SPPI Mini Presentation

Direct Insurance Carriers Services in Canada

by

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Introduction

The purpose of this paper is to provide an overview of the development of a Services Producer Price Index (SPPI) for *Direct Insurance (Except Life, Health and Medical) Carriers,* more commonly referred to as the Property and Casualty (P&C) insurance industry. The Property and Casualty Insurance Services Price Index (PCISPI) is currently under development at Statistics Canada.[1]

1. Definition of service being collected

Insurance carriers are defined in the North American Industry Classification System (NAICS) as establishments that are primarily engaged in underwriting annuities, insurance policies and reinsurance. Premiums are charged based on actuarial estimates of reserves; the premiums received by the carriers are invested to build a portfolio of financial assets that are intended to meet the obligations of future claims (NAICS 2007; Sector 52).

Insurance Carriers (524) are part of the broader *Finance and Insurance* (52) sector and are disaggregated at the five-digit industry level into:
- *Direct Life, Health and Medical Insurance Carriers* (52411);
- *Direct Insurance (Except Life, Health and Medical) Carriers* (52412); and,
- *Reinsurance carriers* (52413).

It is the *Direct Insurance (Except Life, Health and Medical) Carriers* (52412) industry that is the focus of current development work. This industry comprises establishments primarily engaged in underwriting all types of insurance (other than life, health or medical), directly to policyholders. Examples of establishments in this industry are automobile, property and liability insurance carriers. Establishments primarily engaged in reinsurance are excluded from the industry.

The service produced by insurance carriers can be defined in various ways. Sherwood (1999; pgs. 520-522) outlines the *risk-pooling* and *risk-assuming* views of insurance carriers' behavior. The risk-pooling concept sees the carrier acting as an administrator of the pool of funds (the risk pool) that are available to cover any claims made by policy holders. The risk pool consists of the premiums that the policy holders pay and the investment returns the insurance carriers earn from these premiums. The service produced by insurance carriers is the set of administrative activities associated with managing the risk pool. The output of insurance carriers is measured via the net-premiums approach under this assumption. The net premiums approach subtracts claims (often *expected* claims) from the earned premiums and investment income. It is thought that the remainder is the amount that was intended to pay for the administrative services of the insurance carriers (Sherwood, 1999; pg. 520-521).

An alternative to measuring insurance carriers' output is the risk-assuming concept. Sherwood (1999; pgs. 520-521) outlines this concept as the insurance carriers assuming the risk from the policy holder in exchange for the premium payment. The output of insurance carriers under this

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[1] Property and Casualty Insurance Services Price Index (PCISPI) is the name of the program in development which covers the industry *Direct Insurance (Except Life, Health and Medical) Carriers*. These terms will be used interchangeably throughout the document.

concept is the amount of risk they assume from the policy holders. Under this concept, output is measured by the premiums and investment returns. This approach is known as the gross-premiums approach. The investment returns act to lower the premiums from what they would be in the situation that the insurance carriers did not engage in investment activities (Triplett and Bosworth, 2004; pg. 151).

The risk-pooling concept of output is recommended by the SNA 1993/2008 guidelines. The CSNA approach will be discussed in more detail later; it will be compared with the SNA 1993/2008 recommendations.

Standard Classification Structure

Finance and Insurance (52) is comprised of establishments that engage in financial transactions or in facilitating financial transactions. This sector includes, but is not limited to, banks, security dealers and brokers, insurance carriers and funds and other vehicles (NAICS 2007; Sub-Sector 524). *Insurance Carriers and Related Activities* (524) is made up of establishments that underwrite insurance policies and annuities, reinsurance and various activities related to the retailing of insurance and related products (NAICS 2007).

Direct Insurance (except health, life and medical) Carriers (52412) is disaggregated into six 6-digit sub-industries (Table 1) which range from more general insurance providers (in which no more than 70% of output comes from one line of business), to providers engaged in specific product lines. The last group (524129) is reserved for establishments that primarily underwrite the smaller lines of P&C insurance, such as boiler and machinery, aircraft or marine insurance, directly to policy holders.[2]

Table 1 summarizes the number of Enterprises on the Statistics Canada Business register by product line. The Enterprise (the top of the hierarchy), is associated with a complete set of financial statements. The enterprise, as a statistical unit, is defined as the organisational unit of a business that directs and controls the allocation of resources relating to its domestic operations, and for which consolidated financial and balance sheet accounts are maintained. It corresponds to the institutional unit as defined for the System of National Accounts. Data collected on this industry, both administrative and survey, are at this level rather than at the establishment level due to the availability of the financial information listed above.

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[2] These lines are smaller in terms of premiums written and earned, the number of policies in force and claims incurred.

Table 1: Number of enterprises by 6-digit NAICS

NAICS	Name	Enterprise Count	QFS Sample Count
524121	Direct General Property and Casualty Insurance Carriers	201	51
524122	Direct Private Automobile Insurance Carriers (excludes public carriers)	23	5
524123	Public Automobile Insurance Carriers	9	-
524124	Direct Property Insurance Carriers	43	5
524125	Direct Liability Insurance Carriers	10	1
524129	Other Direct Insurance (Except Life, Health and Medical) Carriers	334	11
Total	**Direct Insurance (except health, life and medical) Carriers**	**620**	**73**

Source: Enterprise count based on the survey universe file of all active Statistical Enterprises as of June 2011 on Statistics Canada's Business Register.

With the upcoming historical revision of the CSNA, the North American Product Classification System (NAPCS) will form the basis of the commodity dimension of the production accounts in the CSNA (NAPCS, 2007). The NAPCS organizes goods and services produced in the economy in a systematic way. Insurance activities are represented by 3 output groups; "the groups which products have been assigned is based on the industry which typically produces them (NAPCS, 2007)." These groups are *Life Insurance and Pension Products* (524001), *Other Non-Life Insurance Products* (524002), and *Reinsurance Products* (524003). The second group, *Other Non-Life Products* (524002), represents the commodities relevant to P&C insurance and is further disaggregated into three main product codes:

1. *Health and Accident Insurance Products* (524002.1)
2. *Surety Bond and Property and Casualty Insurance Products* (524002.2)
3. *Other Direct Insurance Products* (524002.3)

The second and third main product lines listed above are further disaggregated into items that are closely linked to the common product lines of P&C insurance.

Although there are obvious parallels between the industry and product classifications (NAICS and NAPCS), one of the key differences between the classifications are the "other products" categories. The NAICS "other" category (524129) is a residual category that contains business, insurance activities such as Marine and Aircraft and Legal and Financial insurance. Meanwhile,

under NAPCS, the items captured in NAICS (524129) are represented by their own product code under the *Surety Bond and Property and Casualty Insurance Products* (524002.2.*x*) heading.[3]

The P&C insurance industry is diversified in that it covers a wide range of business lines. As shown in Table 1, the majority of insurers are allocated to the more general sub-industries (524121 and 524129); however, across all types of P&C insurance, automobile insurance represents the largest proportion of insurance expenditures by consumers at 53% (Chart 1). When property insurance is included, these two lines account for about 84% of non-life insurance expenditures.

Chart 1: Proportion of P&C insurance net premiums written by line of business, 2010Q4
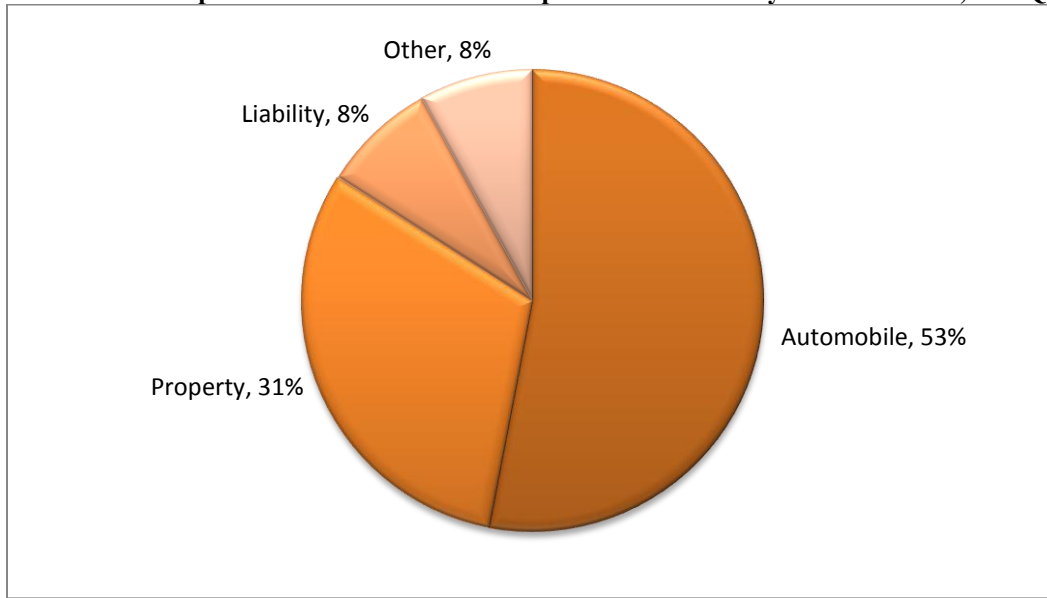
Source: Office of the Superintendent of Financial Institutions – Premiums and Claims Data[4]

Due to the significant contribution to output of automobile insurance within the industry, preliminary development work on the PCISPI has focused on the private automobile insurance sub-industry. A study of premium pricing for typical insurance contracts in the province of Ontario has collected data directly from insurance providers for a two-year period. Levels and trends are being examined against various data sources to assess the quality of information collected. This pilot program is described in more detail in later sections.

2. Market conditions and constraints

a. Size of the Industry

According to the Insurance Bureau of Canada (IBC), there are more than 230 private P&C insurance companies operating in Canada; these companies have a premium base of $36 billion[5] and employ more than 108 000 people (IBC Fact Book 2009; pg. 2). The IBC states that the

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[3] The *x* in (524002.2.*x*) is the index given to the individual lines under NAPCS.
[4] OSFI data accessed from: www.osfi-bsif.gc.ca . Accessed on 22/03/2011.
[5] All figures in Canadian dollars.

majority of private P&C insurance purchased in Canada originates from about 100 companies of domestic and foreign ownership.

Although the P&C insurance industry in Canada provides the essential financial intermediation service that is managing risk, it still represents a relatively small portion of the Canadian economy when compared to financial services as a whole. In the first quarter of 2011, total finance and insurance industries (excluding other funds and financial vehicles) represented 10.0%[6] of total economy revenues. Within the sector, the Insurance Carriers and Related Activities (524) sub-sector held 13.9%[7,8] of assets yet, as shown in Chart 2, generated over one-third of operating revenues. These firms also accounted for just over one-fifth of profits before income tax and equity in affiliates' earnings.

Chart 2: Shares of revenues in the finance and insurance industries, 2011Q1
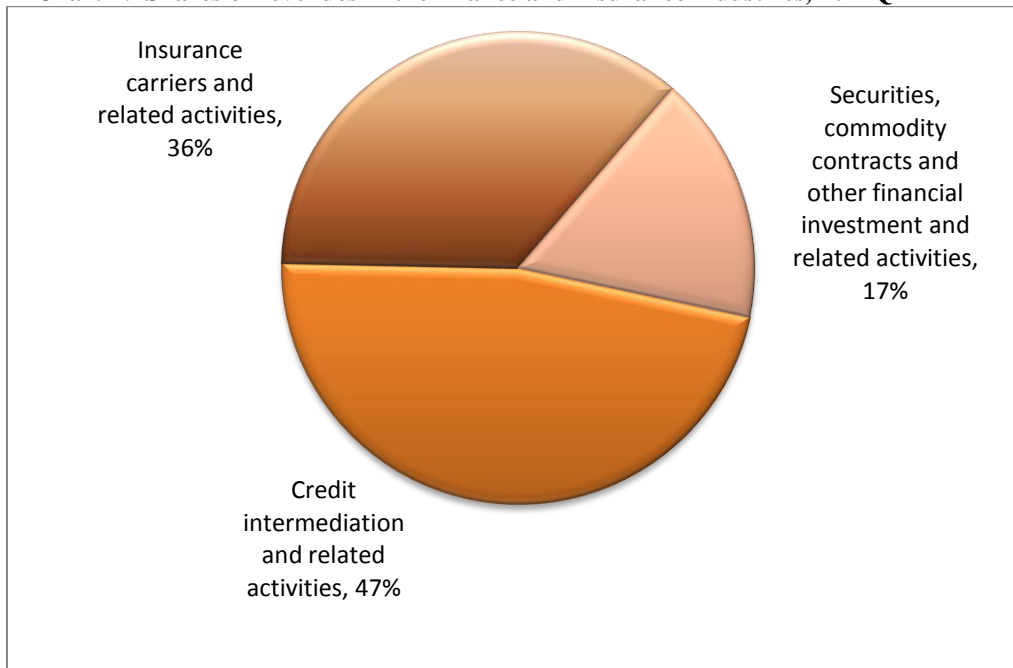
Source: CANSIM table 187-0001.

Overall, P&C insurance represents 1.3% of the total Canadian economy in terms of revenues (Chart 3). Over the past decade, this proportion has fluctuated between 1.1% and 1.4%. Similarly, Insurance Carriers and Related Activities (524) has fluctuated between 2.7% and 3.9% over the same time period.[9]

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[6] Quarterly Survey of Financial Statements, Industrial Organization and Finance Division, Statistics Canada.

[7] Due to the availability of published data, the aggregation of information presented in this section varies.

[8] Source: Statistics Canada. Table 187-0001 - Quarterly balance sheet and income statement, by North American Industry Classification System (NAICS), quarterly, CANSIM (database). http://www5.statcan.gc.ca:80/cansim/a01?lang=eng (accessed: June 24, 2011).

[9] It should be noted that this total includes amounts related to reinsurance.

Chart 3: Proportion of P&C insurance revenues in the Canadian economy, 2011Q1
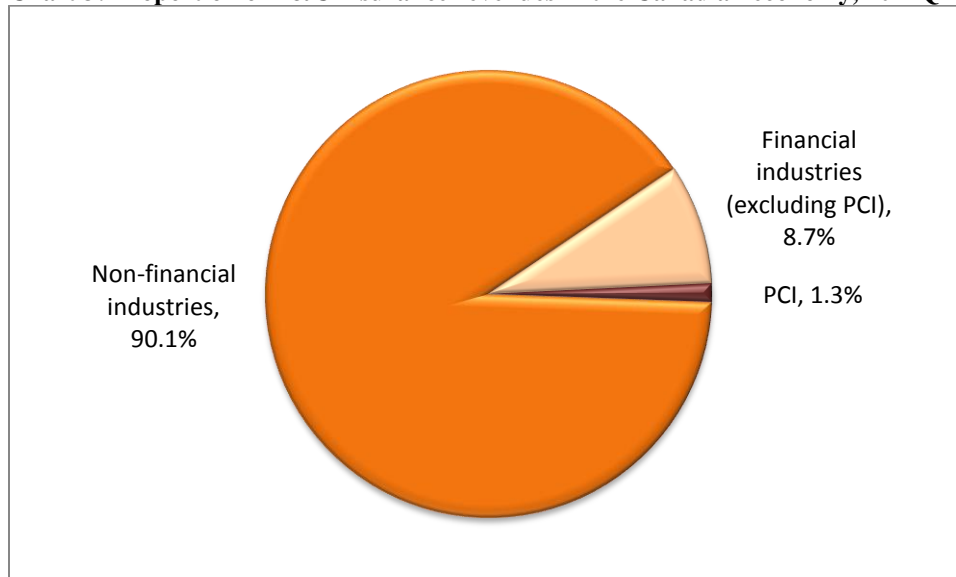
- Financial industries (excluding PCI), 8.7%
- PCI, 1.3%
- Non-financial industries, 90.1%

b. Regulation and Special Conditions or Restrictions

The Office of the Superintendent of Financial Institutions (OSFI) is the primary regulatory body for the insurance industry in Canada. All federally chartered insurance carriers[10] have to report to OSFI (IBC Fact Book 2009; pg. 3). Included in OSFI's jurisdiction are the foreign-controlled firms that operate within Canada; OSFI collects financial and operations data on the domestic interests of registered companies.

In all Canadian provinces and territories, it is mandatory that drivers purchase automobile insurance.[11] Four provinces, British Columbia, Saskatchewan, Manitoba and Quebec, have public automobile insurance regimes while the remaining provinces and territories have private providers.[12]

Provincial regulatory bodies are responsible for provincially chartered insurance companies. Also, regulation of licensing and of the terms and conditions set out in insurance contracts generally falls under provincial authority (IBC Fact Book 2009; pg. 3). As previously mentioned, in Canada the provinces of British Colombia, Saskatchewan, Manitoba and Quebec all have some form of public insurance provision. These public insurance providers are the sole-source for the compulsory component of automobile insurance; additional optional coverage can be purchased through private companies in many of these provinces (IBC Fact Book 2009; pg. 3).

Due to the extensive regulations and attention placed on the insurance industry, surveying insurers directly for pricing information imposes a high degree of response burden. The

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[10] An insurer is deemed federally chartered if it operates in two or more provinces.

[11] The required coverage and minimum amount of said coverage varies by province.

[12] The rules governing the amount of coverage that must be purchased from public providers varies from province to province with some provinces requiring all automobile insurance be purchased through a public source while others mandate a minimum amount (or type) of coverage that must be purchased from the public source; public insurance is not in all cases fully public.

Insurance Bureau of Canada (IBC) advocates on behalf of its members and also collects and disseminates a large array of data and information concerning its members. Current efforts in developing a price index have examined the possibility of using administrative data from OSFI to construct a unit value index as well as the model pricing approach that would use a survey such as the PCIP Report (PCIP report) or a database such as CompuQuote which will be discussed in section 4 e.

c.   Reporting and Record Keeping Practices

OSFI requires that all P&C insurance companies falling under its jurisdiction make required Canadian generally accepted accounting principles (GAAP) disclosures and that all statements are to be prepared in accordance with the guidelines set out in the Canadian Institute of Chartered Accountants (CICA) handbook. All P&C insurance companies that report to OSFI must submit their audited financial statements to the regulator. The company must disclose the balance sheet amount and fair value of investments that it holds. These valuations must be made for each type of investment (i.e. bonds, term deposits and shares) that it holds. They must also declare the intended use of the investments they hold (i.e. hold to maturity, available for sale, receivables, etc.).

Information related to policy liabilities must be disclosed as well. These are defined as "unpaid claims and adjustment expenses, including incurred but not reported (IBNR), unearned premiums and any premium deficiency (OSFI 2009; pg. 4)." OSFI requires that liabilities specific to major lines of business be reported separately when that line represents more than 10% of aggregate balance sheet value (OSFI 2009; pg. 4).

Property and Casualty companies must also report on the risk they face and risk management functions in their organizations. Companies are required to "set out the responsibilities of the board of directors, senior managers and/or branch management for risk management (OSFI 2009; pg. 4)." OSFI expects that companies under its jurisdiction identify and define the significant risks they are exposed to through their various lines of business. Furthermore, the company needs to describe how these risks are monitored and controlled.

3. Turnover

a.   The Quarterly Financial Statistics Program

Information collected as part of the Quarterly Financial Statistics (QFS) for Enterprises program provides data used to measure the financial position and performance of incorporated businesses by industry aggregations. It also provides information on financial holdings and transactions in the CSNA sector accounts.

The second broad objective is to provide information on financial holdings and transactions in the CSNA sector accounts. The accounts comprise the National Balance Sheet Accounts and the Financial Flow Accounts. Within the CSNA, the Canadian economy is composed of the incorporated business sector, including non-financial and financial businesses, the government sector, and the persons and unincorporated business sector, which includes non-profit institutions serving households.

The statistical unit used in this survey is the enterprise. An enterprise is a business or a family of businesses under common ownership and control for which a set of consolidated financial statements is produced on an annual basis. The QFS covers incorporated financial and non-financial business enterprises. Excluded are business enterprises controlled by governments and non-profit enterprises.

The survey questionnaires comprise financial statements typically prepared by incorporated businesses. Corporate activities across the economy are extremely diverse, resulting in the utilization of a variety of unique financial reporting variables. To accommodate the diversity in financial reporting across industries, twelve related but industry specific questionnaires are used to measure the financial sector and three are used to measure the corporate sector.

Of particular interest for the production of a SPPI is the data collected from the F8 related to premiums and claims. This questionnaire collects net premiums written, net premiums earned and net claims by 6 lines of business. The lines of business collected in this section of the questionnaire include property, automobile, accident and sickness, marine and aircraft, liability and other. This data could be used to construct an average or unit price by line of business, however at this time the QFS does not collect information on the number of policies issued either in total or by line of business.

The sample includes a take-all portion, for the largest enterprises within an industry. These units are sampled with certainty. In addition, there are two take-some portions where, on average, one out of eight units are sampled. Finally there is a take-none portion, from which no units are sampled, rather an estimate is derived by applying the quarter-to-quarter movement of sample responses to annual data compiled from Canada Revenue Agency administrative data. These data are used to represent the non-sampled portion of the business population.

As shown in Table 1, as of June 2011, the sample comprised 73 statistical enterprises.

b.   Special considerations

The QFS is a program designed to measure the financial position and performance of incorporated businesses in Canada using accounts commonly found on financial statements according to prevailing accounting standards. This is the context in which the data is collected. Reporting data according to an accounting framework is not generally conducive to measuring output. There is a similar and perhaps more acute issue with regard to the relationship for pricing, where perfectly acceptable accounting practices might distort data not intended for use at a very micro-level, which is required for pricing. However, as described below, PCISPI development efforts are exploring the possibility of collecting data to complement the QFS in order to allow for quality outputs in pricing while managing response burden.

A further issue is that the data that are collected at the enterprise level. Since complex enterprises have multiple activities at the establishment level but are coded to industries based on their dominant activities, significant insurance activity may not be coded to the insurance industry at the enterprise level. For example, an enterprise that has multiple establishments engaged in various activities would have revenue, asset and profit data which contribute to only one industry, the industry in which the enterprise is classified. In this way, QFS data are not completely aligned with the output concept, in that the production accounts (input output

accounts) in the CSNA are compiled at the establishment level and aligning output by commodity to the correct industry is challenging.

4. Price Measurement

Direct insurance providers sell a contract that compensates the policy holder for loss in the event that a specified peril occurs. Payment of the premium includes payment into the risk pool and payment for the administrative services provided by the company. It should be noted that the payments for administration services are indirect; no such charge (usually) appears on an insurance policy statement of charges (Triplett and Bosworth 2004; pg. 139). Otherwise stated, there are is no explicit price associated with administrative services.

The amount of premium intended for the payment of administrative fees is often calculated indirectly as the difference between net premiums earned and claims. The fee that the insurance provider charges to assume one dollar of loss is (in an actuarially fair setting) equal to the probability of one dollar of loss occurring. The price unit being collected is the premium charged for the policy, in dollars.

Rapid changes to product specification are not expected in insurance, and products priced in the reference period should sufficiently reflect current collection product specification. Even so, continuous examination of the industry and products will contribute to product substitution or updating at regular intervals. A model price will also allow for price to reflect features found in an actual transaction. In insurance, since policy characteristics are the basis for determining risk and therefore price, a model approach which controls these characteristics will capture how the pure price of the service changes over time.

Finally, data reflect price in the reference month, but are priced at one point in time during the month. This is done to control response burden given the relative stickiness of prices in insurance within each month.[13]

In developing a PCISPI we have investigated two options; the model pricing approach and the unit value approach. Sub-sections a. and b. will discuss the model pricing approach and the PCIP Report, respectively. Sub-sections c. and d. will discuss the unit value approach and the administrative data sources that facilitate this type of index. Finally, Sub-sections e. and f., will address quality change, and pricing considerations respectively.

a. Model Pricing

In the insurance industry, as in many SPPI, the model transaction approach is recommended (OECD 2005; pg. 39). Employing this approach, sampled units are surveyed initially to obtain information on a "typical" service that is provided, whether or not this transaction actually took place. Even in the instance where an initial period price is observed, subsequent period data may not reflect the actual fulfillment of service if the exact service was not actually provided in that period. This is especially true in insurance where constant quality requires freezing certain price determining characteristics from one period to the next. As an example, the 24 year-old female

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[13] An examination of price data from administrative sources has revealed that prices for automobile insurance policies change fairly infrequently when holding characteristics constant.

driver of a 5 year old vehicle, whose policy was used as a model in the base period, might not represent an actual policy sold by the company in the next period; however, in order to ensure constant quality, the company would later have to proxy the price for that same policy. Taking supplementary sources of data (class, vehicle sales, etc.) into account, when determining model transaction characteristics, ensures that the most representative policies are priced over time.

b. Property and Casualty Insurance Price Report – Private Passenger Auto Survey

The development work for the PCISPI has used the PCIP Report pilot survey as a key data source. The PCIP Report is a monthly survey of the Automobile Insurance carriers in the province of Ontario (additional details on the price report are provided in the Appendix). Insurers were asked to submit a set of model policies that best represented the type of business they would conduct in a typical month. Once the model policy was determined, the insurers were instructed to re-price this policy each month. In regards to the considerations of model pricing (see below), the personal and regional characteristics were to remain frozen for each policy and the vehicle vintage was to be held constant. This report generated more than two years of monthly re-priced data.

The data from the PCIP Report has been used in the preliminary development work conducted on the PCISPI. The prices of the model policies were used to construct a variety of price measures of different frequencies (monthly, quarterly and yearly).

Respondents completing the PCIP Report reported for up to 5 representative policies. Monthly premiums data was then aggregated up to the firm level using a geometric mean (equally weighted policies) as weights for the individual policies were not available. Once the average premium by firm was calculated, the index was constructed with April 2008 as the base period.

The individual policies in the PCIP Report data showed little price movement from month to month, with most policies experiencing price changes only once a year. The PCIP Report suffered from respondent attrition, due likely to the response burden that was placed on the insurance industry. The index was also quite volatile, particularly towards the evaluation period. This was probably also related to sample attrition.

The PCIP Report policies were for Ontario only. Expanding a survey of this nature to cover all provinces with private auto insurance coverage would increase the response burden imposed on the Insurance industry greatly. A further complication with this approach would be dealing with the public insurance providers in select provinces. More work is required to identify the optimal collection strategy for these public insurance providers.

c. Unit Value Pricing

The unit value approach to calculating an index for P&C insurance is another feasible approach. A key assumption of the unit value approach is that of a homogeneous product (Diewert 1995; pgs. 21-22). If aggregate insurance coverage is viewed as the product, so long as the risk determining characteristics remain stable in a macro sense, the homogeneous product assumption is reasonable. The unit value index has the added advantage that it can be constructed using administrative data and therefore poses no additional response burden on the insurance carriers.

The unit value index was constructed with OSFI data on net premiums written and the number of policies in force for automobile insurance. To construct the unit value index, net premiums written were divided by the number of auto policies in force to obtain the unit value. Then, beginning with data from 2008Q4 as the base period, the index was constructed on an annual basis. An important data limitation of this approach is that the OSFI data because of the way it is reported and compiled cannot be used to estimate indexes on a monthly basis. This occurs because net premiums written is reported cumulatively whereas the number of policies in force is a snap shot of the active auto policies as of the quarter in question.

With respect to the PPI Quality Assessment Framework, the price constructed with the OSFI data is a unit value which is acceptable under certain conditions. The factor that determines whether this is a good unit measure or not is the homogeneity of the product, in this case, auto insurance for Canada is the product. The product can be viewed as homogeneous if, from year to year, the distribution of drivers and their vehicles remains constant.[14]

In order to assess whether or not the distribution of drivers by class and region and the distribution of vehicles remains constant, further investigation is required. Insurance industry data on the number of earned vehicles and the amount of earned premiums by driver class will need to be obtained and analyzed. Demographic data on intercity and interprovincial migration can be consulted to gain perspective on population trends. Finally, to assess the distribution of vehicles in the Canadian passenger fleet, records such as provincial registration files could prove useful. Analyzing data of this sort could reveal the exact composition of the passenger vehicle fleet and alert researchers to any meaningful changes in the type of vehicles Canadians are driving and therefore insuring.

d. Administrative data sources

CompuQuote

CompuQuote is an online database that provides estimates of premiums from over 750 insurance carriers in the majority of Canadian provinces and territories.[15] The typical user of the CompuQuote platform is an independent broker. The CompuQuote tool allows the user to obtain a quote of the premium (price) charged for a specific insurance policy. Also, the CompuQuote system allows for cross-company comparisons of the same policy.

To gather the price data required for the empirical investigation, the price determining characteristics of the PCIP Report policies were entered into the CompuQuote database and quotes were obtained from April 2008 to present.[16] This tool could potentially alleviate much of the response burden imposed on insurers by surveys such as the PCIP Report.

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[14] That is, if the distribution of drivers by driving class and region and the distribution of vehicles by vintage and type (i.e. sedan, compact, truck etc.) remains constant.

[15] The North West Territories have no coverage under CompuQuote in either the auto or property sections of the service. The auto section provides quotes for all provinces with private insurance and for Quebec.

[16] Although the Price Report began collecting data in February 2008, CompuQuote would only produce non-zero prices as of April 2008. Furthermore, the quotes were collected as of the 15th of the month in CompuQuote as this is the date the Price Report questionnaires were mailed to respondents.

The statistics were constructed in the same manner for both sources in order to facilitate direct comparison. The premium quotes were summed (un-weighted) and divided by the total number of quotes obtained. Once the average premium was obtained, the index was constructed using April 2008 as the base period to facilitate comparison with the PCIP Report index. High level comparisons of the results from both methods yielded similar movements in the indexes. This is encouraging as indexes generated from CompuQuote would reduce response burden. CompuQuote however is not a panacea for all problems as licensing fees are expensive and some form of survey would still be required to obtain aggregation weights for the indexes.

OSFI

OSFI is the primary regulator of the Canadian insurance industry; the data that they make available are extensive. The OSFI website makes available for download aggregate financial statements such as the balance sheet, income statement, statement of changes in equity and statement of comprehensive income. In addition to these statements, OSFI makes available to the public the Minimum Asset Test and Minimum Capital Test, both of which are related to stress testing the ability of the industry to meet its obligation under varying financial conditions.

The most valuable piece of data on the OSFI website for a PCISPI is the statement of premiums written, earned and claims incurred. This statement gives a snapshot of the amount of premiums received, claims incurred and changes in the earned premiums by line of business for the Canadian insurance industry. Also included on this statement since 2008, is the number of policies in force. Given the information available on this statement, it is possible to calculate an average premium by line of business for the Canadian insurance industry.

OSFI data is a possible source to facilitate the construction of a unit value index. The extent of the coverage of their data (the majority of Canadian Insurers report to OSFI) makes it an acceptable choice. Furthermore, the premiums claims and policies-in-force data is available by line of business. This availability of data helps to accommodate the homogeneous products assumption of unit value indexes.

The data from OSFI was used to construct price statistics in a similar fashion to the PCIP Report and CompuQuote. As discussed earlier, a major limitation of the OSFI data was its inability to render a monthly unit price; the data is available on a quarterly basis only. Furthermore, the quarterly statistics that were constructed from OSFI data exhibited a fair amount of volatility. It is believed that this volatility is related to the notion of accrual accounting.[17] The most stable price statistics were obtained by using the fourth quarter values.

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[17] Premiums earned are not equal to premiums written. Premiums written reflect the value of premiums received for a policy in a given year, even though coverage under that policy may be spread over two calendar years (i.e. June 1st 2011 to May 31st, 2012). Under the accrual system, Earned Premiums for 2011 reflects only that amount meant to pay for coverage in 2011. Similarly, the policies in force are subject to a "mismatch" type problem that prevents meaningful price statistics from being constructed on a quarterly basis.

The property and casualty insurance industry is covered by the F8 form of the QFS. As previously mentioned, response burden is a major concern of Statistics Canada. The insurance industry (as well as other financial industries) is subject to strict regulations that require a large amount of reporting on their behalf. If an existing survey could be augmented to achieve the pricing goals of the PCISPI program, then response burden would be minimized for the participants. The QFS F8 offers such an opportunity. The F8 collects information on premiums and claims incurred by line of business. If this section were augmented to include the corresponding number of policies for which these premiums were collected, this information could facilitate the construction of a unit value index. Since these data would be disaggregated by line of business they would be more accommodative of the homogeneous products assumption. As with OSFI data, a limiting factor of QFS data is that it is collected on a quarterly basis not allowing for construction of a monthly price index.

e. Quality Adjustment Issues

Quality adjustment issues present a challenge for service industry price indices in general and specifically for insurance. As illustrated in the previous section, the OECD guide sets out provision under which price changes can be regarded as having not been generated by quality change. Prudence has been exercised in order to maintain constant quality in the PCISPI. The model pricing approach has allowed for a great deal of control over the price determining characteristics and, therefore, quality (see the appendix for a list of price determining characteristics).

The model policy approach has allowed certain characteristics of the insurance policies to be held constant. This is the method used in the PCIP Report pilot. The personal and geographic characteristics are fixed at representative values (age, gender, marital status, driving record, etc.) so as to hold risk constant. Furthermore, the age of the vehicle being insured is adjusted in each subsequent year so as to maintain a constant vintage. By holding the vehicle's vintage constant rather than the model year, we are able to ensure that a 5 year old vehicle, for example, is being re-priced, and that what the insurance provider charges to assume one dollar of loss is consistently equal to the probability of one dollar of loss occurring over time.

Finally, the industry is being studied in order to address potential quality issues at the sample design and target population level. Specifically, the target population is being examined in terms of stability, such that an efficient sampling interval will be determined and applied in the program methodology. This is discussed in more detail in the following section.

f. Special considerations for Pricing

i. Evaluation of Standard vs. Definition and Market Conditions

The primary user of the PCISPI will be the Canadian System of National Accounts (CSNA) for deflation purposes. The Bank of Canada uses prices for tracking inflation and for productivity analysis. OSFI and the various provincial regulators have an interest in these indices to inform policy and to assess the level of competition in the industry. Academics might use the data to gain insight into such phenomenon as the effects of different policy regimes and the existence

and periodicity of the underwriting cycle.[18]   Finally, the PCISPI will be integrated with other PPIs to facilitate a more thorough understanding of price dynamics through the production chain, prior to final consumption.

While the standard definition of this industry by NAICS will provide an adequate level of detail about the Canadian P&C insurance industry to suit the needs of the above users, there are two areas where the standard and definition diverge. The first relates the Accident and Sickness (A&S) portion of Life insurers' business. In the national accounts, for the purpose of tracking input usage, costs associated with the A&S operation of life insurers are removed and added to the P&C insurance totals. Since A&S accounts for about 1.4% of net premiums written for P&C insurance[19], and this type of insurance is not a price driver, exclusion of pricing this type of insurance and subsequent incorporation will not be undertaken due to the associated burden and questionable benefit.

The second area of concern is in regards to two of the 6-digit P&C insurance sub-industries. *Direct General Property and Casualty Insurance Carriers* (524121) and *Other Direct Insurance (Except Life, Health and Medical) Carriers* (524129) are both composed of a variety of business that do not fit into one of the other narrowly defined 6-digit sub-industries. The former is composed of any company that has no line representing more than 70% percent of its gross output. The latter is made up of a variety of companies engaged in the smaller lines of insurance such as boiler and machinery, aircraft and marine. As will be discussed in a later section, a key assumption of the unit value approach to price indices is that of homogeneous products. The concern that is raised by pricing services in these industries is that of heterogeneous products. Although these two general groupings do account for the vast majority of enterprises in the industry, the analysis in section 1 revealed that automobile and property insurance contribute to the largest proportion of revenues and, as such, these larger albeit heterogeneous sub-industries, in terms of number of enterprises, should not pose any serious problem to the calculation of the index. No matter how insurance carriers are classified, as long as the majority of outputs are derived from one or two main lines of business, pricing these main activities will result in an index which sufficiently represents the dominant service output, prices, and price trends in the industry.

ii. Model Pricing

The model pricing approach is not without its concerns. A potential problem that arises with this approach is whether or not the initial model policy remains representative over time. The pursuit of constant quality dictates that the price determining characteristics should remain frozen. This practice increases the likelihood that the policy will no longer be representative overtime. In any given period, it may be the case that a policy identical to the model is not actually exchanged. If it is the case that over time none of the model policies are actually being exchanged anymore then the price series generated with this data would no longer be suitable for constructing a deflator. Although this issue can be partially resolved by frequently updating the sample policies, response burden is significantly increased at the initialization stage.

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[18] The underwriting cycle is the phenomenon of hard markets – high premiums, tight supply and high profits – followed by soft market – low premiums, loose supply and lower profits. The literature on the underwriting cycle is extensive and the analysis has been applied to many lines of P&C and Life insurance.

[19] As at 2010Q4 from OSFI data. OSFI data accessed from: www.osfi-bsif.gc.ca. Accessed on 22/03/2011

iii. Unit Value Pricing

As previously stated, an important notion in the calculation of any price index – for goods or services – is that of constant quality. The OECD SPPI Methodological Guide states that:

> "The existence of observed unit value differences is not to be considered as an indicator of differences in quality when the following circumstances apply, namely lack of information, price discrimination reflecting limitations in freedom of choice and the existence of parallel markets. In these cases, the unit value differences are considered as differences in prices (OECD 2005)."

The insurance industry meets the first two criteria. There is an information asymmetry between the consumer and producer in insurance markets. This asymmetry is related to the concept of adverse selection. The consumer is aware of information pertinent to the level of risk he/she poses that the insurance company is not. Furthermore, third degree price discrimination takes place in the insurance market. Insurance carriers determine the price of insuring an individual based on their driving record. This effectively allows the insurer to charge each policyholder (or policyholders of a similar rating) a premium based on their personal characteristics.

Given the consideration set out in the OECD guide, it can be concluded that the insurance industry fits the criteria and as such, the price differences could reasonably be taken to reflect pure price changes.

iv. Deflator

The net premiums approach to calculating output includes premiums, claims and investment returns. An ideal deflator would incorporate all of these output components. A deflator constructed with premiums alone however could be sufficient.

Premiums are set based on an actuarial estimate of the probability of loss. Premiums, therefore, already incorporate beliefs of the insurance carriers about the future level of claims that are expected. Furthermore, the expected investment returns of the carriers are already incorporated into the premium level. As previously stated, it is reasonable to believe that insurance companies set premiums based on their expectations of future returns on reserves (Lal, 1990; pgs. 6-7). Given that the premiums are set with the future expected claims and investment earning in mind; a deflator constructed from premiums data alone, though not ideal, may be sufficient.

5. National Accounts Concepts and Measurement Issues for the Area Related to GDP Measurement

a. Unit of Measure for Output

Insurance industry output is measured using data on premiums, claims and investment income. The premiums are what the insurance company receives for the provision of coverage set out in the policy agreement. Once received, these premiums are often invested to grow the risk pool. It is out of this risk pool, often referred to as (technical) reserves that the company pays the claims submitted by policy holders.

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The unit of measure for the insurance industry output is the dollar value of premiums and investment income, net of claims. Under the net premiums approach, advocated by SNA 1993 guidelines, this total gives the total dollar value of output for the insurance industry. The Canadian System of National Accounts (CSNA) approach differs from the SNA 1993 guidelines in regards to the treatment of fee and rental revenue. Fee and rental income is included in the CSNA calculation of output but is not directly mentioned in the SNA 1993 manual.

The recommendations of SNA 1993 are intended to bring the national accounts of observing countries into alignment to facilitate meaningful comparison and analysis across countries. The recommendations of SNA 1993 have been fully implemented by the CSNA at Statistics Canada since 1997 (Lal, 1998; pg. 1). The major conceptual difference between the CSNA and the SNA 1993 recommendations was the treatment of investment income for insurance carriers. Lal (1994; pg. 2) states that prior to the implementation of SNA 1993 investment income earned from investing technical reserves was not included as part of the output of the P&C Insurance industry. Also, the CSNA adds an estimate of gross rental income to the Insurance industry output measure.

SNA 2008 is the new recommended standard for output measurement. SNA 2008 is not as much of a new direction as it is an adjustment of SNA 1993 to meet the changes of the "new economic environment (Statistics Canada, 2011; Introduction). The CSNA will undergo a comprehensive, historical revision set for release in 2012. In terms of the P&C Insurance industry, (referred to as "non-life" throughout the SNA manuals) there are no major conceptual changes.

b. Output compilation

There are two outputs for the Canadian P&C insurance industry. The primary output is Property and casualty insurance, and the other is rental income. The property and casualty insurance output is calculated as premiums earned less claims paid plus investment income (Statistics Canada 1993; pg. 45). The data used for these calculations comes primarily from the Quarterly Survey of Financial Statements (QFS) and OSFI. The QFS is a full universe survey (excluding government business enterprises). Claims data includes adjustment expenses; estimates of these expenses are removed and placed in the appropriate expense account. The provincially registered companies are assumed to exhibit the same expense pattern as the federally registered carriers (Statistics Canada 1993; pg. 46).

The QFS provides the data for the take all, take some, and take none classes[20] of enterprises. Once the necessary data has been collected and estimated, the output is calculated via the net premiums approach which was described in an earlier section of the paper.

The treatment of accident and sickness in the CSNA could present challenges in measurement from GDP to prices. However, as was discussed in greater detail in section 4.f.i, these issues are of little concern. Furthermore, challenges exist based on classification, and also due to the treatment of investment income. Both are discussed in Section 6, *Evaluation of Comparability with Turnover/Output Measures*.

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[20] Take all, take some classes and take none are statistical stratums used by the QFS for sampling. The take all statistical stratum comprises large enterprises; take some stratum comprises medium sized enterprises; and take none stratum comprises small enterprises.

One limitation not discussed below and related to classification, is the fact that output data are combined OSFI and QFS. QFS are enterprise level turnover data which are consolidated. Therefore, all of the revenues, profits and assets associated with an enterprise are allocated to the industry in which the enterprise is classified. This occurs even where major subsidiaries are involved in other activities.

Another related issue arises due to the fact that the production accounts in the CSNA are compiled at the establishment level but the OSFI and QFS are enterprise based data sources. This problem leads to coherence issues when the CSNA allocates the enterprise level turnover data (QFS and OSFI) by industry. Ideally, establishment turnover data would feed the CSNA productions accounts and intra-enterprise transactions would be reflected in the appropriate industrial production accounts. Given the limitations discussed above, there is potential for inconsistency across turnover and output data due to the mismatch of units that make up the parts. These differences however, have marginal effects as explained below.

In terms of pricing, the sampling frame and design could be based on that of the QFS (an enterprise level design) with potentially little impact to the relevance of the program given the fact that a model pricing survey would capture the price of the most significant activities of the enterprise in terms of output contribution. Given that auto and property insurance dominate, the program would appropriately measure prices and price changes in P&C insurance which are related to the most significant components in terms of output.

c. Current and proposed deflation

The CSNA uses double deflation to derive the national annual constant price value-added for each industry, which is the difference between deflated industry output and deflated industry input. Deflated industry output is the summation of deflated output by commodity, whereas deflated industry input is the summation of deflated input by commodity.

The insurance industry is composed of two major commodities, namely life insurance and non-life (P&C) insurance. In order to reach the constant price estimate of the commodity output for P&C insurance, an implicit price index (IPI) is calculated as a deflator, which is derived by calculating the ratio of current dollar output C_t to projected constant price output K_t, where the t subscript represents time.

$$IPI_t = \frac{C_t}{K_t} \times 100$$

Projected constant price estimates are based on the current dollar estimates of auto, property, accident & sickness (A&S) and miscellaneous along with the associated CPI (for A&S: derived price index).

Presently the implicit price deflator for non-life insurance is broken into four categories. These categories are auto, property, accident and sickness (A&S) and miscellaneous. The auto, property and miscellaneous categories are deflated by CPI elements. For auto, the CPI for private and public auto insurance is used and for property, the CPI for homeowner's and tenants insurance

premiums is used. This element is a weighted average of homeowner and tenant insurance, weighted by the respective value of each component. The miscellaneous category is deflated by the all-items CPI. Accident and sickness is not covered by the CPI. The output of accident and sickness insurance at constant price is computed by projecting the base year value by the number of persons covered for each type of insurance, where the data is obtained from the Canadian Life and Health Insurance Association.

The proposed deflators for PCI would track the price corresponding to the output it is intended to deflate. As previously mentioned, output is constructed from premiums plus investment income less claims. How effective would a deflator be that is simply following the premiums paid (quoted) for a particular policy? Would this deflator be an effective measure of the price change when considering that the investment income the insurers earn is viewed as a premium supplement? In Lal (1990; pg. 6-7), the author states that "the level of premiums is probably established so as to take into account the investment income earned on the policy reserves of the insurer." The premiums, therefore, likely have an inverse relationship with (expected) investment returns, if any relationship at all exists. Increases in the premiums would then at least partially reflect the insurers' belief that investment income will be lower in the future. If a deflator were to incorporate the premium supplements (e.g. investment earnings) directly, it would likely have to resort to some form of FISIM calculations.

6. Evaluation of comparability of turnover and output to SPPI

In assessing comparability with turnover and output measures, the framework from which the price index is derived needs to be assessed against the structure from which turnover measures are defined. These are presented first, followed by an examination of how these relate to output measures. A description of each aspect is discussed and, where necessary, potential issues and how they are addressed in the program are also explained.

In general, the level of comparability between the SPPI and QFS turnover data is high. First, both survey programs use the same enterprise frame (Statistics Canada's Business Register) from which to derive their samples, and both are based on the same industry classification system (NAICS). This means that the target population's characteristics are mimicked from one program to the other, ensuring coherence across turnover and price survey programs.

Second, since the SPPI sample is derived from the same frame, using a similar sample design, SPPI samples overlap almost exactly the sample for the turnover survey, in this case the QFS, so the same units are defined and covered.[21,22] This is especially true for portions of the sample which are selected with certainty and represent the vast majority of activity in the industry.

Finally, the quality of the information on the frame is high, being maintained regularly using survey feedback and monthly tax data updates; therefore, the industry within which units are

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[21] Currently, the possibility of exploring elaboration of the turnover program in order to provide information enabling price determination is being explored. Should the process be viable and result in good quality data for pricing, this would further increase the coherence of the two programs.

[22] It should be noted that at this time there are 14 units is the QFS sample that fall under the Reinsurance Carriers (52413) industry. This inclusion is unlikely to be of much consequence in terms of discrepancy, as reinsurers represent a small fraction of sample revenues or assets.

allocated is revised regularly. The PPI Quality Assessment Framework allocates higher rank to prices programs that sample from frames that are updated for industrial classification, births and deaths using timely information (Gerduk 2006). The PCISPI benefits from the availability of such a frame.

The program will manage changes to the sample through imputation using the price relative of the sub-stratum aggregate. This process minimizes the introduction of sample bias while allowing the price sample to continue to mirror the turnover sample. Sample deterioration is managed through re-sampling, the interval of which will be determined via target population stability analysis.

As opposed to turnover data which are based on the same structure and frame as pricing data, output data fall into the Canadian System of National Accounts (CSNA) framework, which is based on commodity groups. Business service commodities benefit from the fact that they align well with the industry-of-origin concept. Indeed, *Direct Insurance (except Life, Health and Medical) Carriers* (52412) corroborates fully with the current Non-life insurance commodity grouping in the CSNA.

At the line-of-business level of detail there may be some discrepancy between the output and price measures. These differences are related to the treatment of investment income in output. The SNA includes investment income (gross rental income) in its output measure. However, including investment income in pricing introduces several conceptual and practical problems.

A key conceptual challenge with the inclusion of investment income is the direction and strength of the relationship. It is believed that premiums and investment returns should be inversely related (Triplett and Bosworth 2004; pgs. 151-152). The strength (magnitude) of the relationship between investment income and premiums is difficult to gauge and likely varies across lines of business. In particular, for auto and property insurance, the claims ratio is much higher.[23] With these two large segments of the industry having high claims ratios it may be the case that investment activities carried out by these segments are less significant, or are short-term and highly liquid; the overall returns of which are likely low. This would imply that income derived from investments might not be as significant in these lines as in others, and that the pricing concept would therefore be more strongly related to the output concept.

Another key issue related to investment income is the timing of the relationship between investment income and premiums. That is, is the link between investment income and premiums contemporaneous or lagged? It seems reasonable to assume that due to the uncertainty involved in investing, premiums would not be linked to contemporaneous changes in expected returns. Rather, the most reasonable scenario would be to adjust premiums to the prior year/period's investment income if, in fact, premiums are adjusted at all.

The main practical problem is how to allocate investment returns to individual lines of business. At the highest aggregate level this can be achieved with OSFI data. At the line of business level, however, such allocations would require knowledge of average returns on investment by line of business. Another option is to allocate aggregate investment income amongst lines of business

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[23] As previously noted, these two lines of business constitute 84% of insurance industry net premiums written.

based on an assumption that would split investment returns weighted by some factor. Such allocations would seem to be ad hoc at best.

However, as noted above, the potentially weaker level of investment activity within the two major lines of insurance (auto and property) suggest a likely stronger relationship between a pricing concept that is based on these two lines, and the output concept, regardless of investment income.

7. Conclusion

Several important lessons have been learned from the work discussed in this paper. The Canadian P&C insurance industry is a highly regulated one with the majority of revenues originating from 2 main lines of business: auto and property. The industry is represented in NAICS by six 6-digit codes; these codes are well aligned with the output of the main lines. The CSNA approach to measuring the output of the insurance industry is compliant with the SNA 1993 guidelines; SNA 2008 will be fully implemented by 2012.

As with all SPPI in *Finance and Insurance*, defining the output of the service is challenging, and measuring the price of the services is no less daunting. Fortunately, the program benefits from the availability of a quality and dynamic Business Register, as well as from a turnover program of similar framework. These two aspects will contribute to consistency in the delineation of economic output and coherence across program outputs. It has been revealed that the definition of output (gross- vs. net-premiums) is connected to the view of what the insurance industry actually does (risk-pooling vs. risk-assuming). The measurement of output, under either approach, can be confounded by a deficiency of accurate data. The net-premium approach incorporates claims and investment income into the output measure. Both of these items can fluctuate a great deal from year to year, the potential result being periods of negative output. Not only is negative output counter intuitive, it is not permissible within the national accounts framework. To address this phenomenon better estimates of *expected* claims and *expected* investment income are required as premiums are set *ex ante* based on expectations. A better understanding of this decision making process would facilitate a more accurate measure of insurance industry output. Under the risk-pooling/net-premiums approach, the difference between premiums plus investment income and claims is the output of the insurance industry; the value of the administrative services provided. If actual claims are exceptionally high or investment income too low, the output could be negative. Using expected values of claims and investment income could help mitigate this potential problem as well as incorporate a more realistic measure of the value of administrative services.

Pricing the commodities of the insurance industry can be achieved with either administrative or survey data. One key lesson learned from this endeavour was in regards to the impact of response burden. The burden imposed by the PCIP Report Survey on insurers requiring them to re-price a set of model policies each month was likely the cause of the high degree of respondent attrition that was experienced. As more and more respondents ceased to respond, the calculated prices began to exhibit fluctuations related to the shrinking sample size rather than of actual price dynamics.

As Statistics Canada moves forward with the development of its PCISPI, the lessons learned from the work conducted so far must not be lost. The problems associated with volatile claims and investment income as well as response burden and respondent attrition must be addressed to ensure the success of this endeavour.

With regards to collecting pricing data, a major setback has been respondent attrition. This attrition is (likely) related to response burden. Moving forward, if a survey is to be conducted for the purposes of pricing insurance services it should be made in such a way as to minimize response burden. A possible solution to this problem could be to augment an existing survey to include questions that would generate the necessary data to calculate prices. As previously mentioned, there exists such an opportunity at Statistics Canada. Another possible solution to the response burden problem is to use administrative data, or a database such as CompuQuote.

This paper has examined two common approaches to pricing services. The model pricing approach would facilitate constant quality price indexes to be calculated but would impose a rather high degree of response burden on the respondents. The unit value approach, on the other hand, is feasible using readily available administrative data (or survey data that is already being collected), thus alleviating the response burden. The unit value approach, however, makes use of some possibly unrealistic assumptions to assert constant quality.

At this time, the unit value approach presents itself as the preferred choice. Construction of a unit value index can be facilitated with administrative data (OSFI) or with survey data (QFS) or a combination of the two. By using data that is already being collected, the unit value approach acts to minimize the response burden placed on industry participants. Although the unit value approach is being favoured at this time, further research is being conducted on the viability of both the unit value and model pricing approaches to constructing a PCISPI.

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Appendix: Calculating the Price

The OECD's *Methodological Guide for Developing Producer Price Indices for Services* (OECD, 2005) states that: "PPIs should measure actual transaction prices reflecting the revenue received by the producer for products actually sold to customers (OECD, 2005)." In order to price the service, in this case the insurance contract, the price determining characteristics must first be identified. Using the example of automobile insurance policies, we will illustrate what is meant by price determining characteristics.

Price Determining Characteristics of Model Automobile Insurance Policies from the Property and Casualty Insurance Price Report – Private Passenger Auto

The model policies of the PCIP Report were meant to be representative of the typical business conducted by the responding companies. The policies were described in terms of their price determining characteristics. The price determining characteristics for personal auto insurance can be classified into three distinct categories:

1. Driver characteristics
2. Vehicle characteristics
3. Regional characteristics (location)

Each of these groups of characteristics describes factors that affect the level of risk present in each policy.

1. Driver Characteristics

The driver characteristics provide specific information about the person or persons who are covered under the insurance policy. These characteristics include:

- Age
- Gender
- Marital Status
- Driver Training Status
- Years Licensed
- Claims History
  - Incidence of Claims
  - Incidence of At-Fault Claims

All else equal, it is expected that a young, single driver with no driver training and a history of recent at-fault claims would pay a higher premium than an older, married driver who has had driver training and has no recent history of at-fault claims.

2. Vehicle Characteristics

The vehicle characteristics provide specific information about the vehicle(s) covered under the insurance policy. The characteristics from the PCIP Report include:

- Year of the Vehicle

- Make/Model

- Whether or not the vehicle has:
  - Airbags
  - Alarms or Anti-Theft Device

- Vehicle Use
  - Commute
  - Pleasure

- Average Daily Commute (if applicable)

- Annual Mileage

All else equal, it is expected that a particular vehicle with an airbag and an anti-theft device that is used for pleasure only would command a lower premium than the same make model and year of vehicle that did not have airbags or an anti-theft device that was used for a lengthy daily commute.

3. Regional Characteristics

The policies in the PCIP Report were re-priced for a specified postal code. This spatial characteristic captures the fact that a driver in a densely populated urban area is more likely to be involved in a collision than the same driver in a sparsely populated area.