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MEASURING SERVICES IN THE PRODUCER PRICE INDEX

Invited paper submitted by U.S. Bureau of Labor Statistics¹

INTRODUCTION

1. The US Producer Price Index (PPI) program continues to expand coverage with a new economy-wide index model based on the input-output tables produced by the US Bureau of Economic Analysis (BEA). All marketed US domestic production of goods and services is considered in-scope under the new economy-wide index model. Excluded are output generating activities with no observable price, such as public administration. Table 1 shows the structure of this new model. This model follows the North American Industry Classification System. This new index model was developed in conjunction with the US PPI's service expansion.

2. For the past 14 years, an expansion of the coverage of service industry indices has been underway. Currently, almost 60% of the in-scope services are covered by direct PPI pricing. In the next few years, services industries accounting for an additional 18% of in-scope services will, hopefully, be added to index calculation. An additional 5% of in-scope services will be covered by direct pricing from Consumer Price Index data. An additional 14% of services will be imputed by directly priced PPI's. Tables 2, 3 and 4 provide a detailed outline of the services coverage.

¹ Paper prepared by Roslyn B. Swick. The views expressed are those of the author and do not reflect the policies of the U.S. Bureau of Labor Statistics.

NEW ECONOMY-WIDE INDEX MODEL

3. In the new PPI economy-wide index model, the leading index will be “All Outputs for Final Sale”. The structure for this index includes services consumed by final users. Final users are defined as personal consumption expenditures, private fixed investment, government purchases and exports. There are four intermediate demand indices which do NOT aggregate to form an index for total intermediate. Since intermediate demand encompasses many different stages of processing, an aggregation of indices in that structure is not meaningful. There is also a special aggregation for business services being developed. The new “Business Services” index is comprised of intermediate services plus goods transportation and warehousing. For all the new indices in this new economy-wide model, there are major issues to be resolved both in developing the new data product and in educating the user public about the new data product and its relationship to the existing PPI.

4. Two of the largest users of the PPI data are the Federal Reserve Board and the Bureau of Economic Analysis. Both of these agencies use PPI data to adjust the estimates for the US national accounts, including real Gross Domestic Product (GDP) and productivity. Therefore, an important benefit of the PPI’s expanded coverage is the production of a more comprehensive set of methodologically consistent deflators that in turn should lead to improved measures for these key economic indicators.

BUNDLING CONCEPT

5. One of the challenges in developing new services price indices is taking the conceptual output definitions and operationalizing that theory. The concept of bundling requires analyzing the actual services provided and the manner in which companies set their prices. Bundling is combining unique services together and then marketing and selling the services for one price that cannot be separated. In the advertising agency industry, the output is the creation of ads and placement of ads in the media. In some cases, the ads are created and sold without being placed in the media. In other cases, the ads are created and placed in the media for one price that cannot be separated. Another example of bundling is in the general medical and surgical hospital industry where the service is the sum of the activities that appear on the patient’s bill. The price is the actual reimbursement that the hospital receives net of negotiated discounts. In some cases, the price is based on a per diem rate, which is a flat charge per day for the entire day with various services provided that cannot be separately priced. Another bundled price in hospitals is the prospective payment case rate, where the entire stay for a specific illness has one price regardless of the individual medical care services provided.

CONSTANT QUALITY PRICE INDICES

6. The US PPI endeavors to produce constant quality services price indices. The Laspeyres formulation is used by the PPI to approximate the fixed input-output price indices (FIOPI). The development of operationally feasible measurements of the output and the ‘price’ associated with that output for service industries is continually a challenge. A pricing methodology has to be developed that either will result in an unchanged input production function or a quality adjustment strategy that relates changes in the output to changes in the input requirements. Examples of output definitions, major service lines and pricing methodologies from several different industries are described in detail in Table 5.

7. For professional services such as accounting, legal, and engineering, the output of the industry is the provision of a specific service. An actual transaction is selected and all price determining characteristics of that transaction are fixed or frozen. The price for these services is the bill rate. The bill rate includes not only the charges to the customer for the employees' services but also charges for supplies, overhead and profit. Changes in the bill rate for that specific transaction are reflected as price changes. As long as those same services are provided by the selected company, no quality adjustment is required. If the sample unit indicates a change in inputs, producer cost quality adjustment is attempted.

8. In the radio and television broadcasting industries, the output is the provision of a broadcast signal and access to an audience. However, the price for that output is the sales of advertising. By measuring the average unit rate for advertising sales for a daypart, a constant quality price is captured that does not require quality adjustment. Broadcasters who do not sell advertising but rather receive government or grant funding are not in scope since there is no marketed output (therefore, no observable price).

9. The output of the real estate agents and investment advice (portfolio management) industries are very different but the price for both industries is measured by the commissions they receive. In both these industries there are assets associated with the provision of the services. In real estate the value of the property is multiplied by the commission rate to calculate the fee. For portfolio management, the value of the assets under management for a particular fund is multiplied by the fee stated in 'basis points' for that fund. In both industries, the value of the assets or property must be updated every pricing period to reflect the current value of the assets in order to capture the pure price change for the service provided. When the value of the property or assets under management is updated, there is no change to the service provided.

QUALITY ADJUSTMENT ISSUES

10. Quality adjustments are used to maintain constant quality price indices where the services provided have changed. When price-determining characteristics change (change in output), the FIOPI concept is violated. The corresponding input changes are utilized to disentangle price changes from changes in the production function. An example of quality adjustment in service industries is the nursing home care industry. A methodology for quality adjusting nursing home care was instituted this past January utilizing government inspection data on staff hours in conjunction with wage data on health care jobs.

11. In determining whether or not the output definition, pricing methodology, and quality adjustment strategy are appropriate for an industry, the national income accounts are utilized. The national income accounts' measure of revenue is analyzed. The deflationary properties of the price index in relation to the revenue are tested. The results from the test are used to evaluate the fitness for use of the output definition, pricing methodology and quality adjustment strategy.

NEW ITEM BIAS

12. While adhering to the FIOPI model is conceptually correct for the PPI, there is a danger

that the services being priced will no longer represent current market conditions. In order to ensure that the indices are representative, several strategies have been developed to reduce or eliminate new item bias. New item bias could occur in industries where there is rapid service or product development that cannot be captured by the usual resampling process. In the US PPI resampling occurs roughly every seven years.

13. Determining the output and pricing methodology for computer services such as prepackaged software and data processing services are challenging because the products and services provided by these industries are constantly evolving. In order to keep these industries up to date, augmentation samples are collected annually and added to the indices. The companies selected for the augmentation samples are usually newer companies that were not in existence when the original sample was selected. Usually these companies produce products or services that were not in existence when the original items were selected. For prepackaged software, all current reporters are contacted every year and the sample of products they are pricing is updated based on current sales. But adding new services and products may require adjusting the output definition and sometimes the pricing methodology. For example, web hosting was added to data processing services. Even though web hosting is basically the 'sale' of server space, the service is unique and very different from the traditional data processing services.

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Table 1.
Proposed New Aggregate PPIs

Producer price indexes for domestic outputs supplied to final demand	Producer price indexes for domestic outputs supplied to intermediate demand
All outputs for final sale	
Goods	Services
Agriculture, forestry, fishery	Information and communications
Mining	Finance and insurance
Utilities	Real estate & rental and leasing
Manufacturing	Professional, scientific, and technical
Nondurable	Administrative and support
Foods	Accommodation and food
Petroleum and coal	Passenger transportation
Other	Other
Durable	
Machinery	Unprocessed goods
Computer and electronics	Agricultural, forestry, fishery
Transportation	Crop production
Other	Animal production
	Other
Construction	Mining
Distribution	Processed goods
Goods transportation and warehousing	First stage
Trade	Second stage
Services	Distribution
Information and communications	Goods transportation and warehousing
Finance and insurance	Motor freight
Real estate & rental and leasing	Other
Professional, scientific, and technical	Trade
Health care and social assistance	Wholesale
Hospitals	Retail
Ambulatory	
Other	
Accommodation and food	
Passenger transportation	
Other	
	Special grouping
Special groupings	Business services
Investment expenditures	

Table 2. Producer Price Index coverage profile**1992 GDP in scope for PPI**

Industry division	% of in-scope GDP	Direct pricing coverage within division (%)			
		1990	1996	1999	2004
Ag, Forest, Fish	2.3	100.0	100.0	100.0	100.0
Mining	1.7	100.0	100.0	100.0	100.0
Construction	4.5	0.0	0.0	0.0	0.0
Manufacturing	21.4	100.0	100.0	100.0	100.0
100.0					
“Goods” subtotal	29.9	85.1	85.1	85.1	85.1
Trans, Utilities	10.6	23.6	85.0	86.9	89.4
Wholesale Trade	7.9	0.0	0.0	0.0	0.0
0.0					
Retail Trade	11.2	0.0	0.0	0.0	85.3
Fin, Insur, etc.	14.9	0.0	28.9	48.7	48.7
Services	23.7	0.0	38.6	53.0	
56.0					
Government*	1.9	0.0	90.0	90.0	90.0
“Services” subtotal	70.2	3.6	34.4	43.8	58.8
Total	100.0	28.0	49.5	56.2	66.7

*Marketed government services, eg. TVA

Table 3. Service sector industries directly priced in the Producer Price Index

Series start date	SIC	Industry	Estimated percent of in-scope GDP
12/84	4011	Railroads, line haul operations	0.46
06/86	4612	Crude petroleum pipelines	0.06
06/86	4613	Refined petroleum pipelines	0.03
12/86	5093	Scrap and waste materials	0.00
06/88	4412	Deep sea foreign transportation of freight	0.06
06/88	4424	Domestic deep sea transportation of freight	0.02
06/88	4832	Radio broadcasting	0.10
06/89	4311	United States Postal Service	0.90
12/89	4512	Air transportation, scheduled	0.69
12/89	4513	Air courier services	0.12
12/89	4724	Travel agencies	0.12
12/90	4449	Water transportation of freight, N.E.C.	0.02
12/90	4981	Electric power and natural gas utilities	3.70
06/91	7513	Truck rental and leasing, without drivers	0.10
12/91	4222	Refrigerated warehousing & storage	0.02
12/91	4432	Freight trans. on the Great Lakes-St. Lawrence	0.02
12/91	4491	Marine cargo handling	0.04
12/91	7514	Passenger car rental, without drivers	0.14
06/92	4213	Trucking, except local	0.86
06/92	4522	Air transportation, not scheduled	0.04
06/92	4581	Airports, flying fields, and airport services	0.07
12/92	4215	Courier services, except by air	0.21
12/92	4221	Farm product warehousing & storage	0.01
12/92	4492	Tugging and towing services	0.02
12/92	8062	General medical and surgical hospitals	3.27
12/92	8063	Psychiatric hospitals	0.18
12/92	8069	Specialty hospitals, except psychiatric	0.20
06/93	4212	Local trucking without storage	0.37
06/93	4214	Local trucking with storage	0.05
06/93	4225	General warehousing & storage	0.04
06/93	4841	Cable and other pay television services	0.39
06/93	7011	Hotels and motels	1.05
12/93	8011	Offices and clinics of doctors of medicine	1.90
06/94	7361	Employment agencies	0.07
06/94	7363	Help supply services	0.54
06/94	8071	Medical laboratories	0.15
12/94	4731	Freight transportation arrangement	0.15
12/94	7349	Building cleaning and maintenance services, N.E.C.	0.25
12/94	8053	Skilled and intermediate care facilities	0.56
06/95	4813	Telephone communications, except radiotelephone	2.25
06/95	7311	Advertising agencies	0.22
06/95	8721	Accounting, auditing, bookkeeping	0.49
12/95	6512	Nonresidential building operators	1.75
12/95	6531	Real estate agents and managers	2.56
12/96	8082	Home health care services	0.19
12/96	8111	Legal services	1.78
12/96	8711	Engineering services	0.94

12/96	8712	Architectural services	0.16
12/97	7372	Prepackaged software	0.34
06/98	6331	Property and casualty Insurance	0.56
12/98	6311	Life Insurance	0.81
06/99	4812	Wireless telecommunications	0.17
12/99	5411	Grocery stores	2.00
12/99	5421	Meat and fish markets	0.07
12/99	5431	Fruit and vegetable markets	0.02
12/99	5441	Candy, nut, and confectionery stores	0.02
12/99	5461	Retail bakeries	0.06
12/99	5499	Miscellaneous food stores	0.03
12/99	5511	New car dealers	1.95
06/00	5912	Drug stores and proprietary stores	0.28
06/00	5921	Liquor stores	0.07
06/00	5941	Sporting good and bicycle shops	0.10
06/00	5942	Book stores	0.06
06/00	5943	Stationery stores	0.01
06/00	5944	Jewelry stores	0.10
06/00	5945	Hobby, toy, and game shops	0.07
06/00	5946	Camera & photographic supply stores	0.02
06/00	5947	Gift, novelty, and souvenir shops	0.07
06/00	5948	Luggage and leather goods stores	0.01
06/00	5949	Sewing, needlework, and piece goods	0.03
06/00	5961	Catalog and mail-order houses	0.26
06/00	5962	Merchandising machine operators	0.05
06/00	598	Fuel dealers	0.07
06/00	5992	Florists	0.04
06/00	5995	Optical goods stores	0.03
06/00	5999	Miscellaneous retail stores, nec	0.10
06/00	6211	Security brokers and dealers	0.81
12/00	7374	Data processing services	0.33
06/01	5561	Recreational vehicle dealers	0.04
06/01	5551	Boat dealers	0.03
06/01	4833	Television broadcasting stations	0.30
06/01	5541	Gasoline service stations	0.79
12/01	5531	Auto and home supply stores	0.17
06/02	6282	Investment advice	0.14
06/02	5661	Shoe stores	0.11
06/02	5611	Men's and boys' clothing stores	0.06
12/02	6412	Insurance agents and brokers	0.81
12/02	5261	Retail nurseries and garden stores	0.04
12/02	5271	Mobile home dealers	0.04
06/03	5712	Furniture stores	0.20
06/03	5713	Floor covering stores	0.06
06/03	5722	Household appliance stores	0.05
06/03	5731	Radio, TV, and electronic stores	0.13
06/03	5734	Computer and software stores	0.04
06/03	5735	Record and prerecorded tape stores	0.04
06/03	5621	Women's clothing stores	0.18
06/03	5651	Family clothing stores	0.19
06/03	5231	Paint, glass, and wallpaper stores	0.04

06/03 5251 Hardware stores

0.07

12/03	5211	Lumber and other building materials	0.41
12/03	5311	Department stores	1.15
12/03	5399	Miscellaneous general merchandise stores	0.30
		Total	41.25
	6321	Accident and health insurance	0.05
	6324	Hospital and medical service plans	0.27
	7359	Equipment rental and leasing	0.24
	6022	State commercial banks	0.97
	6035	Federal savings institutions	0.47
	6036	Savings institutions not federally chartered	0.21
	6081	Branches of foreign banks	0.43
	6021	National commercial banks	1.36
	7375	Information retrieval services	0.15
	7381	Detective, guard, and armored car services	0.15
	8742	Management consulting services	0.34
	7996	Amusement parks	0.09
	7991	Physical fitness facilities	0.07
	7992	Public Golf Courses	0.03
	7997	Membership sports and recreation clubs	0.15
	8243	Data processing schools	0.08
	7699	Repair shops, nec	0.04
	50	Durable goods – wholesale trade	3.91
	51	Nondurable goods – wholesale trade	4.01
		Total	13.02
		Total	54.27

NOTE: Estimates were derived by apportioning BEA GPO by 2-digit industry data with gross output data from Census.

Table 4. Service sector industries not directly priced in the Producer Price Index

SIC	# of SICS	Industry	Estimated percent of in-scope GDP
Imputed based on data for directly priced Producer Price Indexes			
41	8	Local transit	0.23
Part of 42	2	Trucking and warehousing	0.02
Part of 449	2	Water transportation services	0.02
Part of 46	1	Pipelines, nec	0.01
Part of 47	6	Transportation services	0.13
Part of 48	2	Communications	0.05
Part of 49	7	Electric, gas, and sanitary services	0.60
Part of 53	1	Variety stores	0.05
Part of 55	2	Automotive dealers	0.12
Part of 56	3	Apparel stores	0.06
Part of 57	3	Home furnishing stores	0.08
Part of 59	4	Miscellaneous retail	0.13
Part of 60	7	Depository institutions	0.47
61	6	Nondepository institutions	0.52
Part of 62	3	Security and commodity brokers	0.05
Part of 63	3	Insurance carriers	0.01
Part of 65	5	Real estate	0.71
Part of 70	4	Other lodging places	0.04
Part of 73	23	Business services	2.28
Part of 75	4	Auto repair, services, and parking	0.18
Part of 80	11	Health services	0.88
Part of 87	9	Management services	1.05
Part of 72	14	Personal services	0.67
Part of 76	7	Miscellaneous repair services	0.30
Part of 79	8	Amusement and recreation services	0.66
Part of 82	5	Educational services	0.54
		Total	9.86
Calculated from directly priced Consumer Price Indexes			
58	2	Eating and drinking places	1.21
753	7	Automotive repair shops	0.55
4941,52	2	Water & sewage maintenance	0.04
6513,14,15	3	Rent of primary residence	1.72
726	1	Funeral service and crematories	0.11
821,822	3	Educational services	0.30
		Total	3.93
No planned coverage under current budget			
67	10	Holding and other investment offices	0.26
78	7	Motion pictures	0.29
83	5	Social services	0.91
84	2	Museums, art galleries, botanical and zoological gardens	0.06
86	7	Membership organizations	0.50
89	1	Miscellaneous services	0.11
		Total	2.13
		Total Services	70.2

NOTE: Estimates were derived by apportioning BEA GPO by 2-digit industry data with gross output data from Census.

Table 5.

Title	Major Service Categories	Output Definition and Pricing Methodology
General medical and surgical hospitals	Medicare patient treatments Medicaid patient treatments All other patients	The output of the industry is all services provided by a hospital to an individual patient during their hospital stay (from admission to discharge). The index measures the estimated expected reimbursement for the service and payers originally identified in the base period. The existence of different pricing arrangements, such as the prospective payment case rate system, precluded viewing outputs as unique unbundled services.
Investment advice	Portfolio and mutual fund management Financial planning and other advisory services	The output of this industry is investment advice and investment management through portfolio diversification and risk minimization. That is, a client pays for any one or a combination of the primary services to have his/her assets maximized. The index measures the fees earned for portfolio management by portfolio managers, for financial plans created by financial planners, for financial advice given by financial advisors, and for reports concerning securities prepared by investment researchers and portfolio analysts. These fees are generally calculated as a percentage of assets under management per month, semi-annually or annually, or as a flat fee.
Advertising agencies	Ad creation, billed separately Media placement, including ad creation not billed separately	The output of the industry is the creation of advertisements and placement of ads in the media on a contract or fee basis. The ad creation index measures the price of production for items ranging from a full contract with all of its characteristics to a single ad in a single monthly bill. The ad placement index is measured by the commission or fee collected for the ad. Monthly price estimation of a non-repeated service and a service with detailed inputs required a new approach to repricing mechanics.
Accounting, auditing, and bookkeeping services	Single service transactions Multiple service transactions	The output of this industry is the provision of financial information and the proper documentation necessary for a particular business activity. Tax services are included as primary activity in this industry. The index measures the fees for all individuals and the time (chargeable hours) these individuals spend on the service. In an annual retainer relationship, estimation of a one-month bill is used for monthly repricing.

Title	Major Service Categories	Output Definition and Pricing Methodology
Radio broadcasting	Local station time sales Network time sales	The output of this industry is a radio broadcast signal and the access to an audience. The index measures the sale price of radio air time for the purpose of advertising either on a local radio broadcast station or a national or regional network. Package plan sales of various different air time combinations present problems for constant quality indexes.
Real estate agents and managers	Real estate brokerage Property management Real estate appraising Real estate consulting Other real estate services	The output of this industry is the buying, selling, leasing, managing, and appraising of both residential and nonresidential properties for others. The index measures the commission or fees for the performance of each activity. For the first two activities, the price is the commission rate multiplied by the property's sale price. Finding a reliable method to estimate a property's sale price on a monthly basis presented a challenge.
Legal services	Corporate Real estate Civil negligence Insurance Wills, estate planning, and probate Tax	The output of this industry is the legal advice or services provided to a client by a firm headed by a member of the bar. These services are most often performed in accordance with a written agreement between the two parties. The index measures flat fees and contingency fees (based on a fixed service in the base period). For percentage fee contracts, the value of the service is escalated by a national inflator and the fee is allowed to fluctuate with market conditions. Where services are contracted for on an annual retainer basis, a method of component price estimation was used.

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Title	Major Service Categories	Output Definition and Pricing Methodology
<p>Prepackaged software</p> <p>Data processing services</p>	<p>Applications software Computer games and other prepackaged software Maintenance, documentation, training, and other software services</p> <p>Transaction processing services Timesharing services Data entry services Other data processing services</p>	<p>The output of this industry is the design, development, marketing, and production of prepackaged computer software. Important products of this industry include operating, utility, and applications programs. The index measures the price for a software license (single or multi-license) or the cost of maintenance, training, and other software services. With each prepackaged computer software program, a license is sold that gives the user the "right to use" the software. The software product (lines of code that make up the computer program) is not actually sold; only the license to use the software is sold. Software updates/upgrades pose unique quality adjustment issues in this industry.</p> <p>The output of this industry is the provision of electronic data processing services, including data entry, claims processing, payroll processing, data center management, and the provision of electronic data exchange by rental of excess computer capacities. For transaction processing and data entry tasks, the indexes measure the price per transaction or by the number of transactions processed. The index for the rental of computer timesharing measures the price for the amount of computer time used.</p>
<p>Skilled and intermediate care facilities (Nursing home care)</p>	<p>Public payors Private payors</p>	<p>The output of this industry is all care and services provided by the nursing home or personal care facility to an individual resident either on a continuous or non continuous basis. These services include medical care (acute and incidental), the costs of meals, and other "convenience items". The output is typically represented by the monthly bill for a resident (interim billing) or a resident's stay, if that stay is less than a month (total billing). The index measures the per diem reimbursement for the specific level of care that the payors collected. The existence of different pricing arrangements, such as per diem prospective payment rates, precluded viewing outputs as unique unbundled services.</p>

