

William S. Vickrey (*b.* Victoria, British Columbia, Canada, 21 June 1914; *d.* Hastings-on-Hudson, New York, 11 October 1996), *microeconomics, public economics, taxation, efficient pricing structures, incentives and private information, game theory, financial economics, macroeconomic policy.*

Vickrey earned a B.S. in mathematics from Yale University in 1935, and was associated with Columbia University's Economics Department for nearly all the remaining 61 years of his life. He received an M.A. in 1937 and first taught at Columbia that year. The next six years he worked on taxation and public utility pricing, and was a prolific contributor to major economics journals. World War II interrupted his academic career; Vickrey was a conscientious objector, and two years' public service included designing an inheritance tax system for Puerto Rico (he would later design Japan's postwar tax system). Back in Economics at Columbia, he became a lecturer in 1946, was awarded his Ph.D. in 1947, became assistant professor in 1948, associate professor in 1950, professor in 1958, and McVickar Professor of Political Economy in 1971. Emeritus Professor since 1982, he continued to teach occasional courses and interact with students and colleagues at seminars and conferences right up to his death.

Vickrey was ahead of his time in many areas of economics, and it took years, sometimes dozens, for the discipline to catch up. His most lauded works were produced by 1961, but not widely cited at first, sometimes not for decades. He was elected a Fellow of the Econometric Society in 1967, received a University of Chicago honorary degree in 1979, elected Distinguished Fellow of the American Economic Association in 1978 and its president in 1992. 1996 was particularly eventful: election to the National

Academy of Sciences in April, award of the Nobel Prize in Economic Science, announced October 8th, and then his death following three hectic days in the resulting spotlight.

An enormous fraction of the last forty years' theoretical research in microeconomics can be characterized as working out details of large ideas that, as his writings make clear, were well understood by Vickrey in the 1940s or 50s. For one, Vickrey is the father of the vast literature on the "economics of asymmetric information." The Nobel Committee called him the first scholar to focus explicitly on the feature that key information is privately held by individuals (pursuing their informed self-interest), when exploring issues of incentives and the performance of markets, of taxation and of other public regulations.

The Nobel announcement focused on Vickrey's 1961 paper about auctions, which realizes a principal reason for conducting an auction is that critical information about the value of an auctioned asset lies in privately held knowledge of or estimates of its value to each bidder. Among many seminal contributions in a full and thoughtful paper, the simplest and most noted was introducing the second-price auction, often called the "Vickrey auction." In it, each bidder privately submits a bid, knowing the rules: the highest bidder will be awarded the asset at a price set by the highest *losing* bid, i.e., the "second price." Switching from "pay-your-bid" or first-price auction rules to second-price rules has startling consequences. Suppose you know the asset's worth to you; in a first-price auction, you optimally bid below that by an amount that maximizes a complicated tradeoff between the probability of winning and the profitability should you win. Vickrey's rules induce you simply to bid your value: if a rival bids higher, winning

would mean unprofitably overbidding; if all rivals bid less, you want to win, and would gain nothing from bidding lower. Second-price rules are thus “incentive-compatible” in that bidders do not have to be presumed public-spirited: each is given an incentive to truthfully reveal that price at which he or she is indifferent between obtaining the asset and foregoing its purchase. Information thus learned from a second-price auction can be both critical for follow-up decisions (e.g., airwaves auctions yield information about the value of making further slices of the electromagnetic spectrum available for commercial usages) and otherwise unattainable. In the model he presents, Vickrey also originates the issue of market design—how does a seller or public agency set market rules so as to maximize expected revenue, or some other goal?—and establishes that a seller on average earns identical revenues from first- and second-price auctions. Later work has found that, in a wide variety of settings with approximately risk-neutral actors, a revenue-seeking seller will prefer a second-price auction, and an efficiency-seeking seller will more often sell to the highest-valuing bidder via a second-price auction.

Vickrey’s 1961 paper also considered allocation of bundles of goods and services (or public projects), and of cost shares, to individuals. He proposed charging an individual the cost to the rest of the economy that resulted from their usage of an endeavor, the basis for what is now called the Vickrey-Clarke-Groves mechanism and the extensive literature on design of allocation mechanisms for public-good and interrelated-goods problems.

In proposing a framework for understanding auctions and transacting mechanisms, and a simple rule that could improve such markets, Vickrey’s insight that the analyst must account for self-interested individuals acting on the basis of private information presaged developments that have dominated game theory for the last thirty years. John

Harsanyi characterized “games of incomplete information” in the late 1960s, and was a 1994 Nobel Laureate for developing techniques that had been correctly used by Vickrey in the 1940s and 50s. Path-breaking studies of situations where individuals seek to credibly reveal private information about their own abilities to potential transacting partners (“signaling games”) and where firms seek to sort out individuals who are privately aware of their own high intellectual or entrepreneurial abilities from those without the same skills who nonetheless seek the same opportunities (“screening games”) were the subject of the 2001 Nobel Prize to George Akerlof, Michael Spence and Joseph Stiglitz; Vickrey demonstrated his understanding of the key insights in their work nearly a half-century prior to that award.

The 1947 book, *Agenda for Progressive Taxation*, is essentially Vickrey’s doctoral dissertation; to this day it contains frontier research in taxation, and its 21 specific recommendations remain sound. It is strikingly original in its conception that taxes distort incentives to engage in taxed transactions, primarily earning income, and that individuals’ responses to taxes are based on information (about their abilities in alternative occupations and willingnesses to undertake efforts) unknowable to government. It is this original idea which James Mirrlees carries to an explicit characterization a quarter century later, in work that led the Nobel Committee to make him the co-laureate with Vickrey in 1996.

Concern for human welfare was Vickrey’s driving force. In his 1945 paper, “Measuring Marginal Utility by Reactions to Risks,” and his 1947 *Agenda*, Vickrey develops a basis for relating social preferences over alternatives to individuals’ preferences. In so doing, he lays a part of the foundation for Kenneth Arrow’s

dissertation, “Social Choice and Individual Welfare,” which Vickrey supervised, and which was the focal work in the Nobel announcement of the 1972 laureate to Arrow. The Nobel award to Amartya Sen in 1998 also cited work elaborating ideas initiated in these writings by Vickrey.

For all the research in theoretical economics that has elaborated on his original ideas, Vickrey himself was totally focused on practical applications, interested in theoretical models only to rest practical solutions on an underlying logic. In the late 1930’s, he proposed the principle that taxation should attempt to be neutral with respect to decisions as to when to realize a gain in income, and published a full-fledged system for doing so in 1939, “Averaging of Income for Income Tax Purposes.”

His most extensive involvement, though, was in suggesting principles for efficient provision of public utilities, and in coming up with inventive, practical mechanisms to fulfill these principles. The theoretical side involved reaching a subtle understanding of the correct marginal cost to attribute to usage of utilities: what is society’s economic cost to have one more car traveling that roadway at that hour, or of one more subway rider 10 minutes ahead of peak demand? In 1948, Vickrey suggested that seats on airplanes should be purchased on a futures market where prices fluctuated depending on the forecast between demand for seats and supply of seats as the date of the flight approached. Four decades later, airlines began to develop yield management software that quotes prices essentially in imitation of such a market. A big difference is that the airlines choose to sell nontransferable and largely nonrefundable tickets; Vickrey proposed resellable tickets with a penalty to discourage speculation.

Two years' study of patterns of subway ridership led to the 1952 monograph, "*The Revision of the Rapid Transit Fare Structure of the City of New York.*" Vickrey found that marginal-cost pricing implied prices at the very peak of demand five times the off-peak minimum, with substantial savings available if a regular commuter adjusted his schedule as little as 15 minutes away from peak. Serious savings in the cost of rolling stock could result from aggregate commuter responses. In the first of classic examples of how far he went to demonstrate the practicality of his recommendations, Vickrey constructed a prototype of an electromechanical turnstile that automatically implemented shifting prices. Similar turnstiles came into widespread use three dozen years later, but only small steps in the direction of Vickrey's suggested wide variations in price about peak load times have yet arrived.

His 1959 study of road use around Washington, DC led to the Congressional Report, "Statement on the Pricing of Urban Street Use." Again, he found that careful calculation of social marginal costs led to highly differentiated road tariffs according to traffic congestion. Vickrey, though, was appalled at the notion of adding to traffic congestion to collect tolls, and railed against tollbooths, urging the development of a system where small radio transmitters would transmit vehicle or driver IDs over a distance of a few feet, and a computerized system connected to roadbed receivers would calculate liabilities and bill drivers periodically. A few years afterward, Vickrey was challenged that the system he proposed was infeasible. He responded in typical fashion: in the mid-1960's, he first built a rudimentary computer in his home and connected it to a radio receiver, then limited himself to a \$3 budget for parts with which he built a small radio transmitter placed under the hood of his car. He could then show anyone who asked a

printout of the times his own car went up or down his driveway. After a 1970s seminar, I asked and was shown one printout. As someone who practiced the concern for efficiency in transportation that he preached, Vickrey rarely used his car: he almost always took the train into Manhattan, then “commuted” the blocks from the station and across Columbia’s campus to his office on rollerskates.

Vickrey’s 1963 “Pricing in Urban and Suburban Transport” is to this day regarded as the most important paper in the history of urban transport economics. Departure times of commuters are endogenous variables in the model, reacting to personal tastes, plans, and predicted commuting tie-ups. The Belgian economist Jacques Drèze evaluates “That model has received strong empirical support from detailed traffic flow studies, and has changed the way traffic engineers think about the problem,” and notes, remarkably, that Vickrey’s system of tolls varying with traffic densities “leaves commuters at least as well off as before, so that the toll revenues come free.” Vickrey applied similar reasoning to develop efficient pricing structures for telephone services, electricity, water supply, fire protection, parks and recreational services, and education.

For the last decade of his life, Vickrey’s attention returned to macroeconomic policy, a subject he had analyzed in a 1963 book, *Metastatics and Macroeconomics*. Like his other pursuits, that book broke new ground by expecting that macroeconomic policy ought to be derived from an understanding of the economy grounded in equilibrium models of microeconomic behavior. Indeed, some of the real business cycle modeling honored in the 2004 Nobel award to Finn Kydland and Edward Prescott has its first musings in Vickrey’s early analyses.

Vickrey's macroeconomics theme reflected his overriding concern for human welfare: he considered inflation minor relative to unemployment, since the burden of above-minimal unemployment fell on the poor. He argued (in his 1963 book and in eleven papers 1986 and later) that over a considerable range of levels of employment, lower unemployment did not create higher inflation, hence both fiscal and monetary policy should address unemployment, with subsidiary policies addressing inflation. As always, he had inventive recommendations for such policies.

The acclaim Vickrey's work eventually attained was to him secondary; he was more concerned with whether practical recommendations of more efficient methods were adopted. On a half-dozen occasions in the 1990s, most notably his 1993 Presidential Address to the Atlantic Economic Society, Bill Vickrey, somewhat jovially but with some melancholy, pronounced himself a failed innovator.

I have been among scores of economists to experience presenting a seminar while Bill Vickrey is to all appearances asleep, only to have him suddenly ask a more penetrating question than any seemingly more attentive audience member can muster. Then, too, I join those described in the American Economic Association's 1978 Distinguished Fellow citation:

Many of us have had the experience of thinking we were the first to show the neutrality of a particular tax scheme, to prove the incentive characteristics of a particular bidding institution, to deduce the redistributive implications of the expected utility hypothesis, to invent a demand-revealing process, and so on, only to find that William S. Vickrey had done it earlier—sometimes much earlier—and

whereas our 'original contribution' may have contained minor or even substantive errors, Vickrey had done it correctly.

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