

Services and the New Economy: Data Needs and Challenges November 18, 2003.

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1. The North American Industrial Classification System and Service Sector Data Deficiencies

It is a fact that statistical information on the outputs produced and inputs used by services sector industries has been rather poorly developed in all OECD countries. The problem is that the current system of national accounts came into being about 70 years ago when services sector industries were a smaller part of an economy and as the importance of services sector industries grew, the statistical system (with some recent exceptions)² did not invest resources to improve services sector measurement.

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² In Canada, during the last decade, the Project to Improve Provincial Economic Statistics invested very heavily in the improvement of Canada's annual services sector statistics, although this investment was limited to nominal dollar statistics only. Statistics Canada also invested substantial resources into the fuller exploitation of tax data, which are invaluable for measuring characteristics of small firms that dominate in many services industries; resources were also put into the expansion and improvement of the business register in the services industries; the manufacturing and mining survey was enhanced to include questions about purchased services inputs; and big dollars were spent to convert the economic survey system to NAICS, which has a much more detailed and up to date treatment of the services sector than the old classification system. Statistics Canada also built five new price indexes for particular services industries during the 1990s: consulting engineering, traveler accommodation, accounting, business long distance telecommunications and informatics professional services. In the U.S., the Bureau of Labor Statistics has recently embarked on an extensive new program to collect output prices for services sector industries in its PPI program. Also in the U.S., the Bureau of Economic Analysis has recently developed deflators for software services.

In Statistics Canada (1996), basic information on the productivity performance of 154 industries is published. Of these 154 industries, only 37 are services sector industries. Thus although services industries account for about 66% of Canadian output³, only 24% of the industries have published productivity statistics.⁴ Turning to industry price statistics, Statistics Canada (2001) has a monthly publication on industry price indexes, but the entire publication is devoted to goods prices: there are no services sector output prices in this publication. Detailed consumer price indexes for approximately 160 commodities are available from Statistics Canada (1997) on a monthly basis. Of these 160 consumer price indexes, only about 40 are devoted to services prices.

Canada, the United States and Mexico are in the process of switching from the old Industrial classification to the North American Industry Classification System (NAICS). Unfortunately, price indexes to deflate the outputs of these new industries⁵ will not be available unless some resources are allocated to this task. Without proper price indexes, it will not be possible to measure the real output of these new NAICS industries with any degree of accuracy. This in turn implies that it will not be possible to measure the productivity of many new economy industries with any degree of accuracy.

In section 2 below, we attempt to motivate why it is important to measure the prices of services industry outputs accurately.⁶

In section 3, some background material on the measurement of industry net outputs and productivity concepts is presented.

Having motivated why it is important to collect prices for the outputs of services sector industries, section 4 takes a look at Canadian services sector industries in a preliminary fashion. In sections 4-9 of the paper, we systematically go through the 506 NAICS services sector industries in scope and attempt a preliminary classification of these

³ From Statistics Canada (1998; 23), in 1997, services sector industries accounted for \$403,354 millions of GDP at factor cost at 1992 prices compared to the total economy GDP of \$691,625 which is 66% of the total. The corresponding numbers for 1961 were \$124,029 and \$199,053 so that services sector industries accounted for 62% of GDP in 1961.

⁴ Not all of the results for the services sector industries are published. In Statistics Canada (1996), there are details on outputs, inputs and productivity for 28 detailed industries, of which only 5 are services sector industries. The 5 industries are: (i) transportation and storage industries; (ii) communication industries; (iii) wholesale trade industries; (iv) retail trade industries and (v) community, business and personal services industries.

⁵ Most of these “new” industries are not really new in the sense that they did not exist say 10 years ago: they are new in the sense that they have been singled out for disaggregation from a larger grouping of industries.

⁶ See Baily and Gordon (1988) for a good general discussion of the difficulties involved in measuring service sector outputs.

industries according to the difficulties involved in collecting constant quality prices for the outputs of these industries. Section 10 provides a summary of some of the biggest measurement difficulties.

Section 11 outlines a possible strategy that Statistics Canada could pursue in order to collect price information on Canadian services sector outputs. Section 12 concludes.

2. The Importance of Accurate Services Sector Price and Output Measurement

First of all, it should be noted that Statistics Canada does provide reasonably accurate measures of the *value* of the outputs produced by the various services sector industries in Canada. What is not provided is an accurate decomposition of the change in the value of output going from one quarter to the next into an inflation or *price change component* and a real output growth or *quantity change component*. Why is it important to provide accurate measures of price change and quantity change for services sector industries?

There are at least 5 reasons why it is important to provide accurate information on price and quantity movements in services sector industries:

(1) *The provision of basic information on price and quantity movements is a core function of government.*

Nakamura and Diewert (1996; 35) make the case for the importance of the provision of basic data on the economy and the responsibility of the government to provide these data. In a more comprehensive review of government responsibilities, Diewert (2001), following Bates (2000), lists the following *core functions* of a government. These functions include:

- Rule of law and security of property rights (internal security including the courts and the police).
- Defense (external security).
- *Production of national statistical information.*
- Foreign relations.
- Immigration policy.
- Product and workplace safety.
- Maintaining macroeconomic stability (monetary policy).
- Provision of elementary and secondary education.
- Infrastructure spending.
- Support of scientific research.
- Environmental protection.
- Regulation of natural monopolies.

A list of *noncore functions* of government might include:⁷

- Provision of higher education.
- Provision of health services or health insurance.
- Provision of pensions.
- Provision of income support to the poor.
- Provision of unemployment insurance.

Thus the provision of national statistical information is regarded by most observers as a core function of government. Measures of the prices and quantities of two thirds of the economy is pertinent national statistical information.

(2) Services industry outputs form a large proportion of GDP and hence services price movements are an important component of the GDP deflator, which in turn is a key target indicator for monetary policy.

The GDP deflator is probably the second most important target indicator for monetary policy. Obviously, if a large proportion of services sector outputs are not being measured adequately, then the GDP deflator could be subject to very significant errors. The most important monetary target index is the Consumer Price Index. However, as was indicated in section 1 above, the coverage of services is rather inadequate for the CPI as well as for the GDP deflator. Hence, increased industrial coverage of services sector output prices would lead to synergies with the CPI program and improve the coverage of the CPI with respect to services. In the current period of relatively low inflation, the accurate measurement of prices is extremely important to the conduct of monetary policy.

(3) In order to measure the productivity of the economy, it is necessary to measure the real output of services sector industries.

Labour productivity is defined as real value added divided by labour input. Total factor productivity is defined as real value added divided by all primary input. Growth of either labour productivity or total factor productivity is a key to the improvement of living standards. Both measures of productivity require the accurate measurement of the prices and quantities of all outputs (including services sector outputs) and all intermediate inputs.⁸ How can the efficacy of economic policies designed to improve Canada's

⁷ All of the listed "noncore" functions of government are pretty essential in this day and age but they are labeled noncore because it is conceivable that they could be privately provided.

⁸ Actually, economy wide productivity measures can be calculated knowing just the price and quantity information for all outputs delivered to final demand sectors; i.e., for an economy wide productivity

productivity performance be judged if we cannot accurately measure the underlying productivity concept?

(4) In order to measure the contribution of innovations in the economy that either create new goods and services or lower the price of existing goods and services, it is necessary to measure these innovation induced price reductions.

Since innovations are just as likely to occur in the services industries as goods producing industries,⁹ it is clear that without the accurate measurement of services sector outputs, the efficacy of many innovations cannot be measured. Innovations essentially lead to more real output for the same amount of real input and hence we *must* measure real output in order to determine the effects of innovations.

(5) The accurate measurement of prices and quantities is a necessary input into any kind of general economic model that attempts to capture the effects of changes in economic policies.

Econometric models of the economy are useful for a wide range of policy purposes. Two such uses are the modeling of changes in taxation and modeling the effects of complying with the Kyoto Treaty.¹⁰ Producer and consumer theory is usually used as a framework for deriving the supply and demand equations for these types of general equilibrium models. However, in order to apply producer or consumer theory, *values must be decomposed into their price and quantity components*. Hence with inaccurate price indexes for services sector outputs, most applied econometric models will be inaccurate and large policy mistakes may result.

A careful examination of the first four reasons for providing additional information on the prices of services sector outputs reveals that for these purposes, it would not be absolutely necessary to provide price indexes for services products that were pure (domestic) intermediate products, since transactions involving these intermediate products would cancel out as we aggregated over industries. Hence, in order to decompose the components of final demand into price and quantity components, it would

measure, accurate price and quantity information on intermediate input flows is not required. However, there is great interest in Canada in comparing the productivity performance of particular industries with their U. S. or international counterparts. In order to measure industry productivity, we require information on the gross outputs and intermediate inputs by industry; see the next section for more discussion on this topic.

⁹ Think of fiber optic cable which has dramatically reduced the price of long distance telephone communication and led to greater choice for cable television viewers, think of medical improvements, increased choice in bigger stores, and so on.

¹⁰ Econometric models that rely on producer theory are also common in regulatory policy.

not be necessary to obtain price indexes for *these purely domestic intermediate products*, such as business services. Thus it might be thought that for many purposes, accurate price indexes for outputs and intermediate inputs by industry would not be required. There are a number of problems with this line of thought:

- Since so many services sector products are exported or imported in an open economy like that of Canada (and of course, we require accurate price deflators for these products since they are part of final demand), there would be little saving in resources in following the final demand services measurement strategy as opposed to systematically providing services sector price indexes for outputs and intermediate inputs industry by industry.
- Most economic forecasting models have an industrial structure and if they are at all based on production theory, it will be necessary to have accurate industry price deflators for outputs and intermediate inputs; i.e., reason (5) above is still an important reason for industry price deflators.
- There is great interest in determining exactly where improvements in productivity are taking place; i.e., there is a demand on the part of applied economists to determine the industries that appear to be experiencing the greatest increases in productivity. There is also a tremendous demand to compare the productivity performance of particular industries at home with their counterparts abroad and of course, this cannot be done at all accurately without accurate price and quantity information on the home industries.¹¹
- Many statistical agencies produce economy wide real input output tables that seem to have solved all of the deflation problems. However, for most services sector outputs and inputs, accurate deflators are not available and so rough and ready proxies are used, which can have substantial errors imbedded in them. Statistical agencies do inform users somewhere in their documentation that these real input output tables may not be very accurate but most users of these tables tend to ignore these warnings and use the numbers as if they are completely accurate. Then policy implications are often drawn from studies based on these possibly quite inaccurate tables and of course, these policy recommendations could be quite “wrong”.¹² The solution to this difficulty is of course to provide more accurate numbers and that will involve calculating new service sector price indexes.

¹¹ There is tremendous interest in *benchmarking* the performance of a large number of domestic production units with foreign counterparts. Examples of industries that have been benchmarked in this way include electricity generation, coal mining, electricity distribution, garbage collection, railroads, port operations, airlines telecommunication services, and so on. These benchmarking exercises also require price and quantity decompositions of all inputs used and outputs produced.

¹² Zvi Griliches warned me around 1970 that some official statistical agency numbers may not be very accurate. For 15 years, I ignored his warning: how could official numbers possibly be “wrong”? However, I did finally realize that Zvi’s caution was warranted and have been trying ever since to help bring about the needed improvements.

Before we look at detailed proposals to remedy the measurement shortfall for services industries, we will take a brief look at some of the problems involved in the measurement of productivity.

3. The Measurement of Industry Output and Productivity

We begin by defining various productivity concepts. *Total Factor Productivity* is the real output¹³ of a production unit (establishment, firm, industry, economy) divided by the real input used over a given time period. *Productivity growth* of a production unit is the rate of growth of its real output divided by the rate of growth of its real input used over two time periods. *Partial productivity measures* are obtained by including only a subset of all of the outputs produced and inputs utilized by the production unit. For example, *labour productivity* is real output (or real value added) divided by labour input and is a partial productivity measure because it neglects the contributions of other inputs, like capital and land. On the other hand, multifactor productivity (or total factor productivity) includes all outputs produced and inputs utilized by the production unit.

While labour productivity does have its uses, multifactor productivity seems to be the more useful measure of productivity. A rapid growth in a partial productivity measure could be due to a rapid growth in an omitted input category and thus could be quite misleading. In the remainder of this section, we concentrate on some of the difficulties involved in measuring multifactor productivity.

In order to measure the productivity of a firm, industry or economy, we need information on the outputs produced by the production unit for each time period in the sample along with the average price received by the production unit in each period for each of the outputs. In practice, period by period information on revenues received by the industry for a list of output categories is required along with either an output index or a price index for each output. In principle, the revenues received should not include any commodity taxes imposed on the industry's outputs, since producers in the industry do not receive these tax revenues. The above sentences sound very straightforward but many firms produce thousands of commodities, so the aggregation difficulties are formidable. Moreover, many outputs in services sector industries are difficult to measure conceptually: think of the proliferation of telephone service plans and the difficulties involved in measuring insurance, gambling, banking and options trading.

In addition to information on the prices and quantities of outputs produced by an industry, we require information on all the intermediate inputs utilized by the industry for each time period in the sample along with the average price paid for each of the inputs. In practice, period by period information on costs paid by the industry for a list of intermediate input categories is required along with either an intermediate input quantity index or a price index for each category. In principle, the intermediate input costs paid

¹³ Real output is simply deflated nominal output.

should include any commodity taxes imposed on the intermediate inputs, since these tax costs are actually paid by producers in the industry.

The major classes of intermediate inputs at the industry level are:

- materials
- business services
- leased capital.

The current input–output framework deals reasonably well with the flows of materials but not so well with real intersectoral flows of contracted labour services or rented capital equipment. The input-output system was designed long ago when the leasing of capital was not common and when firms had their own in-house business services providers. Thus the input-output system has had a difficult time keeping up with the rapid increase in interindustry flows of services. Although current flows are modeled reasonably well (at least in terms of broad aggregates) in the input-output tables, the real flows are not adequately modeled due to the lack of appropriate deflators.

This lack of information means the real input–output accounts will have to be greatly expanded to construct reliable estimates of real value added by industry.

It should be noted that at the level of the entire market economy, intermediate inputs collapse down to just imports plus purchases of government and other nonmarket inputs. This simplification of the hugely complex web of interindustry transactions of goods and services explains why it may be easier to measure productivity at the national level than at the industry level.

We now turn to a discussion of how difficult it may be to collect constant quality price information on the outputs of Canadian services sector industries.

4. Preliminary Considerations on Measuring Services Sector Output Prices

There are some 926 NAICS 6-digit industries. Of these, 381 are goods industries and are out of scope for the present paper, which discusses the data needs of services sector industries. A further 29 industries are in public administration and 10 more are religious, grant-making, civic and professional services. Given the theoretical difficulties involved in measuring these public sector and nonprofit institution sector outputs, and given our focus on measuring and comparing the productivity of private sector industries, for the present paper, we regard these 39 industries as out of scope. The remaining 506 services sector industries break down as follows:

- Education, health and social assistance industries (49 industries).
- Wholesale and retail trade (147 industries).
- Transportation (51 industries).
- Services 1 (Communication Services consisting of 37 industries), including postal and courier services, warehousing, periodicals and books, software publishers,

- movies, music, radio and television, telecommunications, news and data processing.
- Services 2 (Business Services consisting of 98 industries) including property leasing, real estate management, car and other rental and leasing, lawyers, accountants, architectural engineering, drafting, design and similar business services, computer services, administrative services, consulting and R&D services, advertising, photography, veterinary services, head office services, employment agencies, telephone call centers, collection agencies, travel agencies, security services, janitorial and cleaning services, and waste collection and disposal services.
 - Services 3, (Personal Services consisting of 79 industries), including performing arts, professional sports, museums, parks, zoos, gambling, sports facilities, hotels and other accommodation, food services, drinking places, auto repair, car washes, equipment maintenance and repair, barber shops and beauty salons, funeral homes, laundries, pet care, photo finishing and parking lots.
 - Finance and insurance, (45 industries), including the Bank of Canada, banking and related services, brokerages, exchanges, investment advice, accident, property and life insurance agencies, brokerages and carriers, pension funds and other financial services.

Statistics Canada has very rough and ready price indexes for the wholesale and retail trade industries (147 industries)¹⁴ and more accurate price indexes for the 51 transportation industries.¹⁵ Statistics Canada also has approximately 60 indexes from the Consumer Price Index that it uses to deflate the outputs of some of the remaining services sector industries. This leaves about 250 industries for which we have no deflator at present. In the following sections, we shall list these remaining services sector industries and comment on the difficulties involved in measuring the prices of the outputs of these industries.¹⁶

5. Services 1 (Communication, Storage, Information and Entertainment Services)

The 37 industries classified in this class of industries are listed below:

1. Postal Service
2. Couriers

¹⁴A detailed methodology for pricing the outputs and intermediate inputs of a distribution firm can be found in Diewert and Smith (1994).

¹⁵The methodology for measuring the prices of transportation outputs is generally well developed.

¹⁶The North American Product Classification is not yet complete. Hence, we shall have to guess to a certain extent about the nature of the products in each industry.

3. Local Messengers and Local Delivery
4. General Warehousing and Storage
5. Refrigerated Warehousing and Storage
6. Farm Product Warehousing and Storage
7. Other Warehousing and Storage
- 8.* Newspaper Publishers
- 9.* Periodical Publishers
- 10.* Book Publishers
11. Database and Directory Publishers
12. Other Publishers
- 13.* Software Publishers
- 14.* Motion Picture and Video Production
15. Motion Picture and Video Distribution
16. Motion Picture and Video Exhibition
17. Post-Production and Other Motion Picture and Video Industries
- 18.* Record Production
19. Integrated Record Production/Distribution
- 20.* Music Publishers
21. Sound Recording Studios
22. Other Sound Recording Industries
- 23.* Radio Broadcasting
- 24.* Television Broadcasting
- 25.* Pay and Specialty Television
- 26.* Cable and Other Program Distribution
27. Wired Telecommunications Carriers
28. Wireless Telecommunications Carriers (except Satellite)
29. Telecommunications Resellers
30. Satellite Telecommunications
31. Other Telecommunications
32. News Syndicates
- 33.* Libraries
- 34.* Archives
35. On-Line Information Services

36. All Other Information Services

37. Data Processing Services

Industries 1-3 are essentially (physical) mail delivery industries and are conceptually straightforward from the viewpoint of pricing products.¹⁷ Industries 4-7 are storage industries and these industries produce outputs which are also reasonably straightforward to price. Industries 8-10, Newspaper, Periodical and Book Publishers, could also be viewed as having straightforward to price outputs; for example, simply look at the price of the newspaper or periodical in the base period and compare that price with the current period price. But what if the quality of the newspaper or periodical has changed? This problem is much more evident with books, since they tend to be relatively unique products and hence, quality may be very difficult to pin down. There is another problem that is particularly acute with newspapers (and may also apply to some periodicals): namely, the newspaper may contain *advertising*. Thus a typical newspaper is an example of a *tied product*: consumers buy it for its (nonadvertising) content but they are also forced to take advertising (that they may not value at all) along with its desirable content. Thus the question arises: how do we treat advertising revenues; i.e., what is its price and quantity? This question has not yet been answered in a definitive manner.

The outputs of Data Base and Directory Publishers and Other Publishers (industries 11 and 12) *may* be relatively straightforward to price but the outputs of the Software Industry (industry 13) are *not*. The problem is that each version of a software package is generally a unique product and, typically, later versions do more than earlier versions. To deal with this quality change problem, it is possible to use either a matched model approach¹⁸ or a hedonic regression approach.¹⁹

Industry 14 listed above, Motion Picture and Video Production, is another example of a difficult to price industry. The different components of making a movie can be priced reasonably accurately, but the overall output of a movie making project is typically a *unique product* that cannot be readily compared with previous movies. Moreover, the final value of the movie typically cannot be determined in the period when it is completed and ready to be distributed; returns to an excellent movie can persist for years and even decades. I do not have any good suggestions on how to proceed with pricing the outputs of this industry; this is a topic for further research!

¹⁷ This is probably not entirely accurate; there are no doubt many difficult measurement problems hidden away in this industry as will be the case with every industry. However, it is all relative. Physical mail delivery is much more straightforward to price than the outputs of many of the industries which follow.

¹⁸ See Ohliner and Sichel (1994) and Abel, Berndt and White (2003).

¹⁹ See Seskin (1999) and Grimm and Parker (2000) for the Bureau of Economic Analysis hedonic approach. Hedonic regression techniques date back to Court (1939) and were popularized by Griliches (1971a) (1971b). For a recent comprehensive survey, see Triplett (2002). For recent applications of the technique, see Silver and Heravi (2001) (2002) (2003).

Industries 15 and 16, Motion Picture and Video Distribution and Motion Picture and Video Exhibition, are reasonably straightforward. I am not sure what are the major products of industry 17, Post-Production and Other Motion Picture and Video Industries, so it is difficult to determine how difficult it will be to price this industry's outputs.

Industry 18, Record Production, is similar to Movie Production, in that the mechanical aspects of record production can be priced with minimal problems but the problem is to price the value of the artistic original. The final value of a "hit" song can take years to determine and as was the case with movies, songs tend to be unique commodities that are not readily comparable. Industry 20, Music Publishers, has similar measurement problems.

Industries 21 and 22, Sound Recording Studios and Other Sound Recording Industries, presumably provide straightforward services that can readily be priced.

Industries 23-25, Radio Broadcasting, Television Broadcasting and Pay and Specialty Television, have outputs that are difficult to price. Again, the problem is advertising revenues: radio and television stations broadcast programming that households enjoy but do not directly pay for; they pay for the desirable programming indirectly by consuming a tied product, commercials.²⁰ Again, a standard pricing paradigm has not emerged for these industries. In addition to the advertising problem, there are problems in dealing with unique programs.²¹

Industries 25 and 26, Pay and Specialty Television and Cable and Other Program Distribution, also pose some complex measurement problems. With pay television, there can also be advertising revenues to somehow "price" and with both industries, there are problems with the quality of individual stations or programs changing over time plus complex packages of programming that are not exactly comparable over time.

The five telecommunications industries, 27-31, are reasonably straightforward except for two factors:²²

- Telecommunications services are typically of two types: access and minutes of use. It is not always clear how to price these two components.

²⁰ The revenue flows are different for public broadcasters, who may receive some or all of their revenues as subsidies. This just makes the price measurement problems more complex.

²¹ The essence of statistical agency pricing is to compare like with like. This is hard to do (in an unambiguous, reproducible manner) when products are one of a kind!

²² See the papers on telecommunication services in Woolford (2001).

- Telecommunications firms provide users with a variety of (complex) plans. Up to the recent past, statistical agencies have tended to price a plan until it expires and then move to pricing a newer plan, without doing any quality adjustment between the two plans. This tends to lead to price indexes that do not show the dramatic drops in unit values for telecommunication services that have occurred in recent years.

Industries 32-36, News Syndicates, Libraries, Archives, On-Line Information Services and All Other Information Services, are information provision industries. For private sector firms in these industries, there are often prices for outputs that can readily be collected. For other establishments such as public libraries, outputs will be difficult to measure and prices for services may be nonexistent; i.e., we have the problem of *subsidized outputs*. For services that are largely subsidized (by public transfers that are not directly related to quantities of services sold), it may be preferable to estimate marginal or average costs for the provision of the service rather than using a nominal or zero price.

For industry 37, Data Processing Services, it should be reasonably straightforward to collect meaningful prices.

My subjective evaluation of the difficulty of collecting prices for the outputs of the 37 industries in this group is as follows: there are 13 “difficult” to measure industries and 24 “straightforward” to measure industries. Difficult to measure industries are indicated by an asterisk beside their number in the list above.

6. Finance and Insurance

Space does not permit a full exposition on how to measure the outputs and intermediate inputs of Finance and Insurance firms. Virtually all of these industries hold various types of financial assets and it is necessary to work out the *user costs* and benefits of these various assets. For material on user costs of financial assets, see Barnett (1978), Donovan (1978), Hancock (1986), Fixler and Zieschang (1992) (1999), Diewert and Fox (1999) (2001), Hartwick (2000; 17-48), Barnett and Serletis (2000) and Schreyer and Stauffer (2003).

The following quotation illustrates some of the complexities involved in deciding how to price the outputs of the insurance industry:²³

“The nature of the insurance industry’s productive activity requires some discussion. Note that defining the nominal output of the insurance industry as premiums less claims has the rather unpalatable implication that a perfectly efficient industry that had no transaction costs would end up contributing nothing to

²³ For additional discussion on pricing concepts for insurance outputs, see Sherwood (1999).

national output. To avoid this unpleasant implication, Denny (1980), Ruggles (1983; 67) and Hornstein and Prescott (1991) suggested that gross premiums paid (rather than net premiums or premiums less claims) is a more appropriate measure of the nominal output of the insurance industry. In this view, consumers are buying protection services rather than forming a club to pool risk. ... This protection services view of insurance services will give rise to a much larger nominal gross output for the insurance industry than the traditional net claims approach, which leads to zero or negative nominal output in years when claims are large.” W.E. Diewert and Kevin J. Fox (2001; 186).

In addition to accounting complexities, the production decisions of financial and insurance firms take place in an uncertain context; i.e., financial firms manage risks of various types. Economic theory has suggested various models to deal with these risk aspects²⁴ but empirical applications of these rather complicated models in a statistical agency measurement context are few and far between.²⁵

A listing of the 45 NAICS industries in this sector follows. An asterisk indicates that the outputs and output prices of the industry will be difficult to measure. Of course, even in the industries where the conceptual problems are thought to be less severe, there can still be problems in following the prices of outputs that are subject to rapid quality change.

- 1.* Monetary Authorities - Central Bank
- 2.* Personal and Commercial Banking Industry
- 3.* Corporate and Institutional Banking Industry
- 4.* Local Credit Unions
- 5.* Other Depository Credit Intermediation
- 6.* Credit Card Issuing
- 7.* Sales Financing
- 8.* Consumer Lending
- 9.* All Other Non-Depository Credit Intermediation
- 10.* Mortgage and Other Loan Brokers
11. Financial Transactions Processing, Reserve and Clearing House Activities
- 12.* Other Activities Related to Credit Intermediation
- 13.* Investment Banking and Securities Dealing
14. Securities Brokerage
15. Commodity Contracts Dealing
16. Commodity Brokerage

²⁴ See for example Arrow (1951) (1984), Bowers, Gerber, Hickman, Jones and Nesbitt (1986) and Diewert (1993; 401-433), (1995).

²⁵ A recent important empirical study of gambling that takes into account risk factors is Yu (2003).

- 17.* Securities and Commodity Exchanges
- 18.* Miscellaneous Intermediation
- 19.* Portfolio Management
- 20.* Investment Advice
- 21.* Investment Companies
- 22.* All Other Miscellaneous Financial Investment Activities
- 23.* Direct Individual Life, Health and Medical Insurance Carriers
- 24.* Direct Group Life, Health and Medical Insurance Carriers
- 25.* Direct General Property and Casualty Insurance Carriers
- 26.* Direct, Private, Automobile Insurance Carriers
- 27.* Direct, Public, Automobile Insurance Carriers
- 28.* Direct Property Insurance Carriers
- 29.* Direct Liability Insurance Carriers
- 30.* Other Direct Insurance (except Life, Health and Medical) Carriers
- 31.* Life Reinsurance Carriers
- 32.* Accident and Sickness Reinsurance Carriers
- 33.* Automobile Reinsurance Carriers
- 34.* Property Reinsurance Carriers
- 35.* Liability Reinsurance Carriers
- 36.* General and Other Reinsurance Carriers
- 37.* Insurance Agencies and Brokerages
38. Claims Adjusters
- 39.* All Other Insurance Related Activities
- 40.* Trusteed Pension Funds
- 41.* Non-Trusteed Pension Funds
- 42.* Open-End Investment Funds
- 43.* Mortgage Investment Funds
- 44.* Segregated (except Pension) Funds
- 45.* All Other Funds and Financial Vehicles

Thus 40 of the 45 industries in this sector have significant conceptual measurement difficulties.

7. Services 2 (Leasing Services, Real Estate Services and Other Business Services)

A listing of the 95 industries in this sector follows.

1. Lessors of Residential Buildings and Dwellings (except Social Housing Projects)
2. Lessors of Social Housing Projects
3. Lessors of Non-Residential Buildings (except Mini-Warehouses)
4. Self-Storage Mini-Warehouses
5. Lessors of Other Real Estate Property
6. Offices of Real Estate Agents and Brokers
7. Real Estate Property Managers
8. Offices of Real Estate Appraisers
9. Other Activities Related to Real Estate
10. Passenger Car Rental
11. Passenger Car Leasing
12. Truck, Utility Trailer and RV (Recreational Vehicle) Rental and Leasing
13. Consumer Electronics and Appliance Rental
14. Formal Wear and Costume Rental
15. Video Tape and Disc Rental
16. Other Consumer Goods Rental
17. General Rental Centres
18. Construction, Transportation, Mining, and Forestry Machinery and Equipment Rental and Leasing
19. Office Machinery and Equipment Rental and Leasing
20. Other Commercial and Industrial Machinery and Equipment Rental and Leasing
21. Owners and Lessors of Other Non-Financial Assets
- 22.* Offices of Lawyers
23. Offices of Notaries
24. Other Legal Services
- 25.* Offices of Accountants
26. Tax Preparation Services
27. Bookkeeping, Payroll and Related Services
- 28.* Architectural Services
29. Landscape Architectural Services
- 30.* Engineering Services
31. Drafting Services
32. Building Inspection Services
33. Geophysical Surveying and Mapping Services
34. Surveying and Mapping (except Geophysical) Services
35. Testing Laboratories
- 36.* Interior Design Services
- 37.* Industrial Design Services
- 38.* Graphic Design Services
- 39.* Other Specialized Design Services
- 40.* Computer Systems Design and Related Services

- 41.* Administrative Management and General Management Consulting Services
- 42.* Human Resource and Executive Search Consulting Services
- 43.* Other Management Consulting Services
44. Environmental Consulting Services
45. Other Scientific and Technical Consulting Services
- 46.* Research and Development in the Physical Sciences and Engineering Sciences
- 47.* Research and Development in the Life Sciences
- 48.* Research and Development in the Social Sciences and Humanities
- 49.* Advertising Agencies
- 50.* Public Relations Services
- 51.* Media Buying Agencies
- 52.* Media Representatives
53. Display Advertising
54. Direct Mail Advertising
55. Advertising Material Distribution Services
56. Specialty Advertising Distributors
- 57.* All Other Services Related to Advertising
58. Marketing Research and Public Opinion Polling
59. Photographic Services
60. Translation and Interpretation Services
61. Veterinary Services
- 62.* All Other Professional, Scientific and Technical Services
- 63.* Holding Companies
- 64.* Head Offices
65. Office Administrative Services
66. Facilities Support Services
67. Employment Placement Agencies
68. Temporary Help Services
69. Employee Leasing Services
70. Document Preparation Services
71. Telephone Call Centres
72. Business Service Centres
73. Collection Agencies
- 74.* Credit Bureaus
- 75.* Other Business Support Services
76. Travel Agencies
77. Tour Operators
78. Other Travel Arrangement and Reservation Services
- 79.* Investigation Services
80. Security Guard and Patrol Services
81. Armoured Car Services
82. Security Systems Services (except Locksmiths)
83. Locksmiths
84. Exterminating and Pest Control Services
85. Window Cleaning Services
86. Janitorial Services (except Window Cleaning)

87. Landscaping Services
88. Carpet and Upholstery Cleaning Services
89. Duct and Chimney Cleaning Services
90. All Other Services to Buildings and Dwellings
91. Packaging and Labelling Services
92. Convention and Trade Show Organizers
93. All Other Support Services
94. Waste Collection
95. Waste Treatment and Disposal
96. Remediation Services
97. Material Recovery Facilities
98. All Other Waste Management Services

Only 25 of the above 98 industries were regarded as having outputs that are conceptually difficult to measure. However, hedonic regression techniques or model pricing may have to be used to control for quality changes in many of the remaining industries.

8. Education, Health and Social Assistance

A listing of the 49 industries in this sector follows.

- 1.* Elementary and Secondary Schools
- 2.* Community Colleges and C.E.G.E.P.s
- 3.* Universities
4. Business and Secretarial Schools
5. Computer Training
6. Professional and Management Development Training
7. Technical and Trade Schools
8. Fine Arts Schools
9. Athletic Instruction
10. Language Schools
- 11.* All Other Schools and Instruction
12. Educational Support Services
- 13.* Offices of Physicians
14. Offices of Dentists
- 15.* Offices of Chiropractors
16. Offices of Optometrists
- 17.* Offices of Mental Health Practitioners (except Physicians)
18. Offices of Physical, Occupational, and Speech Therapists and Audiologists
19. Offices of All Other Health Practitioners
20. Family Planning Centres
- 21.* Out-Patient Mental Health and Substance Abuse Centres
- 22.* Community Health Centres
- 23.* All Other Out-Patient Care Centres
24. Medical and Diagnostic Laboratories
25. Home Health Care Services

26. Ambulance (except Air Ambulance) Services
27. Air Ambulance Services
28. All Other Ambulatory Health Care Services
29. General (except Pediatric) Hospitals
- 30.* Pediatric Hospitals
- 31.* Psychiatric and Substance Abuse Hospitals
- 32.* Specialty (except Psychiatric and Substance Abuse) Hospitals
33. Nursing Care Facilities
34. Residential Developmental Handicap Facilities
35. Residential Substance Abuse Facilities
36. Homes for the Psychiatrically Disabled
37. Community Care Facilities for the Elderly
38. Transition Homes for Women
39. Homes for Emotionally Disturbed Children
40. Homes for the Physically Handicapped or Disabled
41. All Other Residential Care Facilities
- 42.* Child and Youth Services
43. Services for the Elderly and Persons with Disabilities
44. Other Individual and Family Services
45. Community Food Services
46. Community Housing Services
- 47.* Emergency and Other Relief Services
48. Vocational Rehabilitation Services
49. Child Day-Care Services

At least 15 of the 49 industries in this sector will have outputs for which it will be difficult to obtain comparable and meaningful prices over time. A major problem with many education, health and social service industries is that they are heavily *subsidized* in a manner that is not very directly related to their outputs. Thus the nominal or zero prices for many of their outputs are not meaningful from the viewpoint of developing productivity statistics. In other industries listed above, it will be difficult to measure the outputs. For example, a medical procedure should be judged on *outcomes* and not on the *inputs* to the procedure. But in some cases, it will be difficult to determine whether the patient is “cured” and in other cases, the “quality” of the patient will matter to the outcome; i.e., a physically and mentally fit patient is less likely to die from complications arising from the procedure (but it will be difficult to measure the physical and mental fitness of patients). On the other hand, many of the industries listed above are in the private sector and deliver reasonably well defined services.

9. Services 3 (Live Entertainment, Sports, Cultural, Recreational, Travel, Restaurant and Personal Services)

The 79 industries in this sector are listed below.

- 1.* Theatre (except Musical) Companies
- 2.* Musical Theatre and Opera Companies

- 3.* Dance Companies
- 4.* Musical Groups and Artists
- 5.* Other Performing Arts Companies
6. Sports Teams and Clubs
7. Horse Race Tracks
8. Other Spectator Sports
- 9.* Live Theatres and Other Performing Arts Presenters with Facilities
- 10.* Sports Stadiums and Other Presenters with Facilities
- 11.* Performing Arts Promoters (Presenters) without Facilities
- 12.* Festivals without Facilities
- 13.* Sports Presenters and Other Presenters without Facilities
- 14.* Agents and Managers for Artists, Athletes, Entertainers and Other Public Figures
- 15.* Independent Artists, Writers and Performers
- 16.* Non-Commercial Art Museums and Galleries
- 17.* Museums (except Art Museums and Galleries)
18. Historic and Heritage Sites
19. Zoos and Botanical Gardens
20. Nature Parks and Conservation Areas
21. All Other Heritage Institutions
22. Amusement and Theme Parks
23. Amusement Arcades
- 24.* Casinos (except Casino Hotels)
- 25.* Lotteries
- 26.* All Other Gambling Industries
27. Golf Courses and Country Clubs
28. Skiing Facilities
29. Marinas
30. Fitness and Recreational Sports Centres
31. Bowling Centres
32. All Other Amusement and Recreation Industries
33. Hotels
34. Motor Hotels
35. Resorts
36. Motels
37. Casino Hotels
38. Bed and Breakfast
39. Housekeeping Cottages and Cabins
40. All Other Traveler Accommodation
41. RV (Recreational Vehicle) Parks and Campgrounds
42. Hunting and Fishing Camps
43. Recreational (except Hunting and Fishing) and Vacation Camps
44. Rooming and Boarding Houses
45. Full-Service Restaurants
46. Limited-Service Eating Places
47. Food Service Contractors
48. Caterers

49. Mobile Caterers
50. Drinking Places (Alcoholic Beverages)
51. General Automotive Repair
52. Automotive Exhaust System Repair
53. Other Automotive Mechanical and Electrical Repair and Maintenance
54. Automotive Body, Paint and Interior Repair and Maintenance
55. Automotive Glass Replacement Shops
56. Car Washes
57. All Other Automotive Repair and Maintenance
58. Electronic and Precision Equipment Repair and Maintenance
59. Commercial and Industrial Machinery and Equipment (except Automobile and Electrical) Repair and Maintenance
60. Home and Garden Equipment Repair and Maintenance
61. Appliance Repair and Maintenance
62. Reupholstery and Furniture Repair
63. Footwear and Leather Goods Repair
64. Other Personal and Household Goods Repair and Maintenance
65. Barber Shops
66. Beauty Salons
67. Unisex Hair Salons
68. Other Personal Care Services
69. Funeral Homes
70. Cemeteries and Crematoria
71. Coin-Operated Laundries and Dry Cleaners
72. Dry Cleaning and Laundry Services (except Coin-Operated)
73. Linen and Uniform Supply
74. Other Laundry Services
75. Pet Care (except Veterinary) Services
76. Photo Finishing Laboratories (except One-Hour)
77. One-Hour Photo Finishing
78. Parking Lots and Garages
- 79.* All Other Personal Services

Only 18 of the 79 industries in this personal services sector were indicated as having major measurement problems but this is a rather tentative judgment.

The problem with measuring theatre and other fine arts outputs is that the quality can vary with the chosen play or exhibit and the cast or staff. If we are willing to ignore this problem, then pricing of commercial theatres or museums is straightforward. However, often cultural activities are subsidized and the subsidy is usually a general subsidy, not related to the specific cultural products produced from one time period to the next. This creates severe measurement problems.

I have not labeled sports teams and clubs as being hard to measure but a case could be made for quality problems in this context as well. For example, if the Ottawa Senators are doing well, it is likely that more seats will be sold, television revenues will be higher and

consumers (in Ottawa) will enjoy their viewing experiences more. However, I would say that this type of hedonic adjustment could be left to the distant future.

10. Summarizing the Service Sector Measurement Difficulties

There are some general themes running through the previous sections that make certain types of service products difficult to measure. We list below some general categories of difficult to measure service products (the categories overlap).

- *Unique products.* This is a pervasive problem in the measurement of the prices of services.
- *Complex products.* Many services products are very complicated; e.g., telephone service plans.
- *Tied products.* Many services products are bundled together and offered as a single unit; e.g., newspapers, cablevision plans, banking services packages. In principle, hedonic regression techniques could be used to price out these first three types of service products.
- *Joint products.* For this type of product, the value depends partially on the characteristics of the purchaser; e.g., the value of a year of education depends not only on the characteristics of the school and its teachers but also on the social and genetic characteristics of the student population.
- *Marketing and advertising products.* This class of services sector outputs is dedicated to influencing or informing consumers about their tastes. A standard economic paradigm for this type of product has not yet emerged.
- *Heavily subsidized products.* In the limit, subsidized products can be supplied to consumers free of (explicit) charges. Is zero the “right” price for this type of product?
- *Financial products.* What is the “correct” real price of a household’s monetary deposits? Somewhat surprisingly, this question has not yet been resolved in a definitive manner.
- *Uncertain products.* What is the correct pricing concept for gambling and insurance expenditures? What is the correct price for a movie or a record original when it is initially released?

What is somewhat surprising to me is that academics have not been more interested in the above questions. Hopefully, this conference will help stimulate some interest in these questions.

11. The General Structure of a Proposal for Better Services Measurement in Canada

I do not believe that it is feasible to measure the outputs of all 506 NAICS services sector industries in the near future. Even if the money could be raised to do this, it can be seen from the brief survey of various measurement problems listed above that appropriate methodology does not even exist for many industries. Moreover, it will not be possible to

hire a sufficient number of skilled staff to undertake and supervise the actual surveys for all 506 industries.

However, I do think that it is feasible to have a multiyear program where the (relatively) easy to measure sectors would be attacked first. At the same time, Statistics Canada should cooperate with other statistical agencies that are faced with the same measurement problems in trying to fill a tremendous gap in our system of business statistics. In particular, the US Bureau of Labor Statistics, under the direction of Irwin Gerduk, is in the process of extending its Producer Price Index to cover services sector industries. We should be able to learn from their experiences in this area.

The proposed services sector measurement program would involve the collection of producer prices on a quarterly basis and would be a direct input into the calculation of real quarterly national accounts. The proposed program would also allow services sector industrial real output to be calculated on a quarterly basis. However, given the extra resources that would be used in the program, it would be useful if some synergies with the CPI program could be developed. In particular, if services sector firms were able to tell what proportion of their sales was sold to the household sector, then those sales could be targeted for representative output prices, which in turn could be fed into the consumer price index.²⁶ The frequency for collecting the price quotes for items that feed into the CPI universe would have to be on a monthly basis rather than a quarterly basis. However, there would be advantages to having the entire output price collection process on a monthly basis rather than quarterly in any case.²⁷

12. Conclusion

As was outlined in section 2 above, from many perspectives, it makes sense to fund better basic economic measurement. This is a core responsibility of the Federal Government.²⁸ However, the spillovers from the better economic measurement will be large. In particular, the conduct of monetary policy should be greatly improved and the economic policy community should be able to conduct better analyses and do a better job of managing the economy with the benefit of better data if a proposal for better services sector price information is funded.

²⁶ This is an ideal situation. An adequate approximation may be to just use the industry output price indexes, adjusting for taxes and transportation if necessary, as direct inputs into the CPI.

²⁷ Monthly prices would be more representative and monthly estimates of real industry product could be provided. Finally, the effects of a missing price quote would not be as severe if prices were collected on a monthly basis.

²⁸ In addition to funding Statistics Canada to collect service sector prices, it would be useful for the Social Sciences and Humanities Council to fund a specific program that would help solve some of the many conceptual problems in defining and measuring services sector outputs.

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