strength-NCM's not posted to ships

TOTAL	%	CWO	%	NWO	%	WO	%	SGT	%	MCPL	%	CPL	%	PTBT	%	PTTB	%
F 2	0.00	0	0.00	0	0.00	0	0.00	02	0.00	0	0.00	1	0.00	1	0.00	0	0.00
M 1896	1.00	16	1.00	58	1.00	158	1.00	250	1.00	258	1.00	438	1.00	221	1.00	497	1.00
1898	0.45	16	0.01	58	0.03	158	0.08	250	0.13	258	0.14	439	0.23	222	0.12	497	0.26

Table 9. Strength-NCM's posted to ships

TOTAL	%	CWO	%	NWO	%	WO	%	SGT	%	MCPL	%	CPL	%	PTBT	%	PTTB	%
F 135	0.03	0	0.00	1	0.00	5	0.01	22	0.04	21	0.04	47	0.05	19	0.05	20	0.02
M 4047	0.97	70	1.00	196	1.00	357	0.99	558	0.96	528	0.96	894	0.95	380	0.95	1064	0.98
4182	1.00	70	0.02	197	0.05	362	0.09	580	0.14	549	0.13	941	0.23	399	0.10	1084	0.26

Table 10. Total strength-NCM's

TOTAL	%	EY	%	SH	%
F	0	0	0.00	0	0.00
M	4	3	1.00	1	1.00
	4	3	0.75	1	0.25

Table 11. Strength-management group

TOTAL	%	SE	%	AR	%	CH	%	ED	%	ENG	%	LS	%	UT	%	DS	%	
F	18	0.15	1	0.50	0	0.00	0	0.00	9	0.53	0	0.00	3	1.00	2	0.05	3	0.06
M	99	0.85	1	0.50	1	1.00	2	1.00	8	0.47	5	1.00	0	0.00	36	0.95	46	0.94
	117	0.05	2	0.02	1	0.01	2	0.02	17	0.15	5	0.04	3	0.03	38	0.33	49	0.42

Table 12. Strength-scientific and professional group

TOTAL	%	AS	%	CS	%	PI	%	PR	%	PG	
F	13	0.17	0	0.00	1	0.00	5	0.01	22	0.04	21
M	62	0.83	70	1.00	196	1.00	357	0.99	558	0.96	528
	75	0.03	70	0.02	197	0.05	362	0.09	580	0.14	549

Table 13. Strength-administrative and foreign services group

TOTAL	%	DD	%	EL	%	EG	%	GT	%	PY	%	SO	%	TI	%	
F	5	0.02	2	0.07	1	0.03	2	0.03	0	0.00	0	0.00	0	0.00	0	0.00
M	204	0.98	25	0.93	33	0.97	69	0.97	2	1.00	3	1.00	69	1.00	3	1.00
	209	0.00	27	0.13	34	0.16	71	0.34	2	0.01	3	0.01	69	0.33	3	0.01

Table 14. Strength-technical group

TOTAL	%	CM	%	DA	%	CR	%	ST	%	OE	%
F 346	0.07	11	0.42	12	0.92	221	0.87	101	1.00	1	0.50
M 51	0.13	15	1.58	1	0.08	34	0.13	0	0.00	1	0.50
397	0.16	26	0.07	13	0.03	255	0.64	101	0.25	2	0.01

Table 15. Strength-administrative support group

TOTAL	%	FR	%	GL	%	GS	%	HP	%	HS	%	SC	%	SR	%
F 125	0.07	0	0.00	4	0.01	110	0.33	0	0.00	7	0.70	1	0.01	3	0.00
M 1555	0.93	117	1.00	325	0.99	219	0.66	91	1.00	3	0.30	94	0.99	706	1.00
1680	0.68	117	0.07	329	0.20	329	0.20	91	0.05	10	0.01	95	0.06	709	0.42

Table 16. Strength-operational group

Classifications and ranks: CFB Esquimalt

A) Military personnel

i) Officers

OCDT: officer cadet
SLT : second lieutenant
LT : lieutenant
CAPT: captain
MAJ : major
LCOL: lieutenant colonel
COL : colonel

ii) Non-Commissioned Members

PTE(B): private-basic
PTE(T): private-trained
CPL : corporal
MCPL : master corporal
SGT : sergeant
WO : warrant officer
MWO : master warrant officer
CWO : chief warrant officer

B) Civilian personnel

i) the management group

EX : executive
SM : senior manager

ii) The scientific and professional group

SE : senior executive
AR : architect
CH : chemist
ED : educator
ENG: engineer
LS : library scientist
UT : university teacher
DS : defence scientist

iii) The administrative and foreign services group

AS : administrative services officer
CS : computer systems administrator
FI : financial administrator
PE : personnel administrator
PG : purchasing and supply administrator

iv) The technical group

DD : draftsman
EL : electronics technician
EG : engineering and scientific support technician
GT : general technician
PY : photographer
SO : ships officer
TI : technical inspector

v) The administrative support group

CM : communicator
DA : data processor
CR : clerk
ST : secretary
OE : office equipment operator

vi) The operational group

FR : firefighter
GL : general labourer
GS : general services employee
HP : heating and power plant operator
HS : patient and health services employee
SC : ships crew
SR : ship repair worker

Survey results

A total of 1000 questionnaires were sent out to the base personnel. The degree of success of the survey is displayed in the table below.

	Total sample	% of total sent	Military personnel	% of total sent	Civilian personnel	% of total sent
total # received	507	50.7	321	47.2	186	58.1
# usable for study of spending patterns	304	30.4	188	27.6	116	36.3
# invalid	157	15.7	123	18.1	34	10.6
# blank received	46	4.6	10	1.5	36	11.3

Table 17. Survey results

Computation of the total gross injection in the CRD

Total annual gross pay of base personnel =	\$218 945 784
(as computed in appendix L)	
Base procurement budget	= \$ 35 263 714
Grants in lieu of taxes	= \$ 4 677 946

Gross injection	= \$258.89 million

Monthly expenditures of the civilian personnel

		Group #2	Group #3			Group #2	Group #3
Water & oil	total	12208.78	5208.75	Amus. & rec.	total	7617.98	8356.88
	local	12208.78	4515.00		local	6566.69	4786.88
Cable TV	total	1198.68	1396.50	Eating & dr. pl.	total	5140.50	4162.50
	local	1198.68	1396.50		local	5088.75	4162.50
Rent	total	862.50	11171.25	Charities	total	10412.48	2767.50
	local	0.00	11171.25		local	7806.78	2767.50
Fin. inst.	total	46891.44	58421.10	Property taxes	total	11120.60	6312.00
	local	32245.04	31687.50		local	10601.37	6312.00
Retail stores	total	91758.69	58264.50	Other exp.	total	25280.07	8737.50
	local	91053.17	58001.25		local	25280.07	7537.50
Pers. serv.	total	6851.70	3930.00	Total	total	219343.4	168728.5
	local	6618.06	3795.00		local	198667.4	136132.9

Table 18. Monthly expenditures of civilian personnel-part 1 (\$)

Note: Group #1 (the management group) is not included in the above table because no information was obtained from the survey about these classifications and because of the very low number of people in this group (4).

		Group #4	Group #5			Group #4	Group #5
Water & oil	total	10899.0	26290.03	Amus. & rec.	total	30073.36	21620.14
	local	10472.6	23577.09		local	14350.18	13507.04
Cable TV	total	2132.41	5243.16	Eating & dr. pl.	total	17950.87	20501.04
	local	2132.41	4937.47		local	13813.72	19330.06
Rent	total	30814.26	21903.47	Charities	total	1622.36	4400.38
	local	30814.26	16829.01		local	1158.56	3839.84
Fin. inst.	total	117464.3	207547.6	Property taxes	total	13564.13	19470.60
	local	100487.2	181575.9		local	10583.02	19470.60
Retail stores	total	142763.7	248605.4	Other exp.	total	12058.99	18489.13
	local	130322.0	224459.8		local	7868.19	13659.23
Pers. serv.	total	8686.04	16807.51	Total	total	388029.4	618878.5
	local	8477.74	16562.96		local	330479.9	537749.0

Table 19. Monthly expenditures of civilian personnel-
part 2 (\$)

	Group #6		Group #6	
Water & oil	total	110599.3	total	199805.3
	local	106371.4	Amus. & rec. local	109416.0
Cable TV	total	38272.18	total	113221.7
	local	37310.20	Eat. & dr. pl. local	91146.20
Rent	total	199961.3	total	20740.14
	local	199961.3	Charities local	19555.88
Fin. inst.	total	865214.3	total	103481.0
	local	815478.4	Property taxes local	96555.63
Retail stores	total	945889.2	total	90752.27
	local	873898.3	Other exp. local	72301.60
Pers. serv.	total	50836.95	total	2738774
	local	48128.23	Total local	2470123

Table 20. Monthly expenditures of civilian personnel-
part 3 (\$)

Monthly expenditures of the military personnel

		NCH's	Officers			NCH's	Officers
Water & oil	total	148973.9	28602.88	Amus. & rec.	total	230596.6	70936.36
	local	124370.6	28602.88		local	177786.8	56165.16
Cable TV	total	54530.44	10494.76	Eating & dr. pl.	total	249097.8	58114.45
	local	51945.74	10494.76		local	229701.8	53235.36
Rent	total	914548.7	189365.9	Charities	total	26442.40	10946.95
	local	862336.5	184115.3		local	20728.25	10120.86
Fin. inst.	total	1750199	420058.7	Property taxes	total	73596.50	29288.39
	local	1337205	341243.8		local	52004.47	27009.85
Retail stores	total	2387825	511951.9	Other exp.	total	129717.4	17051.80
	local	2102921	493789.5		local	119830.9	15842.64
Pers. serv.	total	233989.9	37668.41	Total	total	6199518	1384480
	local	226158.8	37427.19		local	5304990	1258047

Table 21. Monthly expenditures of military personnel (\$)

Payroll-to-sales ratios

INDUSTRY	GDP \$ 1	EMP. 2	V.EAR. \$ 3	PAY \$ 4	PSR % 5
MANUFACTURING IND.:					
food & beverages	40	975	404.53	20509671	0.512741
misc. semi-durables	5	207	474.59	5108406	1
furniture & fixtures	3	105	474.59	4565555	1
printing & pub.	24	871	397.76	18015345	0.750639
primary metals	2	45	539.19	1261704	0.630052
metal fabricating	15	506	472.00	14385221	0.959014
machinery ind.	10	347	472.25	8521279	0.852127
transportation equipment	35	1277	477.53	31709902	0.905997
electrical products	2	81	467.29	1968225	0.904112
non-metallic minerals	10	257	480.93	6427148	0.642714
petroleum & coal products	1	13	608.25	411177	0.411177
CONSTRUCTION	201	7291	436.31	1.65E+08	0.82298
TRANSP., COMM. & STORAGE	267	5336	529.43	1.47E+08	0.550194
UTILITIES	85	586	592.91	18067153	0.212554
WHOLESALE TRADE	90	2794	374.58	54421979	0.604688
RETAIL TRADE	260	13152	268.02	1.83E+08	0.704999
FIN., INS. & REAL ESTATE	611	5652	435.39	1.28E+08	0.209431
COMM., BUS. & PERS. SERV.					
COMMERCIAL SERV. TOTAL					
accom. & food serv.	137	7233	181.53	68276337	0.498367
bus. management serv.	130	4366	427.45	97044028	0.746498
other comm. serv.	75	2239	362.39	42192342	0.562564
NON-COMM. SERV.-TOTAL					
education & related serv.	232	7395	478.69	1.84E+08	0.793428
health & welfare serv.	310	10303	382.38	2.05E+08	0.660846
OTHER NON-COMM. SERV.	24	3575	362.39	67368301	1
PUBLIC ADMIN. & DEFENCE	807	19888	571.78	5.91E+08	0.732739
SPECIAL CASES					
water & heating oil					0.408621
charities					0.818091
other expenditures					0.691361

Table 22. Calculation of the payroll-to-sales ratios

Notes: i) The payroll of each industry (column 4) is the result of the product of column 2 by column 3 by 52 since column 2 is the weekly earnings of the workers and the payroll is in annual terms.

ii) The special cases (water & heating oil, charities and other expenditures) were included in the

questionnaire as expenditure items. Since they comprise more than one industry, an average of the PSR of the industries incorporated in these items was used as a proxy of their own PSR. The PSR of "water & heating oil" is an average of the PSR of "utilities" and "wholesale trade". The PSR of "charities" is an average of the PSR of "education & related services", "health & welfare services" and "other non-commercial services". Finally, the PSR of "other expenditures" is an average of all the industries.

iii) Computations of values in column 3 are shown in appendix K.

Computation of regional GDP

	GDP B.C.	EMPLOYMENT CRD / B.C.	GDP CRD 1 X 2
	1	2	3
	\$	%	\$
MANUFACTURING IND.:			
food & bev.	759	0.052569	40
misc. semi-durables	193	0.024249	5
furniture & fixtures	55	0.047252	3
printing & pub.	302	0.079511	24
primary metals	401	0.005748	2
metal fabricating	353	0.04122	15
machinery ind.	210	0.047278	10
transportation	315	0.111018	35
electrical prod.	93	0.019623	2
non-metallic minerals	218	0.043942	10
petroleum & coal prod.	223	0.006171	1
CONSTRUCTION	2695	0.074704	201
TRANSP., COMM. & STOR.	5240	0.050984	267
UTILITIES	1860	0.045755	85
WHOLESALE TRADE	2042	0.044017	90
RETAIL TRADE	3180	0.081869	260
FIN., INS. & REAL ESTATE	7922	0.077129	611
COMM., BUS. & PERS. SERV.			
COMM. SERV. -TOTAL			
accomm. & food serv.	1585	0.085878	136
bus. management serv.	1720	0.075126	129
other commercial serv.	991	0.075315	75
NON-COMM. SERV. -TOTAL			
education & related serv.	2500	0.092029	230
health & welfare serv.	2805	0.109681	308
other non-comm. serv.	245	0.097777	24
PUBLIC ADMIN. & DEFENCE	3666	0.218255	800

Table 23. Computation of regional GDP from provincial GDP

Note: The figures in column 1 & 3 are in millions of dollars.

Computation of weekly earnings (at the regional level) for selected industries

	ANNUAL PROVINCIAL AVERAGES FOR 1986	PROVINCIAL AVERAGE FOR SELECTED SECTORS (1986)	REGIONAL AVERAGE FOR SELECTED SECTORS (1986)	% DIFFERENCE	ADJUSTED REGIONAL AVERAGE FOR 1986
	\$	\$	\$		\$
		MANUF-BC	MANUF-CRD		
food & bev.	495.95	569.07	474.49	0.15	404.53
paper & allied	719.29	569.07	474.49	-0.21	573.59
printing & pub.	489.85	569.07	474.49	0.16	397.76
primary metals	658.93	569.07	474.49	-0.14	539.19
metal fab.	566.20	569.07	474.49	0.01	472.08
machinery ind.	566.40	569.07	474.49	0.00	472.25
transportation equ.	572.74	569.07	474.49	-0.01	477.53
electrical prod.	560.56	569.07	474.49	0.02	467.29
non-metallic min.	576.90	569.07	474.49	-0.01	480.93
petroleum & coal	792.47	569.07	474.49	-0.28	608.25
		UTIL-BC	UTIL-CRD		
utilities	668.30	588.16	529.43	-0.12	592.91
		TRADE-BC	TRADE-CRD		
wholesale trade	461.06	340.44	296.9	-0.26	374.58
		SERV.-BC	SERV.-CRD		
bus. management serv.	430.82	353.48	362.39	-0.18	427.45
education & rel. serv.	520.53	353.48	362.39	-0.32	478.69

Table 24. Computation of weekly earnings (at the regional level) for selected industries

Source: Cansim, Databank L 56061, Matrix 009600

Adjustments

The weekly earnings by industry were available at the regional level. However, the level of disaggregation was rather low (10 sectors). For this reason, the figure for

some industries were computed using the weekly earnings at the provincial level. For example, the provincial average of weekly earnings of the "education and related services" industry for the 12 months of 1986 was \$520.53. This number was adjusted downward by comparing it with the provincial average for the service industries (\$353.48). It can be seen that the weekly earnings of this industry is 32% higher than the average weekly earnings of the service industries as a whole. Therefore, it is assumed that there is a similar difference at the regional level. By increasing the average of the service industries in the CRD by 32 %, the weekly earnings of this industry in the region is estimated at \$478.69.

Computation of average personal income of CFB Esquimalt

	ANNUAL MEDIAN GROSS PAY \$	NB. OF MEMBERS	TOTAL \$		ANNUAL MEDIAN GROSS PAY \$	NB. OF MEMBERS	TOTAL \$
GROUP #1				GROUP #4			
EX	74100	3	222300	DD	30269	27	817263
SM	55900	1	55900	BL	34845	34	1184730
				RG	31563	71	2240973
GROUP #2				GT	38179	2	76358
SE	53566	2	107132	PY	27153	3	81459
AR	45941	1	45941	SO	42500	69	2932500
CH	40330	2	80660	TI	37968	3	113904
ED	43855	17	745535				
ENG	50683	5	253415	GROUP #5			
LS	33591	3	100773	CH	23596	26	613496
UT	42897	38	1630086	DA	23802	13	309426
DS	55116	49	2700684	CR	22837	255	5823435
				ST	18874	101	1906274
GROUP #3				OR	20049	2	40098
AS	34146	35	1195110				
CS	40121	17	682057	GROUP #6			
FI	37958	1	37958	PR	30216	117	3535272
PE	36746	15	551190	GL	26312	329	8656648
PG	35275	7	246925	GS	31096	329	10230584
				HP	32213	91	2931383
				HS	25733	10	257330
				SC	26880	95	2553660
				SR	33821	709	23979089
				TOTAL		2482	76939488

Table 25. Gross pay of the civilian personnel (\$)

	ANNUAL MEDIAN GROSS PAY \$	NB. OF MEMBERS	TOTAL \$
OFFICERS			
OCDT	9204	264	2429856
SLT	23616	198	4675968
LT	26700	104	2776800
CAPT	42972	320	13751040
MAJ	50772	128	6498816
LCOL	57276	35	2004660
COL	62484	9	562356
NCM'S			
PTB(B)	12372	1084	13411248
PTB(T)	17760	399	7086240
CPL	29880	941	28117080
MCPL	31008	549	17023392
SGT	33828	580	19620240
WO	36576	362	13240512
MWO	39624	197	7805928
CWO	42888	70	3002160
TOTAL		5240	1.42E+08

Table 26. Gross pay of military personnel (\$)

Adjustments

total annual gross pay of base personnel = \$218 945 784

average annual gross pay (1987) = \$28368

average annual gross pay (1986) = \$27474

average annual gross pay (1985) = \$26545

average annual gross pay (1984) = \$25646

general pay rate increase in 1986 = 3.2%

general pay rate increase in 1985 = 3.5%

general pay rate increase in 1984 = 3.5%

N.B. General pay rate increases and gross rates were provided by the Pay Office of CFB Esquimalt.

Adjustments of data

i) Provincial GDP:

The 1984 figures were inflated to 1986 using the following provincial GDP deflator:

1984-1985: 2.7%
1985-1986: 3.6%

ii) Average personal income of the base:

The 1986 figures were deflated to 1984 to make them comparable with the figures of the CRD. They were adjusted using the following general pay rate increases:

1984-1985: 3.5%
1985-1986: 3.5%
1986-1987: 3.2%

iii) The pay rate for Colonels:

The 1985 number was adjusted to 1986 using the general pay rate increase indicated above.

iv) The population of B.C.:

The figure for 1985 was adjusted to 1986 by multiplying it by 1.7%.

v) The employment data of the Victoria Metropolitan Area and Canada:

When computing the location quotient, the 1981 employment data for the Victoria Metropolitan Area was decreased by 8.8% and the 1981 employment data of Canada was increased by 4.5%. These adjustments were necessary in order for the employment data to reflect the situation of 1986. The above percentages were based on the change in total employment between 1981 and 1986 at the regional and the national levels.

Example of the questionnaire

Following is an example of the questionnaire as distributed to the military personnel. The questionnaire sent to the civilian personnel was almost identical.

1. What is your rank ? (circle one)

- | NCM's | OFFICERS |
|--|--|
| <ul style="list-style-type: none"> a. PTE(B) / OS b. PTE(T) / AB c. CPL / LS d. MCPL / MS e. SGT / P2 f. WO / P1 g. MWO / CPO2 h. CWO / CPO1 | <ul style="list-style-type: none"> i. OCDT j. 2LT / ASLT k. LT / SLT l. CAPT / LT(N) m. MAJ / LCDR n. LCOL / CDR o. COL / CAPT(N) |

2. Indicate your sex. (circle one)

- a. M
- b. F

3. Do you have a copy of your latest PAY GUIDE at your disposal? (circle one)

- a.NO
- b.YES

4. Using the latest copy of your PAY GUIDE (or if you do not have it, your best estimate), please answer the following question:

4a. What is your total monthly net pay as indicated in the NME (Net Monthly Entitlements) box?

_____ \$ PER MONTH.

5. Do you save money other than by pay allotments? (circle one)

- a. NO
- b. YES →



→5a. What kind of savings instruments are you using (e.g. mutual funds, stocks, term deposits, savings account, etc)? (specify) _____

→5b. How much are you saving every month?

_____ \$PER MONTH

6. Subtract the amount reported in question 5b from the amount reported in question 4a:

(4a) _____ \$ - (5b) _____ \$ = (6) _____ \$

7. Do you receive any other income such as off-duty extra-work pay, interest from Savings Bonds, savings account, dividends from stocks, etc ? (circle one)

a. NO

b. YES

7a. What is the monthly total of this supplemental income ? _____ \$ PER MONTH.

8. What is the total NET monthly income (i.e. after deductions) of your wife (husband) and of your dependants (e.g. children or any other persons you are supporting)?

_____ \$ PER MONTH.

9. What is your total NET monthly household income less savings ? (Add the amounts reported in question 6, 7a, and 8)

(6) _____ \$ + (7a) _____ \$ + (8) _____ \$ =
(9) _____ \$ PER MONTH

10. Are you posted to a ship ? (circle one)

a. NO

b. YES

11. In an AVERAGE month, how do you distribute your total NET monthly household income less savings (as reported in question 9) among the following items?

IF YOU ARE POSTED TO A SHIP, ANSWER THESE QUESTIONS ON THE BASIS OF EXPENDITURES WHILE YOU ARE ASHORE IN VICTORIA.

11a. WATER & HEATING OIL: _____ \$PER MONTH *

11b. CABLE T.V.: _____ \$PER MONTH *

11c. RENT (EXCLUDING QUARTERS): _____ \$PER MONTH *

REPORT THE AMOUNTS MARKED "*" TO COLUMN 2 IN TABLE BELOW

11d. PAYMENTS TO FINANCIAL INSTITUTIONS:

-mortgage: _____ \$PER MONTH

-other loans: _____ \$PER MONTH

-insurance: _____ \$PER MONTH

-TOTAL: _____ \$PER MONTH *

11e. RETAIL STORES:

-food at home (excluding rations): _____ \$PER MONTH

-motor vehicle (e.g. motor vehicle payments, gas,
parts & servicing): _____ \$PER MONTH-clothing, footwear, jewellery:
_____ \$PER MONTH-tobacco & alcoholic beverages:
_____ \$PER MONTH-furniture & appliance (inclu. radio & T.V.):
_____ \$PER YEAR / 12 = _____ \$PER MONTH

-drugs & cosmetics: _____ \$PER MONTH

-hardware: _____ \$PER MONTH

-general merchandise (such as sports & photo
equipment, books & magazines, games & toys, etc.):
_____ \$PER MONTH

-TOTAL: _____ \$PER MONTH *

REPORT THE AMOUNTS MARKED "*" TO COLUMN 2 IN TABLE BELOW
--

11f. PERSONAL SERVICES:

-barber & beauty shops: _____ \$PER MONTH

-dry-cleaning & self-service laundries:

_____ \$PER MONTH

-other personal services: _____ \$PER MONTH

-TOTAL: _____ \$PER MONTH *

11g. AMUSEMENT & RECREATION:

-movies: _____ \$PER MONTH

-theatrical and staged entertainment:

_____ \$PER MONTH

-sports activities and sport clubs:

_____ \$PER MONTH

-other (e.g. trips, etc): _____ \$PER MONTH

-TOTAL: _____ \$PER MONTH *

11h. EATING & DRINKING PLACES (EXCLUDING MESS DUES):

_____ \$PER MONTH *

11i. CHARITIES (CHURCHES, ETC): _____ \$PER MONTH *

11j. OTHER EXPENDITURE(S): _____ \$PER MONTH *

REPORT THE AMOUNTS MARKED "*" TO COLUMN 2 OF TABLE BELOW
--

12. Are you spending more than you earn? (that is, are you dipping into your savings to meet expenses?) (circle one)

- a. NO
- b. YES

13. Do you (circle one)

a. RENT AN APARTMENT OR A HOUSE?

b. OWN A HOUSE? →

←

→ 13a. how much did you pay in property taxes last year ?

_____ \$PER YEAR / 12 = _____ \$PER MONTH

→ 14. Where do you live? (circle one)

a. OFF BASE BUT IN THE CAPITAL REGIONAL DISTRICT →

←

→ In the "PROPERTY TAXES" row of the table below, report the monthly amount indicated in question 13a in **COLUMN 3**.

b. OUTSIDE THE CAPITAL REGIONAL DISTRICT →

→ In the "PROPERTY TAXES" row of the table below, report the monthly amount indicated in question 13a in **COLUMN 4**.

The Capital Regional District includes the following municipalities and electoral areas:

Victoria	Saanich	Sidney	Langford
Central Saanich	North Saanich	Colwood	Metchosin
Esquimalt	Oak Bay	View Royal	Sooke
Outer Gulf Islands		Saltspring Island	

PLEASE FILL IN THE FOLLOWING INFORMATION IN THE TABLE BELOW:

15. How are your expenditures distributed geographically ? (i.e. what amount of each item is spent in the Capital Regional District and outside the Capital Regional District)?

For example, suppose that your payments to financial institutions are equal to \$600.00 per month and that 25% of this amount is paid to a bank outside the Capital Regional District. Then in the "PAYMENTS TO FINANCIAL INSTITUTIONS" row of the table below you should write \$600.00 in column 2, \$450.00 in column 3 and \$150.00 in column 4.

COLUMN 1	COLUMN 2	COLUMN 3	COLUMN 4
category of expenditures	total monthly amount (as computed in question 11)	amount spent in the Capital Regional District	amount spent outside the Capital Regional District
WATER & HEATING OIL	_____ \$	_____ \$	_____ \$
CABLE T.V.	_____ \$	_____ \$	_____ \$
RENT	_____ \$	_____ \$	_____ \$
PAYMENTS TO FINANCIAL INSTITUTIONS	_____ \$	_____ \$	_____ \$
RETAIL STORES	_____ \$	_____ \$	_____ \$
PERSONAL SERVICES	_____ \$	_____ \$	_____ \$
AMUSEMENT & RECREATION	_____ \$	_____ \$	_____ \$
EATING & DRINKING PLACES	_____ \$	_____ \$	_____ \$
CHARITIES	_____ \$	_____ \$	_____ \$
PROPERTY TAXES	_____ \$	_____ \$	_____ \$
OTHER EXPENDITURE(S)	_____ \$	_____ \$	_____ \$

VITA

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Place of Birth: Gagnon, Québec Date of Birth: 30 Sept. 1964

Educational Institutions Attended, with Dates of Entering and Leaving:

COLLEGE MILITAIRE ROYAL DE ST-JEAN, ST-JEAN	1981 TO 1984
ROYAL MILITARY COLLEGE OF CANADA, KINGSTON	1984 TO 1986
UNIVERSITY OF VICTORIA, B.C.	1986 TO 1988

Degrees, Diplomas, Etc., Awarded, with Dates and Names of Institutions:

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Honours and Awards:

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Sara Spencer Research Award, 1987/88

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Author



Mave Rivers

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