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Industry and Commodity Accounts in an Integrated SNA framework
Challenges in the Canadian context

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I Introduction

Annual regional Input Output Accounts serve as benchmark production accounts in the Canadian SNA, detailing the structure of the Canadian economy in terms of both inter-industry relationships and commodity supply-use. In addition to their traditional use to model economic impact they play a central role as integrating infrastructure to SNA programs in Canada, and serve as the foundation of productivity measures. Regional Input-Output Accounts are entrenched in Canadian fiscal policy implementation, including sales tax allocation and the equalization of fiscal capacity among provinces.

This paper will provide an overview of recent challenges for the Input-Output Accounts within the context of larger objectives in the Canadian System of National Accounts. Specific illustrative examples will highlight measurement issues in both the basic compilation of estimates and in their reconciliation with aggregate measures from more timely sub-annual programs. Future strategies and upcoming developments in the Canadian SNA will be discussed.

Section II will review the historical development of the Canadian IO accounts and their primary uses today. Section III will outline the process of compilation of the IO accounts, touching on practical issues and constraints impacting the estimates, including SNA revision policy. Section IV will provide specific examples in three areas: distributive trades industries, labour income and personal expenditure, to illustrate recent measurement challenges. A concluding section will outline strategies in course or under consideration as part of an upcoming revision to historical time series coincident with the implementation of SNA2008 in Canada.

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II Provincial Input-Output Accounts in an integrated SNA framework

The basic design

National Input-Output Accounts were developed in the 1960s in Canada, and were conceived with a rectangular design incorporating both industry (input-output) and commodity (supply-use) dimensions. They are comprised of 3 matrices: the "make" matrix, detailing the production of commodities by industries, the "use" matrix, showing the use of commodity intermediate inputs and primary factors in the production process, and the final demand matrix, articulating final demand categories corresponding to broad institutional sectors in a commodity dimension. The rectangular model has the advantage of better representing industry activity by recognizing secondary outputs. At present, the Canadian IO tables are compiled at an extremely detailed level (roughly 300 industries by 700 commodities) in nominal terms for each of Canada's 13 provinces and territories. Constant price tables are derived on a national basis.

The Input-output accounting framework is a fully balanced system in both its industry and commodity dimensions. Accounting identities implicit in the framework assure the coherence of all elements in the fully articulated production account. The industry balance ensures that for each industry, the sum of all outputs is equal to intermediate inputs and the use of primary factors. For each commodity, total supply is equal to total (intermediate and final) use.

National integration: IO as the SNA production account

In the mid-1980s, in a major historical revision to SNA time series, individual accounts were integrated statistically in nominal terms. Revisions were undertaken across SNA programs, including the Input-Output Accounts and projections of GDP by industry, productivity measures, income and expenditure accounts, financial flows and balance sheets and the Balance of Payments. These programs had long histories prior to the exercise, with classification systems, methodologies and measurement strategies evolving independently over a number of decades. Their statistical integration consisted of an *ex post* reconciliation process, where programs were integrated conceptually and statistically. Since Canadian programs were not designed from their inception in an integrated way, the process of integration presented considerable challenges and to a certain extent continues today.

In addition to being in line with international recommendations from the 1968 United Nations SNA, the quality advantages of anchoring all production account variables to the fully articulated IO framework were well-recognized at the time of integration in Canada. Timely aggregate measures of GDP derived by the primary income, final demand and value added by industry could be linked in benchmark years via the comprehensive IO accounting system. Commodity balancing would help establish benchmark levels of personal expenditure, for example, to complement estimates derived from retail sales and occasional family expenditure surveys. Since all available source data was confronted and discrepancies investigated in resolving commodity imbalances, feedback could be

provided to source data systems in terms of classification, valuation, timing, reporting and coverage gaps. Annual IO tables were central to Statistics Canada's strategy to develop an integrated system of economic statistics[2]. They have come to serve as the foundation of other statistical programs, such as labour and multi-factor productivity, environmental accounts and provide macro controls to Statistics Canada's Social Policy Simulation Model, a micro-simulation database for analyzing tax and transfer policy.

Investments in an integrated System of Provincial Accounts

In the mid 1990s, an important development occurred with the introduction of a shared, "harmonized" sales tax (HST) between the federal government and three Atlantic provinces, Newfoundland, Nova Scotia and New Brunswick. A decision was made to use statistical data to allocate HST revenues among the federal government and the participating provinces based on shares derived from provincial macroeconomic data. While significant investments would be required to fully develop and improve the required statistical outputs and improve their quality, this was seen as an effective means to minimize administrative burden on firms, who would otherwise have to remit taxes for multiple provincial jurisdictions with different sales tax regimes.

While personal expenditure and housing were the largest components of the value added tax base, commodity-specific exemptions meant that the business sector provided a non-trivial portion of HST revenues. The development of provincial IO tables was central to the strategy, both in terms of providing base information for the HST revenue allocation formula and serving as quality control in a newly integrated System of Provincial Accounts.

Because the HST revenue allocation formula is based on provincial shares of a national total, it was necessary to have information of roughly equal quality for all provinces, even those not participating in the HST agreement. An ambitious project, the Project for the Improvement of Provincial Economic Statistics (PIPES) was launched. Among its objectives were significant investments in the collection of base economic statistics, a revamping and integration of the business survey programs at Statistics Canada and the development of annual Provincial Input-Output Accounts, to feed into the formula and to serve as serve as an integrating framework for an improved system of provincial accounts. Annual provincial accounts were introduced and integrated with measures of GDP income and expenditure-based and value added by industry beginning in 1997. The full extent of industry and commodity detail previously contained in the national tables was maintained at the provincial level.

The scale of the PIPES project was ambitious, and it took many years to fully realize the quality improvements initially envisaged. In the years following its implementation, provincial SNA estimates previously based on indirect estimation techniques and approximate allocations of national totals benefited from the incorporation of solid provincial source data, including an annual household expenditure survey, quarterly retail commodity data, a revamped wholesale trade survey and surveyed estimates for many

[2] See Appendix 1 for a diagram of the Canadian System of National Accounts.

service industries where previously data gaps had existed. Many other uses have since emerged for improved provincial economic data that benefited from this investment.

Impacts of PIPES on the Provincial Input-Output Accounts and integrated SNA programs were gradual and cumulative as the underlying data system developed and matured. Certain areas remain challenging, such as the measurement of inter-provincial trade flows and collecting sufficient commodity detail on service inputs. Harmonizing commodity classifications in feeder data systems to conform to the North American Product Classification System (NAPCS) also remains an ongoing goal.

In addition to sparking the development of Provincial Input-Output Accounts, the entrenched use of the Provincial SNA data in fiscal formulas such as HST allocation influenced their development in very important ways. Since tax outputs are of critical importance in this application, their appropriate estimation is accorded a high priority in the process of IO compilation. Since different effective tax rates or tax exemptions apply to specific commodities, this elevates the importance of accurate commodity distributions by province. Since establishing provincial shares is the ultimate goal, maintaining an accurate picture of the *levels* of provincial variables relative to the national becomes key, in addition to properly tracking provincial patterns of economic growth.

"Blue sky" rethink and IO modernization in today's climate

The recent financial crisis and subsequent economic downturn refocused attention on timely macroeconomic statistics and reinforced the need for capacity to quickly address emerging economic issues. It had become clear that the resource demands of compiling annual provincial IO tables at an extremely detailed level were considerable, and 10 years after PIPES a rethink of the appropriate balance of timeliness and detail in the core SNA program was warranted. There was clearly a need to create capacity to respond quickly to new user requirements, but production capacity in the SNA was fully dedicated to meeting ongoing program commitments. There was virtually no flexibility to react quickly to specific issues as they emerged**.**

An initial direction proposed to create needed capacity in the SNA was to scale back the industry and commodity detail contained in the Provincial Input-Output Accounts substantially, producing detailed benchmark tables on an occasional basis (every 3-5 years) and considerably reduced tables (roughly 130 industries by 200 commodities), estimated via a "synthetic" approach in the interim years. The synthetic strategy combined high-level financial control variables, based on survey and tax data, with modeled commodity and expense detail based on partial information. As part of this proposed strategy, commodities would be carefully chosen to differentiate by taxability and new estimation methods would ensure the appropriate quality and detail to meet annual requirements for HST allocation.

Subsequent to the conception of this "blue sky" proposal for the Canadian SNA, two larger provinces, Ontario and British Columbia, joined the harmonized sales tax agreement and new requirements surfaced from Finance Canada and the provinces. It

became clear in user consultations that commodity detail was viewed as important from a quality perspective in building estimates, but also in communications among partners to facilitate transparency in payment allocations. Users were prepared to accept a streamlining and rebalancing of industries and commodities contained in the provincial IO framework, but not a fundamental rescaling of the detail available on an annual basis.

A decision was made to proceed with a less drastic rescaling and "modernization" of the IO framework, with a new industry and commodity classification to be implemented over the coming two years, by the release of reference year 2009 in 2012, coincident with a historical revision to time series across the SNA. Plans are in place to compile provincial tables on the new basis for the two preceding years, 2007 and 2008, to enable the analysis of important structural changes over the recessionary period.

Work had already been accomplished on a prototype modernized classification, which aims to improve the relevance of the IO accounts by streamlining and rebalancing industry and commodity detail to better reflect today's economy. It is currently being adjusted in light of the most recent user requirements. While the existing framework contains legacy detail heavily weighted towards goods producing industries, the modernized tables eliminate obsolete goods detail and improve the representation of the growing service sector.

The rebalancing of industries is enabled by the expansion of survey activity into new areas, and the new proposed commodity dimensions have been developed using predetermined criteria, such as size, industry of origin, emerging issues, taxability, data availability and historical continuity. The new commodity structure is based on the North American Product Classification System (NAPCS) which has been largely implemented, at least on the output (revenue) side, in many industry surveys. The modernized framework reduces the number of working-level industries from 303 to 243 and commodities from 727 to 480. Detail in manufacturing is significantly reduced in areas that were important historically but are no longer as significant. A split of conventional and non-conventional oil and gas extraction is introduced for mining and services detail is expanded for the retail and wholesale sectors, finance, information and culture, and arts, entertainment and recreation.
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III The process of compilation

Integrating source data to compile CSNA estimates

Understanding the production cycle, operational conventions and processes and how they tie in with broader measurement objectives in the integrated Canadian SNA provides important context to challenges in estimation. In general, the SNA production cycle begins with the release of timely sub annual aggregates, often based on partial or proxy projectors. At first release, the focus is to appropriately represent short term signals in terms of economic growth. Estimates are subsequently revised in successive iterations as solid benchmark information becomes available. Throughout the process, data quality is improved as more comprehensive source data is incorporated. The final stage of the revision cycle is the alignment of aggregates with the full detail of the Input-Output Accounts by region.

Estimates in the Canadian SNA, therefore, benefit from the integration of both a *"top down"* approach to compilation, where high-quality aggregate controls are implemented across the system, and a *"bottom up"* method, where all available detailed statistics are concorded and confronted in a balanced accounting framework. The combination of these two approaches helps to assure the quality of both the aggregate and the detailed accounts in the context of a larger integrated framework. It is also intended to assure an accurate representation of growth and an appropriate calibration of levels and structure in the overall result.[3] As is the nature of any statistical exercise, the data quality of very specific detail will generally be lower than that of principal aggregates in the SNA accounting system.

Balancing the IO accounts

As in any national accounts compilation exercise, IO analysts rely on accounting identities, coherence analysis, plausibility checks and assumptions to build macroeconomic statistics from available source data. The compilation of national and provincial industry and commodity accounts is a complex and iterative process occurring over a fixed annual production and release cycle within the Canadian SNA.

The two primary identities contained in the Canadian IO accounting framework are:

1) ***The industry balance (inputs = outputs)***
2) ***The commodity balance (demand = supply)***

The IO production cycle begins by processing available source data, including survey, administrative and other sources. Raw source data must be adjusted to match national accounts concepts and mapped to the IO industry and commodity classifications. Detail must be estimated in areas where it is unavailable, and approximate concordances applied when classification systems in source data are not uniform. Gaps must be filled using

[3] As will be demonstrated later in the paper, achieving these objectives simultaneously within a practical production environment is not without important challenges.

residual or other indirect estimation techniques where survey or tax information is unavailable. This has been the case to a large extent for the inter-provincial trade flows, where regular access to wholesale origin and destination information has not been assured in the past.

When initial estimates are assembled from existing information, the process of balancing the industry and commodity dimensions of the tables can begin. IO balancing is undertaken at a detailed level by a team of analysts working collaboratively to identify issues and resolve imbalances. The IO compilation process proceeds in balancing "rounds" in which analysts switch iteratively between industry and commodity balancing, eventually converging on final national and provincial estimates as issues are progressively resolved.

Estimates are built by province at each stage of the process. The first rounds focus on identifying outliers in source data and undertaking high-level analysis, such as examining the stability of IO ratios. Subsequent rounds serve to refine estimates and investigate and resolve imbalances. National estimates are deflated to derive constant price tables at specific iterations throughout the production process and feed back sheds light on the analysis of estimates in nominal terms.

National estimates in nominal terms are finalized first, and reconciled aggregates are published in benchmark form in the Income and Expenditure Accounts first quarter release in the spring of each year. Work-in-progress provincial estimates are sent to provincial statistical offices for data quality review prior to their official publication in the fall. Comments received from the provinces are investigated and adjustments made if required.

Throughout the production process, IO analysts are required to investigate and document large movements in industry or commodity series to validate the estimates and assure their quality. This investigation involves assessing the plausibility of the signal in light of economic intelligence. If a reasonable explanation cannot be found, analysts will investigate the source of incoherence with the compilers of the source information. Statistical anomalies, breaks and errors are often identified in this process and fed back to subject matter specialists. Survey specialists at Statistics Canada will follow up with respondents for additional information when large issues cannot be easily resolved.

Knowledge of the relative strengths and weakness of source estimates and well-developed analytical judgment are the key skills of an IO compiler. Commodity imbalances can result from a range of factors affecting the coherence of estimates, including valuation differences, timing issues, coverage or reporting problems, misclassifications, conceptual differences, or statistical errors.

As the balancing process is complex both technically and analytically, a set of best practices has been established as a useful aid for the IO production team. In addition to laying out recommended steps in analysis, a rough hierarchy of which data are generally of higher quality, and therefore should be less subject to adjustment, is provided as a

general guide. Survey or source data outputs (revenues) and the components of primary input and final demand, which already incorporate source data and analysis from their prior release in more timely SNA programs, are generally considered firmer than material inputs, inter provincial trade flows and inventory estimates.

Reconciliation with quarterly GDP income and expenditure-based

Superimposed on the IO compilation process and an important ingredient feeding into it is the annual reconciliation with other SNA programs, in particular the quarterly Income and Expenditure Accounts and their provincial counterpart, the Provincial and Territorial Economic Accounts. This program also houses the quarterly institutional sector accounts, tracking incomes and outlays of institutional sectors, financial transactions and wealth accumulation. The main aggregates of GDP income and expenditure-based (primary inputs and final demand) are reconciled statistically in nominal terms over the course of each annual production and release cycle.[4] Selected components are reconciled progressively at different stages, beginning with labour income then moving through mixed income and the components of final demand. Surplus is the final income item to reconcile nationally, when other components are more solid.

This reconciliation process serves to improve the quality of many SNA datasets. More timely quarterly aggregates, estimated with a combination of partial or proxy sub annual projectors and annual benchmark information, benefit from the rigour of the commodity balancing process. Detailed industry and commodity statistics, often built from the bottom up using a range of industry source data of varying quality, benefit from the introduction of high quality control totals established at a more aggregate level for the components of primary inputs and final demand. . Benchmarks established in the reconciliation process serve as the foundation for sub annual projection systems, including monthly real GDP by industry.

The reconciliation process is not without its challenges, however, some of which are inherent in the elements used to build the estimates independently and others stem from internal policies chosen to facilitate the production and dissemination of estimates. Some examples are outlined below.

Institutional sectors and industries

The focus of the Income and Expenditure Accounts is on institutional sectors and not industries. While certain estimates are built by industry via an allocation of tax controls to establishments on the business register (labour income and mixed income, for example) others, such as surplus, industries can at present only be approximated using enterprise-based data.[5] As will be discussed in more detail later, industry allocations of tax controls are often difficult to reconcile with surveyed industry data. In order to

[4] Growth rates are aligned for CSNA estimates in real terms, for both sub annual estimates (quarterly GDP expenditure-based and monthly real GDP by industry) and their annual counterparts.

[5] Available data have up to now not allowed surplus to be estimated at the establishment level, but new work on tax-based estimates for corporations will enable this in the future.

mitigate this problem, reconciliation by industry is generally undertaken at a fairly aggregate level (2-digit NAICS), when it is necessary at all. Integration at this level is already challenging, and at a more detailed level it would be unlikely to reap quality benefits.

Harmonization of classification systems

In certain cases, a lack of harmonization of underlying classification systems complicates the task of reconciliation. In the case of personal expenditure, for example, the working-level classification used in the Income and Expenditure Accounts does not map perfectly to the final demand categories and associated commodities in the IO system and must be concorded. While efforts are in course to finalize a new, more harmonized SNA personal expenditure classification, doing so effectively involves balancing the objectives of COICOP, a purpose-based classification, with NAPCS, a standard commodity classification based on industry of origin. In certain cases compromises must be made.

Growth vs. levels and structure

While the primary objective of the Income and Expenditure Accounts is to measure economic *growth*, the thrust of Input Output Accounts is to measure the *structure* of the Canadian economy in terms of industry and commodity relationships. While it would seem that these objectives should not be at odds, in practice, as the underlying data system develops and improves, a choice is sometimes made to preserve time series continuity to accurately measure growth rather than introduce a new data source that could better measure levels and improve the representation of structural relationships by industry and commodity. Specific examples will be provided later in the paper.

This is generally a short term decision to postpone the introduction of new source data until historical time series can be opened for revision. The alternative is to attempt to "wedge in" new levels over time so as to minimize distortions in growth patterns. This strategy was used in the post-PIPES period, when the incorporation of new source data resulted in larger than usual upward revisions to growth in personal expenditure, the most important component of the HST allocation formula.

Minimizing revisions and revision policy

As mentioned previously, in compiling national accounts statistics, there is an inherent tradeoff between timeliness and the comprehensiveness of statistics and data quality. More complete source data and the full detail required to estimate commodity supply-use are generally available with a considerable lag. Attempts are made to minimize revisions by best anticipating benchmark series with projection systems wherever possible. Large revisions require explanations to data users and call into question the reliability of previously published estimates. In reconciling the estimates, a "burden of proof" is therefore required before data can be revised. If two data sources are of roughly similar quality, there may therefore be a bias towards the more timely data source in establishing benchmarks in the reconciliation process.

The Canadian SNA has traditionally maintained a four year annual revision cycle with the first two years incorporating benchmark information for a preliminary and revised set of IO tables. There are plans to reduce the revision cycle to three years in the coming year, eliminating the revision year for the IO accounts, and generating efficiencies in branch production process. It was found that while the incorporation of the first set of IO benchmarks leads to improvements in the estimates, with advancements in production and improved timeliness of receipt of source data, the final revision no longer has a significant impact.

In general, time series are opened for revision only during very infrequent historical revisions, which have traditionally occurred every 10 years or so in major staged undertakings coordinated across all SNA programs. Since revisions to historical time series are infrequent, the need to recalibrate levels to reflect updated concepts, revised methodologies and new source data becomes more urgent as time goes by and issues accumulate. While a "big bang" revision of this nature is currently underway coincident with the implementation of SNA2008, more frequent, smaller scale revisions are envisaged for the future.

This will be particularly important in the future, since business survey processes at Statistics Canada are entering into a full scale redesign, to further streamline and integrate content, collection and processing and optimize the use of tax data. First estimates under the new Integrated Business Statistics Program are slated to be available for reference year 2013, and all business surveys are slated to transition to the new integrated model in predetermined phases over the coming years. While impacts of the new survey approach are not yet known, there are bound to be effects, and data sources may be unstable during the transition.

IV Illustrative examples

The following section presents three illustrative examples of current measurement challenges and highlights some of the strategies under consideration to address them in the upcoming historical revision to national accounts time series. The first example looks at the case of the retail and wholesale trade industries, where available source data has developed considerably since base methodologies were put in place, enabling important improvements. The second deals with the estimation of labour income, and how to most effectively integrate benchmark tax controls with industry survey data without distorting industry structure. The third and final example looks at the estimation of personal expenditure, where a great deal of source information has been incorporated into estimates prior to the establishment of IO benchmarks, but estimates can still be improved in specific areas through commodity balancing.

Wholesale and retail trade: updating methodologies to better reflect source data

In the case of the wholesale and retail trade, industry surveys did not exist in their current form when the provincial input-output tables were developed in the mid to late 1990s. Methodologies were put in place with partial information, and many measures had to be based on approximate splits and assumptions, often using historical patterns. Since that time, many improvements have been introduced in the data system, including more frequent and timely commodity detail for retail trade and an annual wholesale trade survey, introduced in its current form in 1999.

While the IO accounts estimates have benefited from the incorporation of new source data, the upcoming historical revision is an opportunity to make important enhancements to methodologies and statistics to use the information to its full potential. Improvements are planned in the following three areas:

1) Expanding industry detail to the 3-digit level
2) Revising the methodology to produce retail and wholesale margins
3) Better reflecting the levels and industry structure indicated by source data.

Expanding industry detail to the 3-digit level

In the current Input-Output accounts, the retail and wholesale industries are presented at the 2-digit level of the North American Industry Classification System (NAICS). This aggregate level shows only the total retail and wholesale trade industries with no further breakdown. The new modernized industry classification planned for implementation in 2012 breaks these industries down to the three digit level, showing detail as follows:

Table 1, Wholesale and retail industries at the 3 digit level, North American Industry Classification System, 2007, Canadian version

Wholesale	Retail
411 Farm product Wholesaler-Distributors	441 Motor Vehicle and Parts Dealers
412 Petroleum Product Wholesaler-Distributors	442 Furniture and Home Furnishings Stores
413 Food, Beverage and Tobacco Wholesaler-Distributors	443 Electronics and Appliance Stores
414 Personal and Household Goods Wholesaler-Distributors	444 Building Material and Garden Equipment and Supplies Dealers
415 Motor Vehicle and Parts Wholesaler-Distributors	445 Food and Beverage Stores
416 Building Material and Supplies Wholesaler-Distributors	446 Health and Personal Care Stores
417 Machinery, Equipment and Supplies Wholesaler-Distributors	447 Gasoline Stations
418 Miscellaneous Wholesaler-Distributors	448 Clothing and Clothing Accessories Stores
419 Wholesale Electronic Markets, and Agents and Brokers	451 Sporting Goods, Hobby, Book and Music Stores
	452 General Merchandise Stores
	453 Miscellaneous Store Retailers
	454 Non-Store Retailers

This increased detail on the distributive trades will be of great benefit to the user community, as divergent signals relating to different types of activity are often lost in the aggregate statistics. It will also benefit internal programs such as the monthly GDP by industry, to better understand GDP to sales ratios used in the projection system.

A couple of important challenges must be overcome in order to build this new detail into the IO tables. First, growth patterns of industry estimates at this level of detail tend to be very volatile. As study was undertaken to investigate the source of the volatility and found it was driven primarily by specific practices in the processing and validation of estimates and instability in coding of locations and establishments on the business register as it transitioned to a redesigned system. It is expected that estimates will become less volatile as improvements are made to coding and imputation processes for the wholesale and retail industries.

Second, because the source data has limited information on the commodity composition of outputs and intermediate inputs, it will be necessary to build a methodology, based on available aggregates with estimated splits using some reasonable assumptions. This will be particularly challenging in areas where there is significant secondary activity in manufacturing, for example. The current commodity breakdown of the very aggregate industries is based on historical patterns and requires updating.

Better reflecting levels and structure of source data

While there are many reasons to diverge from any specific source in an SNA data integration exercise, current differences for specific components in wholesale and retail IO estimates reflect both conceptual and statistical issues. An important conceptual issue has been the treatment of commissions relative to margins. In the IO accounts wholesale commissions are aggregated with margins, while in retail they are aggregated with a separate retail service commodity. Commissions represent approximately $6 billion of the difference between the IO estimates and source data for the wholesale industry. In the upcoming historical revision, separate commodities for both wholesale and retail trade commissions will be introduced to clarify this treatment**.**

The following table shows IO estimates vis-à-vis the current survey estimates from the Annual Wholesale Trade Survey. While the overall output of the wholesale sector is very close to the levels indicated by industry source data, its distribution to specific components can be improved. While the primary output of wholesale margins, albeit incorporating commissions, is reasonably well represented, while some statistical issues regarding secondary outputs are evident For example; secondary output of rental and leasing is estimated at $5.2 billion in the IO system, while the survey indicates a level of roughly $1.7 billion. Expenses are also underestimated in certain areas, notably for advertising ($ 2.8 billion versus $6.7 billion), and other commodity inputs ($ 40.6 billion versus $29.8 billion). The practice of calibrating levels at a particular point in time, then carrying them forward using a growth methodology to preserve time series continuity has generated this result.

Table 1: Comparison of wholesale survey data with IO estimates, 2006, $ 000 CND

	IO tables	Source Data	Difference	%
Output				
Goods manufacturing	4541902	4159837	382065	9%
Net margin, including commissions	110013368	108511985	1501383	1%
Repair and maintenance	1833690	3344846	-1511156	-45%
Rental and leasing	5236570	1655334	3581236	216%
All other services	1084105	5058234	-3974129	-79%
Gross margin	122709635	122730234	-20599	0%
Input				
Rental and leasing expenses	4391784	3869125	522659	14%
Advertising expenses	2792085	6698660	-3906575	-58%
Wages and salaries	40137695	39499634	638061	2%
Employer contributions (SLI)	4413775	6130844	-1717069	-28%
Mixed income	958900	958900	0	0%
Other operating surplus	26849716	33201899	-6352183	-19%
Other commodity inputs	40617287	29822779	10794508	36%
Other primary inputs (net tax)	2548393	2548393	0	0%
Total inputs	122709635	122730234	-20599	0%

As demonstrated by table * above, the net result of the recalibration of estimates for the industry would be a significant upward revision to surplus for the wholesale industry (from $26.8 to $33 billion). Since there are many other checks and balances in the overall macro data system, it is unlikely the total surplus is underestimated by as significant an amount, and the impact on overall GDP is likely to be minor. Offsetting adjustments will have to be made in other industries via the reconciliation process. This requires further investigation and will be difficult to assess until all statistical revisions are examined in the context of industry and commodity balancing.

Revising methodologies for retail and wholesale margins

While control totals for retail and wholesale industry production can be established from industry surveys, estimates of the demand for margins and the determination of margin rates by detailed commodity do not exist. However, rough estimates can be derived by concording the industry data to a set of commodities, assuming a relatively homogenous set of associated commodities. For example, the industry margin for a 5 digit NAICs industry (e.g. 31312, Dairy and Milk producers) can be assumed to represent the sum of wholesale margins for specific related products (e,g. milk, cheese, etc.).

Using these assumptions, an internal CSNA study indicates significantly different margin rates for a large range of commodities vis-à-vis what is currently estimated in the IO accounts, based on historical ratios and an assumption of rates as a fixed percentage of sales. Margin levels by commodity will be re-examined in the upcoming historical revision.

Labour income: combining industry surveys with tax controls

In the case of labour income, economy-wide benchmarks for the Canadian SNA are established using tax benchmarks from the T4 Statement of Remuneration and Benefits originating from the Canada Revenue Agency. These files are processed at the micro level at Statistics Canada and an allocation by industry is undertaken through an extensive matching exercise with Statistics Canada's Business Register. The T4 allocation exercise maps information provided generally at the legal entity level to establishments on the BR using employment as an indicator.

In addition to the allocation exercise, sectoring is undertaken to specify the federal, provincial and local government components of labour income, including education and health and social services. The NPISH component is currently identified using tax information on registered charities. Specific adjustments to base T4 estimates are also made to control totals in a range of areas. These include, for example, upward adjustments in child care and tips for workers in accommodation and food services, where tax benchmarks likely understate activity due to under-reporting. In addition, a number of substitutions are made to supplementary labour income in areas where alternative information is available from a different source, such as information on health premiums or employer contributions to group insurance plans, which have different tax treatments across provinces.

In certain rare cases, adjustments are made to benchmark T4 based estimates when it is judged that reporting issues have led to an inaccurate representation of trends. Such was the case during the high-tech boom in the late 1990s, when a large downward adjustment was made to initial T4-based estimates of labour income as a result of growth differences in T4 benchmarks and amounts reported in tax returns filed by individuals (the T1 file).

The ongoing estimation of labour income is not based on pure T4 levels with adjustments, but uses a growth methodology by industry applied to historical estimates. The determination of appropriate growth patterns also considers other indicators, such as sub-annual trends of employment and wages and salaries by industry from the monthly Labour Force Survey and the Survey of Employment, Payroll and Hours.

Initial historical levels by industry for the business sector were established at the time of the last historical revision, when provincial input-output tables were introduced and the provincial components of the SNA were integrated for the first time. These levels were established using a combination of T4 tax and industry survey information. Levels were subsequently recalibrated with the introduction of the North American Industry Classification (NAICS) and the conversion from the former Standard Industrial Classification (SIC). They have been carried forward using the growth of T4-based benchmarks, balanced to annual business sector controls obtained residually in the sectoring exercise when the government and NPISH elements have been identified and removed.

At the time of building provincial input-output tables, estimates of labour income derived via the method described above must be reconciled with provincial IO estimates built from the bottom-up using industry source data, based on a combination of industry surveys and tax information on corporations from the T2 General Index of Financial Information (GIFI) return. This reconciliation is undertaken at a fairly aggregate level, at the level of 2-digit NAICS, and there is flexibility within aggregate totals to allow for different results. Even at this level of detail, however, there are some important challenges in reconciling *top down* labour income estimates with *bottom up* industry source data.

This is demonstrated in the Table 2 below, which shows the differences in levels of estimates derived from the tax benchmarking exercise with initial IO estimates based on industry source data.[6] As can be seen by the table, significant level differences exist in many industries, notably manufacturing, retail trade, professional, scientific, architectural, engineering and related services, and real estate agents and brokers.

Depending on the source and industry, a range of factors could explain the differences evidenced in the table. One possibility is imperfections in the T4 allocation method used to derive industry estimates. The method relies on employment counts to allocate wages and salaries reported at the legal entity level to establishments across provinces and industries via the Business Register. Depending on the nature of the industry, there may be significant differences in average wages between head offices and associated units, for example. In addition there may be inadequate profiling of units for certain industries on the BR, and it is possible there are coverage issues for ancillary activity in areas such as transportation. Warehouses or other transport activities may be registered under a different NAICS or industry classification, and thus may not be picked up by the relevant survey (for example, in the case retail trade).

In the case of industry surveys or estimates based on corporate tax returns, there may be coverage issues or problems related to sampling variability. In addition, business accounting conventions may allocate labour income to other components of the income statement, such as the cost of goods sold in the case of wholesaling or manufacturing.

Irrespective of the reasons for the differences, when labour income from the T4 allocation method is combined with an industry structure from a surveyed or tax source, this creates potential distortions for industry balancing. In the input-output accounts, where measuring industry structure is an objective, this is an important issue. When 2-digit industry benchmarks are entered into the IO balancing process, they are generally disaggregated to the more detailed IO industries under an assumption of relatively fixed labour income to gross output ratios. Output is sometimes not adjusted to be consistent with the adjustments to labour income at this stage of the compilation process. It is possible, however, that this effect may be mitigated as estimates are adjusted throughout the iterative process of industry and commodity balancing.

[6] In the IO tables, construction own account wages and supplementary labour income are currently estimated by non construction industry and transferred to the construction industry. The estimates presented below do not incorporate own-account construction estimates.

Table 2 , Business sector CSNA estimates versus survey or tax data, wages and salaries, 2006, $ 000 CDN

Industry	CSNA Wage estimates 2006	Survey or GIFI data 2006	Difference 2006p	% 2006p
Accommodation, RV, Food Services and Drinking Places	20527355	15182767	5344588	26.0%
Support Activities for Crop and Animal Production and Forestry	832409	854442	-22033	-2.6%
Offices of Physicians, Dentists and Misc. Health Care	9176368	10011349	-834981	-9.1%
Administrative Support Services	23035142	27379507	-4344365	-18.9%
Crop and Animal Production (including Animal Aquaculture)	3877362	3920429	-43067	-1.1%
Construction	45884307	44284385	1599922	3.5%
Education and Educational Support Services (excluding non-profit and go	1464145	1455499	8646	0.6%
Finance	41601561	41067098	534463	1.3%
Forestry and Logging	2397390	2453168	-55778	-2.3%
Fishing, Hunting and Trapping	294149	312061	-17912	-6.1%
Amusement, Gambling and Recreation Industries	3859638	4074363	-214725	-5.6%
Heritage Institutions (excluding Government Funded)	86953	574437	-487484	-560.6%
Information Services	18412224	16847925	1564299	8.5%
Manufacturing	91526199	84591804	6934395	7.6%
Mining	19316314	18501768	814546	4.2%
Grant Making Civic and Prof.	2015872	6437716	-4421844	-219.4%
Personal Care Services and Other Personal Services	3128854	2809907	318947	10.2%
Performing Arts, Spectator Sports and Related Industries	1941253	1788638	152615	7.9%
Private Households	2859128	2705881	153247	5.4%
Prof. Scientific, Architectural, Engineering and Related Services	41646333	36564229	5082104	12.2%
Repair and Maintenance	6879978	4816502	2063476	30.0%
Nursing and Residential Care Facilities	2416685	2472609	-55924	-2.3%
Retail Trade	46526706	39440021	7086685	15.2%
Real Estate Agents and Brokers and Activities Related to Real Estate	18804240	12387104	6417136	34.1%
Social Assistance	2426963	2426293	670	0.0%
Transport and Storage Services	31584226	31040586	543640	1.7%
Utilities	8245574	5218377	3027197	36.7%
Wholesale Trade	40990862	39499634	1491228	3.6%
Total Business Sector	**491758190**	**459118498**	**32639692**	**6.6%**

As a result of these potential distortions and the complexity of reconciliation and balancing, a rethink of the level at which the reconciliation occurred was considered in planning discussions for the upcoming historical revision. Options considered included reconciliation at the total province level, leaving flexibility in the IO accounts to determine the industry distribution within a given province. Alternatively, reconciliation at the 2-digit level, but going back to pure T4 levels by industry rather than those that have been arrived at via the growth methodology was considered. In the end, a compromise position was adopted where reconciliation will still occur at the 2-digit level but improvements will be implemented via the following:

1) T4 base controls will be reexamined to identify cases where the growth methodology has resulted in a drift off the appropriate levels.
2) Statistical revisions will be undertaken to update methodologies for control adjustments to labour income industry benchmarks.
3) New benchmarks will be examined in light of the industry balance indicated by new industry source data and adjustments will be made where warranted.

Understanding the differences between labour income estimates from the T4 allocation method and those obtained from industry source data remains a longer term goal, as does implementing any needed improvements to the T4 allocation method.

Personal expenditure: growth and levels in the context of commodity balancing

Personal expenditure on consumer goods and services is compiled on a quarterly basis in the Income and Expenditure Accounts and is the largest component of expenditure based Gross Domestic Product, Canada's featured measure of economic growth. The estimates also feed into the institutional sector accounts and are key to the residual calculation of personal saving and the personal saving rate for Canada and the provinces. They are estimated for approximately 130 series at the current working-level classification in place for a number of decades in the Income and Expenditure Accounts program.

Two primary data sources are used in the estimation of the commodity composition of personal expenditure: the demand based Survey of Household Spending, an annual survey of the detailed spending patterns of Canadian households, and the supply based Quarterly Retail Commodity Survey, a survey of retail establishments, conducted as a commodity supplement to the Monthly Retail Trade Survey. Each of these surveys has strengths and deficiencies with respect to measuring SNA personal expenditure.

While the Survey of Household Spending collects information directly from households and yields estimates that represent a pure household sector, there are important issues with sampling variability with respect to infrequent purchases, such as durable goods, and concepts differ from SNA standards in some important areas (for example, residential rents, insurance, used motor vehicles and banking services). It is therefore generally used for the estimation of personal services. While the Quarterly Retail Commodity Survey has the advantage of covering a major portion of retail activity in Canada, retail sales include not only the purchases of individuals, but also sales to businesses and governments. The survey generally covers goods purchases only and has insufficient commodity detail for SNA purposes.

In addition to these sources, a range of other information is exploited to build important components of personal expenditure. Specific alternative data sources are available and methodologies in place to build annual benchmark and quarterly projections for motor vehicles, tobacco, paid and imputed rental of buildings and dwellings, insurance, financial services and net expenditure abroad. A variety of methods are employed to compile estimates for working level series, sometimes involving direct estimation of estimates in nominal terms, others using volume projectors and converting to current price values.[7] While the aim is to attain both appropriate growth patterns and levels, measuring economic growth is a fundamental objective of the quarterly GDP program and maintaining time series continuity is a necessary prerequisite to this goal.

At the time of reconciliation with the IO accounts, a great deal of source information, including both sub-annual growth patterns and annual benchmarks, has been built in to PE estimates. They have, however, thus far been compiled outside of the full supply-use framework implicit in the IO system. Commodity balancing brings intelligence from

[7] An additional, important check on the validity of levels for personal expenditure consists of comparisons of implied sales tax, estimated from known tax rates applied to personal expenditure commodities, with actual sales tax collections for a given period.

other data sources that can serve to recalibrate levels and improve the quality of the estimates. The quality improvement in this case may pertain more to the distribution of personal expenditure by component than to its overall, aggregate level.

An important challenge in the reconciliation process is the lack of harmonization in classification systems in individual SNA programs. The input-output system records 40 odd PE categories, which can be articulated by detail IO commodity. As mentioned previously, this presentation does not map perfectly to the income and expenditure "j-series" classification and they must be concorded before they can enter as an input to the commodity balancing process. This complicates reconciliation, since supply-use analysis is undertaken at a detailed commodity level, and commodity definitions do not map mutually exclusively to the "j-series" components.

Nonetheless there is often clear evidence in specific cases that personal expenditure should be adjusted in light of the broader information contained in the supply-use framework. A recent example relates to the IO commodity for "Motor homes, motorcycles and ATVs". A newly-available micro-data file for international trade allows detailed analysis of specific importers by detailed HS-code. Prior to obtaining this file, significant excess supply for this commodity was assumed to stem from a misclassification of international trade. The new evidence indicates that trade is indeed correctly classified and an upward adjustment to PE to increase demand for the commodity is in fact warranted. Since implementing this adjustment within the standard period open to revision each year would break the time series for personal expenditure, corrections to trade were deferred until estimates could be opened in the historical revision. Please see table * below for the level adjustments to trade.

Table 3: Changes made to the Level of Imports of "Motor homes, motor cycles and ATVs" in IO Commodity Balancing, $ CDN 000

		2004	2005	2006	2007
I	Motor homes, motorcycles & ATVs				
	Imports (post balancing)	1,642,360	1,888,701	1,918,823	2,091,355
	Imports (pre balancing)	109,340	984,077	1,218,853	1,251,359
	Adjustments	**1,533,020**	**904,624**	**699,970**	**839,996**

In other cases, compromises are made in commodity balancing to minimize revisions where there is ambiguity in the classification or in the quality of source data. A recent example was in balancing the set of commodities for red meat, a component of the working level "j-series" for total food in the income and expenditure classification. A perennial issue in commodity balancing is that the combination of source data on output (from the Annual Survey of Manufacturing), trade (exports) and personal expenditure projections generates persistent over supply in these commodities. The compromise in the most recent production cycle was to adjust all three elements proportionally to achieve a commodity balance. In prior years, output alone has been adjusted. It is

possible offsetting adjustments in other food commodities feeding into the aggregate personal expenditure component should be considered, and the overall value may not be changed significantly.

A final example was the IO commodity for photographic film, which was specified in the IO system to exclude digital cameras and related accessories (memory cards etc.) Available evidence from the supply use framework suggested that the level of demand for this commodity, which corresponded directly to a personal expenditure "j-series" was overstated by a significant margin. Ambiguity in the coherence of the classification of components of supply and demand and variable definitions in the projector series available from the Survey of Household spending prompted a decision to defer adjustments in this commodity until the SNA historical revision.

Moving forward improvements will be made in the historical revision to better facilitate reconciliation in the future and recalibrate personal expenditure levels by commodity. As mentioned previously, as part of the IO modernization project, a new, harmonized SNA personal expenditure classification will be implemented across all implicated SNA programs. The new classification will adhere to the purpose-based principles of COICOP, and attempt to map the new NAPCS-based IO commodities to a single PE category if possible. The introduction of a new classification does not in and of itself contribute to increased quality of PE estimates, but clarifying underlying classifications and minimizing the use of approximate concordances may have indirect effects.

In addition, a comparative study will be undertaken to assess how SNA personal expenditure levels compare to current source information from the Survey of Household Spending and the Quarterly Retail Commodity Survey. As indicated previously, these surveys have a number of deficiencies and must be used in conjunction with numerous other data sources for an appropriate, item-specific, assessment of levels. This comparative study will serve as initial intelligence to the process, however.

V Conclusion

With more than a decade since their development and integration, annual Provincial Input Output Accounts are a well-established feature of the Canadian SNA. While important challenges remain, source data feeder systems have matured and internal production processes have been refined and streamlined. The user community has come to rely on the strengthened System of Provincial Accounts as an essential analytical tool, and estimates are entrenched in fiscal formulas and heavily exploited for other policy applications. They serve as the foundation of projection systems for current measures and as important quality infrastructure to Statistics Canada's economic statistics program.

This paper has reviewed a number of specific measurement challenges in the current context to be addressed in the upcoming historical revision to the System of National Accounts. These relate to fully exploiting new data sources within an integrated system to accurately portray both structure and growth as feeder data systems develop and evolve. Achieving the appropriate balance of these objectives in ongoing production within a fixed annual revision cycle continues to be an important challenge and a fundamental goal in an integrated provincial system of accounts.

Moving forward, the Provincial Input-Output Accounts will transition to a modernized framework of industries and commodities which will streamline and rebalance detail to better reflect today's economy. The modernized framework will move to a NAPCS-based commodity classification, and introduce more harmonized classifications of final demand which will facilitate reconciliation when they are implemented across SNA programs.

The harmonization of estimation techniques across related SNA programs and the introduction of early measures to better anticipate IO benchmarks will also help facilitate reconciliation moving forward. Important developments envisaged include timelier benchmark controls for operating surplus derived from corporate (T2) tax information and quarterly supply-use analysis, and the introduction of quarterly supply-use analysis in the Income and Expenditure Accounts program.

In addition to revised concepts in line with SNA2008, the upcoming historical revision to the Canadian SNA will introduce statistical revisions across SNA programs to recalibrate levels and improve the representation of industry and commodity relationships. Beginning this year, the annual revision cycle will be reduced from four years to three, and production cycles will be gradually advanced to eventually release provincial estimates coincident with national.

The upcoming SNA historical revision is envisaged as the last of a 10-year, "big bang" nature. It will be important to introduce more frequent, smaller scale historical revisions to SNA time series in the future for a number of reasons and to develop systems and processes flexible enough to accommodate this objective. The reduction of the annual revision cycle will reduce scope to introduce historical changes, and there will be a need to re-open time series as SNA2008 objectives are more fully implemented as time and resources permit. In addition, while the potential effects are not yet known, it is possible

there will be a need for important statistical revisions as business survey feeder programs transition to the new Integrated Business Statistics Program model over the next several years.

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Appendix 1. A Schematic of the Canadian System of National Accounts