

Forest Economic Multipliers

The multipliers presented below are Ministry of Forests' estimates of the impact of one thousand cubic metres of timber harvest on key B.C. economic indicators. They were developed in partnership with the BC Council of Forest Industries (COFI). These estimates are based on the economic impacts provided by Statistics Canada based on a special run of its Input-Output Model (the IO Model) for the BC forest sector. The economic impacts are expressed in key economic indicators, such as output, Gross Domestic Products (GDP), employment and tax revenues. **These are the average annual impacts for the years 2018-2020.** The Ministry uses these multipliers for economic impact analysis, such as the impacts presented in Timber Supply Reviews.

Table 1: Forest Sector Impact per thousand m³ of Harvest (including waste) - in thousands of dollars (except employment)

2018-2020 average basis	Impact Type	Output	GDP	Labour Income	Employment	Provincial Tax Revenue**
Northern Interior ¹	Direct	\$240	\$81	\$52	0.51	\$7.3
	Indirect	\$64	\$33	\$21	0.30	\$3.4
	Induced*	\$44	\$28	\$12	0.25	\$3.3
Southern Interior ²	Direct	\$390	\$131	\$86	0.85	\$11.9
	Indirect	\$101	\$52	\$33	0.47	\$5.3
	Induced*	\$72	\$46	\$20	0.40	\$5.3
Coast ³	Direct	\$565	\$190	\$123	1.28	\$17.2
	Indirect	\$162	\$84	\$53	0.77	\$8.5
	Induced*	\$106	\$68	\$30	0.60	\$7.9

*Note: We generally do not recommend including the induced impact, given the limitations associated with this estimate. Please see the text on the second page for more details.

**Provincial Tax Revenue doesn't include stumpage payments from logging on Crown land.

The Forest Sector consists of seven sub-sectors as defined using Statistics Canada's Input-Output Industry Classification (IOIC). These are as follows:

- Forestry and Logging (BS113000)
- Support Activities for Forestry (BS115300)
- Sawmills and Wood Preservation (BS321100)
- Veneer, Plywood and Engineered Wood Product Manufacturing (BS321200)
- Other Wood Product Manufacturing (BS321900)
- Pulp, Paper and Paperboard Mills (BS322100)
- Converted Paper Product Manufacturing (BS322200)

¹ Region of Omineca, Cariboo, Northeast, and Skeena. Includes Kalum District, which is mostly coastal species, but it has insignificant harvest volume. Reference map available [here](#).

² Region of Kootenay Boundary plus Thompson Okanagan. Excludes the Cariboo region which is designated as Southern Interior in FLNR management units.

³ Region of South Coast and West Coast, excluding the North Coast (Kalum/Coast Mountains District).



The economic impacts include direct, indirect, and induced impacts as defined below:

- Direct impact refers to changes to the forest sector itself.
- Indirect impact refers to impacts to the supplying industries, from which the forest sector purchase goods and services.
- Induced impact refers to impacts to the economy resulting from employees in the direct and indirect industries spending their income.

It is important to note that the induced impact is estimated solely based on changes in employment income and does not consider the income collected by people through their social safety net, such as unemployment insurance and other social assistance or from their savings. In addition, it may not always be the case that employees working in BC would only spend their income locally in BC. Some employees, for example, might have come from other provinces or countries and send most of their pay cheques to their families back home. The surge of E-commerce shopping further weakens the link between income and local consumption. These limitations suggest that the induced impact tends to exaggerate the impact to the economy. For this reason, we usually do not include the induced impact in our analysis.

The economic impacts were “delinked” by Statistics Canada to remove most of the double counting amongst the seven forest subsectors. In other words, the forest sector’s intermediate consumption of forestry products (defined as products primarily produced by the forestry sector industries) were zeroed out, so were the indirect and induced effects associated with the intermediate consumption.

Methodology

The estimation of the above presented impacts are done in the following steps:

- Regionalization of province wide impacts to [Natural Resource Regions](#)
- Projection of economic impacts
- Estimation of provincial government tax revenues
- Estimation of the three-year average impacts per thousand cubic metres of timber harvest

Regionalization

Statistics Canada provided economic impacts of BC’s forest sector using the interprovincial IO model, which is based on the provincial Supply and Use Tables (SUT). While this model provided province wide impacts of different exogenous shocks and factors, it is important to understand the distribution of these impacts among different regions in British Columbia. The distribution of provincial economic impacts into eight natural resource regions was done in two steps.

Conversion of Regional Labour Force Data

At first, the total “experienced” labour force data for each Census subdivision by corresponding four-digit North American Industry Classification System (NAICS) code was extracted from the Census. This data set was ordered from Statistics Canada as a custom tabulation based on the 2016 census. The data counts those individuals who worked from January 2015 to May 2016 in the industry. We chose to use this rather than the employment data which only counts those who worked in the industry in the week preceding the census. Experienced labour force provides a more robust measure that is less influenced by short-term fluctuations or seasonal variation. These labour force estimates were based on the place

of work, rather than place of residence as it was believed to capture the distribution of economic impacts better and link more clearly to fibre source (harvest). The data, which was by Census subdivision, was aggregated to eight natural resource regions using GIS mapping.

While this labour force data is available by four-digit NAICS codes, the economic impacts estimated by the IO model are available by IOIC codes (Input-Output Industry Classification). Hence, the second step is to map the four-digit NAICS codes to corresponding IOIC codes to be able to connect the two datasets. The mapping was performed based on supplemental data from Statistics Canada on wages and salaries, total number of jobs and total compensation for B.C. This exercise yielded an estimate of the experienced labour force in B.C. by IOIC codes.

Regionalization of Province-wide Impacts

Employment ratios were then computed by region for each of the seven forest industries. The employment ratio being an industry's labour force in a given region as a share of total BC labour force for that industry. Employment ratios were then applied to the direct, indirect, and induced impacts of the respective forest sub-sectors, resulting in region-specific impacts by industry. For example, if the Omineca Region has 15% of sawmill employment, then 15% of sawmill direct, indirect, and induced impacts are allocated to the Omineca region. The underlying assumption for this method is that the industry linkage is the same across the province. In other words, the impact of a shock to the forest sector on other industries is the same across the province, regardless of where the shock originated. The estimated impacts represent the province wide impacts and are not restricted to a particular region.

Projection of Economic Impacts

There is usually a three-year lag in Statistics Canada's IO model to allow time for data revisions. The 2018 economic impacts were released in November 2021.

The joint working group between the Ministry and COFI projected the 2018 economic impacts to 2019 and 2020 using GDP deflators, various price indices and more recent labour statistics.

At the time this study was conducted, nominal GDP by industry in current dollars was only available from Statistics Canada up until the year 2018. However, real GDP by industry⁴ (2012 Chained Dollars) was available from Statistics Canada up to 2020. The 2018 economic impacts were projected in terms of 2019 and 2020 current dollars. This entailed calculating a GDP deflator using the available GDP data, which was then projected with the help of available price indices for the relevant industries. Finally, the projected deflator was multiplied with real GDP to get an estimate of nominal GDP. All the GDP calculations were done at basic prices. The projection method is detailed below.

First, from the two series we can get GDP deflators for 2018 as follows:

$$Deflator_t = \frac{Nominal\ GDP_t}{Real\ GDP_t} * 100$$

Since we do not have nominal GDP for 2019 and 2020, next, we use the price indices for calculating the deflators for subsequent years.

$$Deflator_{\{t+n\}} = Deflator_t * \frac{P_{\{t+n\}}}{P_{\{t\}}}$$

⁴ Statistics Canada. [Table 36-10-0402-01 Gross domestic product \(GDP\) at basic prices, by industry, provinces and territories](#)



The following price indices have been used.

- Raw Materials Price Index⁵ (Canada) for Forestry and Logging (BS113000)
- CPI Services⁶ (B.C.) for Support Activities for Forestry (BS115300)
- Industrial Product Price Index⁷ (Canada) for the remaining five (5) industries.

Then Nominal GDP can be forecasted as follows:

$$\text{Projected Nominal GDP}_{\{t+n\}} = \text{Deflator}_{\{t+n\}} * \text{Real GDP}_{\{t+n\}}$$

After that, the percent change from Base IO Year GDP is calculated as follows:

$$\% \text{ change in Nominal GDP}_{\{t+n\}} = \frac{\text{Projected Nominal GDP}_{\{t+n\}}}{\text{Input Output Model Base Year GDP}_{\{t\}}} - 1$$

This percentage change in nominal GDP is then applied to Output, GDP, Taxes on Products & Production, and Gross Operating Surplus to project these indicators to more recent years. For example:

$$\text{Projected Gross Operating Surplus}_{\{t+n\}} = \text{Gross Operating Surplus}_t * (1 + \% \text{ change in Nominal GDP}_{\{t+n\}})$$

This projection exercise is not necessary for direct labour income or the number of jobs as values for 2019 and 2020 are available from Statistics Canada⁸. Indirect and induced impacts were estimated for the 2019 and 2020 years based on the ratios of these impacts to the direct impact in 2018.

Provincial Tax Estimation

Four major sources of revenue to Government have been identified. These are:

- Taxes on Product
- Taxes on Production
- Personal Income Tax (PIT)
- Corporate Income Tax (CIT)

Taxes on Product and Production

Taxes on product and production were included in the IO model results provided by Statistics Canada. Statistics Canada also provided supplemental validation tables that allowed us to calculate the shares between federal, provincial, and municipal governments for each sub-sector. The taxes were allocated to the three levels of government accordingly.

⁵ Statistics Canada. [Table 18-10-0268-01 Raw materials price index, monthly](#)

⁶ Statistics Canada. [Table 18-10-0005-01 Consumer Price Index, annual average, not seasonally adjusted](#)

⁷ Statistics Canada. [Table 18-10-0267-01 Industrial product price index, by industry, monthly](#)

⁸ Statistics Canada. [Table 36-10-0480-01 Labour productivity and related measures by business sector industry and by non-commercial activity consistent with the industry accounts](#)



Personal Income Tax (PIT)

The PIT estimates were calculated based on the IO model's labour income impacts and effective federal & provincial tax rates on taxable income. Using Statistics Canada data⁹, PIT as a share of household primary income was estimated as follows.

$$PIT_{share} (\%) = \frac{Personal\ Income\ Tax\ (PIT)}{Primary\ Household\ Income}$$

This ratio was then applied to the labour income impacts to get an estimate of Personal Income Taxes. To allocate the PIT impacts between federal and provincial governments, we relied on the data from Statistics Canada¹⁰ that shows the level of household income tax collected by the Federal and Provincial Governments.

$$Federal_{PIT\ share} (\%) = \frac{Income\ Tax\ collected\ by\ Federal\ General\ Govt}{Total\ Income\ Tax}$$

$$Provincial_{PIT\ share} (\%) = \frac{Income\ Tax\ collected\ by\ Provincial\ \&\ Territorial\ General\ Govt}{Total\ Income\ Tax}$$

The primary household income (the denominator in PIT ratio) consists of four components. These are: i) Compensation of Employees ii) Farm & Non-Farm Income iii) Rental Income and iv) Net Property Income. Some of these items may not be taxed or may not exist as well (e.g., Imputed Rental Income). As a result, primary household income is more of a measure of household cash flow before transfers, instead of a measure of taxable labour income.

According to the Statistics Canada Table on Household Current Accounts (Table 36-10-0224-01), compensation of employees constitutes about 75% of household primary income. Hence, the tax rate that is being applied on labour income is more likely to be a lower bound for effective tax rate on taxable income.

Corporate Income Tax (CIT)

To get an estimate of CIT, data on Gross Operating Surplus (GOS) available from the Supply Use tables, was used. The GOS is the amount that is left over after labour income is deducted from value added; in other words, it is capital's share of value added. Since GOS includes both corporate income as well as depreciation and amortization, an adjustment needs to be made to it before it can be used in the estimation of the amount of CIT.

Using the most recent year of available data, ratios between GOS and taxable income by industry sub-sector are established.

$$Taxable\ Income_{share} (\%) = \frac{Taxable\ Income^{11}}{Gross\ Operating\ Surplus}$$

This ratio can now be applied on GOS of each industry to estimate taxable income for CIT from each industry. From the same data, the effective federal and provincial CIT rates by industry are calculated.

⁹ Statistics Canada. [Table 36-10-0224-01 Household sector, current accounts, provincial and territorial, annual](#)

¹⁰ Statistics Canada. [Table 36-10-0450-01 Revenue, expenditure and budgetary balance - General governments, provincial and territorial economic accounts](#) "General Government" is a term used by Statistics Canada to indicate that the data does not include public corporations.

¹¹ Statistics Canada. [Table 33-10-0006-01 Financial and taxation statistics for enterprises, by industry type](#)

$$\text{Federal Tax Rate (\%)} = \frac{\text{Federal Corporate Income Tax}}{\text{Taxable Income}}$$

$$\text{Provincial Tax Rate (\%)} = \frac{\text{Provincial Corporate Income Tax}}{\text{Taxable Income}}$$

These rates were then applied to taxable income estimates for each sub-industry to come up with an estimate of the level of CIT paid by the sector to provincial and federal governments.

Note that stumpage payments for Crown timber are not included in the four major sources of revenue outlined above, and are absent from the IO Model results. Stumpage revenue impact needs to be estimated separately if it is relevant to the analysis being performed.

3-Year Average Annual Impact per Unit of Harvest

To calculate impact per unit of harvest, we divided each Natural Resource Region's estimated impacts for any year by their respective annual harvest volumes (in thousand m³), from private, provincial and federal lands, including waste¹². These are coefficients, though they are often referred to as multipliers. The calculation can be written as:

$$\text{Impact per unit of Harvest}_{i,j,t} = \frac{\text{Impact of Industry "j" in region "i" at year "t"}}{\text{Annual Harvest}_{i,t}}$$

After doing this for the eight regions for the years 2018, 2019 and 2020, we took the simple average of the three years to estimate the average impact per unit of harvest. For example, if the output impact was \$325/ thousand m³ in 2018, \$350/ thousand m³ in 2019, and \$300/thousand m³ in 2020, then the average annual output impact would be \$325/thousand m³. Taking the average of three years' estimates based on the IO Model and actual harvest volumes accounts for some of the uncertainty and fluctuations in the forest sector and thus improves estimate stability.

Interpreting Impact Estimates

Impact estimates generated using the above three-year coefficients can be interpreted as the average annual impact associated with every thousand cubic metres of harvest.

Impacts generated using these results may be occurring in any part of BC, not just within the geographic area under analysis. This is particularly true for the indirect and induced impacts. For example, its more accurate to say 10,000 m³ of harvest in the Omineca Area supports X indirect jobs in BC, rather than X indirect jobs in Omineca itself.

In terms of regionalization, the eight Natural Resource Regions were aggregated into Northern Interior, Southern Interior and Coast. These groupings are used in analysis done by the Ministry.¹³ This produces better impact estimates by better accounting for fibre flows between regions.

This document was published in August 2022 and is available online at:

<https://www2.gov.bc.ca/gov/content/industry/forestry/competitive-forest-industry/forest-industry-economics>

¹² Waste volume from the provincial Crown land is directly available from the Harvest Billing System (HBS). Such volume is not available for private or federal lands and therefore, needs to be estimated. We calculated the ratio of waste to timber harvest on the Crown land and applied this ratio to harvest from private and federal lands to estimate the waste volume from these two land types.

¹³ The North Area and South Area used in this work do not match the North Area and South Area identified in the Ministry's Natural Resource Areas.