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**Article**

## New products and price indexes

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## New Products and Price Indexes

Jerry A. Hausman\*

What is the value to consumers of new products? The number of new products introduced in any year is astounding. New varieties of consumer goods such as cereal brands are evident, as any shopping trip to a local supermarket or Wal-Mart demonstrates. Potentially even more important are the new products based on technology: more than 55 million cellular telephones are in use in the United States, and more than 20 million people subscribe to the Internet, for example. Does consumer welfare increase significantly with these new goods and services? If so, then the Bureau of Labor Statistics (BLS) is likely miscalculating the consumer price index (CPI), because the CPI does not take into account the value to consumers of new goods and services.

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The economic theory behind the CPI is well developed. The CPI approximates an ideal cost-of-living index (COLI) which, in turn, tells us how much more (or less) income a consumer would need to be as well off in Period 1 as in Period 0 given changes in prices, changes in the quality of goods, and the introduction of new goods (or the disappearance of existing goods). The omission of the effect of the introduction of new goods in the CPI seems quite surprising since most common business strategies fall into one of two categories: either become the low-cost producer of a good just like your competitors' or differentiate your product from theirs. The latter strategy has become the hallmark of much of American (and Japanese) business practices. The sheer number of brands of cars, beer, cereal, soda, ice cream, yogurt, appliances such as refrigerators, and cable television programming all demonstrate the ability of firms to differentiate their products successfully. Furthermore, consumers demonstrate a preference

for these products, because they buy enough of them that businesses make the expected positive profits on the new brands.

In my first paper on this subject,<sup>1</sup> which considers new cereal brands, I find a significant consumer value placed on new goods. This value may cause the CPI to be seriously overstated, since it neglects new products. In the paper, I first explain the theory of cost-of-living indexes. Then, using the classical theories of Hicks<sup>2</sup> and Rothbarth,<sup>3</sup> I demonstrate how new goods could be included. The correct price to use for the good in the pre-introduction period is the "virtual price," which sets demand equal to zero. Estimation of this virtual price requires estimation of a demand function, which in turn provides an expenditure function, and thus allows exact calculation of the CPI.

As an example, I use the introduction of a new type of cereal by General Mills in 1989, Apple Cinnamon Cheerios. The cereal industry has been among the most prodigious

in terms of new brand introduction. My specification permits differing amounts of similarity among cereal brands; that is quite important given that Apple Cinnamon Cheerios are more like other types of Cheerios than they are Shredded Wheat, for example. I find that the virtual price is about twice the actual price of Apple Cinnamon Cheerios and that the increase in consumer surplus is substantial. Based on some simplifying approximations, I find that the CPI for cereal may be overstated by about 25 percent, because it neglects the effect of introducing new cereal brands.

In my next paper on this subject,<sup>4</sup> I consider the value to consumers of two new telecommunications products, cellular telephones and voice mail, and demonstrate how to value the introduction of new services in telecommunications. Much public discussion has centered on the evolving information superhighway and on the many new services that may be offered as high-capacity fiber-optic transmission networks are extended into the telecommunications infrastructure. How can society establish the value of these new services and increased choices? This question has potentially important economic consequences and equally important public policy implications. Because of the network structure of telecommunications, public policy has always played a large role in its production and regulation.

I find that introduction of new telecommunications services can lead to very large gains in consumer welfare. Voice messaging services, for example, were introduced in 1990. I estimate that the gain in consumer welfare from voice messaging services was about \$1.27 billion per year by 1994. Similarly, I estimate that the introduction of cellular telephone services has led to gains in consumer welfare which now exceed \$25 billion per year.

Introduction of a new telecommunications service is typically quite different from the introduction of a new product in an unregulated industry. If General Mills wants to introduce a new brand of cereal, it simply manufactures the cereal and convinces supermarkets to stock the new brand on their shelves.<sup>5</sup> Consumers then decide whether the new brand will be successful by voting with their dollars.

Because of regulation, though, introduction of new telecommunications services is different. In the United States, telecommunications companies typically must file an application with both federal regulators—the Federal Communications Commission—and state regulators. Approval of these applications can take years and even decades. What is the cost of these delays? Because consumers are not able to use the new service during the delay period, the price of the new service is implicitly set by regulators at the virtual price, causing demand to be zero.

I estimate that the cost of the regulatory delays is quite high. For 1994 I estimate the consumer value from voice messaging services to be about \$1.27 billion. Thus, the approximate 10-year delay attributable to regulation can cost consumers billions of dollars. Next, I apply my methodology to the cost of regulatory delay in the introduction of cellular telephone service. I estimate the cost to consumers to be closer to \$100 billion. This cost of regulatory delay perhaps is not recognized nearly as much as it should be.

Next I consider the value of the Internet to consumers.<sup>6</sup> Using data from 1997, I estimate the consumer value of the Internet to be about \$6.8 billion per year. Given the extremely rapid growth in consumer use of the Internet, any public policy that permits construction of high-speed access to the Internet would significantly increase consumer welfare.

In my last paper on this subject,<sup>7</sup> I consider the effect of including cellular telephone service in the CPI. Cellular telephone is an example of a new product that has significantly affected how Americans live. Since their introduction in 1983, the adoption rate of cellular telephones has grown at 25 percent to 35 percent per year, so that by the end of 1997 about 55 million cellular telephones were in use in the United States. Thus, approximately 20 percent of all Americans use cellular telephones, and there are about one third as many cellular telephones in the United States as there are regular (landline) telephones. The average cellular customer spends about \$588 per year on cellular service. This could indicate that consumers and businesses have found cellular telephones to be valuable additions to their lifestyles.

The BLS did not know that cellular telephones existed, at least in terms of calculating the CPI, until 1998, when cellular service was finally included in the CPI. By 1998, 15 years after the introduction of cellular telephones, more than 55 million Americans were using cellular and personal communications services (PCS), mobile telephones based on the next generation of cellular technology. When the BLS finally included cellular in the CPI in February 1998, its inclusion had *no effect* on the CPI because the BLS reported that the price of cellular had not changed from the previous month.

This neglect of new goods which is implicit in their introduction into the CPI only after a long delay leads to an upward bias in the CPI. The recent Boskin Committee Report<sup>8</sup> found it to be large and significant. However, even if the BLS did not delay the introduction of new products, such as cellular telephones, into the CPI for periods of up to 15 years, its calculation of the CPI for new products still would be biased upward because it does not calculate

the gains in consumer welfare from new products. I demonstrate how this gain in consumer welfare could be estimated, and provide an approximation result, which the BLS could use to calculate gains in consumer welfare from new products for use in the CPI.

The BLS has three potential approaches to the inclusion of new goods into the CPI: 1) It can ignore the new goods for a long time, as with the 15 year delay for cellular. This paper demonstrates that the BLS missed approximately 50 percent of the price decline in cellular using this approach. 2) It can add new products to the CPI earlier. My calculation shows that if cellular service had been included in the CPI in 1988, 5 years after its introduction, the BLS would have missed only about 25 percent of the price decrease, which would have been a significant improvement. 3) It could introduce a true COLI measure that reflects the value to consumers of the new product's introduction, as well as the subsequent decrease in price. I demonstrate that the value of new products such as cellular service to consumers can be very large. Thus, even if the

BLS includes new products earlier, the CPI will still miss a large part of the effect on a COLI of new products. I demonstrate how an approximate measure of the consumer value of new goods can be included in the CPI.

I find a bias in the BLS estimate of the telecommunications services index of between 0.8 percent and 1.9 percent per year over the period 1988–97, because of the omission of cellular telephones from the CPI during this time period. Rather than telecommunications service prices increasing at about 1.1 percent per year, as the BLS calculated for the CPI, the correct calculation has them decreasing at about 0.8 percent per year. Differences of this magnitude are significant and likely arise from the introduction of other new goods and services, for example Internet services. Thus, the omission of new goods and services imparts a significant upward bias to the CPI. Because the CPI is used in many places in the U.S. economy and for making policy decisions, this bias distorts these decisions and gives a misleading impression of real (adjusted for inflation) magnitudes in the U.S. econ-

omy, such as changes in real income and the economic welfare of the U.S. population.

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<sup>2</sup> J.R. Hicks, "The Valuation of the Social Income," *Economic Journal*, (1940).

<sup>3</sup> E. Rothbarth, "The Measurement of Changes in Real Income Under Conditions of Rationing," *Review of Economic Studies*, (1941), pp. 100–7.

<sup>4</sup> J.A. Hausman, "Valuing the Effect of Regulation on New Services in Telecommunications," *Brookings Papers on Economic Activity, Microeconomics*, 1997.

<sup>5</sup> See J.A. Hausman, "Valuation of New Goods Under Perfect and Imperfect Competition."

<sup>6</sup> J.A. Hausman, "Telecommunications: Building the Infrastructure for Value Creation," in *Sense and Respond*, S. Bradley and R. Nolan, eds. Boston, MA: Harvard Business School Press, 1998.

<sup>7</sup> J.A. Hausman, "Cellular Telephone, New Products and the CPI," *NBER Working Paper 5982*, March, 1997; forthcoming in *Journal of Business and Economic Statistics*.

<sup>8</sup> M. Boskin et al., "Toward a More Accurate Measure of the Cost of Living," *Final Report to the Senate Finance Committee*, December 4, 1996.

## The Economics of Crime and the Criminal Justice System

Steven D. Levitt\*

My recent empirical research focuses on crime and the criminal justice system. Within this broad area, three primary themes emerge: identifying the causal link between criminal justice policies and crime rates; differentiating empirically between deterrence and incapacitation; and using nonstandard data sources to

test economic theories. This synopsis of my research is organized around these themes.

### Identifying the Causal Link Between Criminal Justice Policies and Crime Rates

Differentiating between correlation and causality is critical when analyzing the impact of crime policies. For instance, Newark has a violent crime rate four times higher than that of Omaha, and it also has twice as many police per capita. A likely explana-

tion for this relationship, however, is that high crime rates lead cities to hire more police, not that police cause crime. Similarly, when crime is rising, prison populations also tend to rise. This is not surprising: if criminals continue to be caught and punished at a constant rate, then the prison population should mechanically rise one-for-one with the crime rate. From the perspective of ideal public policy, reliance on such correlations provides no guidance. Identifying the causal link between increases in police and the number of prisoners and crime is necessary.

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