Appendix II: Sources and Methods

General Methodology

Except for wages and salaries, and some of the provincial government sector data, all of the quarterly estimates presented in the BCEA have been developed by BC STATS. Where possible, the methods used to produce the quarterly data, as well as the annual estimates of current dollar GDP by industry, are similar to those established by Statistics Canada in preparing the National Accounts. However, in many cases, the data used by Statistics Canada do not exist at a provincial level, and it has been necessary to employ Canadian quarterly patterns or Canadian deflators to allocate annual benchmark estimates for the province. Again, where possible, a British Columbia component has been introduced into the quarterly allocation or deflation procedure in order to account for differences between trends in the national and provincial economies.

A general principle underlying most of the quarterly estimation procedures is that the allocation should occur at the most disaggregated level possible. Thus, even if a quarterly pattern is mainly based on a Canadian series, the weights applied to the quarterly numbers come from provincial data. This allows for differences in the relative importance of various components to the aggregates reported in the Income, Expenditure and Industry Accounts. Similar principles were applied in the development of estimation procedures for the constant dollar series. Most of the data reported in the BCEA are calculated by aggregating quarterly current and constant dollar estimates for component series.

The following is a brief overview of the methodology used to calculate the quarterly estimates. Unless otherwise noted, the disaggregated quarterly data at the national level is obtained from the National Accounts and Environment Division (NAED) of Statistics Canada. Most of the series are unpublished.

Relationship Between Income and Industry Account Estimates

In the Income Account, quarterly estimates are usually derived by applying allocators for each industry to annual estimates for each income component. The overall quarterly pattern is then determined by summing over all industries.

The Industry Measures and Analysis Division (IMAD) of Statistics Canada publishes estimates of GDP for the goods and service-producing industries. However, the current dollar series cover the period from 1984 to 1993 only, while the constant dollar estimates extend from 1984 to 1996.

In general, the method used by BC STATS to derive GDP estimates by industry for 1961 to 1983, is to sum the income components for each industry. The derived GDP estimate for each industry is then applied to extrapolate the IMAD data back to 1961. It is also used to estimate quarterly GDP estimates by industry.

The following discussion, therefore, not only describes the methodology used to calculate the quarterly Income Account, but also explains how the components that feed into the Industry Account are derived.

Appendix II: Sources and Methods

The Income Account

The Income Account measures the incomes earned by the various factors of production, namely land, labour and capital. Included in the Income Account are:

- Wages and salaries
- Supplementary labour income
- Military pay and allowances
- Corporation profits before taxes
- Interest and miscellaneous investment income
- Accrued net income of farm operators from farm production
- Net income of non-farm unincorporated businesses
- Inventory valuation adjustments
- Capital consumption allowances
- Indirect taxes less subsidies

Wages and Salaries

Quarterly estimates of wages and salaries by industry are obtained directly from the Labour Division of Statistics Canada.

Supplementary Labour Income (SLI)

The Labour Division produces monthly estimates of total SLI by province. However, no industry breakdown is available, even on an annual basis, for the provinces. Consequently, estimates of SLI by industry are calculated by multiplying wages and salaries in each industry by the Canadian ratio of SLI to wages and salaries. Quarterly estimates by industry are then benchmarked to correspond to the quarterly total for the province.

Military Pay and Allowances

The quarterly pattern used for military pay is based on Canadian data, available on CANSIM , Statistics Canada's electronic database.

Corporate Profits

For the period from 1961 to 1987, annual data on corporate profits by industry for the province are obtained from NAED. Quarterly estimates are derived using Canadian quarterly profits by industry adjusted by the ratio of wages and salaries for British Columbia relative to Canada. However, for manufacturing, shipments are used instead of wages and salaries to prorate the Canadian data.

Estimates of profits on an industry basis are not available for the years from 1988 on. Instead, Statistics Canada reports profits using an establishment-based concept, which does not conform to the industry definitions used in the BCEA. In order to produce quarterly estimates of profits by industry, BC STATS aggregates Canadian data into "industry" groups, which are similar to the industry data previously produced by Statistics Canada. The derived Canadian series are then used to estimate annual and quarterly profits by industry for the province.

Interest and Miscellaneous Investment Income (MII)

In ***personal income***, the estimate of interest and miscellaneous investment income includes the earnings of persons and unincorporated businesses only. It is reported on a **GNP** basis and includes various types of investment income, such as paid and imputed interest received from financial institutions, bond interest, royalties, dividends and other investment income.

The definition of MII used in the ***Income Account*** differs from the MII of persons and unincorporated businesses as follows:

- Canadian dividend payments are excluded, since they are already included in the Income Account as part of corporation profits.
- MII earned by the non-resident and government sectors is included.
- Interest payments on consumer and public debt are excluded, since they

represent a transfer rather than a payment for a productive service.
- Investment income earned abroad is excluded, while interest and other investment income paid abroad is included, in order to ensure that the data are presented on a domestic, rather than a national basis.

For both personal income and the Income Account, quarterly estimates for each component of MII are determined using data for British Columbia wherever possible. If no data are available at the provincial level, unpublished Canadian data obtained from NAED are used to derive a quarterly pattern, and the overall total is calculated by summing the components.

Accrued Net Income of Farm Operators from Farm Production

The quarterly allocator for this item is farm cash receipts for British Columbia, available on CANSIM .

Net Income of Non-farm Unincorporated Businesses

Quarterly estimates of unincorporated business income by industry are derived using the Canadian quarterly pattern, adjusted by the ratio of wages and salaries for British Columbia relative to Canada. For rent, the quarterly pattern is determined based on housing stock estimates and occupancy rates for the province.

Inventory Valuation Adjustment (IVA)

Estimates of IVA on a quarterly basis are calculated using the Canadian quarterly pattern for IVA by industry.

Capital Consumption Allowances (CCA)

The Canadian quarterly pattern for CCA in each industry is used to allocate annual benchmark estimates by industry for the province, which are derived from unpublished data obtained from NAED.

Indirect Taxes less Subsidies

Annual data on indirect taxes and subsidies by type of tax or subsidy are available by province in the *Provincial Economic Accounts (Statistics Canada Catalogue 13-213).* For federal and local taxes, the quarterly pattern is determined based on a related Canadian series. For provincial taxes, however, quarterly unpublished data for British Columbia is obtained from the Public Institutions Division (PID) of Statistics Canada. The PID data are only available for the years from 1982 on. For the period from 1976 to 1981, the quarterly series are based on information from the *Quarterly Financial Review*, which is published by the Ministry of Finance and Corporate Relations. Quarterly estimates for previous years are based on related Canadian series.

Users should note that the statistics from the Ministry of Finance and Corporate Relations are reported on a Public Accounts basis, which uses different accounting conventions as well as a different definition of the government sector than the BCEA. The quarterly PID data are derived from the Public Accounts, after adjusting for differences in definitions and coverage.

Gross Domestic Product at Factor Cost or Market Prices

Theoretically, the estimate of GDP obtained by summing the income components should be the same as that obtained by adding up the individual items of expenditure. However, due to limitations in the data, these numbers are usually not equal.

In the BCEA, GDP at market prices is determined for both the Income and the Expenditure Accounts, and the difference, or ***statistical discrepancy***, is split evenly between the two sets of numbers.

GDP at factor cost is then calculated by summing the income components (excluding indirect taxes net of subsidies) and the statistical discrepancy.

Appendix II: Sources and Methods

The Expenditure Account

The Expenditure Account outlines the disposition of incomes earned by the personal, business, government and non-resident sectors. Components of the Expenditure Account include:

- Personal expenditures on goods and services
- Government current expenditures on goods and services
- Government investment in fixed capital and inventories
- Business investment in fixed capital and inventories
- Net exports of goods and services

Unlike the Income Account, which is expressed in current dollars only, the Expenditure Account is calculated in both current and constant dollars. For each component of the Expenditure Account, quarterly current dollar estimates are calculated, then deflated to derive the constant dollar series. The quarterly series are then benchmarked to correspond to the total published by Statistics Canada. At the provincial level, constant dollar data are only available from Statistics Canada for the years from 1981 on. Estimates for years prior to 1981 are calculated by BC STATS.

In all cases, where there is an aggregate of sub-categories, the series for the years from 1961 to 1985 include an adjusting entry. Similarly, the overall estimate of real GDP at market prices includes an adjusting entry. The purpose of the adjusting entry is to ensure that overall growth rates are not affected by changes in the base year that is used. Consequently the components of the Expenditure Account do not sum exactly to the published totals and subtotals. In the case of personal expenditures, the adjusting entry is included with the "residual" (e.g. other durables) for each expenditure category.

Personal Expenditures on Goods and Services

Personal expenditures on goods and services comprise about 60% of total gross domestic expenditures. Estimates of quarterly personal expenditures on goods are derived based on an algorithm developed by Statistics Canada. This method uses weights from the Annual Retail Commodity Survey (extra-polated for more recent years) to convert retail sales data classified by kind of business into estimates of expenditures by commodity. Quarterly estimates of retail sales by kind of business are available on CANSIM . The quarterly pattern of retail sales taxes paid by individuals is determined by multiplying quarterly personal expenditures by the retail sales tax rate.

For personal expenditures on services, the source of the quarterly pattern varies among different types of services. A number of the quarterly estimates are calculated using related allocators, some of which are specific to British Columbia, while others depend on national quarterly patterns. For example, data from the BC Ferry Corporation are used to calculate quarterly spending on water transportation in the province. In some cases, where no quarterly data are available, the quarterly pattern is based on linear interpolation of the annual estimates.

Quarterly constant dollar estimates are, in general, calculated by deflating the current dollar numbers using the British Columbia consumer price index for each commodity, although other deflators may be used for specific series.

Government Current Expenditures on Goods and Services

The government sector includes federal, provincial and local governments, as well as schools, hospitals and the administration of the Canada Pension Plan. Annual estimates of current government expenditures on goods and services by level of government can be

disaggregated into wages and salaries and expenditures on goods. The quarterly pattern of the wage portion of government expenditures is based on quarterly estimates of labour income, which are available from the Labour Division of Statistics Canada. For government expenditures on goods, the quarterly pattern is based on data for British Columbia where possible, otherwise the Canadian quarterly pattern for each component is used.

Constant dollar estimates are generated using two basic types of deflators. For the wage portion of government expenditures, the deflator is based on employment, while expenditures on goods are deflated using a weighted average of various industry product price indices and/or personal expenditure deflators. The weights are obtained from NAED.

Investment in Residential Construction

Quarterly estimates of investment in residential construction are calculated using published provincial data which are obtained from the Investment and Capital Stock Division of Statistics Canada. Estimates of quarterly transfer costs (real estate commissions) originate with NAED, and may also be based on quarterly multiple listings service (MLS) sales data for the earlier period. For acquisition costs (which are mainly legal fees), quarterly personal expenditures on legal and other services are used. In most cases, the quarterly deflators are also available on a provincial basis from Statistics Canada.

Investment in Non-Residential Construction

Annual estimates by industry, in current and constant dollars, of investment in non-residential construction for British Columbia, are obtained from the Statistics Canada publication *Fixed Capital Stocks and Flows*. For the most recent year, the estimates are based on data from the Private and Public Investment Intentions Survey. The quarterly current dollar pattern used in the BCEA is based on GDP in the non-residential construction industry, while the quarterly deflator is derived by adjusting the Canadian deflator for non-residential construction by an index of the ratio of wages and salaries in British Columbia relative to Canada.

Investment in Machinery and Equipment

Quarterly estimates of investment in machinery and equipment are determined using the Canadian quarterly pattern up to 1980. For later years, the quarterly pattern is based on retail sales tax information for British Columbia.

Constant dollar estimates for this component are derived using quarterly Canadian deflators for investment in machinery and equipment by industry. The overall deflator is benchmarked to the NAED estimate for 1981 onward.

Investment in Inventories

The quarterly estimates of investment in inventories and the value of physical change in inventories are calculated for each industry using Canadian quarterly patterns and Canadian deflators. The data are then benchmarked to the annual estimates produced by NAED for the years from 1981 on.

External Trade of Goods and Services

Estimates of trade in goods and services rely on data produced for the Interprovincial Trade Flows Project (IPTF). This project used an input-output based methodology to produce estimates of international and interprovincial trade in goods and services for the years from 1984 to 1990. The 1990 data are consistent with the 1990 input-output model for British Columbia. However, the 1984 data are not entirely consistent with the 1984 input-output model, since some of the data sources used in the IPTF project were felt to be of better quality than the input-output

data for 1984. Users should note that significant differences remain between the input-output estimates for 1984 and the NAED data on which the BCEA are based. These differences are especially large for the external sector.

Because the IPTF project only produced data for seven years, it was necessary to extrapolate the trade estimates back to 1961 and forward to 1995. For the period from 1981 to 1995, the extrapolation is done by NAED. The benchmark estimates produced by Statistics Canada are then extended back to 1961 using allocators derived by BC STATS.

For trade in goods, the allocators are based on benchmark information from the 1974 and 1979 input-output models for the province.

The basic methodology for calculating trade with the rest of Canada is outlined below, using exports as an example. For the period from 1961 to 1980, these methods are also used to derive the annual estimates. The data for 1961 to 1980 are then linked to the Statistics Canada series for 1981 on.

- **Merchandise exports to the rest of Canada**

Figures on exports to the rest of Canada are derived from information in the use and final demand matrices of the Canadian input-output model. An estimate of the British Columbia component of commodity usage by each industry or final demand category is calculated using data for commodity exports to the rest of Canada which are obtained from the provincial input-output models for 1974 and 1979. Coefficients relating commodity usage to output or final demand are then applied to allocators for each industry in order to calculate a time series of commodity exports to the rest of the country. The allocators used are estimates of Canadian output and final demand by industry.

The data based on the 1974 and 1979 input-output models are linked for the period from 1974 to 1979. They are then benchmarked to the annual estimates for 1981 to 1995 which are obtained from Statistics Canada. Finally, they are deflated using British Columbia commodity weighted industry product price indices.

The major assumption underlying the estimates of exports to the rest of Canada is that the relative use of commodities originating in British Columbia remained more or less constant prior to 1974. This assumption of stability, on which the import estimates are also based, is not necessarily true; however, annual measures of exports to the rest of Canada for the 1961 to 1980 period are not available. The estimates must therefore be regarded as being somewhat less reliable than the other Expenditure Account components.

- **Merchandise exports to the rest of the world**

These estimates are derived directly from data on British Columbia product exports which were published in the *British Columbia External Trade Report* (for the earlier years). For the more recent years, customs ports exports by commodity are obtained in machine readable form from Statistics Canada and aggregated up to the BCEA groupings. The customs data is then restated on a Balance of Payments basis, and is linked to the annual estimates for 1981 to 1995 which are produced by NAED. Up to 1981, most of the deflators used to calculate the constant dollar series are implicit deflators which are based on changes in the prices of British Columbia's exports. For 1981 on, the deflator for exports to the rest of the world is based on a British Columbia-weighted average of Canadian export deflators. The constant dollar series are forced to correspond with the annual benchmarks from NAED.

- **Merchandise imports from the rest of Canada**

Imports from the rest of Canada are calculated using benchmarks from the 1974 and the 1979 input-output models for British Columbia, as well as the NAED estimates for the period from 1981 to 1995.

The method used to calculate quarterly imports from the rest of Canada is essentially the same as that which is described in the discussion of exports to the rest of the country. However, in this case, the British Columbia use and final demand matrices are utilized, and the allocators are output and final demand estimates for this province. Once the quarterly data have been benchmarked to the published annual totals, constant dollar imports are calculated using British Columbia-weighted commodity price indices.

- **Merchandise imports from the rest of the world**

British Columbia customs ports import estimates are used to extend benchmark estimates of commodity imports from the rest of the world, which are obtained from the 1974 and 1979 input-output models for British Columbia and from the IPTF project. The ratio of the 1974 input-output estimate to the custom ports data for each commodity is used up to 1974; the 1979 input-output benchmark is the basis of the estimates for 1979 to 1987, and the data for 1974 to 1979 are calculated as a weighted average of the two sets of estimates. The 1979 input-output data are used for the period from 1979 to 1984. For 1984 to 1990, the ratios of the IPTF estimates to the custom ports data for each commodity are used. The series are then benchmarked to the published annual data for 1981 to 1995 and the current dollar data are deflated using Canadian import deflators for each commodity.

Net Service Exports

Trade in services is much more difficult to measure. In general, the quarterly series, and the annual data for the years prior to 1981, are calculated using either a Canadian quarterly pattern or, where it is more appropriate, a ratio of services such as transportation to the total value of goods exports or imports. This ratio is derived from the IPTF data.

Gross Domestic Product at Market Prices

As indicated in the discussion of the Income Account, the quarterly pattern of GDP at market prices is determined by summing the various components of the Expenditure Account (in both current and constant dollars). The difference between the current dollar Expenditure Account estimate of GDP at market prices and the estimate from the Income Account (also known as the statistical discrepancy) is allocated equally between the two sets of accounts.

The GDP deflator is determined as a weighted average of the deflators for each component. An implicit adjusting entry is also included in the final estimate of real GDP for 1960 to 1985.

The Industry Account

The GDP estimates in the Industry Account are reported at ***factor cost***: that is, excluding indirect taxes net of subsidies.

The Industry Measures and Analysis Division (IMAD) of Statistics Canada now produces annual estimates of GDP for each industry for the years from 1984 to 1991 in current dollars, and for the years from 1984 to 1995 in constant dollars. For most goods-producing industries, as well as for a small number of service industries, estimates are also available going back to 1971.

The IMAD estimates of GDP at factor cost are not exactly equal to the estimate of GDP at factor cost which is

reported in the Income Account. IMAD and NAED are working on resolving the remaining differences between the two data sources, and it is expected that when the next set of Accounts are released in 1996, any remaining discrepancies will be quite small. However, at present, the Industry Account numbers remain somewhat different from those reported in the Income Account.

Goods-Producing Industries

Benchmark estimates of GDP by industry are obtained from IMAD for the years from 1981 on, and in most cases, going back to 1971. Although the current dollar estimates only extend from 1971 to 1991, the constant dollar series cover the entire period from 1971 to 1995.

For all of the goods industries, annual current dollar estimates for the years from 1992 on are derived by inflating the Statistics Canada benchmarks using an output-based price index. The price indices are constructed by extrapolating the implicit GDP price index for each industry using an output price index.

In most cases, the quarterly allocator, which is also used to extend the annual estimates back to 1961, is the sum of the income components for each industry. The exceptions are mining and manufacturing, where annual production and shipment estimates are used to push the annual benchmarks back to 1961 and forward to 1995. In the case of manufacturing, census value added is also used, where available. The quarterly allocator for the mining industry is production, while shipments are used to derive quarterly estimates for the manufacturing industries.

Service Industries

In the service sector, annual benchmark estimates for the years from 1984 to 1991 are extrapolated back to 1961 and forward to 1995 using a variety of methods which are outlined below:

- For industries such as education, health and public administration, where the GDP estimate from IMAD is basically calculated by summing the income components, the sum of income components is used to extrapolate the GDP series.
- In other cases, the Canadian GDP series for a particular industry may be used to extrapolate the data back to 1961. When a Canadian series is used to derive an annual estimate, it is usually modified by a suitable ratio, such as British Columbia to Canada wages and salaries, or if possible, by the ratio of the sum of income components. GDP estimates for industries like transportation, storage, communication, retail and wholesale trade are calculated using this methodology, as are the estimates for a number of other service industries.
- Methodologies similar to those used by Statistics Canada to derive the annual estimates have been adopted in the BCEA. For example, GDP in the Finance, Insurance and Real Estate Industry is calculated using methods similar to those described in Statistics Canada catalogue 15-203.

Once the initial estimates have been generated, the data are benchmarked so that the total for all industries corresponds to IMAD's published value for GDP at factor cost.

Canadian deflators for each industry are used to extend the implicit GDP deflator back to 1961 and forward to the current year.