A Methodological Overview of U.S. Producer Price Indexes for Services

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In 1992, service producing industries accounted for slightly over 75 percent of the Gross Domestic Product of the United States economy. These industries accounted for almost 79 percent of employment. Over time, the percentages have grown steadily. As a result of this growing importance, it is essential that price movement for service industries be accounted for in the Producer Price Index (PPI), which measures price change for the output of the U.S. domestic market economy. However, due to the unique characteristics of service industries, many conceptual and operational challenges have been associated with this undertaking.

The major conceptual problems in developing producer price indexes for services are defining: 1. the unique outputs of the industry, and 2. an operational methodology for accomplishing monthly repricing while maintaining constant quality for the priced service. To define a unique output, it is necessary to understand what is being transacted between the service provider and the customer. In defining a repriceable entity, it is necessary to determine how the price movement for the specific service can be captured. It is also necessary to develop a way for the respondent to provide, or at least estimate, price change from month to month on defined services which are often not exactly repeated. In addition, a major operational problem is to develop appropriate lists of establishments from which to select a sample efficiently. Finally, government regulation/deregulation adds additional challenges in the transportation and communication sectors.

This paper reviews some of the major methodological difficulties encountered in the development of Producer Price Indexes for services in the U.S. economy and provides examples of how they were resolved. Part I discusses the fundamental challenges of identifying the unique output(s) of a service industry and defining an operationally feasible methodology for collecting pure (constant quality) output price change over time. Part II describes other service sector pricing problems encountered, including the difficulty of capturing discounts. Part III summarizes the specific lessons learned during service sector pricing for the PPI. The appendix lists the specific service industries for which Producer Price Indexes are currently published, are currently being developed, and those scheduled for development.

Exhibit 1. Output definition and pricing methodology for selected service industries included in the PPI

SIC	Title	Major Service Categories	Output Definition and Pricing Methodology
4213	Trucking, except local	Agricultural trucking Household goods carriage General freight Other trucking Leasing of truck with driver	The output of the long distance trucking industry is the inter-city movement of freight on trucks and tractor - trailers provided by a motor carrier. Output is measured by pricing the total freight hauled per truck or tractor -trailer, or by pricing the individual freight shipments hauled. Since costs vary by size of shipment, using a "per shipment" unit better reflects true price change based on producer costs. We estimate a current price for the service identified at initiation.
4215	Courier services, except air	Local courier services Non-local courier services	The output of this industry is the door-to-door delivery of individually addressed letters, parcels, and packages generally under 100 pounds, except by air. Output is measured by pricing the individual rate per unit delivered. The rates are based primarily on weight and destination. Delivery is separated from all other charges, especially pick-up charges, due to unit of measure problems.
4512	Air transportation, scheduled	Scheduled air cargo transportation Scheduled air passenger transportation	The output of this industry is the furnishing of air transportation of passengers and cargo over regular routes and on regular schedules. Output is measured by the price paid by an individual passenger for a specific level of service (first class, coach etc.) and a specific origin and destination. Constant shifts in transaction terms due to competitive pressures require frequent quality adjustments.
4581	Airports, flying fields, and airport terminal services	Services provided by airports, including lease space for concessions; services rendered to air and cargo carriers Airplane services, including fueling services; maintenance and repair services; and hangar and tie-down services	The output of this industry is the operation and maintenance of airports including providing space to airlines and concessionaires, and servicing, repairing, maintaining, and storing aircraft. In the case of airport operation, output can be measured by rent collected for the airport space and maintenance of the terminal and runway. In the airplane service sector, fees, often tied to the volume of traffic, serve as service measures of the output. Monthly repricing involves following specific contracts between the airport and and the airline or concessionaire.

SIC	Title	Major Service Categories	Output Definition and Pricing Methodology
4813	Telephone communications, except radiotelephone	Local service, except private lines Public switched toll service Private line service Other telephone services	The output of the industry is the provision of telephone voice and data communications services. The output, "calls" (line minutes) and access to a communications network, is measured by recurring charges and usage fees. Monthly repricing involves either re-estimating an actual bill holding all calling characteristics constant or collecting revenue data for all transactions for a narrowly defined service. Frozen specification pricing is very costly for the reporter; universe pricing introduces product mix problems.
4832	Radio broadcasting stations	Local station time sales Network time sales	The output of this industry is a radio broadcast signal and the access to an audience. The output is measured by the sale 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 times present problems for constant quality indexes.
4841	Cable and other pay television services	Subscriber services Advertising Network affiliate services	The output of this industry is the provision of the cable signal that enables the dissemination of visual and textual television programs. The output is measured by the sale of subscriber services and advertising. Promotional pricing and bundling of services constrain industry output definitions.
6512	Operators of nonresidential buildings	Retail property operation (rents) Office property operation (rents) Industrial property operation (rents) Auditorium and theater property operation (rents) Piers, docks and associated buildings and facilities operation (rents) Other nonresidential property operation (rents)	The output of this industry is the service that operators of nonresidential buildings provide to tenants. This includes the space provided to tenants by owners and the management of the rented space (which could include physical upkeep, maintenance of common areas, provision of utilities , and any other services necessary to keep a rented property in operation). The output is measured by the average gross rent per occupied square foot. Respondent confidentiality concerns prevented using a unique leasing agreement as the unique output. By repricing the entire building, we were able to overcome confidentiality concerns about divulging proprietary leasing information.

SIC	Title	Major Service Categories	Output Definition and Pricing Methodology
6531	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 output is measured by the commission or fees for the performance of each activity. 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.
7011	Hotels and motels	Guestroom rental Food and nonalcoholic beverages Other guest services	The output of the industry is the provision of lodging or lodging and meals for the general public. Output is measured by the charges for the unbundled transaction (e.g. lodging charges separate from parking, meals, etc.).
7311	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. Ad creation output is measured by the price of production ranging from a full contract with all of its characteristics to a single ad in a single monthly bill. Ad placement 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.
7349	Building cleaning and maintenance services, not elsewhere classified	Janitorial/custodial services Other building cleaning and maintenance services	The output of this industry is the provision of cleaning and maintenance services for buildings (including services such as janitorial/custodial services, maid/housekeeping services, window cleaning services, and chimney cleaning). The output is measured by the price of a contract for all activities performed, a bundled service. This precludes identifying detailed service lines for publication.

SIC	Title	Major Service Categories	Output Definition and Pricing Methodology
7363	Help supply services	Temporary help supply services Employee leasing services Other help supply services, except temporary	The output of the industry is the supply of temporary or continuing help on a contract or fee basis. The help is always on the payroll of the supplying establishment, but is under the supervision of the business to which it is furnished. Output is measured by the total charge for the time that temporary help is employed including the gross pay, administrative fee, and any additional charges (e.g. social security, insurance, etc.). This involves a constant quality employee cost pricing methodology - bringing wage survey methodologies into play.
8011	Offices and clinics of doctors of medicine	Medicare treatments Non-Medicare treatments for one and two physician practices and single specialty group practices Multispecialty group practices	The outputs of the industry are medical treatments provided by establishments of licensed practitioners having the degree of M.D. classified by the stated specialty of the practice. Specific procedures are general to many treatments. The creation of useful aggregate service lines causes us to focus on the practice specialty. The output is measured by the services included on a single bill. The bill represents one or more office visits, diagnoses, or procedures, especially in the case of surgery.
8062	General medical and surgical hospitals	Medicare inpatient treatments Medicaid inpatient treatments All other inpatients Medicare outpatient treatments Medicaid outpatient treatments All other outpatients	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 output is represented by the total charges that appear on a patient's bill. The output is measured by the estimated expected reimbursement for the service and payers originally collected in the base period. Different pricing arrangements such as a prospective payment case rate system, precluded viewing outputs as unique unbundled services.

SIC	Title	Major Service Categories	Output Definition and Pricing Methodology
8111	Legal services	Corporate Real estate Civil negligence Insurance Wills, estate planning, and probate Tax Other legal services	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 output is measured by the 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.
8711	Engineering services	Building related engineering services Nonbuilding related engineering services	The output of this industry is the professional engineering services including the design, analysis, and consulting services that pertain to the development of building and nonbuilding related projects. Service providers in this industry must be state certified. The output is measured by a contract between a client and a designer in combination with internal data used to calculate a fixed price, or a contract in combination with a representative, subsampled billing invoice in cases where a fee is not predetermined. We estimate a current price for the service identified at initiation.
8712	Architectural services	Residential dwelling related architecture Commercial building related architecture Public/Institutional facility related architecture Other architectural services	The output of this industry is the professional architectural services including the design , analysis, and consulting services provided in the development of building related projects. Service providers in this industry must be state certified. The output of this industry is measured in the same manner as Engineering services.
8721	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 output of this industry is measured by the fees for all individuals and the time (chargeable hours) each individual spends on the service. In an annual retainer relationship, estimation of a one - month bill for monthly repricing was used.

I. Fundamental Challenges of Service Sector Pricing

Exhibit 1 presents the output definitions and pricing methodologies for selected service industries included in the PPI. The following two sections discuss the main challenges encountered in their development. In the case of output definition, the issue is whether or not to unbundle the many distinct services and products often included in a bill from a service provided to a customer. In the case of pricing methodologies, the challenge is to develop a fixed service specification for monthly pricing. This task is difficult because a service provider's outputs typically vary from transaction to transaction based on the needs and requirements of the customer.

Defining the Unique Output

Defining the unique output in service industries is usually not straightforward and is often extremely difficult. The most difficult aspect of defining the unique output relates to when to bundle and when to unbundle services. Bundling refers to aggregating separate line items on the customer's bill to define a unique service. Unbundling involves recognizing that a bill contains more than one unique service, and selecting a single line item from a multiple line item bill as the unique service. The decision to measure a bundled or an unbundled service depends on two important factors - the method by which the service is delivered and the ability of the respondent to reprice the service on a monthly basis over the life of the sample. Whether or not a respondent is able to reprice a service often depends on discovering and implementing a methodology that defines a constant quantity and constant quality service. Although defining the unique output and assuring the measurement of a constant quality service is a challenge in virtually all service industries, we have picked a few specific industries to illustrate the difficulties we have experienced thus far.

As can be seen in Exhibit 1, the unique output in the General Medical and Surgical Hospitals industry is the medical services provided to patients by hospitals. These services are not delivered in a piecemeal fashion. A hospital visit entails diagnostic services, nursing services, medical supplies, drugs, and the list goes on. These services are linked to one another. For example, a patient would never have a bill just for operating room (OR) time. That bill must include, at the very least, surgical supplies, charges for OR equipment, recovery room charges, and charges for anesthesia. It follows that the service provided, according to the PPI definition, covers all services provided by the hospital for a patient's entire stay, from admission to discharge.

Conveniently, the hospital industry has a system already in place that classifies inpatients according to the bundle of services they receive in a hospital visit. A patient is assigned a Diagnosis Related Group (DRG) code based on his or her illness. DRGs are codes that identify illnesses requiring similar treatment resources. The Prospective Payment System enacted by the U. S. Congress in 1983, requires that Medicare, the Federal government program of health insurance which covers most of the elderly population, reimburse hospitals a fixed fee based on which DRG the patient is assigned. DRGs are now used by

virtually every hospital in the U.S. to classify all of their inpatients, not just Medicare inpatients. The PPI took advantage of this by using the DRG to define our repriceable output in this industry. There are currently 495 DRGs in the Medicare Prospective Payment System. We felt this was too large a number both for the hospitals to perform the first step of disaggregation (a process used to randomly select a unique repriceable item), and for the PPI to capture and reprice. A database which contained national DRG frequencies was obtained and combined with reimbursement rates per DRG published in the Federal Register to estimate DRG expenditures. We used this information to randomly select the DRGs for collection using selection probabilities proportional to total expenditures from all payor sources in each DRG. 189 DRGs were given a chance of selection in each hospital. We then created a data collection form that we called a Quote Assignment Sheet. This sheet listed the randomly selected DRGs to be initiated at each hospital. This method of preselecting DRGs avoids a lengthy disaggregation process, thus reducing the burden on the respondent. We selected anywhere from 6 to 10 DRG's per sampled hospital.

Each respondent was asked to report on a single representative patient bill for each of the randomly selected DRGs. A bill was chosen as the vehicle to measure a hospital price because billed charges represent the bundle of services provided to a patient during his or her visit. Even charges that are built into the hospital room rate, such as nursing services and patient food service, were captured. We specifically did not attempt to include the charges that did not appear on the hospital's bill, such as physician charges that are billed separately, because the revenue from these activities does not belong in this industry. In this particular example, collecting a bundled service, a patient bill, provided assurance that the data we collected actually belonged in this industry.

In the hospitals case, the unique output is a bundle of services because that is how the services are delivered and also because the "bundle" is repriceable by the hospital on a monthly basis. In contrast, the Hotels and Motels industry illustrates the case of unbundling a bill into multiple services. In hotels and motels, the unique output is the provision of lodging or lodging and meals for the general public. There are a number of services involved in a stay at a hotel or motel. The provision of space for lodging, the provision of meals, and telephone services are all common in this industry. There are several reasons to price these services separately, the most important of which is the fact that they are not linked in a contingent fashion. Meals can be provided without lodging, and you do not have to avail yourself of the laundry service just because you are renting a room. In addition, the set of inputs and service production costs for each of these activities is markedly different, which led the PPI to conclude that these services are not similar. These methodological justifications for measuring unbundled services in this industry were reinforced by the fact that they are also easily separable on a hotel bill.

In some instances, services may appear to be bundled or combined, but upon closer examination are found to be based on different units of measure. An attempt to reprice such a bundled service would result in an inflated implicit weight for the service whose

unit of measure is overstated. An example of this problem appears in the Courier Services, Except Air industry.

The primary output for this industry is the door-to-door delivery of individually addressed letters, parcels, and packages generally under 100 pounds, which are not transported by air. In addition to this primary output, an ancillary output is package pickup. It is common for a surcharge to be levied for pick-up without regard to the number of packages to be handled in one pick up. For some large commercial customers hundreds of items are picked up at one time with a single nominal pick-up charge levied. In this industry, many respondents chose to reprice specified rates for a particular type of service. These rates are based principally on weight and destination. As a result, for the major service, delivery, the unit of measure was a single letter, parcel, etc., to which this rate applies. This would be an adequate method to capture price change in the delivery service. Problems would however arise, if , for each delivery service, which is based on a unit of measure of a single parcel, a pick-up charge were also included. This method would likely overstate price movement related to pick-up charges compared to that of delivery charges by exaggerating the implicit weight of the pick-up charge. In order to avoid this, it was necessary to collect separate prices for delivery services and pick-up charges and to reprice these as separate entities, while appropriately weighting each service as a percent of the company's business.

In this example, an understanding of the unit of measure for each service, dictated controlling for unit of measure problems. This in turn, resolved the question of bundling or unbundling the pick-up charge.

Defining a Constant Quality Pricing Methodology

Historically, one of the most difficult problems in price index methodology has been measuring the long term price trends of goods which undergo changes in quality characteristics. For service industries, where the service transaction rendered each month is constantly changing, the problem of repricing a service of constant quality became an exercise in innovation.

The major challenge in trying to maintain a constant quality service is to initially establish what the output of an establishment is and then to create a pricing mechanism that will capture pure price change on a month to month basis. In defining a repriceable entity it is necessary to determine how a respondent can provide a price, or at least estimate a price, for a service which may never be repeated in the same way in which it was originally performed. Two industries which required similar approaches to the constant quality problem were Advertising Agencies, and Accounting, Auditing and Bookkeeping Services.

In the Advertising Agency industry, each time a client selects an agency and a specific type of advertisement, the service to be provided will be customized. Many variables make up the broad service of creating the advertisement and then placing it in the media. Each

advertisement can be considered to be produced specifically for each given buyer. In order to reprice a constant quality service two approaches are possible.

First, a set contract to deliver an advertising service could be evaluated each month as if it were being negotiated for the first time. This is essentially an estimated price because the reporting agency may not experience exactly recurring transactions each month. The reporter would estimate the price that the agency would receive for a contract exactly like the selected item. In this case the agency's average discount rates may be key to getting good net transaction price data.

The second approach asks the reporter to monitor an ongoing contract and to report price changes as they occur. Because the reporter is monitoring an ongoing contract throughout its lifetime, this is a net transaction price. Here, an average discount may not be explicitly stated but may be reflected in the negotiated price reported. Price change would be captured through the contract's built-in escalation mechanism or through contract renegotiation. Therefore, this approach makes sense when long term contracts (one year or more) are selected.

The above procedures allow for the collection and repricing of the service on an ongoing basis. If these procedures had not been developed, it would be prohibitively difficult for respondents to provide information to adjust for changes in contracts where the quantity and type of service delivered varied from month to month. The procedures above guarantee a repriceable monthly service which requires no adjustments due to quality change. The service is held constant unless replaced by a new repriceable item.

In either of the above cases, it may still be difficult for the respondent to reprice a full contract. For both ad creation and ad placement, the ideal transaction is the full contract with all of its characteristics. Some of the characteristics of ad creation include the number of hours and the billing rate of in-house services rendered such as account management, creative services, and media services, and the markup on outside services hired. However, respondents were expected to be reluctant to reprice a complete contract, due to the myriad repricing factors involved. Therefore fallback procedures were developed. The preferred fallbacks are the ones that include a larger part of the total service rendered. For example, in the case of ad creation, the four fallbacks allowed, in their preferred order, were:

1. A group of similar ads with all characteristics. This is the fallback which most closely approaches the full contract and may actually be easier to provide than just a single ad.
2. A group of similar ads in a single monthly bill, where both the month and year are specified. This monthly bill may only indicate a portion of the total services that were used to create the entire group of ads.
3. One ad with all of its characteristics. This is for the creation of one particular ad.
4. One ad in a single monthly bill, where both the month and year are specified. This bill may only indicate a portion of the total services that were used to create the single ad.

In the case where the fallback is for a monthly bill, the service must have been rendered that month. It must not be the monthly prorated part of a larger entity. In addition an important requirement of the above fallbacks is that, in each case, the respondent is actually performing that part of the service they are reporting. Thus, the respondent is providing an estimate which is based on real knowledge of what the service is and its current price.

A similar approach was undertaken for the Accounting, Auditing, and Bookkeeping industry. In this industry the primary output is the provision of financial information and the proper documentation necessary for a particular business activity. Thus, the unit of measure must be the entire service provided by the accounting firm to the client, not simply the hourly rate of the accountant providing the service. Measured will be the fees for all individuals and the time (chargeable hours) each individual spends on the service, and the prices of any other miscellaneous inputs. The ideal method of pricing would be to collect an observed price for the total bundle of services identified in the engagement (contract). However, exactly repeated service bundles are expected to be unusual.

In order to reprice a constant quality service, there are two approaches for price reporting. In the first, an engagement letter, the contract for services, would be evaluated each month as if it were being negotiated for the first time. This is essentially an estimated net transaction price because the reporting firm may not experience exactly recurring transactions in each index period. The reporter would estimate the revenue their firm would receive for an engagement exactly like the selected item. In this case the reporting firm's realization rate (average discount) is key to getting good price data.

The second approach asks the reporter to monitor an ongoing contract and report price changes as they occur. Because the reporter is monitoring a live engagement (contract) throughout its lifetime, this is a net transaction price. In this case, explicit knowledge of an average discount may not be necessary because the actual price data for the transaction should be available. Price change would be captured through the engagement's built in escalation mechanism or through engagement renegotiation. Therefore, this approach makes the most sense when long-term engagements are selected.

In some cases a total price for the engagement cannot be obtained. In these instances, our procedures call for an engagement's billing invoice covering a single month to be used. Only the subset of services provided in the selected billing period would be repriced. However, the entire engagement is described in case details of the entire contract affect how the subset of services is billed each month.

II. Other Challenges of Service Sector Pricing

A number of other problems have been encountered in PPI service sector pricing. These are discussed below.

Collecting Net Transaction Price Data

One of the main goals of the PPI is to collect net transaction prices. Only actual transaction prices reflect true price movement in the economy. As a result, the PPI always attempts to collect all discounts which may be available in the marketplace. The challenges associated with collecting net transaction price data grew with the PPI service sector expansion.

Unless new procedures were developed or new approaches were taken to capture discounts, respondents would in many cases be unable, although not necessarily unwilling, to report net transaction prices. An excellent example of how an appropriate definition of the repricing entity allowed the collection of net transaction prices occurred in the Operators of Nonresidential Buildings industry.

The service that owners provide to tenants in this industry is twofold. First, owners provide space for tenants. This space can vary in size and function depending upon the needs of the tenant. Secondly, owners provide some degree of management of the rented space. This may consist of the physical upkeep of the rented space, maintenance of the common areas, provision of utilities and any other services necessary to keep a rented property in operation.

As an incentive to get a customer to sign a lease, concessions such as free rent may be given for a period of time. Since this is a discount, the PPI should reflect it. However, it was necessary to define a repricing entity which could reflect free rent or other concessionary incentives as well as other price movement, for example the price paid by existing tenants. Since free rent is essentially a zero price for certain individually leased space, a special method had to be developed to reflect these types of discounts.

The method developed to capture all rents, operating expenses and all concessions ,such as free rent, was to collect an average price for all leases in an entire building. This price measures what tenants in a particular building pay, on average, for their rented space. The type of price that was collected for retail, office, and industrial buildings was an average gross rent per occupied square foot covered by a lease. Specifically,

$$\text{Average gross rent per occupied square foot} = \frac{\text{total rent revenue (gross rent + operating expenses - concessions)}}{\text{total occupied square footage in the building}}$$

Where:

Gross rent includes all fixed base rents, percentage rents (rents paid by retail tenants based on percent of gross sales), storage rents, parking garage rents (if not operating the garage), and all escalations (adjustments made to base rents due to escalators).

Operating expenses includes all operating expenses that tenants pay separately to the building owner that are not included in the base rent, including utilities, taxes, insurance, routine maintenance and repairs, and common area expenses.

Concessions include inducements to tenants that directly or indirectly lower actual rent. They are often offered when owners are prohibited from lowering rents due to the terms and conditions of a mortgage loan. Some common concessions include: signing bonus, moving allowances, lease buy-outs, tenant improvements, and free rent.

The advantage of repricing the entire building is that it allows all types of price movement in the industry to be captured in an operationally easy yet comprehensive way. An attempt to reprice individual leases, on the other hand, may have lead to an index dominated by existing leases which could not correctly reflect many types of concessions, and therefore would not reflect true transaction prices.

Frame Source and Sample Design

The universe of establishments in service industries is often very large. Service providers also tend to have relatively high birth and death rates. Often in service industries, employment (the traditional measure of size in the PPI) is not the only indicator required to stratify a sample. Also, the size of an establishment may not be price determining at all. All of these factors and issues create a significant challenge when choosing a frame and designing a sample for service industries.

Some of the challenges listed above were experienced in the Offices and Clinics of Doctors of Medicine industry. This industry, according to the Census of Service Industries, has almost 200,000 establishments. Because there are so many physician establishments in the U.S., the search to find an adequate frame that was also affordable was difficult. Our interest in finding an alternative frame to our administrative file was two-fold. First, we determined that the most useful service line publication structure was by single specialty versus multispecialty practices. Within single specialty practice, we wanted to publish by major specialty - internal medicine, psychiatry, surgery, etc. Second, sampling efficiency was of great concern given the huge frame size. We needed a frame that would permit stratification by specialty.

The main tool that was used to determine the most representative service line publication structure was a statistical analysis examining variables to be used as revenue proxies. According to this analysis, specialty type variables were found to have the greatest degree

of correlation to revenue. Using these results, we developed weights that were not only used as the basis for the cell weighting of our publication structure, but also to weight our sampled strata. Prior to obtaining this statistical tool, we had determined that payor type and number of physicians in each practice were price determining variables that were the most important for publication purposes. Ultimately, we incorporated all of these variables in our publication structure which is organized first by type of payor, then by number of physicians in the practice, and then, most specifically, by type of service (specialty type).

After the publication structure had been determined, we were required to create a sample design which insured data capture for all physician specialty types. First, in order to represent all establishments in this industry, two frames were used. One frame included establishments with one and two physician practices (these are considered to be the same type of practice) while the other frame included group practices with more than two physicians. They both included a field for the number of physicians in each practice (the variable used to approximate revenue) and a field for the current specialty of the physician (to be used as a sample stratification variable in the sample design explained below). These frames were both very expensive to purchase in their entirety so we purchased a randomly selected portion of each frame. This "portion" of the industry was still over 75 times larger than our final sample allocation. We ultimately selected our final sample from their larger sample. Because we are required by law to protect the confidentiality of those included in our index, we could not allow our final sample to be directly chosen by a source outside the Bureau of Labor Statistics.

The frame that included physician practices with either one or two physicians was explicitly stratified into the nine single specialty categories broken out in the publication goals. An extra stratum was also formed to include those physician records in the frame where no primary specialty was given. Sample units were then selected using equal probability of selection, because each record represented one physician, from each stratum.

For the frame that included group practices, explicit stratification was used to create nine single specialty categories and one multispecialty category. As with the other frame, an extra stratum was created to include all those group practices where no **primary** specialty was listed. Additionally, one stratum was formed for records where there was **no** indication of whether a practice was single or multispecialty. The sample units drawn from this frame were given a probability of selection proportional to the number of physicians in each group practice within each of the 12 strata. For records with either a zero or a blank in the field for "number of physicians", a one was substituted to give these units a chance of selection.

Reporter burden also had to be considered in the sample design. The rationale used in this industry was that there would likely be fewer total employees the smaller the number of physicians in a practice. The type of practice was also considered in some cases (e.g. surgeons tend to have very few employees in their practice while an obstetrical practice

may have many). Therefore, we assigned most establishments only four different services (quotes) to be repriced every month. The number of quotes assigned generally increased with the number of physicians in the practice.

A second example of creative sample design to insure proper representation of all segments of the target population is from the Operators of Nonresidential Buildings industry. New buildings or totally renovated buildings generally are leased at a substantial premium over previously occupied space. As such, they represent a special sector of the market that should be adequately represented in the index. Underrepresentation of this sector could seriously bias the index.

The PPI solved this challenge by first asking each respondent whether they are currently leasing out any nonresidential buildings that have been either built or completely renovated in the last three years. If the respondent answered in the affirmative, one of their (on average) four building leases that we collected was automatically assigned to a "new" building. The lease agreements that we collected for new buildings contained all of the necessary terms needed for repricing such as, square footage leased, buyer type, building name, type of building, etc. We also collected additional information such as the class of the building (there is a widely recognized 3-class rating system) and the location of the building (the city that it's in) to insure accurate and comparable service substitution. Each month we ask the respondent to provide the per square foot lease rate for any new space leased out for the first time, while holding the square footage constant from the base month. We introduce these new building leases into our index only after they are at least 50 percent leased. Once the building is fully rented, we plan to substitute to a new building and again only price newly rented space each month.

Government Deregulation

Historically, transportation and communication industries in the United States have been subject to regulation by the federal government. However, with the passage of the Motor Carrier Act of 1980, a number of major changes took place in the trucking industries. This act liberalized the granting of authorities, removed operating restrictions of existing carriers, and allowed for more flexible pricing. It was presumed that deregulation would increase competition, and produce better quality services, with consumers benefiting from pricing driven by this competition. The challenge of developing an index in this area was to capture the true price trends in an environment which remained quasi-regulated, and which was ostensibly still governed by a tariff system. In addition, as a result of the quasi-regulated environment where published tariffs were available, problems were anticipated in securing net transaction prices.

Under deregulation, if a rate is not a contract price, defined as a negotiated rate contained in a written agreement between the shipper and carrier, the carrier is required to file the rate with the Interstate Commerce Commission (ICC) within seven days to make that rate available to all shippers. It became apparent, as evidenced by a U.S. Supreme Court ruling which allowed bankrupt carriers to collect additional fees, that unauthorized discounting

below the legal tariff rate is a widespread phenomenon. If the BLS were to rely on tariffs alone, it would miss capturing these discounts of rates and instead would have an index based on a fictitious inflated price.

These discounts usually take the form of cumulative volume discounts and additional services not included in the tariff, which are provided at no extra charge. Cumulative volume discounts do not appear on an actual bill-of-lading, but would be based on the total volume of business generated by one shipper over time. Periodically, the common carrier adjusts the discount amount based on the volume to date. To reflect this type of discount at initiation, the respondent is asked to provide the discount rate currently in effect. This is updated in repricing. The respondent is also asked to describe any additional services provided at no extra charge, such as loading or unloading a truck without billing for the added service. Through these procedures, BLS insures that it publishes an index based on the net transaction price, not the official tariff rate.

In addition to identifying the appropriate repricing entity, another facet of the problem was to gain cooperation from the industry for repricing. During pre-survey contacts, carriers claimed that the information requested by BLS would be available from other sources, namely the ICC or Rate Bureaus. (In the long distance trucking industry, there are eight rate bureaus each of which is responsible for monitoring tariff rates originating from its region). In order to gain cooperation it was essential to be able to explain why the information collected by the regulatory agencies was not usable in the survey. Along with the widespread discounting off the tariff rates there were a number of other reasons for direct collection of transaction rates from carriers and not tariff rates from the Rate Bureaus or the ICC. These included:

1. Not all carriers belong to, or file with, one of the Rate Bureaus, but choose to file directly with the ICC.
2. In excess of one trillion tariffs are on file at the ICC, not readily available in an automated format.
3. There are on average 1,000 tariffs revised daily.
4. A portion of the industry, exempt agricultural trucking, is excluded from ICC regulation. Hence no tariffs are filed with the ICC or Rate Bureaus, and
5. The ICC and Rate Bureaus do not require the filing of contract rates. Since deregulation, the number of contract carriers, and therefore the number of contract rates have increased steadily.

Due to the importance of collecting transaction prices in the long distance trucking industry, an in depth post collection study was done. The study examined the collected prices to determine if they were contract or discounted tariff prices, the two desired prices, or non-discounted tariffs which would not reflect true transaction prices. The study found that the prices BLS had collected were nearly all either contract prices or discounted tariffs. The research done on the industry, the design of the collection materials, and the effort made to secure discount and surcharge information all contributed to the successful collection of the long distance trucking industry.

III. Lessons Learned

The key to developing price indexes for service industries is to understand a.) how the service is performed and b.) how the service is priced (as well as billed). This knowledge will tell one how to describe the repricing entity; how to price it monthly; and how to capture relevant discounts. The resulting price index will successfully capture the price movement of the service.

Throughout our experiences in pricing service industries, three general lessons have been learned.

1. Development of service industry price indexes takes time. A thorough study of the industry is necessary to prepare for the unusual collection and pricing strategies that are required to provide our customers (data users) with accurate and representative indexes.

2. Flexibility is required in all facets of service industry pricing methodology. Conventional sampling, collection, and repricing strategies often cannot be applied to service industries.

3. Price estimation is often required for service industries due to the custom and unique nature of most services. In many instances, the exact service is never repeated.

The more specific lessons learned in our quest for coverage of the service sector include the following:

<u>Defining the Unique Output</u>

- The two most important factors in determining whether to bundle or unbundle services are the industry specific pricing policy and the consumer's perception of how the service is delivered.

<u>Defining a Constant Quality Pricing Methodology</u>

- Constant quality is ensured by setting a description which will not change. This can be done by a.) estimating prices for a fixed specification (performed in the past). In this case, the respondent must include estimation of average discounts, or b.) estimating prices for a fixed specification based on current price movement for that specification (long term contracts). In this case actual discounts are reflected by escalation or negotiation.
- For complex services, the fixed specification may be only a part of the relevant service, but this should be as large a part and as representative of the entire service as possible. All aspects of the entire service which may affect the repricing of the part must be specified.
- In all cases, the respondent must have actual knowledge of what the service is and its

current price.

Collecting Net Transaction Prices

- In order to collect net transaction prices it is necessary to ensure that the respondent has a basis on which to report them. For services, this often involves estimating some kind of average discounts in one way or another. In every case, the procedure and reason for doing this must be made clear to the respondent.

Frame Source and Sample Design

- Appropriate frame sources sometimes do not exist for service industries. The frame source that is normally used in the PPI (the Unemployment Insurance file) does not always contain enough information to appropriately and efficiently stratify a service industry.
- Alternate frame sources that provide adequate information for sample design and stratification are often costly and difficult to locate. Sometimes, several frame sources are combined and cross matched to assure a representative universe of establishments.
- The best proxy for establishment revenue (our measure of size) is not always employment.
- Special considerations must be made to insure that respondents do not experience a larger burden than absolutely necessary especially in industries where there are a very large number of possible services performed at each establishment.

Government Deregulation

- Regulatory (set) prices may not reflect actual transaction prices.
- Regulatory agencies may not have access to actual transaction prices.
- Both of the above must be clearly explained to potential respondents in order to gain cooperation in reporting transaction prices.

Appendix

PPI Service Sector Coverage

1. Industries in Publication

SIC	Title
4011	Railroads, line haul operations
4212	Local Trucking without storage
4213	Trucking, except local
4214	Local Trucking with storage
4215	Courier Services, except by air
4221	Farm product warehousing & storage
4222	Refrigerated warehousing & storage
4225	General warehousing & storage
4311	United States Postal Service
4412	Deep sea foreign transportation of freight
4424	Domestic deep sea transportation of freight
4432	Freight transportation on the Great Lakes-St. Lawrence Seaway
4449	Water transportation of freight, N.E.C.
4491	Marine cargo handling
4492	Tugging and towing services
4512	Air transportation, scheduled
4513	Air courier services
4522	Air transportation, not scheduled
4581	Airports, flying fields, and airport services
4612	Crude petroleum pipelines
4613	Refined petroleum pipelines
4724	Travel agencies
4731	Freight transportation arrangement
4813	Telephone communications, except radiotelephone
4832	Radio broadcasting
4841	Cable and other pay for television services
7011	Hotels and motels
7311	Advertising Agencies
7349	Building cleaning and maintenance services, N.E.C.
7361	Employment agencies
7363	Help supply services
7513	Truck rental and leasing, without drivers
7514	Passenger car rental, without drivers
8011	Offices and clinics of doctors of medicine
8053	Skilled and intermediate care facilities

8062	General medical and surgical hospitals
8063	Psychiatric hospitals
8069	Specialty hospitals, except psychiatric
8071	Medical laboratories
8721	Accounting, auditing, and bookkeeping

2. Industries in Development

SIC	Title	Publication Date
6512	Nonresidential Building Operators	January 1996
6531	Real Estate Agents and Managers	January 1996
8111	Legal Services	January 1997
8711	Engineering Services	January 1997
8712	Architectural Services	January 1997
8082	Home Health Care Services	January 1997
6311	Life Insurance	January 1998
6331	Fire, Marine and Casualty Insurance	January 1998
7372	Prepackaged software	January 1998

3. Industries Scheduled for Development

SIC	Title	Methodology
4812	Radiotelephone Communications	Direct Pricing
4833	Television Broadcasting Stations	Direct Pricing
50-59	Wholesale & Retail Trades	Direct Pricing
6021	National Commercial Banks	Direct Pricing
6022	State Commercial Banks	Direct Pricing
6035	Federal Savings Institutions	Direct Pricing
6036	Savings Institutions excluding 6035	Direct Pricing
6211	Security Brokers & Dealers	Direct Pricing
6282	Investment Advice	Direct Pricing
6321	Accident & Health Insurance	Direct Pricing
6324	Hospital & Medical Service Plans	Direct Pricing
6411	Insurance Agents & Brokers	Direct Pricing
7359	Equipment Rental & Leasing. N.E.C.	Direct Pricing
7374	Data Processing Preparation	Direct Pricing
7378	Computer Maintenance & Repair	Direct Pricing
7381	Detective & Armored Car Services	Direct Pricing
41	Local Transit	Impute from CPI data
6513	Apartment Building Operators	Impute from CPI data
6514	Dwelling Operators, excluding 6513	Impute from CPI data

72	Personal Services	Impute from CPI data
75	Auto Repair, Service, and Purchasing	Impute from CPI data
7622	Radio and Television Repair Shops	Impute from CPI data
7623	Refrigeration Service and Repair	Impute from CPI data
7832	Motion Picture Theaters	Impute from CPI data
7841	Video Tape Rental	Impute from CPI data
82	Educational Services	Impute from CPI data
8351	Child Day Care Services	Impute from CPI data