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The Ideal Pricing Index

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It's time to index some pricing data you were given, or better yet, data you have compiled on your own data. You have decided on the collection method that you are going to use: survey, interview, focus group or, at a bare minimum, obtained data from a reliable and confirmable source. You have remembered to make sure the data is accurate, consistent, precise and most of all *without bias.*

You spent days, weeks, and possibly months collecting the perfect data set in pursuit of the ultimate Widget pricing index. It is done… It is perfect… It is the ultimate pricing data set:

	Quantity Sold	Quantity Sold	Unit Pricing	
Asset	2006	2015	2006	2015
Widget - Style A	400	500	$ 7.00	$ 8.00
Widget - Style B	300	400	$ 6.50	$ 7.50
Widget - Style C	200	300	$ 5.50	$ 6.50
Widget - Style D	300	400	$ 6.00	$ 7.00
Widget - Style E	200	300	$ 5.00	$ 6.00
Widget - Style F	100	200	$ 4.50	$ 5.50

Now what?

You remember back to ME202 "Machinery and Equipment Valuation Methodology" and what you learned about two Economists, Étienne Laspeyres and Hermann Paasche, both of whom developed weighted aggregate pricing indexes.

Laspeyres Price Index: $$P_P = \frac{\sum(p_{c,t_n} \cdot q_{c,t_n})}{\sum(p_{c,t_0} \cdot q_{c,t_n})}$$

Paasche Price Index: $$P_L = \frac{\sum(p_{c,t_n} \cdot q_{c,t_0})}{\sum(p_{c,t_0} \cdot q_{c,t_0})}$$

Simply stated:

Laspeyres Price Index: $\frac{\Sigma \text{ Base-year quantities at current-year prices}}{\Sigma \text{ Base-year quantities at base-year prices}}$

Paasche Price Index: $\frac{\Sigma \text{ Current-year quantities at current-year prices}}{\Sigma \text{ Current-year quantities at current-year prices}}$

So, which one is better? We can see that Laspeyres likes to calculate the relative index of price levels using Base-year quantities, while Paasche prefers calculating the relative index of price levels using Current-year quantities.

Now that we understand the basic workings of each index lets calculate both indexes.

Laspeyres Price Index

Asset	Quantity Sold 2006 (Base-year)	Unit Pricing 2006	Unit Pricing 2015	Total Pricing 2006	Total Pricing 2015
Widget - Style A	400	$ 7.00	$10.00	$ 2,800.00	$ 4,000.00
Widget - Style B	300	$ 6.50	$ 9.50	$ 1,950.00	$ 2,850.00
Widget - Style C	200	$ 5.50	$ 8.50	$ 1,100.00	$ 1,700.00
Widget - Style D	300	$ 6.00	$ 9.00	$ 1,800.00	$ 2,700.00
Widget - Style E	200	$ 5.00	$ 8.00	$ 1,000.00	$ 1,600.00
Widget - Style F	100	$ 4.50	$ 7.50	$ 450.00	$ 750.00
Total				**$ 9,100.00**	**$ 13,600.00**
				10 Year Price Increase	49.45%

Paasche Price Index

Asset	Quantity Sold 20015 (Current-year)	Unit Pricing 2006	Unit Pricing 2015	Total Pricing 2006	Total Pricing 2015
Widget - Style A	500	$ 7.00	$10.00	$ 3,500.00	$ 5,000.00
Widget - Style B	400	$ 6.50	$ 9.50	$ 2.600.00	$ 3,800.00
Widget - Style C	300	$ 5.50	$ 8.50	$ 1,650.00	$ 2.550.00
Widget - Style D	400	$ 6.00	$ 9.00	$ 2,400.00	$ 3.600.00
Widget - Style E	300	$ 5.00	$ 8.00	$ 1,500.00	$ 2.400.00
Widget - Style F	200	$ 4.50	$ 7.50	$ 900.00	$ 1.500.00
Total				**$12,550.00**	**$ 18,850.00**
				10 Year Price Increase	50.20%

The above tables show that each index result is close to the other (49.45% vs. 50.20%), but there is a slight variance between the two approaches used. Each approach has its own bias. In this example the Laspeyres Index may help a lender, but hurt a borrower by showing a lower price increase than would be derived if we had used the Paasche Index.

If we were to use the Paasche Index, a seller of our Widgets may benefit at the expense of a buyer. In both examples there is inherent bias of each index. No matter what its use, it will incorrectly project the price increase (or decrease) of a good or service over time. Though both methods of indexing are generally accepted and used by both governments and businesses today, it must be understood that bias does occur when either approach is used.

So what is the solution? How do we resolve the issue of bias?

The answer is the Fisher Index or what is commonly referred to as the Ideal Index. This index is considered ideal because it eliminates the bias found in both the Laspeyres and Paasche Indexes. Since the construct of the Laspeyres and Paasche

Indexes in the mid-1800's, mathematicians and economists have argued over which method was 'more correct' and 'most valid'; but Irving Fisher, an American Economist, recognized that bias was found in both indexes and concluded that the true price increase (or decrease) could be found at a point exactly between both results (the Arithmetic Average). So Fisher concluded that using a combination of Laspeyres and Paasche's Indexes to calculate the true price increase (or decrease) was the most ideal solution.

Let's do the Math:

$$\text{Fisher Price Index} = \sqrt{(\text{Laspeyres Price Index})(\text{Paasche Price Index})}$$

$$\text{Fisher Quantity Index} = \sqrt{(49.45\%)(50.20\%)}$$

$$\text{Fisher Quantity Index} = \sqrt{2{,}482.39\%}$$

$$\text{Fisher Price Index} = 49.82\%$$

Though recognized by most as the *Ideal Index* at the time of its development in the early 1900's, most economist and price survey companies did not use the Fisher Price Index, as the additional cost of labor to calculate both indexes manually was prohibitive. But today, with the advent of the mainframe and personal computers as well as the development of software & MS Excel™ templates, little additional cost or effort is needed to compute the *Ideal Index*.

As USPAP compliant appraisers', we must attempt to remove bias from all of our appraisal assignments. The use of the Fisher Price Index, the *Ideal Index*, is a positive step toward that direction.

About the Author

Walter O'Connell, M.E., ASA, SCSP, Senior Consultant with Porto Leone Consulting, LLC ("PLC") and is responsible for managing cost segregation studies and tangible asset valuations. He has provided these services to clients in a variety of industries for over ten years. Prior to joining PLC, Walter worked in the manufacturing and distribution sectors as an Inventory Control Manager for Newell Rubbermaid (NYSE:CHX) and Marcolin S.p.A.. While working as an Inventory Control Manager, Walter specialized in Material Requirements Planning ("MRP") and Manufacturing Resource Planning ("MRP II"), in matters of national and international purchasing, the procurement of production equipment, plant and production design, cost allocation studies, and inventory accounting.

He has performed and managed cost segregation studies on hundreds of properties, including hotels, senior living facilities, manufacturing facilities, research & development facilities, office buildings, hospitals, and retail properties. Walter has experience in tangible asset valuations for tax, book, insurance placement, due diligence and business planning purposes in the Healthcare, Hospitality, Manufacturing, Chemical, Food Processing, Cable and Telecommunications industries nationally.

Walter holds a Master of Arts degree in Economics from Montclair State University, Bachelor of Science degree in Finance and a Bachelor of Arts degree in Economics from Kean University. He is an Accredited Senior Appraiser ("ASA") with the American Society of Appraisers and is an Accredited Senior Cost Segregation Professional ("SCSP") with the American Society of Cost Segregation Professionals ("ASCSP").