

FEED BC ECONOMIC IMPACT ANALYSIS:

**How shifting to more B.C. food in the
public healthcare and post-secondary
sectors impacts B.C.'s economy**



Ministry of
Agriculture
and Food

feedBC Bringing B.C. food to public institutions

FINAL REPORT

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STUDY OBJECTIVES AND METHODOLOGY

OBJECTIVES

Feed BC is a provincial government partnership initiative led by the Ministry of Agriculture and Food to increase B.C. food in hospitals, residential care facilities, public post-secondary institutions, and other government-supported facilities.

Feed BC commissioned this study to explore the use of the B.C. Input-Output Model (BCIOM) to measure the estimated total value of shifting to more B.C. food in the public healthcare and post-secondary sectors to B.C.'s economy for the purpose of better understanding program impacts and opportunities.

INPUT-OUTPUT METHODOLOGY

B.C. STATS (the Provincial Government's statistical agency) utilises an *Input-Output Model* (BCIOM) for all provincial government economic assessments and, the BCIOM generally is the required platform private sector firms wishing to submit impact statements to the provincial government¹. The BCIOM is based on detailed Supply and Use Tables for B.C. issued by Statistics Canada and is augmented using industry-specific information on taxes, margins (wholesale and retail mark-ups and embedded transportation costs) and wage rates.

The structure of the BCIOM enables an analyst to identify the increase in expected employment (and other measures such as GDP, wages, taxes, and the like) stemming from an increase in domestic demand for a commodity. This increase in demand can be structured as an increase in purchasing by companies or people or, and which is the approach taken in this study, as a decrease in the level of imports (international and/or interprovincial). With the latter approach, the lower imports are replaced by greater domestic production resulting in increased direct employment (and other measures).

When an industry increases production, it generates additional activity in all the domestic industries supplying goods and services to that industry. By definition, these downstream industries must increase their own production and, because they too purchase inputs for their own production, generate even more economic activity throughout the economy. In this context, an industry generates *indirect* impacts on the local and B.C. economies as a result of these purchases, and these impacts on the economy must be measured in order to evaluate the true value of the change in demand.

In addition, the wages and salaries paid by the industry and the additional wages paid by all the supplying industries will be spent (after subtracting personal federal and provincial incomes taxes and a proportion attributed to savings) on consumer goods and services. These added personal expenditures generate additional impacts on revenues, employment and the like. Again, in order to measure correctly the total impacts of a change in demand to the local and B.C. economies, one must identify these *induced* impacts.

¹ Further explanation of the structure of the BCIOM and the differences between Financial Accounting and I/O Accounting (National Accounts Accounting) can be found in Appendix A and Appendix B respectively.

ASSUMPTIONS AND LIMITATIONS

There are a number of assumptions and limitations that underpin Input-Output (I/O) models which should be noted. Some of these are generalised limitations in that they pertain to all analyses using the BCIOM. But some are more specific to the present study.

General Limitations

- **Linearity:** A given change in the demand for a commodity or for the outputs of a given industry will translate into a proportional change in the use of intermediate inputs and a proportional change in the use of value-added inputs, including employment. Likewise, there will be a proportional change in the taxes generated.
- **Industry Structures:** The current BCIOM is derived from a “snapshot” of B.C.’s economic structure in 2017. It assumes that relationships between industries are relatively stable over time (that is, the material inputs used per dollar of output by each industry, the proportion of inputs that are imported, the level of wages paid per dollar of output, etc. are more-or-less constant). Accordingly, it is assumed that the 2017 structure of the economy can be used to estimate the economic impact associated with a particular project in other years.
- **No Capacity Constraints:** The BCIOM assumes that there are no capacity constraints on production. An increase in domestic demand for, say, meat products, will be satisfied by the existing productive capacity of the meat producing industry. Likewise, an increase in the demand for labour will result in a proportional increase in employment (rather than simply re-deploying workers). Effectively, the BCIOM does not allow for firms to invest in new equipment to make the production activity more efficient. Note, the BCIOM can estimate the impacts of new investment; it just doesn’t make changes to the structure of its production.
- **Price Changes:** Input-Output (I/O) Models in general do not include any price changes and therefore there is no possibility for firms to change their use of specific material inputs as a result of changing price signals. This is important, since part of the rationale of implementing the Carbon Tax is to increase the cost of fossil fuels and thereby to increase the incentive to either switch fuels or invest in fossil fuel saving equipment.
- **Inter-temporal Constraint:** The BCIOM does not take into account the amount of time required for changes to happen. Economic adjustments resulting from a change in demand are assumed to happen immediately.
- **Personal Expenditures:** Once personal income taxes (federal and provincial) are subtracted from total incomes earned, it is assumed that consumers spend an average of 95% of this disposable income on goods and services. The remaining 5% of disposable income goes into savings. This assumption can be changed if there is evidence to suggest doing so in particular cases but was not changed in this analysis.

Limitations Specific to the Agricultural/Food Sector

- Commodity breakdowns within the BCIOM are not quite detailed enough for an analysis of all the different food products and/or categories used by the public sector. For example, there are no specific commodities for “chicken” or “turkey”; rather they are both subsumed under the commodity “Poultry”. Likewise, there are no commodities for individual fruits or vegetables but rather are included under the rubric “Fruits and Vegetables”. It is assumed that the derived multiplier for “poultry” adequately captures the true impact values for both chicken and turkey. Note that the final multiplier for chicken may differ from the final turkey multiplier if the proportion of processed poultry (purchased from a manufacturer) to raw poultry (purchased from the farm gate) is different from that of turkey.
- Likewise, industry breakdowns are restrictive. There is, for example, no industry for the production of “chicken”. Rather, the chicken processing activity is subsumed under the “Poultry Processing” industry. Accordingly, the BCIOM assumes that an increase in the demand for chicken will be adequately captured by the overall Poultry Processing sector.

In most cases, all of these assumptions are not met. Especially with COVID, it is likely that the use of materials and wages per dollar of output has changed (for example, when revenues fall, many costs such as accounting costs or heating costs do not fall as much), resulting in lower profits. If more materials are used per dollar of output, then the economic impacts of reducing imports (i.e., increasing domestic demand) will be higher than stated here. At the same time, it is possible some economies of scale might occur over time, and this would lead to slightly lower impacts on the economy (but higher profits to firms).

APPROACH

The approach adopted for this analysis is to first enter the (purchaser) use values² for the industries under consideration, in this case public healthcare (comprised of the Hospital sector – GS622000 and the Nursing and Residential Care Facilities sector – GS623000) and the post-secondary sector (comprised of the Universities sector - GS611300 and the Community Colleges sector - GS611200) into the “Financial Inputs Impacts” module of the BCIOM. The BCIOM automatically calculates the (international and interprovincial) imports by commodity. The import values are then adjusted downward proportionately by \$1 million and the Model re-run. The BCIOM automatically calculates and removes all input taxes

² The Use values are effectively the industry expenses by commodity including payroll as identified in the Supply and Use Tables. Purchaser values are automatically adjusted in the BCIOM to generate Basic values which exclude all associated taxes, wholesale and retail margins, and transportation margins. The margins are reallocated to the appropriate margin industry (e.g., retail trade) which has its own impact on the economy.

(since taxes do not contribute to additional economic activity).³ After that, all margins are re-allocated⁴, imports removed and direct, indirect and induced impacts estimated.

It is important to note that the methodology used in this analysis is the exact same approach that both BC STATS and Statistics Canada use to determine the economic impacts of other industry sectors such as the Forestry Industry or the Mining Industry. As such, the estimates presented in this Report are completely comparable to other BC STATS/Statistics Canada measures.

ECONOMIC IMPACTS

The analysis was undertaken for the public healthcare sector (GS622000 and GS623000) and the post-secondary Education sector (GS611300 and GS611A00) as defined by Statistics Canada. We have calculated impacts for a selection of food products within each sector which comprise the bulk of the major food product categories (there are some larger groupings within the I/O categories – e.g. “other food products” that are too diverse to be useful in the analysis). The impacts by product are almost identical in the healthcare vs the post-education sectors – the only variance being due to the different tax rates associated with each sector and the different margins (wholesale, retail, and transportation) connected to the purchase of each product in each sector.⁵ Nevertheless, impacts of each sector are presented separately below.

³ There are 15 different input and 15 different consumer spending tax types: Fed Trading Profits Tax; Fed Gasoline Tax; Fed Excise Tax; Fed Excise Duties; Fed Air Transport Tax; Fed Import Duties; Fed GST; Prov Environmental Tax; Prov Trading Profits Tax; Prov Gasoline Tax; Prov Other; Prov PST; Land Transfer Tax; Municipal Sales Tax; and Aboriginal Trading Profits Tax. There are tax rates assigned for each tax for each commodity type (e.g., there are a total of 7,440 input tax rates and another 7,440 consumer tax rates included in the BCIOM).

⁴ The purchase price of most commodities includes a portion for the actual producer cost (at the factory gate), markups (or “margins”) by wholesale and retail trade sectors, and a cost for transporting the commodity from the producer (transportation margins). For example, when there is a purchase price of say, \$100 for a commodity, a part (say \$60) is allocated to the producer industry, another \$15 and \$20 are allocated to the appropriate wholesale industry and retail industry, and the remainder (\$5) allocated to the appropriate transport industry.

There are 8 different wholesale margins (Farm, Petroleum, Food, Household Appliances, Autos, Construction Products, Machinery, and Other), 11 retail margins (Autos, Furniture, Electronics, Construction Products, Food, Health, Auto Fuels, Clothing, Sport Equipment, Household Fuel, Other), and 13 Transportation margins (Gas, Pipeline Oil, Pipeline Gas, Storage, Air, Rail, Water, Truck General, Truck Special, Water Supply, Road, Brokerage, Other) included in the BCIOM. There are margin rates assigned for each margin type for each commodity type for inputs and consumer spending separately. That is, there are 15,872 different margins rates for business inputs and another 15,872 margin rates for consumer goods and services contained in the Model.

⁵ The more-or-less equivalency of impacts across products should not be surprising. The impacts derived are based on changes in domestic production in each affected food product industry. The food product industry itself does not care if the increase in the demand for its product comes from the healthcare sector, or from the post-secondary education sector or any other sector. If there is an increase of \$1 million for a food product (the standard impact for this analysis), then the impacts are what are highlighted, irrespective of the sector generating the increased demand.

PUBLIC HEALTH CARE

By increasing domestic (B.C.) food purchases such as by replacing imports of particular food products within the healthcare sector by domestic production, the modelling estimates the number of new jobs that would result. **Figure 1** highlights those impacts. If \$1 million of poultry imports were replaced, the first column in the chart shows that 8.0 new jobs would be generated in the province. Other types of food products (e.g., juices, seafood or processed fruits and vegetables) would generate somewhat lower employment impacts, but other products (e.g., fresh vegetables) have much higher employment impacts. Overall, the weighted average for all food products purchased by the healthcare sector is new 8.5 jobs (with a range of 6.7 to 13.1 jobs).⁶

Figure 1: Job Impacts from Increasing Domestic (B.C.) Food Purchasing by \$1 Million

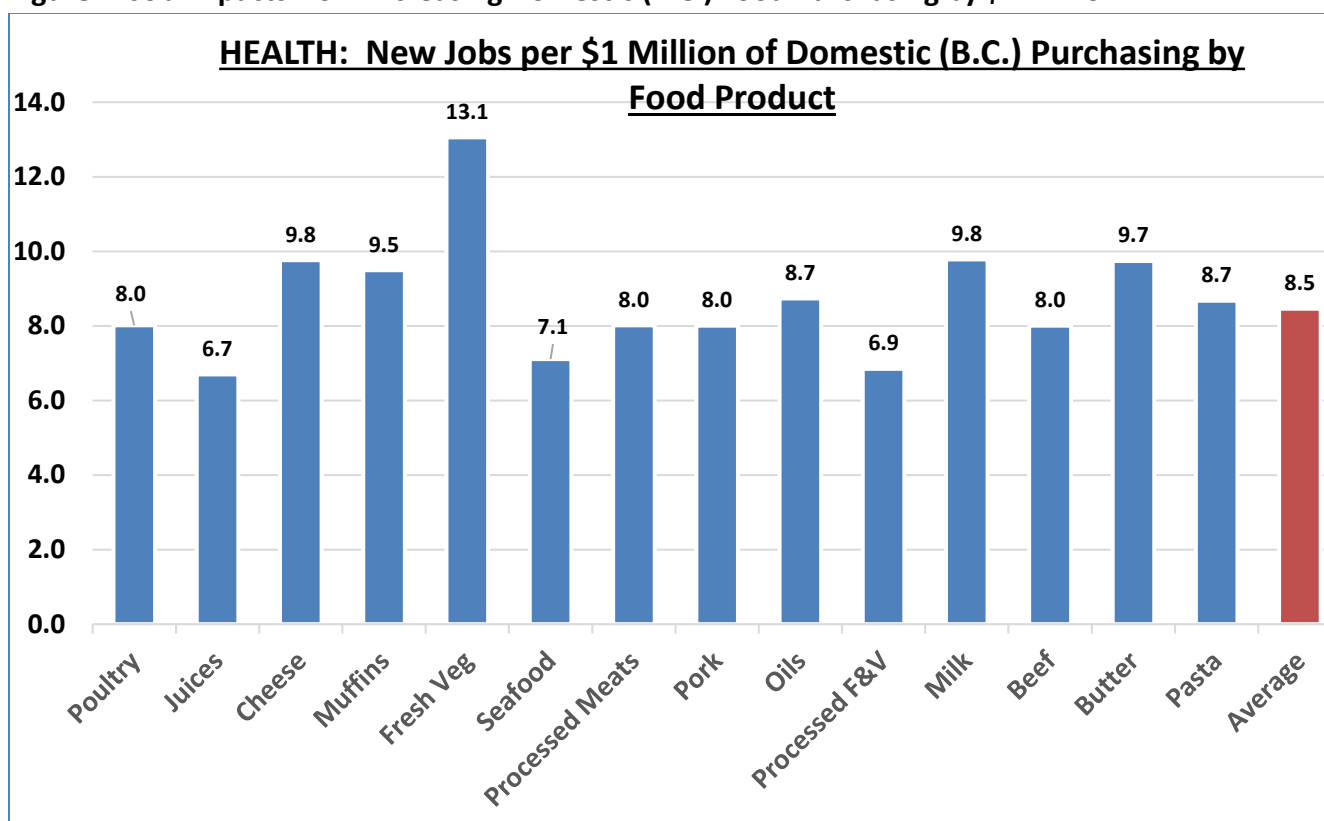


Figure 2 below highlights similar employment impacts, but in this case, the impacts have been converted to Full-Time Equivalents (FTEs)⁷. The \$1 million replacement of Poultry imports with domestic production generates 6.8 new FTEs in the province. On average, import substitution generates 7.0 new FTEs (with a range of 5.5 to 10.7).

⁶ The weighted average is based on the Health sector's purchases of the various food/agr products.

⁷ A "Job" consists of a person holding a job irrespective of whether the person is working a full 8 hours a day, a full 5-day week or is working the whole year. The FTE value adjusts for all that, so 1 FTE is equivalent to a person working all the regular hours in a year. Note that the Model has different FTE ratios for each industry sector since some industries have different standard hours per day, etc.

Figure 2: FTE Impacts from Increasing Domestic (B.C.) Food Purchasing by \$1 Million

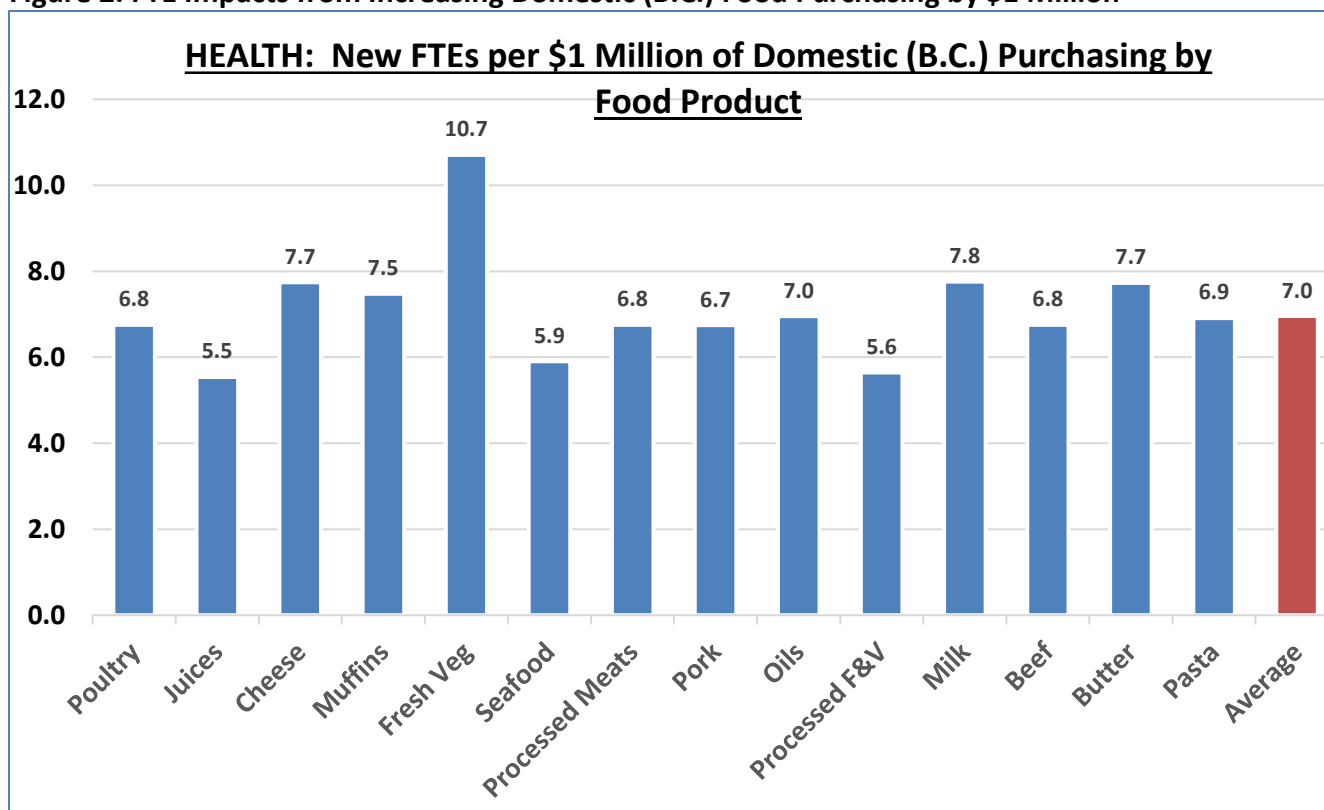
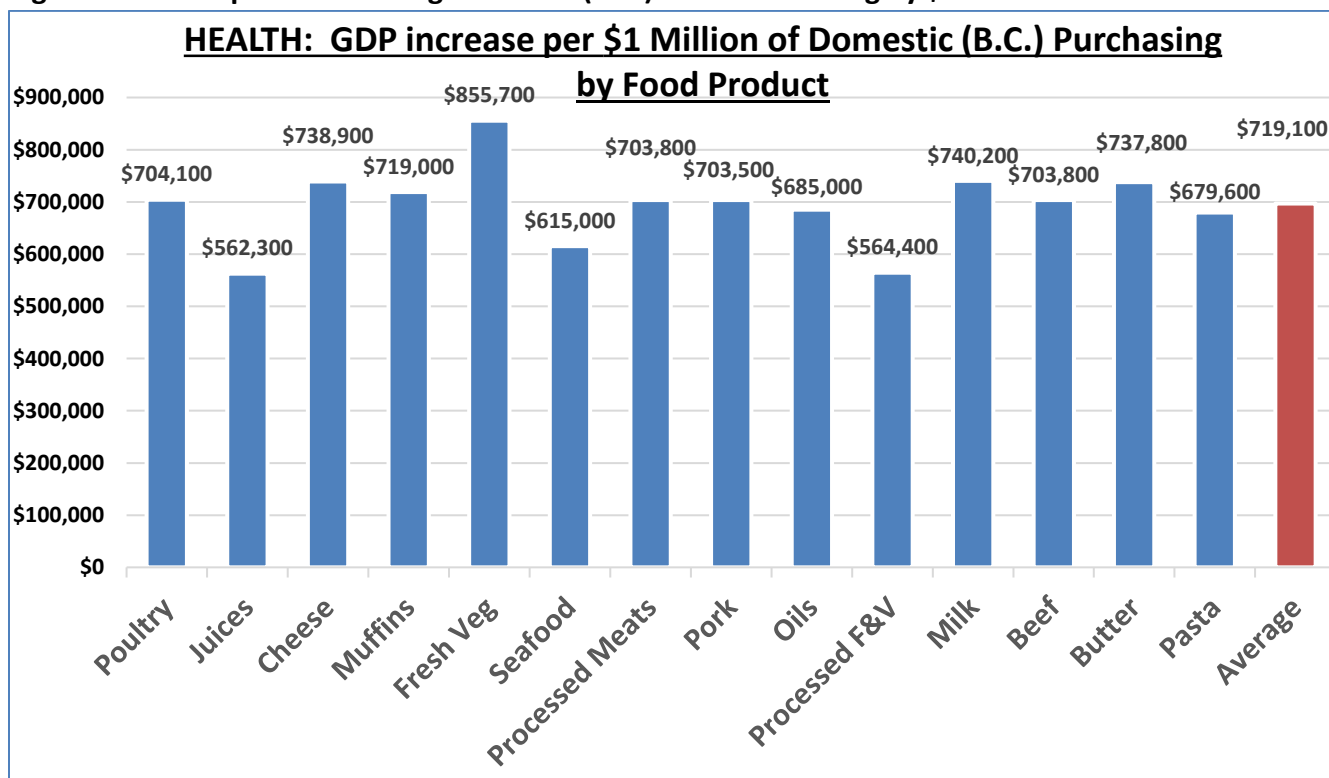


Figure 3: GDP Impacts Increasing Domestic (B.C.) Food Purchasing by \$1 Million



The model analysis also estimates the impacts on Gross Domestic Product (GDP) as highlighted in **Figure 3** on the previous page. Again, specific food products have different impacts on GDP, the range being between \$562,300 for Juices to \$855,700 in the Fresh Vegetable sector. On average, a \$1 million in import substitution will result in an increase in GDP of \$719,100

Figure 4 highlights the impacts on wages (excluding benefits) from each product. A reduction of \$1 million in Poultry imports and an equivalent increase in domestic purchases would result in \$390,600 in additional wages in the B.C. economy. On average, import substitution would result in just over \$421,000 in new additional wages (with a range between \$343,700 and \$596,400).

Figure 4: WAGE Impacts from Increasing Domestic (B.C.) Food Purchasing by \$1 Million

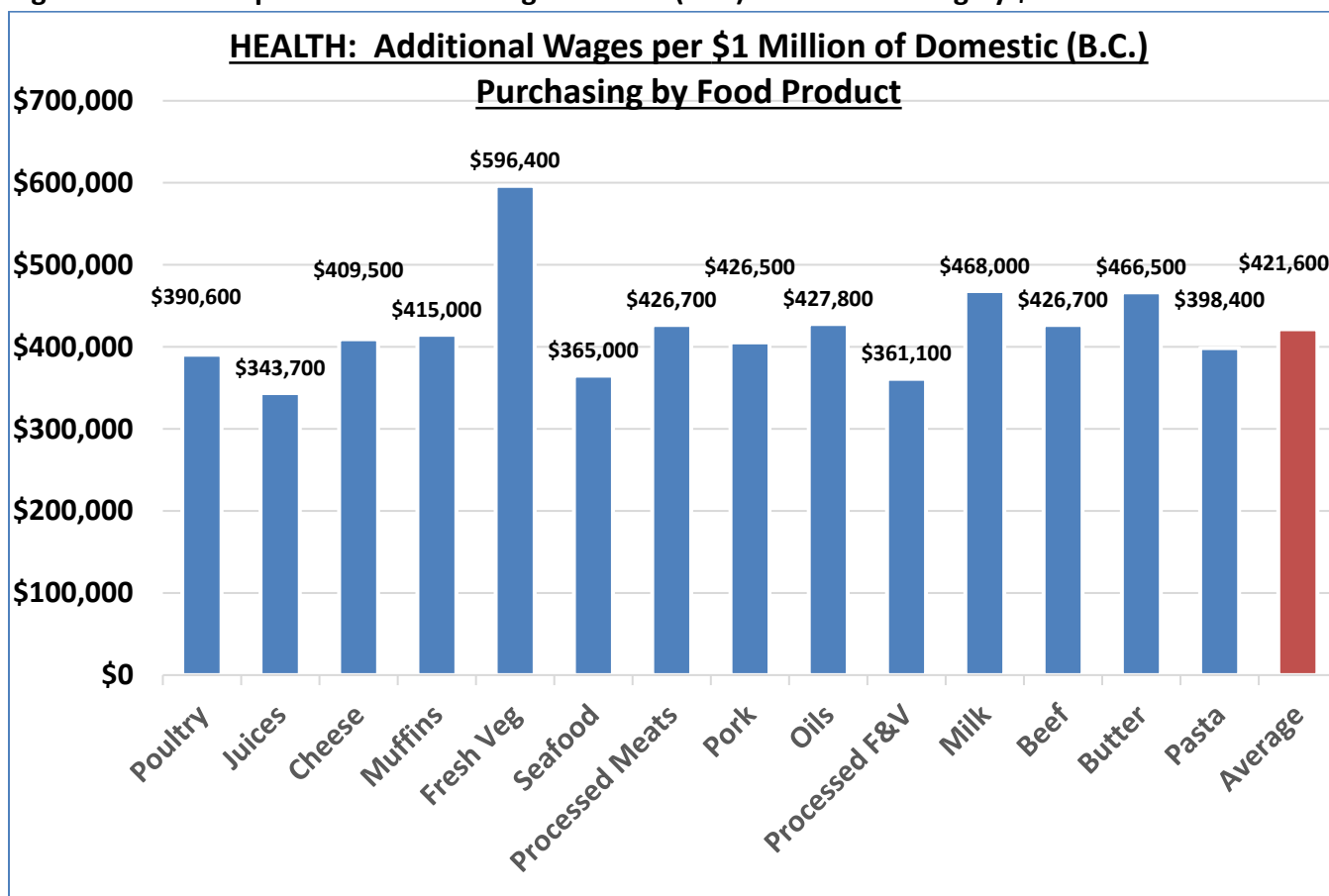


Figure 5 on the following page highlights the impacts of \$1 million increase in domestic purchases on Provincial and Regional Government taxes. On average, \$1 million increase in domestic purchases will add over \$57,600 to provincial government tax revenues (with a range of \$47,300 to \$75,800).

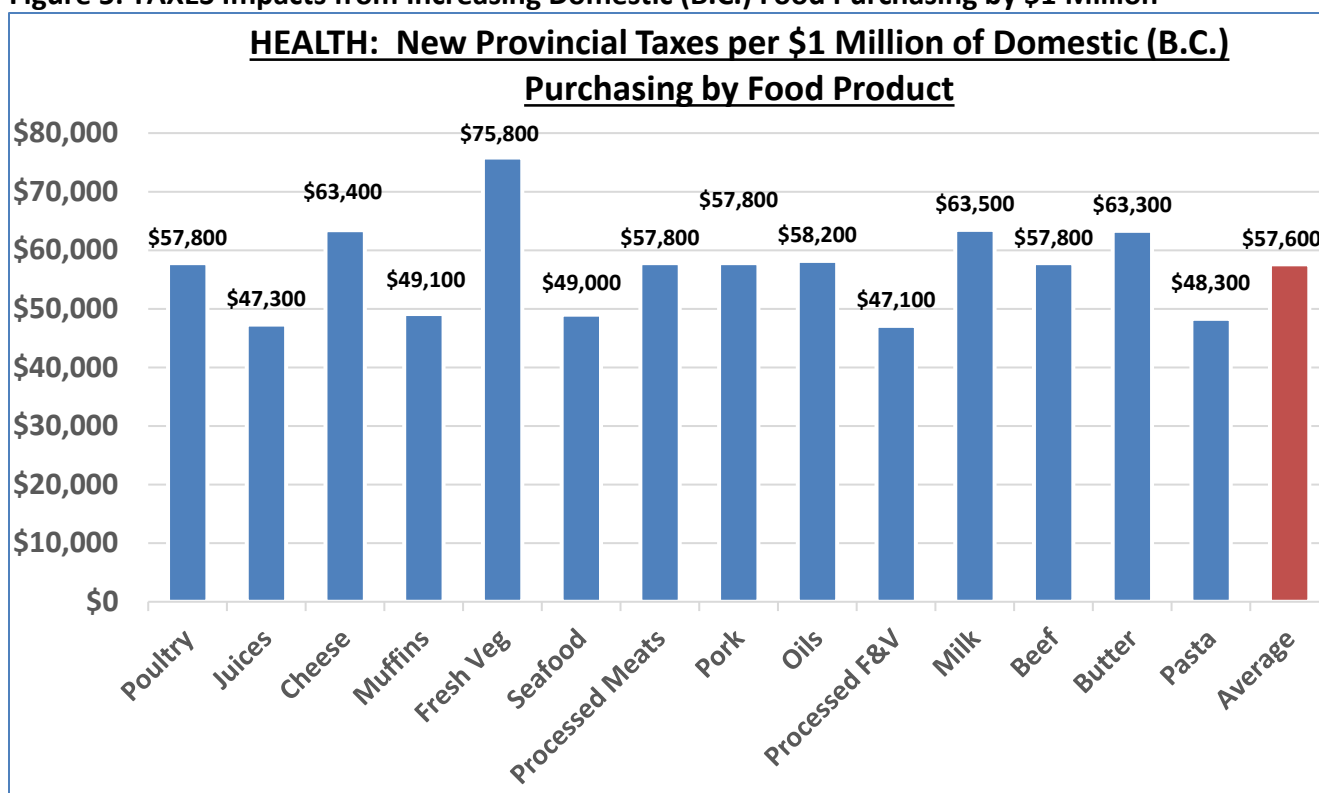
Figure 5: TAXES Impacts from Increasing Domestic (B.C.) Food Purchasing by \$1 Million

Figure 6 on the following page presents the detailed impacts (including the indirect separate from the induced) for an average \$1 million increase in domestic purchases. On average (across all food products), a \$1 million increase in domestic food purchases will increase total Output activity in the economy (direct + indirect + induced) by \$1.964 million of which ranges from \$1,541,390 to 2,247,077. Besides providing information on the impacts on employment, wages and taxes, **Figure 6** also highlights the indirect impacts split between the Agriculture/Food Manufacturing sectors and Other sectors of the economy. The equivalent data for each product can be found in the Detailed Tables document.

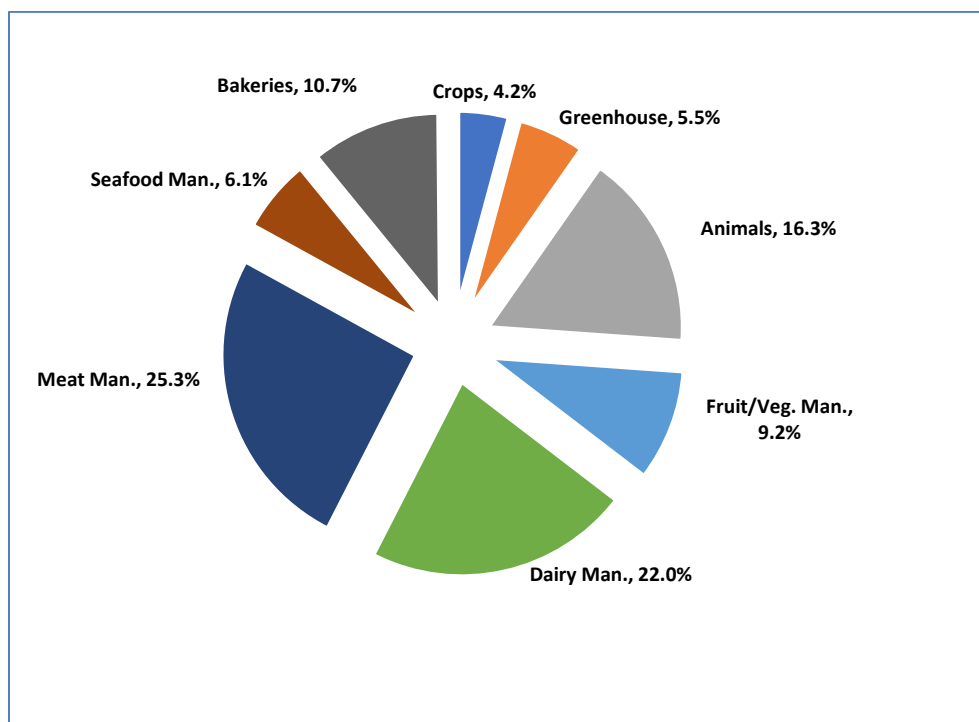
The impacts of a change in food purchases indirectly affects a variety of different industries in the province, many of those within the Primary Food and Food Manufacturing sectors. As shown in **Figure 6**, a \$1 million on average increases indirect demand in the Ag/Food Manufacturing sectors by \$1,408,281 (\$997,461+\$410,820). **Figure 7** below highlights how that \$1,408,281 indirect impact is spread across all the Ag/Food-related sectors.

⁸ Own indirect refers to the impacts on each specific industry, for example, the impact of increased poultry demand (decreased poultry imports) on the industry producing poultry (in that case the “meat processing” industry). The Own Indirect will differ from the \$1 million import substitution value for several reasons: 1) a some taxes are removed, reducing the impact slightly; 2) the “own” industry may not be the only industry producing the product again possibly reducing the impact; 3) there may be some second round demand for, say, poultry by the meat processing industry thereby increasing the impact.

Figure 6: Detailed Average Impacts per \$1million Increase in Domestic Demand for the Public Healthcare Sector

DOMESTIC OUTPUT				GDP (Basic Prices)				Wages & Salaries*			
Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL	Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL	Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL
\$997,461	\$410,820	\$334,577	\$1,742,858	\$277,625	\$129,629	\$183,629	\$590,883	\$115,334	\$101,407	\$105,942	\$322,683
			\$221,472				\$129,203				\$98,957
			\$1,964,329				\$719,085				\$421,641
EMPLOYMENT (Jobs)				EMPLOYMENT (FTEs)							
Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL	Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL				
2.98	2.68	2.02	7.68	2.43	2.23	1.66	6.32				
			0.78				0.45				
			8.46				6.96				
Provincial and Regional Business Taxes				Provincial Income Taxes							
Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL	Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL				
\$4,071	\$7,706	\$9,661	\$21,438	\$4,407	\$4,551	\$5,330	\$14,288				
			\$20,016				\$1,906				
			\$41,454				\$16,194				
MARGINS											
Wholesale	Retail	Transport	Tax	TOTAL							
12.3%	5.7%	2.2%	0.6%	20.8%							

Figure 7: Average Indirect Impacts by Industry of \$1 Million Increase in Domestic Demand by the Healthcare Sector



POST-SECONDARY EDUCATION

The charts below highlight the impacts for the post-secondary education sector changing its value of domestic food usage. As noted earlier, the results almost mirror the results for the healthcare sector; the only difference for each food product (e.g., poultry) is due to the slightly different tax and wholesale, retail and transportation margins within the post-secondary education sector as compared to the sector. Measures of these impacts are found in the separate Detailed Tables document, but, as an example, the wholesale trade margin for poultry purchased by the healthcare sector is estimated at 3.0% whereas the same wholesale margin facing the post-secondary education sector is estimated at 3.3%.

Figure 8 below highlights the impacts on employment (jobs) from an increase in domestic purchases of \$1 million. Reducing poultry imports and increasing domestic purchases generates 8.1 new jobs in B.C. On average, reducing imports and increasing domestic purchases by \$1 million results in 8.5 new jobs with a range of between 6.7 and 13.1.

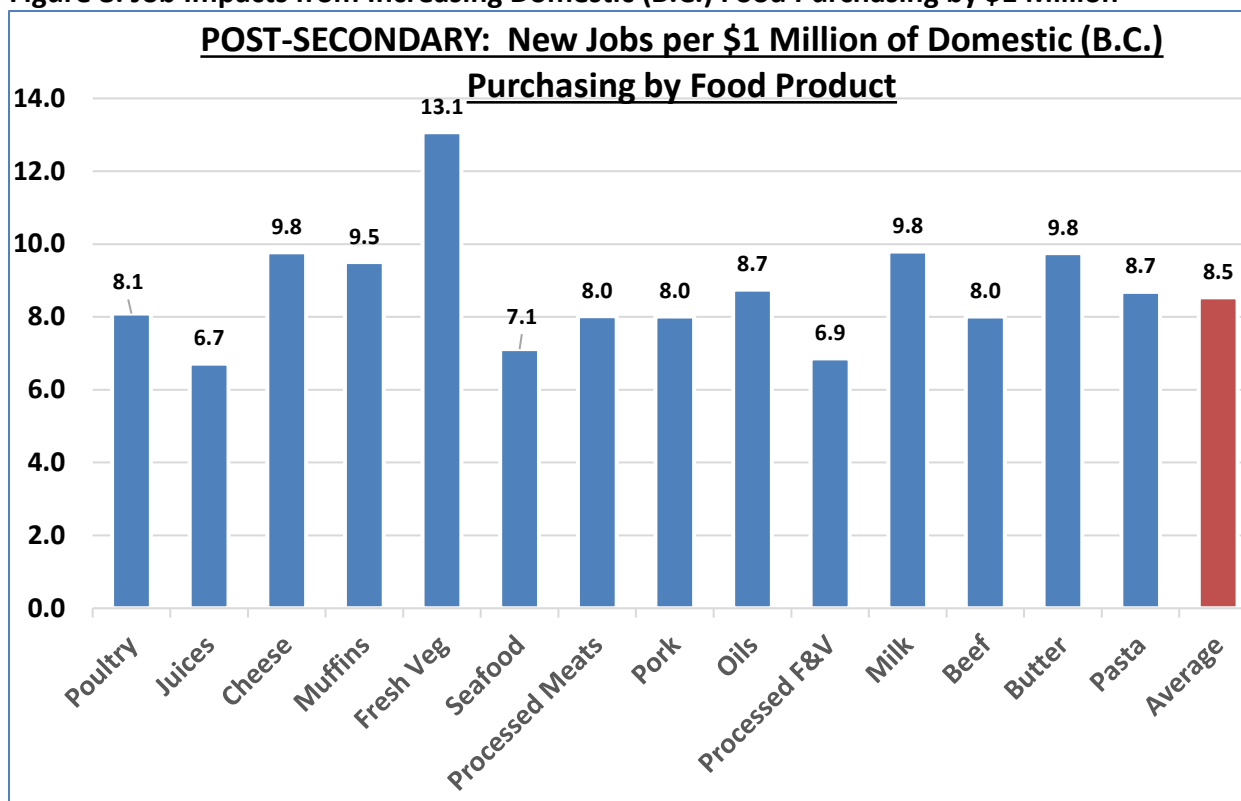
Figure 8: Job Impacts from Increasing Domestic (B.C.) Food Purchasing by \$1 Million

Figure 9 on the following page highlights the same impacts but in new FTEs. Here the reduction in imports of \$1 million and equivalent increase in domestic production results in an average of 7.0 new FTEs with a range between 5.6 and 10.7. Likewise, the increase in GDP (as highlighted in **Figure 10**) averages at \$777,500 with a range of between \$601,700 and \$858,000.

Figures 11 and 12 on the page following next highlight the impacts for Wages and for Taxes. Additional wages are gained by an average of \$499,700 (range of \$382,500 and \$598,300) while Taxes are increased by \$58,100 with a range between \$47,100 and \$76,000. The details for the average impacts per \$1 million import substitution are highlighted in **Figure 13** and the impacts on the Ag/Food industries in

Figure 14. See Detailed Tables for the full range of impacts by commodity.

Figure 9: FTE Impacts from Increasing Domestic (B.C.) Food Purchasing by \$1 Million

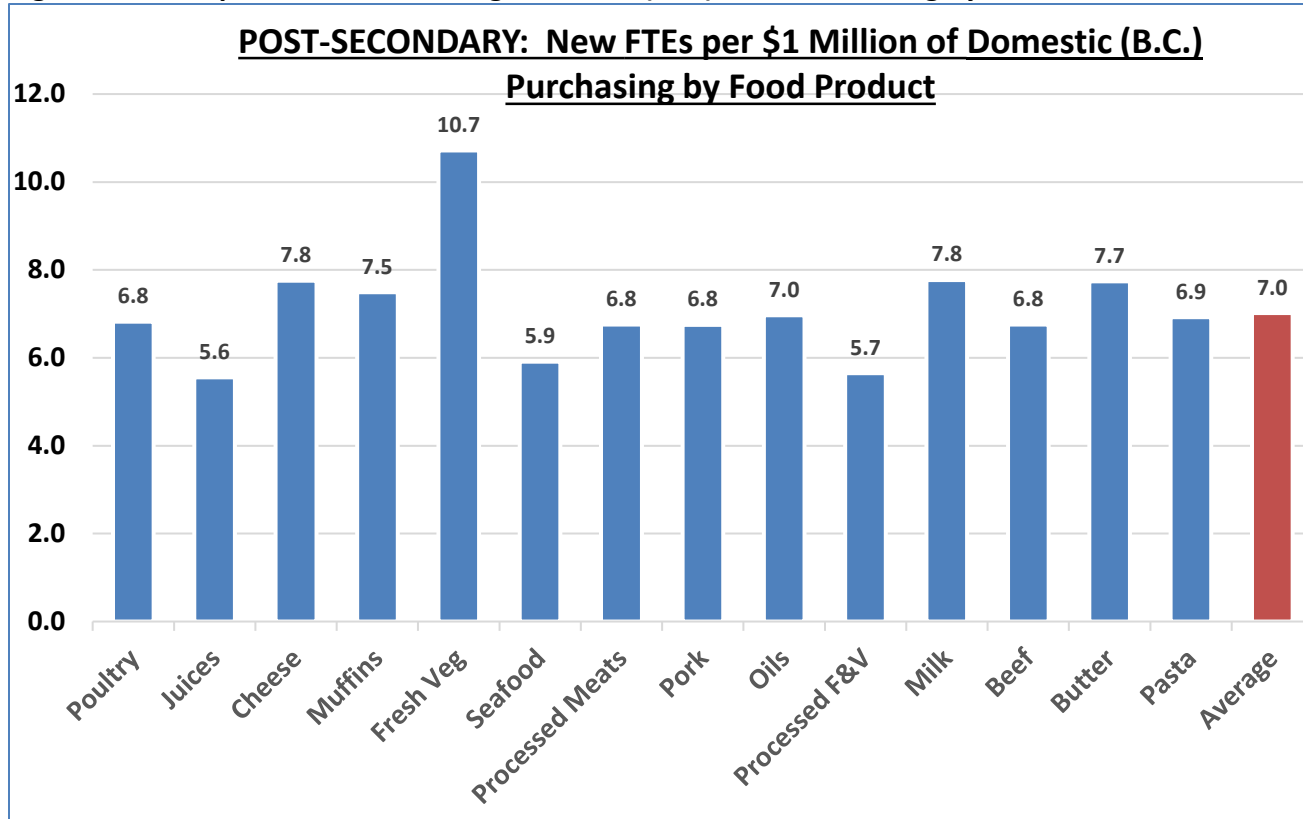


Figure 10: GDP Impacts from Increasing Domestic (B.C.) Food Purchasing by \$1 Million

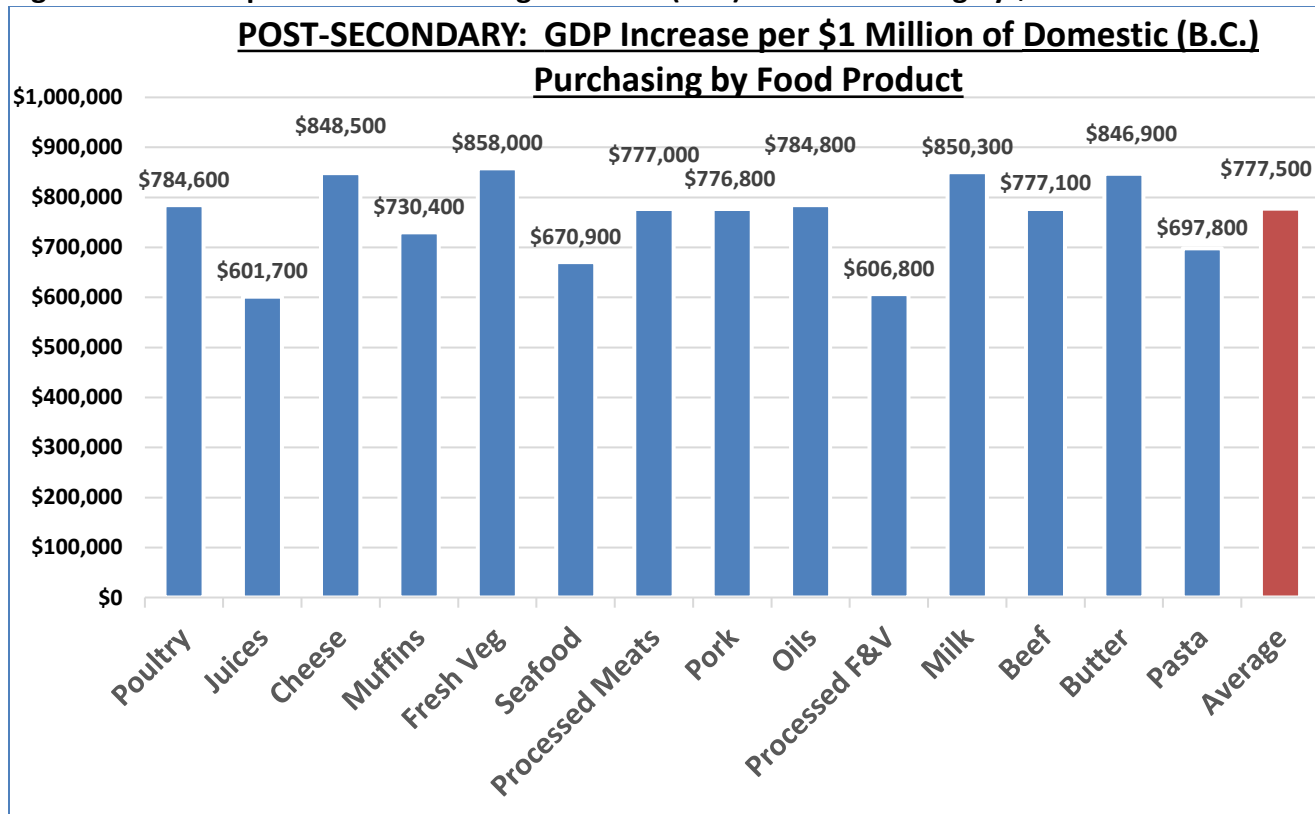


Figure 11: Wage Impacts from Increasing Domestic (B.C.) Food Purchasing by \$1 Million

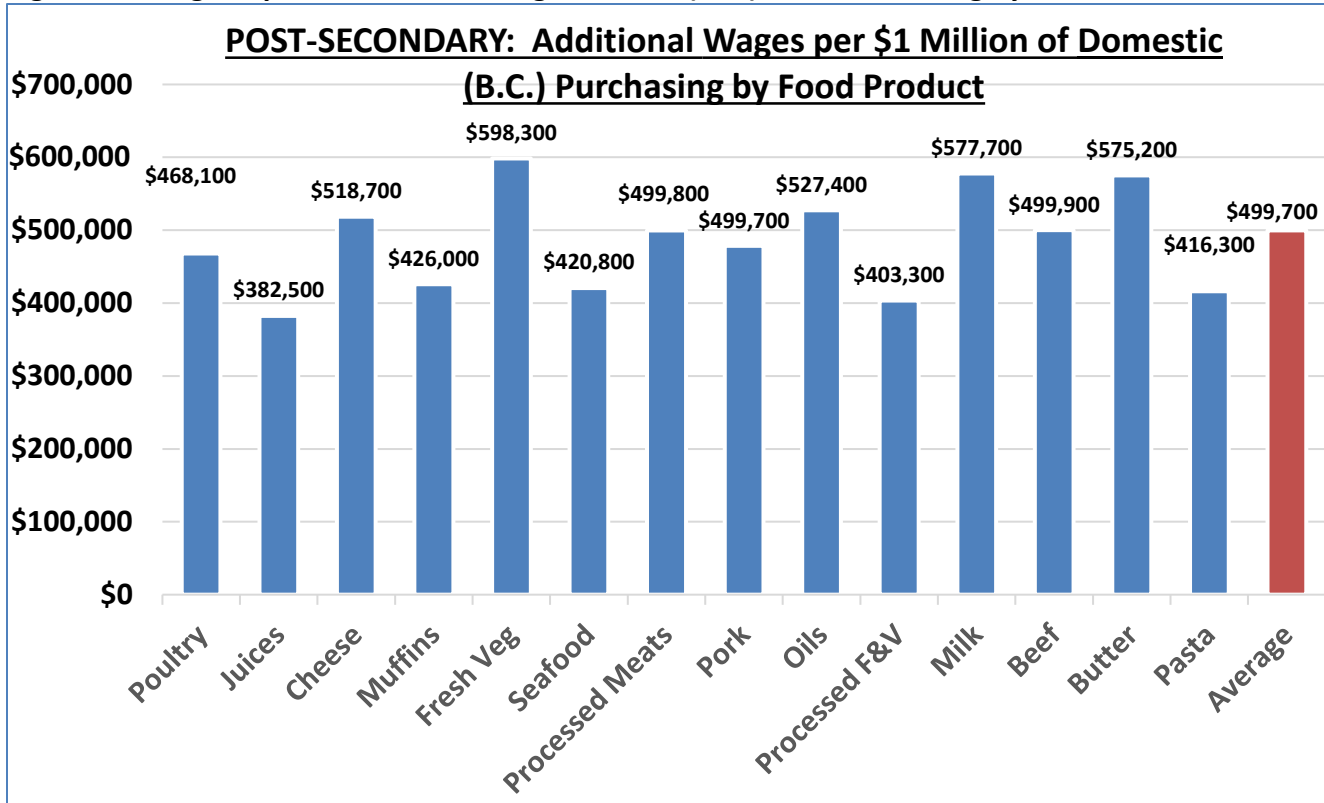


Figure 12: Tax Impacts from Increasing Domestic (B.C.) Food Purchasing by \$1 Million

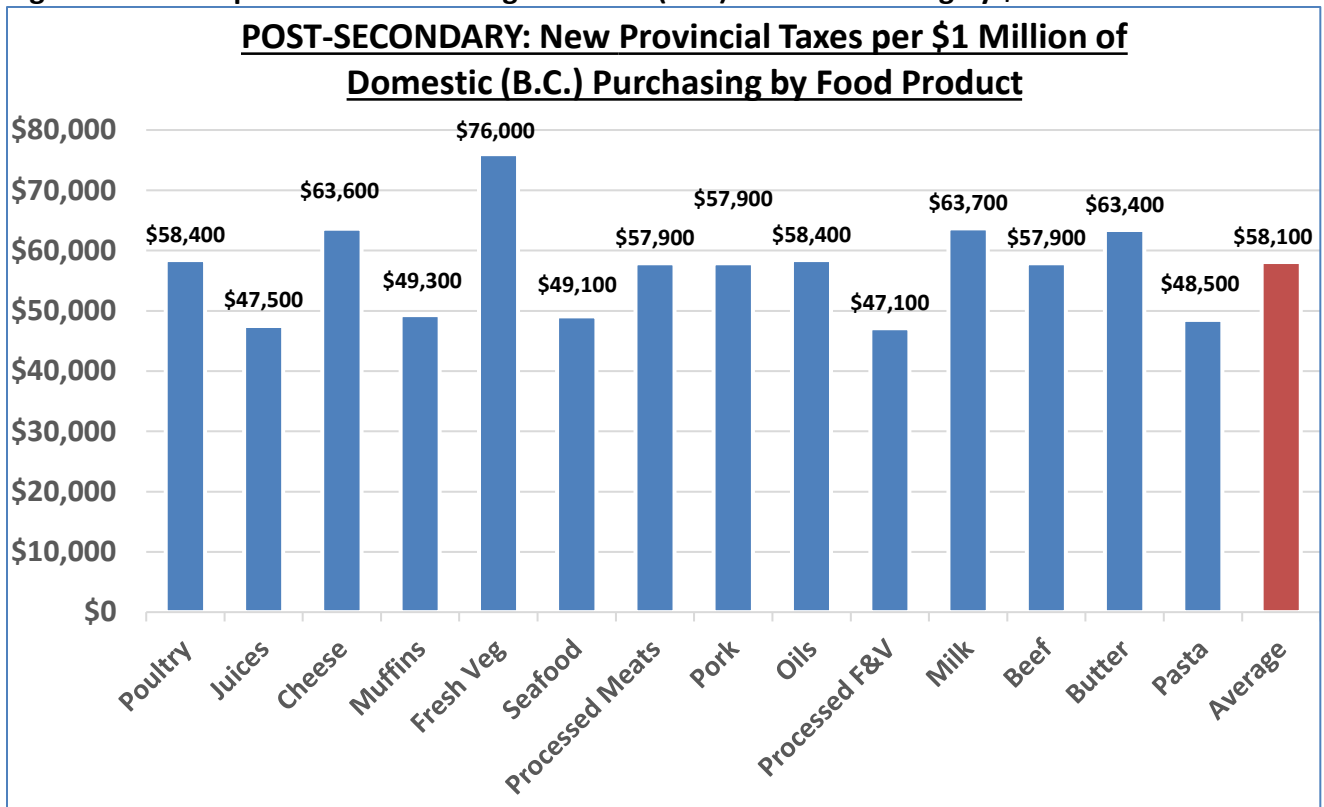


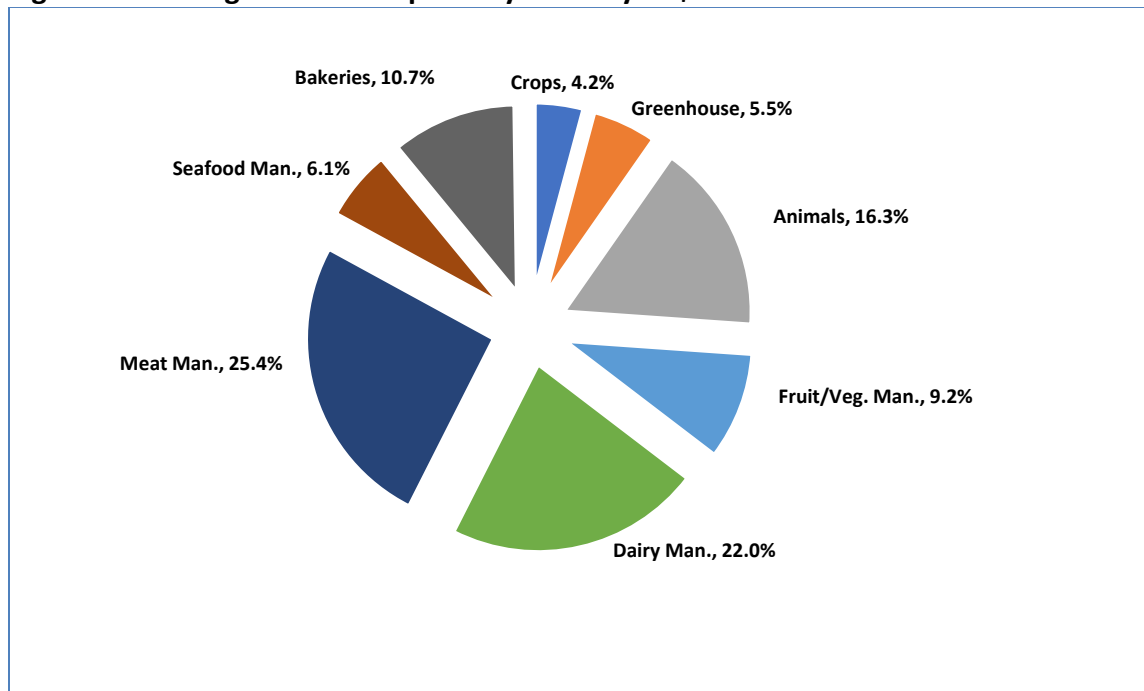
Figure 13: Detailed Average Impacts per \$1 Million Domestic Food Purchases by the Post-Secondary Education Sector

DOMESTIC OUTPUT				GDP (Basic Prices)				Wages & Salaries*			
Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL	Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL	Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL
\$1,046,144	\$417,721	\$337,652	\$1,801,517	\$277,786	\$106,302	\$185,875	\$569,963	\$116,391	\$96,887	\$108,402	\$321,679
			\$177,953				\$207,547				\$178,025
			\$1,979,469				\$777,510				\$499,704

EMPLOYMENT (Jobs)				EMPLOYMENT (FTEs)			
Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL	Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL
2.43	2.96	2.05	7.44	2.04	2.51	1.68	6.24
			1.09				0.78
			8.54				7.02

Provincial and Regional Business Taxes				Provincial Income Taxes			
Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL	Own Indirect	Other Ag/Food Indirect	Other Sectors	TOTAL
\$4,348	\$7,764	\$9,852	\$21,965	\$4,637	\$4,311	\$5,369	\$14,317
			\$19,888				\$1,952
			\$41,853				\$16,270

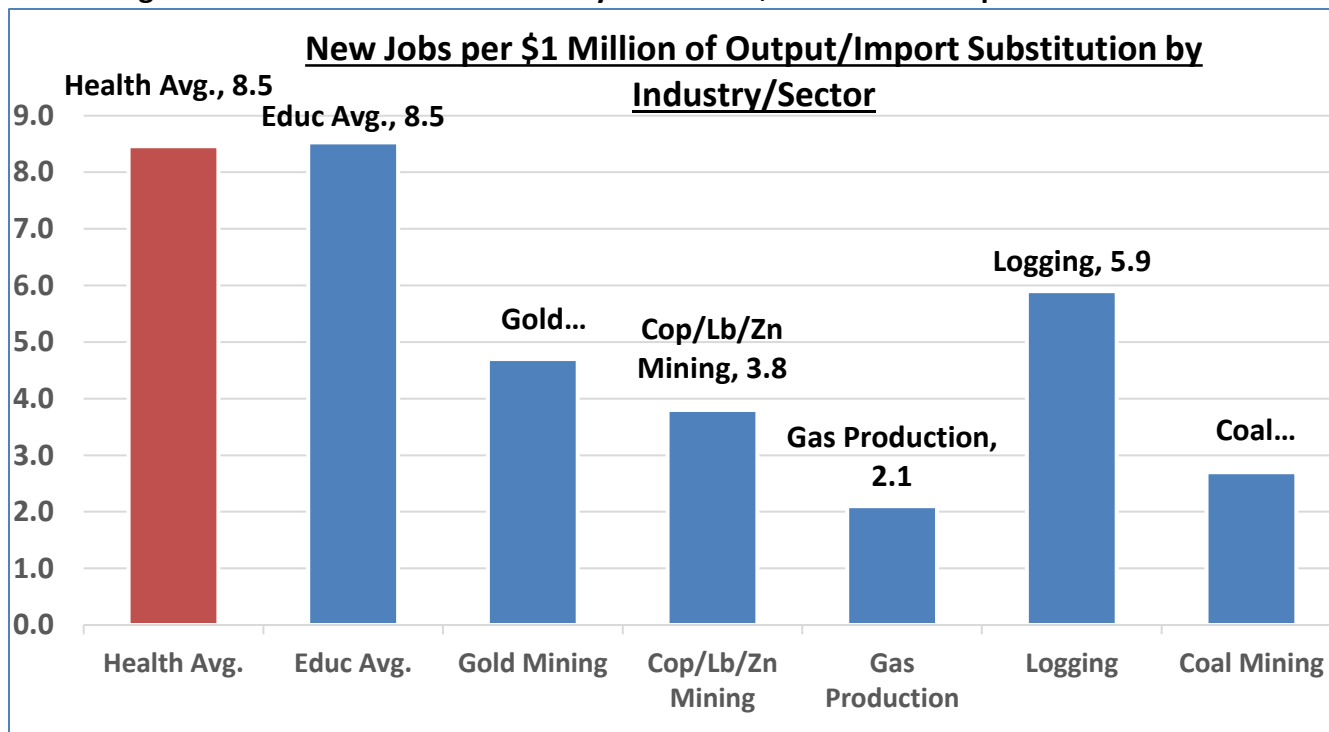
MARGINS				
Wholesale	Retail	Transport	Tax	TOTAL
13.0%	5.0%	1.9%	0.5%	20.3%

Figure 14: Average Indirect Impacts by Industry of \$1 Million Increase in Domestic Food Purchases

INDUSTRY COMPARISONS

As stated previously, because the analysis uses the exact same model and the exact same methodology as BC STATS uses, we can compare the results to those of other industries in the province. **Figure 15** below highlights the employment impacts of an increase in domestic purchases of food products (using the average) in the healthcare sector and post-secondary education sector versus impacts of an increase in output (via exports) by a variety of resource-based industries.

Figure 15: A Comparison of Jobs Generated per \$1 Million of an Increase in Domestic Food Purchasing in Healthcare and Post-Secondary Sectors vs \$1 Million of Output in the Resource



As can be seen, the employment impacts are higher for an increase in domestic food demand by both the healthcare sector and the post-secondary education sector vs all the other resource-based industries. Indeed, with the exception of logging, the impacts are generally double or triple those of the mining/oil/gas sectors. **Figure 16** details the industry comparisons for the other measures such as GDP, Wages, Provincial Taxes and Output, and mirror the advantageous impact characteristics of food product import substitution of the employment impacts in **Figure 15**. Suffice-to-say, if choosing between a policy that promotes domestic food purchasing vs a policy for encouraging greater resource exports (and ignoring any cost of the policy), the better choice is unambiguously the policy to promote domestic food purchases.

Figure 16: A Comparison of Average Jobs, FTEs, Wages, Taxes and Output Generated per \$1 Million of Domestic Purchasing (Demand) in Healthcare and Post-Secondary Sector vs \$1 Million of Output in the Resource Industry

Sector/Industry	Jobs	FTEs	Wages & Salaries	Provincial Taxes	Output
Healthcare Avg.	8.5	7.0	\$421,641	\$57,648	\$1,964,329
Post-Secondary Avg.	8.5	7.0	\$499,704	\$58,123	\$1,979,469
Gold Mining	4.7	4.7	\$343,292	\$41,877	\$1,426,700
Cop/Lb/Zn Mining	3.8	3.8	\$286,052	\$55,261	\$1,503,200
Gas Production	2.1	2.1	\$126,337	\$30,119	\$1,329,900
Logging	5.9	5.9	\$344,843	\$54,896	\$1,722,300
Coal Mining	2.7	2.7	\$184,844	\$30,745	\$1,323,100

CONCLUSION

The analysis presented here has outlined how, if the healthcare and/or post-secondary education sectors increases purchases of B.C. food products through import substitution or other means, the B.C. economy would benefit to a marked degree. If, for example, they were able to replace \$1 million in Fresh Vegetables, employment in the province would increase by over 13 jobs. Even for those products that have lower impacts to the economy, such as juices, the economy would benefit by well over 6.5 new jobs. Thus, even at the low end, the impacts are roughly double those that an equivalent \$1 million change in resource industry demand.

As noted in the above section on “Limitations”, this analysis makes several assumptions which are not met in all cases of import substitution in B.C. public healthcare and post-secondary institutions. For example, an increased demand for a B.C. food product by institutions may not be met due to limitations in the domestic production and/or processing capacity to meet the needs or requirements of purchaser. In other cases, the cost of the imported versus domestic food product is not equivalent. Likewise, this analysis doesn’t take into consideration price changes. And so on (see page 5). For all of these reasons, the results of this analysis should be considered in the context of any particular case of the import substitution and assumptions of input/output models described in this report.

It also should be noted that, although this analysis does not attempt to address food-related imports by other sectors (including stand-alone restaurants, some of which may be located in public sectors), increasing local food production will likely open up further opportunities to replace food-related imports by non-health, non-education sectors which will benefit the B.C. economy even further.

APPENDIX A: STRUCTURE OF THE BCIOM

The BCIOM (2017 data) is comprised of three main tables: the Supply table; the Use table; and the Final Demand table.

1. **Supply Table:** The Supply table details the various commodities (of a possible 488 different commodity output types) produced by each of 234 individual industries. It is possible (likely) that an industry produces a number of different commodities;
2. **Use Table:** The Use table details the various commodity inputs used by each industry. The 488 material commodities (in contrast to the use of labour, product taxes, and operating surplus, aka, the value-added inputs) used by each industry are also known as intermediate inputs;
3. **Final Demand Table:** The Final Demand table details the commodity purchases by each of the final demand sectors. These final demand sectors include **Personal Expenditures** (which is itself subdivided into 100 aggregate spending components such as “Food”, “Major Appliances”, “Major Durables for Outdoor Recreation”, etc.), **Capital Investment** (disaggregated into “Construction”, “Machinery & Equipment”, and “Intellectual Property” with each of these three components subdivided into 54 industry subsectors); **Government Expenditures** (by 9 expenditure types), **Inventory Changes, Imports** (International and Interprovincial) and **Exports**.

Input-Output (I/O) analysis works by keeping the supply of each commodity equal to the demand for that same commodity in the economy. Demand is equal to the final demand plus the intermediate demand for the commodity. If demand goes up (by say, an increase in purchases by a tourist) then there must, by definition, be an increase in supply. This increase in supply can come from either an increase in production by domestic industries or by an increase in imports of that same commodity. If the increase in supply comes from imports, there is no improvement to the economy (other than any associated domestic transport and wholesale/retail costs); if the increase comes from an increase in domestic production, then those industries producing the commodity will increase their own purchases of material inputs, increase their employment and thus wages and salaries paid, and will see the level of taxes they pay increase. The overall effects of this increase in purchases of material inputs (indirect impacts) and increase in wages paid (induced impacts) are discussed below under the heading **Inverse Matrix**.

The three tables: Supply, Use, and Final Demand are the main tables of the I/O. There are, however, two more tables that are important: the Tax table; and the Margins table.

1. **Tax Table:** The Tax table highlights the taxes paid (by individual tax type) for each commodity by Industry sector and by Final Demand sector. There are 19 different tax types⁹ which potentially are paid on each of the 488 commodities (note: for many commodities there will be no payment for a particular tax). These taxes by commodity are identified and set to different rates by those paid on inputs purchased by industry (input taxes), those paid by consumers (consumer taxes), and those paid on investments (investment taxes);
2. **Margin Table:** When a commodity is purchased, either as an input to industry production or by consumers or for investment purposes, under I/O accounting standards, the cost of the commodity (the “purchaser price”) is **NOT** what the industry or consumer paid. Rather, the purchaser price is made up of the “cost of the commodity at the factory gate” (also known as the “Basic Cost”), the taxes (already documented) associated with each commodity, and the “margins” embedded in that cost.

The Margin table highlights the various margins embedded (by individual margin type) in each commodity by Industry sector and Final Demand sector. There are 3 major margin categories: Wholesale Margins (8 categories), Retail Margins (12 categories), and Transport Margins (12 categories).¹⁰ Each of these margins potentially are embedded in each of the 488 commodities (although in practice for many commodities there will not be any margin).

9 Federal Trading Profits; Federal Gasoline Tax, Federal Excise Tax, Federal Excise Duties, Federal Air Transport Tax, Federal Import Duties, Prov Environmental Tax, Prov Gallonage Tax (not applicable in B.C.), Prov Trading Profits Tax, Prov Gas Tax, Prov Amusement Tax (not applicable in B.C.), Prov Other Tax, Land Transfer Tax, Municipal Amusement Tax (not applicable in B.C.), Municipal Sales Tax (MST), GST, PST, HST (not applicable in B.C.), and Aboriginal Trading Profits.

10 **Wholesale Margins** include margins on: farm products, petroleum products, food products, household products, autos, construction, machinery, and other. **Retail Margins** include margins on: autos, furniture, electronics, construction, food, health, auto fuel, clothing, sport, other, household fuel, and household natural gas. **Transport Margins** include margins on: oil pipeline distribution, natural gas distribution, storage, air transport, rail transport, water transport, general truck transport, specialized truck transport, water supplies, road supplies, brokerage, and other.

The Inverse Matrix

Critical to estimating the indirect and induced impacts of a change in demand is the “Inverse Matrix”. When there is an increase in demand for a commodity, there is a corresponding increase in the demand for the inputs used to produce that commodity. As describe above, the Use table, after all imports, taxes are removed and margins reallocated, will identify the increase in those inputs. However, the increase in demand for those inputs will, itself, cause additional increases in production to satisfy that demand. But then, that increase in demand will cause more increases in production and even more increases in demand. Accounting for all increases gives the indirect impacts.

Just as an increase in demand will cause increases in the demand for inputs, there will also be a corresponding increase in labour requirements and therefore in wages earned. These wages, once all personal income taxes and savings are removed, are available to be spent as Personal Expenditures. After removing the imports and taxes and reallocating margins, this increase in expenditures will increase demand. Accounting for all increases due to the increase in wages gives the induced impacts.

Calculating the Inverse Matrix is a complicated matrix manipulation of the various tables and rates plus the inverting of the resulting manipulated tables. It is far too complicated to detail here, but suffice to say that the resulting inverse matrix details how, for a \$1 increase in demand for a specific commodity, the ultimate demand for different commodities increases.

APPENDIX B: AN INPUT-OUTPUT PRIMER

National Accounting (also termed Economic Accounting) assumes a company undertakes two steps in its production process. First, it purchases material inputs from other industries; and second, it transforms those material inputs into finished goods (or services), ready for resale. Take as an example a Restaurant. Restaurants buy fresh vegetables, meat, etc. from the Agriculture sector. Using other material inputs (e.g., electricity, cooking oil, etc.), it transforms them into finished dishes, which, in turn, are sold at a selling price higher than the cost of its inputs. The difference between the selling price and the material input cost is the “mark-up” or “value-added”. This value-added is used to pay for the kitchen and wait personnel, any taxes levied by governments, the depreciation of equipment, any interest costs the restaurant may have, and will also generate, the owner hopes, a profit.

National Accounting asserts that the value which the restaurant sector adds to the economy (hence, the term “value added”) is equal **not** to the total revenues of Restaurants, but only to this “mark-up” value. That is, the value of an industry to an economy is the difference between the value of its output (effectively, total operating revenues) and the cost of its material inputs. In this way, the Restaurant industry does not claim the value of the agriculture inputs it uses, which should rightly be accounted for by the Agriculture industry. As a result, there is no double counting when measuring the value of the entire economy.

In other words: the value-added of the Outfitting Industry is the revenue from all of its sales to clients (output) minus all of its costs for payments to other firms for goods or services (material inputs), or:

$$\text{Value Added} = \text{Output (or Final Sales)} - \text{Material Inputs}$$

Another way of defining value added is that it is the sum of an industry’s payments to employees, for indirect taxes, for depreciation and interest costs, and for profit:

$$\text{Value Added} = \text{Labour} + \text{Indirect Taxes} + \text{Depreciation} + \text{Interest Costs} + \text{Profit}$$

The resulting value-added of any firm (or industry) is available to be shared among labour (wages, salaries and benefits), indirect taxes and “operating surplus.” The operating surplus itself is shared between payments for the use of physical capital (depreciation), payments for the use of monetary capital (interest costs), and payments (profits) to the owner(s) of the enterprise. Value-added is an industry’s contribution to, or **direct impact** on, the economy. And the sum of value-added of all industries is termed the country’s Gross Domestic Product (GDP).

An important distinction needs to be made between Financial Accounting and National Accounting. Under financial accounting, an industry which has a high value added (i.e.,

contributes a lot to the economy)), can be unprofitable if, for example, its payments to labour or for interest costs are too high. Alternatively, low value-adding industries can be very profitable to their owners, depending on their usage of labour and their capital structure.

Economists have standardized the measure of these flows and the inter-relationships of inputs and outputs among industries through the concept of Input-Output (I/O) analysis. The **SUPPLY** matrix identifies the various types of output the sector produces. The **USE** matrix highlights all of the various types of inputs used to produce that output.¹¹ One can readily determine from these tables that subtracting total Material Inputs from total Output leaves Gross Domestic Product (GDP). This GDP is equal to the sum of Wages and Salaries, Benefits, and Operating Surplus.

The GDP-to-Output ratio is a measure of the direct contribution to the economy *per dollar of output*. Clearly, an industry that requires a lower dollar value of inputs to produce a given dollar of output is a higher value-adding industry. One must note, however, that a higher GDP-to-Output ratio does *not* imply that the industry is more important to the economy. It merely states that for every dollar of output the impact on the economy is greater. Obviously, when examining an industry's importance to an economy one must also take into account the total output of the industry. There is, however, another important characteristic of an industry that must be examined if one is to determine the importance of a sector to the local economy: its *linkages* to other industries.

When inputs such as fresh produce or meat are purchased by the Restaurant sector, the industries supplying those goods and services (in this case farmers, food manufacturers, and food wholesalers and retailers) increase their own economic activity. This increased activity itself creates demand for other products. Farmers, for example, may need more fertilizers for their land and more petrol to run their machinery. Food wholesalers may require additional box material. The demand for extra fertilizers and petrol and box material will, in turn, stimulate activity in the fertilizer, petrol and box industries. The increased activity in the fertilizer industry will create greater demand for its own inputs, perhaps some chemicals. And so it continues down the chain of industries. The sum effects of all this additional economic activity are known as *indirect impacts*.

Such indirect impacts (also known as “multiplier effects” or “spin-offs”) on the economy clearly are important. They should not be ignored (as they usually are with financial accounting) if we are to measure the true benefits of an industry to an economy. An

¹¹ Output is closely associated with industry revenues and client spending, but there are important differences. Likewise, the inputs used by the Restaurant industry are highly related to industry expenses. But, again, the differences are important. For a summary of these differences, see the next sub-section: *Technical Differences*.

interesting observation is that, while it is true that high value-adding industries have low indirect impacts, those industries with relatively lower direct impacts have relatively higher indirect impacts. This is because, by definition, low value-adding industries consume more inputs per dollar of output and thus have a greater impact on their supplying industries. It should be noted, however, that the level of indirect impacts is highly influenced by the type of goods and services demanded and by the propensity of the companies (or the economy) to import those particular goods and services. The higher the propensity to import the required goods and services, the lower will be the effects on the local economy. Indeed, an industry that imports all its inputs will have virtually no indirect impact on the economy, save the small level of distributive activity (wholesale, retail and transportation margins) the imports may generate.

Increased industrial activity has a third effect on the economy. When additional wages and salaries are paid out, those dollars (appropriately adjusted for taxes and savings) are available to be re-spent on consumer goods and services. Take, for example, an additional \$1 million in wages resulting in say, an increase of disposable income of \$750,000. Depending on the spending patterns, this may result in extra consumer spending of say, \$500,000 in the retail sector (the remaining being spent in the entertainment sector, restaurant sector, etc.). This will increase the economic activity of the manufacturers and other suppliers of consumer goods who, in turn, will increase their own employment and their own wage payments. The sum effects of this additional activity due to increased wages are known as ***induced impacts***. Again, it should be clear that, like indirect impacts, induced impacts are highly influenced by the economy's propensity to import, as well as by taxation and savings rates, the level of wages paid to employees and the level of capacity at which the economy is operating.

The question arises: given that there are many levels of indirect and induced spending which affect many different firms and industrial sectors, how can we estimate these impacts on the economy? Fortunately, economists have developed a method to estimate these impacts, by using the same input-output tables to which we already have been introduced.¹² However, since the base information is coming from financial statement data directly provided by operators, it is critical to understand how financial statement data are re-structured to meet National Accounting standards.

Technical Differences

Although the National Accounting (Input-Output) measurement of the value and impacts of Restaurants begins with the same set of data as the financial results of the industry, a number

¹² For a detailed discussion of the underlying mathematics of Input-Output analysis, see *Input-Output Analysis: Foundations and Extension*, Ronald E. Miller and Peter D. Blair, Prentice Hall, 1985

of adjustments are required in order to conform to strict National Accounting standards. To avoid possible confusion, these technical differences between Financial Accounting and National Accounting should be understood. The intent here is not to provide a comprehensive or definitive discussion of these differences, however, but rather to provide a cursory overview. For a more in-depth discussion of the differences and of the methodology underlying National Accounting, the interested reader is referred to the National Accounting compendium published by the UN.¹³

The following outlines the major differences:

1. The first and perhaps most important difference is that National Accounting measures all non-tax related revenues and expenses related to production, even those not itemized on the corporate income statement. Hence, gratuities paid to staff are included as output (in the case of the Restaurant Industry, as an increase in Restaurant revenues). This increases output but not material inputs, and therefore it increases the estimate of GDP (Output – Inputs) by precisely the amount of gratuities. Using our other definition of GDP (GDP = indirect taxes + wages, salaries and benefits + operating surplus), we see that the increase in GDP is reflected in an increase in wages and salaries equal to the reported gratuities.

Another (usually) off-budget item is an estimate of the value of imputed room and board. On the Output side there is an increase in lodging revenues and, since the provision of room and board is a value to the employee, it is considered equivalent to a wage subsidy, and thus contributes to overall GDP. Normally, the cost of food is already accounted for within the financial statement, thus the net impact on GDP is equal to the value of the imputed room and board. Statistics Canada has standard values that it uses to assess the value of this room and board and it is that standard that is used in this report.

At the same time, National Accounting omits revenues not directly related to the production process. Generally, these incomes are limited to interest and dividend earnings, but include non-operating revenues related to rental incomes, commissions and the like.

A fourth difference is that, under National Accounting, the value of each input in the USE matrix is stated in “producer” prices. That is, all wholesale, retail, and transportation costs included in the “purchaser” price of a commodity are removed, as are all commodity taxes, indirect taxes and import duties. These “distributive and tax margins,” as they are called, are explicitly recognized in the USE matrix as separate line items. The reader should understand

13 *System of National Accounts*, Statistical Papers Series F No 2 Rev. 4, New York, 1993

that this does not in any way reduce the total cost of inputs to the industry; it simply re-assigns the costs to different input categories.

A fifth difference lies in the treatment of merchandise sales. National Accounting treats the purchase of merchandise as partly a purchase from the manufacturer of the good (equal to the cost price of the good less distributive and tax margins) and partly a purchase from the retailer (equal to the mark-up for the good). Consequently, in an input-output table for a sector selling some retail goods, there is no recognition of the cost of the merchandise on the input (USE) side, and only the mark-up value is recognized on the output (Supply) side. The cost of the merchandise is captured in the Manufacturing sector as output. It is for this reason that some analysts recognize certain manufacturing industries as **direct** tourism, even though tourists do not actually buy any goods directly from those manufacturers.

Related to this unusual approach to merchandise sales is the treatment of “service margins.” When a firm purchases a product (such as liquor, beer or wine) and re-sells it with a mark-up without any fundamental change to it, National Accounting recognizes only the mark-up or “service margin” as output. It then treats the purchase cost of the product (less distributive and tax margins) as an output to the original producer of the good. The main instance that affects most industries (besides retail sales) is alcohol sales. In this case, only the service margins are recognized as output, and the costs are assigned to the alcohol manufacturing sectors (beer, wine and liquor/distillers). In effect, then, the alcohol manufacturing sector is a direct provider to tourists under National Accounting principles.

APPENDIX C: DEFINITIONS

As in any technical briefing, a number of terms are used in this Report that may be confusing to those not directly working in the field. The following provides some help with definitions.

1. **Input-Output Model:** comprised of three tables or matrices: a **Make** matrix, a **Use** matrix, and a **Final Demand** matrix. The Make matrix lists all the different outputs produced by each industry. The Use matrix lists all the different purchases (material inputs) by each industry used in the production process as well as itemizing all taxes (explicit and implicit) paid by the industry (GST is not a company-level tax; rather it is a tax paid by final consumers but channelled through the company). The Final Demand matrix lists all the various purchases by persons (including GST), by government, by industries for investment purposes, plus all net exports (exports minus imports) of each commodity (good or service). Mathematically re-arranging the tables enables one to determine how much additional production will be generated in the economy from an increase in demand for a commodity or series of commodities.

Domestic Output: equal to total consumer spending minus all imports (international plus interprovincial) minus forward consumer taxes. The resulting Domestic Output is equivalent to the value of the consumer (tourist) spending dollars that go directly to provincial businesses

Gross Domestic Product (GDP or Value-Added): a measure of the total flow of goods and services produced by the economy and used for final domestic consumption, investment and export (e.g., excluding immediate consumption). GDP can be calculated in three different ways, all of which yield the same results. The first method, used in this Report, estimates the difference between the value of gross output of all industries minus the value of gross material inputs used for immediate production (excluding indirect taxes). The second method sums the values of Wages and Salaries, Supplementary Labour Income (Benefits), Operating Surplus (Profits plus Depreciation plus Interest on Long Term Debt) and Indirect Taxes for all industries. And the third method sums the values for personal consumption, government expenditures, investment (including changes to inventories) and net exports. In addition to total GDP for the economy, GDP is also estimated for individual industrial sectors.

Direct Impacts: equivalent to the level of direct value-added (or GDP) generated by an industry.

Indirect Impacts: the impacts resulting from the expenses (goods and services) of a firm or industry used in the production process. The purchase of goods or services increases the economic activity of the supplying firms and, in turn, the supplying firms themselves must purchase their own goods and services which generates further economic activity in those supplying firms.

Induced Impacts: the impacts resulting from the wages and salaries paid by a firm or industry. When the wages and salaries are spent (less taxes and savings), the economic activity of the firms supplying those goods and services increases. As well, the supplying firms themselves will pay additional wages and salaries to their own employees which, when spent, generates more economic activity.

Person-Year (PY) Employment: the level of employment in a firm or industry when part-time positions are counted as a fraction of full-time positions. Four half time positions equal 2 Person-Years of work.

Intermediate Demand (material inputs): sales to each industrial sector used for further production.

Producer Prices: the value of a commodity (good or service) at the factory gate. It excludes all indirect taxes, as well as wholesale, retail, and transportation costs (called “margins”) associated with the final selling (purchaser) price.

Purchaser Prices: the price of a commodity (good or service) actually invoiced to the purchaser. It includes the factory gate cost of the commodity plus any additional costs associated with indirect taxes, wholesale and retail margins, and costs associated with transporting the commodity from the factory gate to the final purchaser.

Value-Added: a term identical to GDP in concept, but referring to a particular establishment.