New Item Bias in the PPI's Pharmaceutical Index?

Background

In 1976 Congress passed Section 936 of the IRS tax code which provides U.S. firms operating in Puerto Rico with tax-free income. Section 936 was not precedent setting but extended previous tax breaks dating back to 1921 designed to foster economic growth in the U.S. commonwealth.[1] Due mainly to the section 936 tax incentive, U.S. Pharmaceutical companies have moved a substantial part of their output to facilities located in Puerto Rico. Industry estimates credit pharmaceutical exports from Puerto Rico as accounting for more than 40 percent of U.S. prescribed drugs in 2003. However measures of U.S. domestic output published by the Bureau of Economic Analysis (BEA) excludes production activities based in Puerto Rico. Therefore to publish price indexes with the most appropriate deflation properties, the PPI's pharmaceutical coverage should be conceptually similar to the BEA's measure of industry outputs. The question of whether domestic pharmaceutical reporters are able to correctly identify and exclude drugs manufactured by subsidiaries in Puerto Rico has been raised in the past due to the discovery of such drugs in the PPI. As a result, new procedures were developed to reduce the chance of inadvertent inclusion of out-of-scope drugs in PPI samples. The most aggressive PPI response occurred in 1999 when pharmaceutical reporters were sent questionnaires asking them to identify the manufacturing location of all prescription drugs in the sampling frame. The survey results indicated that most reporters were sympathetic to PPI concerns and were able to research point of manufacturing origin and exclude drugs manufactured in Puerto Rico. Because the 1999 survey involved substantial additional reporter burden, the current assessment of whether the PPI continues to exclude drugs produced in Puerto Rico is based on secondary data. Table 1 provides a list of the top 20 drugs prescribed in the US and whether they are manufactured in Puerto Rico.

Table 1.

Top 20 Selling Prescription Drugs Ranked in Terms of Retail Sales Produced in Puerto Rico*

Rank	Prescription Drug	Manufacturer	Produced in PR	Retail Sales in 2001**
1	Lipitor	Pfizer	Yes	$4.50 billion
2	Prilosec	AstraZeneca	Yes	$3.90 billion
3	Prevacid	TAP Pharmaceuticals	No	$3.10 billion
4	Zocor	Merck	Yes	$2.70 billion
5	Celebrex	Pharmacia & Upjohn	Yes	$2.30 billion
6	Zolof	Pfizer	Yes	$2.10 billion
7	Paxil	GlaxoSmithKline	Yes	$2.10 billion
8	Vioxx	Merck	Yes	$2.00 billion
9	Prozac	Eli Lilly	Yes	$1.90 billion
10	Augmentin	GlaxoSmithKline	No	$1.80 billion
11	Claritin	Schering	Yes	$1.80 billion
12	Zyprexa	Eli Lilly	Yes	$1.80 billion
13	Norvasc	Pfizer	Yes	$1.70 billion
14	Glucophage	Bristol Myers Squibb	Yes	$1.70 billion

[1] http://www.pridco.com/english/3.13cap_gains_tax.html

15	Oxycontin	Purdue Pharma L.P.	No	$1.40 billion
16	Neurontin	Pfizer	Yes	$1.40 billion
17	Pravachol	Bristol Myers Squibb	Yes	$1.40 billion
18	Premarin Tabs	Wyeth	Yes	$1.20 billion
19	Hydrocordone/Apap	Watson	No	$1.10 billion
20	Risperdal	Janssen	Yes	$1.10 billion

* 16 of top 20 prescription pharmaceutical products are manufactured in Puerto Rico.
** Sales list from a report by the National Institute of Health Care Management Foundation (NIHCM).

The influence of the section 936 tax incentive is clear when you consider that 16 of the top 20 prescribed drugs in the US are manufactured in Puerto Rico. A review of the PPI sample indicates that only 4 of the drugs listed in table 1 are currently repriced. Two of the four are not produced in Puerto Rico and the remaining two, while produced in Puerto Rico have been confirmed by reporters as also produced in US facilities.[2] Therefore, the secondary data appears to indicate that PPI reporters have continued to exclude output from Puerto Rico without the need to burden them with another formal request to analyze production origins.

Drug Price-Age Sensitivity

The question of price-age sensitivity is in some ways more important than the question of production origin. The primary reason that annual sample augmentation has been used in the PPI's pharmaceutical coverage since 1996 is that both outside and internal research have shown that price trends may differ according to product life cycle. More specifically, price trends for early life drugs (less than 2 years since FDA approval) have often trended down, while prices for older drugs have trended up. As samples age, if new drugs are not introduced to the PPI, then the pharmaceutical index may become upward biased. Berndt, Griliches and Rosset (1993) documented this phenomenon (also known as out-of-sample bias) in a paper that attributes an upward bias to the PPI due to underrepresentation of newly developed drugs.[3]

The PPI confirmed the Berndt, Griliches, Rosset findings of price-age sensitivity in an internal study published in 1995.[4] Table 2 is taken from the PPI study and shows that drugs on the market for less than two years followed a much different price trajectory than drugs older than 2 years.

Table 2
Relative Price Change as a Function of Drug Life Cycle

Prescription Drug Age	Percent Price Change 1993-1994
Total	2.4
Less than 2 years	**-24.9**
2 to 4 years	1.1
4 to 6 years	.8

[2] A member of the US Pharmaceutical Association mentioned in a 2000 meeting with the BLS that drugs manufactured in Puerto Rico tended not to also be manufactured in the US, though exceptions may occur.
[3] "Auditing the Producer Price Index: Micro Evidence from Prescription Pharmaceutical Preparations", Journal of Business and Economic Statistics, July 1993.
[4] Kanoza, D., "Age Distribution and Price Movements of Drugs in the 1994 PPI Prescription Drug Sample", Producer Price Indexes Detailed Report May 1995.

7 to 9 years	3.2
10-24 years	5.7
25 or more years	2.6

The data in table 2 strongly supported the need for sample augmentation. Otherwise as the normal 6-7 year PPI sample ages, only drugs more than two years old are represented which means that drugs that tend to increase in price become oversampled and drugs that often decrease in price are not sampled at all. However, summary statistics are often too coarse for the most useful analysis. If we dig deeper, then the strong price trend divergence of drugs less than two years old can be placed in better context. The PPI data indicate that the overall 24.9 percent decline for new drugs is due to new generic drugs which fell 41.5 percent in the 1993-94 time frame. If drugs less than two years old are restricted to new branded drugs then prices actually increased 1.4 percent, which is more similar to price movement for other previously sampled age categories. In other words, if new generic drugs are removed from the data, then the case for frequent sample augmentation to address potential age bias is significantly weakened.

As part of this review it seemed reasonable to ask if the price-age sensitivity for prescription pharmaceuticals shown in the mid-1990s continues. The question is important because the potential of significant price-age sensitivity has provided the rationale for devoting PPI resources to annual sample augmentation since 1996. The PPI pharmaceutical analyst prepared an updated price-age sensitivity calculation that includes new drugs captured in recent PPI sample augmentations and is presented in table 3.

Table 3
Relative Price Change as a Function of Drug Life Cycle

Prescription Drug Age	Percent Price Change 2003
Less than 2 years	4.3
2 to < 4 years	1.7
4 to < 7 years	1.4
7 to < 10 years	3.9
10- < 25 years	3.4
25 or more years	4.4

At first look, the data in table 3 is somewhat startling. The new data indicate that the dramatic price decline for drugs less than two years old shown in table 2 has now reversed. This remarkable turnaround can be at least partly explained if, as in the previous example, we move our analysis below the summary statistics level. It turns out that as the PPI has improved its frame refinement process to exclude drugs produced in Puerto Rico, the opportunity to directly compare prices between branded incumbents and new generic equivalents has dropped significantly. Recall that our research has shown that 16 of the top 20 branded drugs and more than 40 percent of all prescribed drugs in the US are manufactured in Puerto Rico. Because drugs produced in Puerto Rico are out of scope, new generics brought into the index through sample augmentations often do not have an equivalent branded predecessor in the PPI for which a direct price comparison can be made. According to the Generic Pharmaceutical Association (GPhA), the average U.S. price of a branded prescription drug in 2003 was $84.21 but the average price of a generic prescription drug

was only $30.56.[5] It is this large general price delta between branded and new generic equivalents that lends itself most effectively to arguments that the PPI may suffer from upward bias if new drugs are not regularly added to the index through augmentations. However, the last two sample augmentations have captured no new marketed generics that have therapeutically equivalent branded drugs in the PPI (all first time generics w/branded predecessors in the PPI are certainty selected in sample augmentations).

Fortunately the PPI calculated a research index for a 30 month period that helps document the effect of recent sample augmentations on measures of price change. The research index excluded all new drugs introduced through sample augmentation and for the period of June 2001 through December 2003 the research index moved from 100.0 to 109.8. In contrast, the official sample augmented pharmaceutical index moved from 100.0 to 109.7 in the same period. Therefore, the net effect of sample augmentations for the 30 month period covered by the research index has been 0.1 index point. This tiny difference can be easily attributed to random sample effects but would stretch credibility as an indicator of sample augmentation "fixing" a perceived problem of new item bias.

An argument could be made that if sample augmentations do not capture new generic drugs that can then be directly compared with previously sampled branded equivalents in the PPI, then augmentations do little to address the potential of new item bias for domestically produced pharmaceuticals. If the rationale for sample augmentation for this industry is based on the assumption of an upward bias due to under representation of new drugs then this rationale has become at least partly undermined as the PPI does a better job of capturing only in-scope domestic outputs. There is also the issue of perception. If users of the PPI Pharmaceutical index perceive coverage as including most of the blockbuster and cutting edge drugs produced mainly in Puerto Rico, then it is not surprising that some have argued that the PPI is susceptible to an upward bias as samples age due to under representation of new drugs. However, if price comparisons between new generics and branded are generally out of scope, then the PPI cannot effectively respond to concerns of upward bias with the current sample augmentation process and may need to do a better job of educating users as to the limits of PPI coverage.

A case can be made that the majority of the more than 550 industries periodically sampled by the PPI have new products introduced within a sample rotation period. However, limited resources do not allow the PPI to conduct annual augmentations unless the new outputs of a particular industry (such as semiconductors, telecommunications or software) are especially dynamic, important to the economy and subject to divergent price trends. While the domestic Pharmaceutical industry is certainly important (revenues of $113 billion in the 2002 Census), there does not appear to be a consistent divergence between price trends for in-scope new outputs and price trends for in-scope older outputs.

Summary

The data suggest that recent sample augmentations designed to address potential new item bias have not had a significant impact on index movement (0.1 index points over a recent 30 month period). However, recent experience may not prove to be a reliable indicator of future industry structure and marketing practices. Therefore, the PPI will continue to annually augment current samples with

[5] http://www.gphaonline.org/aboutgenerics/index.html

new FDA approved drugs on a probability basis. In addition, the PPI has decided to change from an annual to a continuous (monthly) augmentation strategy for newly approved generics that have previously sampled branded equivalents in the PPI and new chemical molecules. The rationale for increasing the frequency of augmentations for new generics and new chemical entities is that our research has shown that both types of drugs, if not sampled, would be the primary contributors to an increased potential for new item bias in the PPI's measure of prescription pharmaceutical price change.