

**Should User Value Trump Resource Cost As A Quality Valuation
Method in PPIs And If So Under What Condition(s)?**

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Should User-Value Trump Resource Cost as a Quality Valuation Method in PPIs And If So Under What Conditions?

An old contention has been recently resurrected proposing that user-value or consumer welfare concepts may be the conceptually correct (or at least preferred) approach when estimating values of quality change for output price indexes such as PPIs. Triplett (1983) explicitly addressed this issue long ago in his hedonically oriented paper titled "*Concepts of Quality in Input and Output Price Measures: A Resolution of the User-Value Resource Cost Debate*". As the title implies Triplett believed that the debate was resolved in his paper. Triplett's "resolution", simply stated, is that the production or resource cost approach is the theoretically correct methodology for valuing quality change in an output price index. Conversely, user value/welfare concepts were identified as the theoretically correct methodology for valuing quality change in input indexes such as CPIs.¹ Support for the methodology of valuing quality change in output indexes with the marginal cost of new input requirements (resource cost) preceded Triplett in various forms. For instance as far back as 1957 Edward Dennison championed the production-cost criteria as the correct concept for use in the U.S. national accounts (capital goods). And perhaps most influential and persuasive from a purely theoretical standpoint are price index pioneers Fisher and Shell (1972) in their seminal publication, *The Economic Theory of Price Indexes*.

The references mentioned above are not intended to dismiss outright the concept of user value as the preferred valuation of quality change in output price indexes. Rather it will be useful to establish upfront that a rigorous economically sound rationale in price index number theory is desirable prior to allowing resource cost to be overthrown in a palace coup.²

One of the motivational sources mentioned in recent calls to consider user value in output price indexes is the 2004 publication from the International Monetary Fund, "*Producer Price Index Manual Theory and Practice*". The IMF report covers a lot of ground in a pragmatic presentation that is primarily aimed at statistical agencies that publish PPIs. Chapter 7 of the manual, "*Treatment of Quality Change*", is of most interest for the purpose of this commentary because it has been cited as supportive of the idea that user value concepts may be appropriate not only for consumption price indexes but also output price indexes. The manual does offer maneuvering room for either side of the argument, first with comments on the desirability of maintaining consistency between deflated supply and use volume in the national accounts. We can, without prejudice, refer to this symmetrical deflation argument as the national accounting motivation. However, the PPI manual also champions the price index practitioner motivation when it argues with the seemingly unqualified statement that "when resource cost is the best

¹ Utility and user value do not always mean the same thing, but in the narrow context used for descriptive purposes here, user value and consumer utility are treated as interchangeable.

² From Triplett (1988), "... a conceptually correct measurement from the standpoint of economic or statistical theory that is not accepted by, or is not understood by, broad user groups does not meet all the requirements for a public measurement."

available technique, it should be applied to output price indices ensuring consistency with the method's microeconomic foundations.”³

This last statement in support of resource cost is actually somewhat qualified because the manual also states that it “broadly prefers overlap and hedonic, <but> ... recognizes that statistical offices will still find the traditional resource-cost technique to be their first choice among the **second best methods**⁴ for making quality adjustments to output price indexes.” At this point I want to take a slight detour and return to the user value questions later because the manual's assertion that overlap prices are a “best” method and resource cost a “second best” method is surprising. The U.S. PPI program has used both quality valuation methods, but for the last 30 years has considered the resource cost approach as “best” and most consistent with the FIOPI model. The rationale used in the IMF manual for elevating overlap to the “best method” for valuing quality change is based on two restrictive assumptions imposed by the resource cost approach in the FIOPI framework. The manual's explanation of the first restriction is that the production transformation process for the new (quality adjusted) product must be separable from the transformation activities for other outputs of an establishment. The second restriction is that resource cost methods assume that the transformation process has constant returns to scale equal to one. The two restrictions are generally not subject to empirical testing at the sample unit (establishment) level so for any particular real world product substitution reported, one is unlikely to be certain whether the restrictions hold at a point in time or not. However, I think for many, this lack of absolute clarity in a complicated economic world is not a sufficiently strong justification to displace a methodology (resource cost) that has had long-standing acceptance in price theory and in many statistical offices around the world.

Since the PPI manual uses two somewhat restrictive assumptions to demote resource cost to “second best” why not consider an even bigger restriction encountered by statistical offices that publish PPIs. In principle, most output oriented PPIs target the FIOPI model but in practice miss this target because a Laspeyres formula is generally used. While the FIOPI holds inputs fixed, the Laspeyres introduces the additional restriction of also holding outputs fixed by the reference period sample. It is difficult to imagine stricter more unrealistic assumptions while trying to represent real world economic dynamics. Nevertheless, data constraints often force price index practitioners to be pragmatists when making quality adjustments in response to real world violations of the pristine FIOPI model and its assumptions. Otherwise few price indexes (acceptable to users) could be published.

At the operational level most price index (PPI) practitioners are aware that the overlap method has its own set of flaws/restrictive assumptions that may introduce significant measurement bias. One of the more troubling overlap assumptions is that it is based on the overly simplistic “law of one price” which requires the entire price difference between the old and replacement product be treated as the value of quality change in

³ Section B.2.6, pg. 154.

⁴Emphasis <bold> is mine.

some overlapping period.⁵ In the most dynamic parts of the economy, such as software, semiconductors, computers, telecommunications and health care, (where measures of quality change are most likely to be an issue), large dominant producers often have substantial price setting powers that enable discriminatory pricing policies. It is also true that due to growing product complexities in the high-tech area, it is often difficult for consumers to immediately acquire sufficient pricing information (lack of market/product feature transparency) within a typically limited overlap period in order to make the optimal quality adjusted purchasing decision. To be fair the PPI manual acknowledges many of these and other drawbacks to the overlap method. Therefore it appears that the choice of overlap method as “best” is a compromise choice between two potentially flawed quality valuation tools.

Another unrelated but ironic argument used in the PPI manual against resource cost is based on an example from Holdway (1999). The example referenced in the PPI manual was presented in a paper describing some of the price measurement challenges associated with microprocessors. The basic challenge was that new production technologies reduced the physical dimensions of microprocessor silicon circuits thereby reducing unit costs for the newest most advanced chips relative to older obsolete chips (even after taking into account the amortized cost of new capital equipment).⁶ If taken literally the resource cost method would indeed present a conundrum in terms of valuing changes in quality. Basically the problem arises because a drop in resource cost associated with higher quality outputs runs counter to basic FIOPI assumptions and therefore appears to be unsuited for estimating a value for this type of quality change. The microprocessor example was made deliberately extreme to help illustrate the need for alternative quality valuation methodologies when information is not available on producing the old and new product with the SAME production technologies.⁷ In principle the resource cost approach would work fine but in practice the requirement that resource cost differences between the predecessor and successor products are derived from the same production transformation technologies is problematic.⁸ In practice, estimating hypothetical production costs for the old or new replacement product requires more data than most respondents can or will provide. The main point is that the example was never intended to invalidate the resource cost approach but instead to point out that some of the more dynamic industries may require an expanded quality valuation tool set because of rapid changes to noncomparable production transformation processes. For this particular and extreme example, the tool that I had in mind was hedonics because it appeared to be the most likely alternative methodology (certainly more so than overlap) that might offer

⁵ This assumes that prices for a replacement and a predecessor product/service are even available in an overlapping period(s). In the US PPI, resource cost data is relatively more plentiful because products/services tend to disappear in t-1 and a replacement is introduced in t or reporters simply cannot /will not provide overlapping price data for different products. The main point here is that both overlap and resource cost has restrictive assumptions, but in a tie-breaker, the pragmatist keeps resource cost in the “best method” category where it has resided for many years.

⁶ Often referred to in the popular press as “faster, better, cheaper”.

⁷ Using the same production technologies for the new and old products to estimate resource cost differences eliminates the counterintuitive situation of quality improvements at lower costs by getting the comparisons back on a more analytically relevant and objective playing field.

⁸ Triplett (1988) makes the same point about using comparable production technologies when analyzing marginal costs for new higher quality computers relative to previous models.

reasonable estimates for valuing rapidly changing product features brought about by new production technologies.

Returning to the user value question, the IMF PPI manual does not directly advocate or suggest that user value should ever supplant resource cost as the preferred choice for quality valuations in output price indexes. Going further, it also appears that no rigorous economic model or pricing theory has been presented that clearly supports user value/consumer utility concepts as a preferred method for valuing quality change in output price indexes. On the other hand, it should also be noted that many PPIs are not presented strictly as measures of average price change from an output perspective.

PPIs can be reorganized to support either a commodity or input perspective, though this viewpoint is usually derived from industry output based samples. Unfortunately, resource constraints do not allow most practitioners to design and collect samples from both output and input perspectives. Instead, products priced from industry output samples can also be “mapped” into either commodity or input tables. In the case of input indices, this “mapping” or reuse of output prices as input proxies also, unfortunately, carry with them quality change valuations (overlap, resource cost, imputations etc.) that are derived from their original use in an output index. Additionally, the repurposing of output prices usually do not include important input related price data (important to correctly estimate “user value”) such as “transportation and distribution charges, subsidies or taxes”. This missing price data for PPI “hybrid” input indexes almost certainly introduces errors of unknown direction and magnitude. Because of the factors mentioned, hybrid input PPIs (as currently collected and published) are likely to be a less accurate approximation of the real world relative to directly collected output PPIs.

Conclusion

Price index theory suggests that, in competitive equilibrium, user value and resource cost may converge. However, user value equivalence should not always be assumed as very different treatments have been applied in the PPI and CPI for quality change in such products as reformulated gasoline and smog equipment for motor vehicles. At a practical level, resource cost may simply be more accessible which may partly explain why it is frequently used in the U.S. CPI, which targets a cost of living (consumer utility) model. As for input PPIs, price index theory certainly supports user value over resource cost. Unfortunately, most pricing agencies (as far as I know) do not sample and collect pricing data that enable them to directly publish PPI input indexes.⁹ In reality, when statistical agencies publish output and input PPI indexes, the de facto quality valuation methods for both are usually based on output concepts because pricing data (samples) are normally drawn from outputs. User value would appear to be a casualty or at least held hostage until input indexes can be collected and published directly instead of as a hybrid derivative of output price indexes. In the mean time I believe that appealing strictly to price index theory (including the FIOPI model) leads to the general support for resource cost/overlap methods when estimating quality change valuations for output price indexes. However, as PPI's continue to expand their coverage into complex service sectors, the

⁹ I am also unaware of a frame that would offer a comprehensive “wherever consumed” universe across thousands of products/services that would be necessary to sample from a PPI input perspective.

pragmatist may offer alternatives on a case by case basis that should be considered (i.e. health care). But I think it is somewhat dangerous to take a single concept (user value or resource cost) and apply them regardless of output or input perspective.

If the main motivation for choosing one methodology such as user value for all price indexes is because of anticipating the possible desires of national income accountants for symmetry across all deflators, then I would urge caution. I suspect that for most national income accountants, at least in the U.S., the user value-resource cost issue is a low priority if they think about it at all. Instead, most national income accountants would probably agree that, by far, their primary concern for PPIs is to extend coverage to as much of the economy as possible. Therefore, I believe (I want to emphasize that this is my opinion) that it would be preferable to postpone discussions about significant shifts to user value concepts in output indexes until such a position has strong and general support in contemporary price index literature.

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