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PPI Experience in Formulating Product Lines in the Service Sector

Irwin B. Gerduk
U.S. Bureau of Labor Statistics

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Abstract

The paper presents the approach used in formulating detailed product line indexes for the service sector in the U.S. Producer Price Index. A conceptual framework is described which largely governs the process. An operational definition of the term "service" is discussed along with the output concept and requirements for identifying a unique service. Logical requirements for a classification system and operational constraints, such as reporter burden concerns, are critical factors in formulating detailed product line indexes. The paper concludes with a discussion of the applicability of any proposed classification structure to the economic reality it purports to describe. The approach detailed in the paper could be useful in providing insights into any attempt to create a service sector classification system.

I. Introduction

The U.S. Producer Price Index (PPI) measures average changes in selling prices received by domestic producers for their output. Most of the information used in calculating the PPI is obtained through the systematic sampling of industries. Monthly measures of price change classified by industry form the basis of the program. These indexes reflect the price trends of a constant set of goods and services and represent the total output of the industry. In addition, the PPI attempts to publish a comprehensive set of product line indexes for each industry in an effort to better meet the varied needs of our data users.

Prior to the program expansion into services, which began in the 1980's, the PPI provided measures of price change for the goods producing sectors of the economy. The program relied almost entirely on the Census of Manufactures and the Census of Mineral Industries for product line definitions and weights. Similar information was not available in the various Economic Censuses covering the non-goods producing sectors. Therefore, in order to expand into services, the PPI program was obliged to create its own product line definitions. We also had to secure reliable revenue data for index weighting. This process, conducted for several score service industries to date, has given us some useful insights into the issues involved in creating meaningful product line detail in a supply-based industry classification structure.

This paper will attempt to communicate our experiences and whatever insights we have gained from defining product lines in the service sector. The paper will be divided into five sections. The second section will present a discussion of the principles and concepts peculiar to the strange world of services. The third section will discuss some constraints we faced. The fourth section will enumerate and explain the basic objectives guiding the PPI in its effort to define service sector product lines. The fifth section will discuss other insights we have attained into product line classification in services.

II. The Services Paradigm

A. Define the term "service". While we know that goods and services are conceptually different, a universally accepted definition of the term "service" appears to be elusive. Dr. Erwin Veil [1991] surveyed the literature and reached the following conclusion: "Several endeavors to formulate a general definition have been made, partly based on a single criterion, partly on several ones (services are invisible and intangible, services cannot be stored and transported, services lead to changes in the condition of a person or a good belonging to some economic unit, services are customised, etc.). However, neither a single nor a combination of criteria have yielded operational clear-cut definitions of services, mainly because services are very heterogeneous and are often intertwined with goods and factor services and are provided as a bundle."

We need to posit a working definition to guide us in formulating service sector product lines. However, Dr. Veil's admonition that no single definition will be universally applicable instructs us to search for a generally applicable definition. We consider a service to be a bundle of goods and labor activities provided to a customer to accomplish a given function and the service must be consumed at the time it is provided. Both the provider of the service and the consumer of the

service must agree on the basic goal of the activity. Goods are physical products provided to the customer for future use. Goods are not consumed when purchased and do not involve a labor activity supplied by the producer when ultimately consumed.

The concept of a service as a bundle of labor activities and goods is exemplified for the service of lawn treatment. The function performed is to provide treatment to the lawn such that weeds are killed, destructive insects are killed, and the lawn grows in a healthy manner. Since we are dealing with a service, we would not consider decomposing the service between its labor and materials components when defining product lines for the lawn treatment industry. We cannot separate out the fertilizer sold as a good and the labor to apply it as the service. The fertilizer is a material input to the firm, the worker is the labor input, and the output is the application of fertilizer to the lawn. The goal of the service has been agreed to by the service provider and the customer. Broadly stated the goal is lawn treatment to insure a healthy lawn. Narrowly stated in the sales agreement, it is the specification of a given number of treatments during the growing season of fertilizer, insecticides, and herbicides.

The PPI's goal is to create a price index suitable for deflating nominal output. We look for aggregations of services that form a service bundle. The service bundle is a unitary output with an observable price. Often, the output concept readily leads one to identify a natural service bundle as in the above example. Occasionally, it is difficult to unambiguously identify the unique service bundle and the price associated with it. Clear identification of the Q, or quantity, is essential if we are to discover the appropriate P, or price, associated with it. Broadcasting is an interesting example. The Q is not the broadcasting of programing, but rather it is the broadcasting of commercials. The P is associated with the audience size watching the commercial, its demographic characteristics, and the length of the advertisement.

Two services may appear to be similar when looking at the activities performed, but in fact should be treated as dissimilar if they are serving different goals. Nursing home care appears to be similar to inpatient hospital care (please note that hospital services are provided at market prices in the U.S. and paid for either out-of-pocket by the patient or partially by the patient and partially by third party insurers). Patients are domiciled in the facility, trained staff administer to the patients needs, medications are dispensed under supervision to the patients, and the patients are fed, bathed and provided clean surroundings. However, there is a major difference in the goals of the service between the two industries. Hospital treatment has the goal of returning a patient to good health (or at least to stabilize an acute condition). Nursing home long-term care has the goal of maintaining some quality of life for patients with chronic conditions.

Some care needs to be taken with the degree of specificity of the goal. We could posit "health" as the goal in the above example. As the production functions between nursing homes and hospitals might look quite similar for some conditions, the similarity of goals test would lead us to view these as the same service. But this is too broad a goal to be useful. "Health" is the goal of approximately one-seventh of the U.S. economy. Therefore, the goal must be quite narrowly specified. We would not want to have a single service product line index in the PPI titled "Health" which equaled one-seventh of the weight of the entire PPI index. Generally, the goal can be derived from the service agreement between the service provider and the customer.

B. *Define the industry output concept.* A conceptual framework must be agreed to by all parties before attempting to create a classification system. Without this focus, parties to the process of developing the classification system will work at cross purposes and not comprehend why they are not being understood. As the PPI by definition measures output price change, we needed to find a conceptual system that determined when a net or gross output concept applied. We adopted the Bureau of Economic Analysis' Input/Output concepts. Which output concept is used will make an enormous difference. For retail trade, the distinction could be between the value of sales as the gross output definition and the value of marketing, or margin, as the net output definition. The value of sales is the revenue derived from retail sales to the consumer and the product line is, for example, sales of canned vegetables. The value of marketing is the revenue derived from retail sales to the consumer less the acquisition costs paid to the vendors. The product line is the marketing of products such as canned vegetables. Both revenues and prices will vary greatly depending on which output definition is used, and this will change the definition of product line. Therefore, the first step in setting up a service sector classification system is to agree on the appropriate sectoral framework for defining output.

After researching the appropriate I/O concept, we need to go through the process discussed in *A.* above of identifying the goal of the service and the activity performed. In SIC 4813 Telephone Communications the goal of the service is to furnish telephone voice and data communications. The activity is to transmit voice and data communications between parties. In transportation the activity is to transport by a specific mode, in communications the activity is to transmit by a specific mode, in trades the activity is to market, in personal, business and professional services the activity is specific to the industry (to house for Hotels, to treat for Hospitals). Note that the actual transaction to some extent determines the industry specific output concept. When voice and data transmissions occur separately, they are treated as two separate transactions and, therefore, two separate outputs of the industry. If technology permitted simultaneous voice and data transmittal, this would change the industry outputs to a single combined voice/data transmission output.

A problem is encountered in an industry-based classification system of differentiating between primary services and miscellaneous receipt activity. A miscellaneous receipt is an output activity that generates revenue but should not be considered primary to the industry. Should receipts for providing garage services be considered primary in the hotel industry? Should receipts for laboratory work done on premises for other physicians be considered primary for the doctors of medicine industry? Should a miscellaneous receipt activity follow the I/O concept associated with the SIC it would be classified in? (If a beauty parlor, a personal services sector industry valued in the I/O at value of sales, also sells cosmetics to customers, should a margin price or a sales price apply to the cosmetics transaction, which appears to be a retail trade activity?). We have used a "usual and customary" criteria to determine what is "primary" versus what is a "miscellaneous receipt". Also, we apply the I/O concept to the specific transaction and not to the entire output of the industry. A retail trade transaction, as in the cosmetics example, would always be associated with a margin price whether it was primary to a retail trade industry or a miscellaneous receipt activity of a personal services industry.

C. *Identify the unique service.* Before finally tackling the issue of defining what is a service product line, we need to explore the concept of unique service. Intuitively, we feel that a product

line is nothing more than an aggregation of like unique services. This should directly relate to a revenue generating activity as we are defining units of output. The unique service must be definable by its revenue generating characteristics. Therefore, one could reference a bill and that would identify the revenue generating activities of the service provider. This overlooks one minor issue; bills are shorthand documents that do not sufficiently delineate the bundled goods and labor that entered into the billing notation. Research is necessary to properly define the service behind the billing entry. It is only after completing this in-depth industry research that we can determine the discrete revenue-generating activities of the industry.

SIC 806 Hospitals provides an example of the problem of how to bound the bundle of goods and activities to identify unique services. The billing entry for a patient spending three days in a semi-private room on the medical ward would read "Semi-private room - $1500.00". This seems little different than the room rental service provided by a hotel. However, further research indicates that the following services are bundled in the semi-private room billing entry: 24-hour nursing care, meals, and health aide assistance. The services provided in reality are part of the overall treatment path designed to restore the patient to health. It is a component of the actual service of treatment for any given medical condition.

The above example is a bit complicated because it discusses bundling as an issue when interpreting a line item on a bill and it introduces the notion of bundling to define the actual service. Simply put, there is no reason to assume that a line item on a bill identifies a distinct service. In the above case, the line item for semi-private room identified a component of the service. Other activities provided need to be included to define a complete service (you would not define the output of SIC 3711 Motor Vehicles and Passenger Car Bodies as being a car less air conditioning, tires, seat upholstery, and all the other options billed separately from the base vehicle). Earlier we determined that the service is defined by the goal of the process where both the service provider and customer have agreed. Thus, treatment for a given medical condition is the goal in the Hospitals industry. Therefore, we must include any surgery, medications, X-rays, therapy, etc. in the service.

Another example of needing to know how to define the appropriate bundle that is the unique service involves repair. In certain communications sector industries repair is a separate revenue-generating activity. Wiring repair inside a customer's premises is a billable activity for SIC 4813 Telephone Communications. In SIC 4841 Cable Television repair work is not billed separately. The monthly fee for subscriber services includes any repair work as bundled in the service. We need to know when to treat repair as a bundled activity that is part of the unique service and when to treat it as a unique service. In the SIC 4813 case most of the repair work (line repairs everywhere but inside a customer's premises) is not billed separately, but is a implicitly covered by the monthly service charge for residential local service. We need to guarantee that we only survey for revenue-generating activities and do not attempt to get a separate dollar estimate for an activity that is already included in the bundle for the unique service.

Our ability to secure a proper market price for the activity is an indication that we are in fact surveying separate revenue-generating activities. Were we to attempt to price nursing services in SIC 806 Hospitals, we would soon discover that a market price did not exist for this activity. Nursing services are bundled with other goods and services, such as room and board and

medications, and are not separately priced. Our paper on Property and Casualty Insurance, to be presented later in this session, is an example of where our inability to find a market price that met our definition of output caused us to rethink the output definition. The U.S. Bureau of Economic Analysis defined the output as premiums less claims. Our inability to formulate a pricing methodology for this output definition led us ultimately to question whether this was the correct definition of industry output. Once we derived an alternative output definition, where output equals premiums plus rate of return on invested portion of premium, we had no difficulty in formulating an operational pricing methodology. This issue is discussed in length in Sherwood's paper "Output of the Property and Casualty Insurance Industry" (Sherwood 1997).

I. Constraints on the Process

The process of defining a product line structure is heavily conditioned by the following three constraints:

A. *Data user needs.* The classification activity must meet the test of passing muster with the real experts – the sophisticated data users. Often it is the industry that has the best insight into which alternative is best for defining product lines. In SIC 5411 Grocery Stores the industry had little interest in our publishing by marketing of a given category of product, such as produce or meats and fish. They were interested in distinguishing supermarkets from other types of retail food stores and then publishing by geographic region. In SIC 8011 Offices and Clinics of Doctors of Medicine the industry had no interest in our publishing by type of illness/treatment (circulatory system problems vs. respiratory system problems). Instead, they wanted us to publish by specialty of the practice (internal medicine vs. psychiatric practice). While we may consider the prescribing of a drug such as Prozac the same service whether performed by an internist or psychiatrist, the industry viewed that as two different services.

B. *Availability of revenue for weighting.* Since each product line represents an index that will be aggregated into a higher level structure, we are concerned with securing accurate revenue weights to support the publication structure. Often, the availability of such weights is indicative of the meaningfulness of the proposed publication structure from a user perspective as it relates to their categorization of their outputs and how they structure their records.

C. *Publishability.* The PPI is constrained by available resources. The sampling approach allows for considerable efficiencies, but has limitations as well. The lack of frame data identifying producers by product line, relatively small sample sizes, and our probability-proportionate-to-size sampling method preclude our including low revenue product lines in our publication structure. Reporter burden is another major limiting factor. Data needs to support a detailed product line structure with monthly company data submissions generally far exceed company ability to cooperate at that level. To insure very detailed coverage in concentrated industries, we would need major producers to report scores or even hundreds of items to us monthly. Therefore, we are forced to adopt a less detailed structure than would result from a strict adherence to the product line concept because of reporter burden and sample size (cost) considerations.

I. Objectives of the Classification System

An industry index publication structure is a list of product lines and aggregations for which indexes will be calculated and published. The process of developing a publication structure involves considering five separate objectives and attempting to find a solution that optimizes them. A product line should be an economically meaningful concept referring to the lowest level aggregation of services in a classification structure. The following objectives assist in defining product lines:

1. Logical rules – Product lines must be defined to be mutually exclusive of each other. The sum of the product lines defined in an industry must equal the entire output of the industry. There must be no product produced in the industry which is not properly classifiable into one of the product lines in the structure. Product lines must aggregate in strict conformance to the hierarchical structure.
2. Industry terminology – Product line titles must be understood by data users and conform to accepted usage. The title should communicate the range of services included in the product line. The title should discourage users from misusing or misinterpreting the data in the product line.
3. Durability – The product line definition should be viable for many years, thus allowing for time series analysis. The definition should accommodate the evolutionary change of products and services.
4. Economic significance – The product line should reflect a significant share of industry revenue; the smaller the industry, the larger the revenue share should be.
5. Product line homogeneity – Ideally, the product line definition would be homogeneous in conformance with the applicable primary classification concept. In an industry based system that would mean that services included in the product line would be more alike in inputs and output uses than services found in other product lines.

I. Other Insights

The PPI Program learned two important lessons as it endeavored to create product line and higher level aggregate indexes in the service sector. It would seem that both process insights would pertain to the creation of either a supply-based or demand-based services classification system.

A. *Applying an operational test to any proposed structure.* Extensive research, both academic and in the field, was necessary in guiding us in formulating the product line structure. We discovered that we needed information on product line revenues, industry products and product characteristics, pricing and product line price behavior, and the production process for producing each service in an industry. With the goal of a classification system being to categorize reality in a useful way, the classification system in large part must reflect the actual underlying economic dynamic it purports to describe. In a supply-based structure, the classification system partially models the functionality of the industry.

B. *Defining detailed product line and aggregation structure as an iterative process.* A logical relationship must exist between the product lines and higher level aggregates in a classification structure. This suggests that a pure top-down or bottom-up approach to formulating a classification system most likely will run into difficulties. If the system is to be conceptually based, such as the new North American Industry Classification System, the concept behind "product line" will largely drive the definitional process. Any a priori notions as to the hierarchical structure must ultimately conform to the conceptually-based product line definition.

An example of a conflict between the conceptually-based product line definition and an a priori defined hierarchical structure could be the following. We set the hierarchical structure based on primary material used (wood, steel, plastic, etc.). We set the product line concept based on elasticity of substitution, a reasonable choice in a demand-based classification system. The product line is residential windows. The product line concept virtually requires that we include all residential windows whether primarily made of wood, plastic, or aluminum. This violates our hierarchical structure, which categorizes all wood products together, all plastic products together, etc. It is clear that the hierarchical principle must not violate the product line concept. This suggests an iterative process will be needed to create a consistent classification structure. It also strongly suggests that a piecemeal approach to forming such a classification system can be problematic.

REFERENCES

Veil, Erwin [1991], "Service Classifications in the OECD Area: Problems and Work in Progress", Proceedings of the 1991 International Conference on the Classification Of Ecomonic Activities, Williamsburg, Virginia, November 6-8, 127-149.