Journal of Economic Perspectives—Volume 9, Number 2—Spring 1995—Pages 111–130

Forty Years of Public Economics: A Personal Perspective

Jacques H. Drèze

This paper presents a personal perspective on the field of public economics, as I have seen it evolve over the past 40 years. I do not survey the field, nor do I aim at a balanced overview. Instead, I note some aspects that have impressed an eyewitness, watching developments from the periphery, and assessing them in the light of his outside experiences. My presentation rests mostly on illustrations.

Two concomitant circumstances prompted the writing of this article. One was my participation in editing a volume of selected papers by William Vickrey (Arnott et al., 1994). I was impressed by Vickrey's persistent efforts to develop economic ideas all the way to operational implementation—including schemes for cumulative income taxation, airline overbooking, design and collection of subway fares, road pricing with Automatic Vehicle Identifiers, responsive pricing of utility services, and more. I was also intrigued by Vickrey's expressions of frustration at the limited or slow adoption of such proposals.[1] The other circumstance was my participation in the work of a committee appointed by the International Economic Association to investigate the desirability and feasibility of establishing a new "Graduate School of Economics and Economic Development" as a center of excellence in a Third-World country (Drèze et al., 1994). In the process, I pondered the report of the AEA's Commission on Graduate Education in Economics (COGEE) and its main conclusion (Krueger et al., 1991, p. 1052) "that graduate education can be improved if relatively more

[1]Thus, Vickrey's (1993b) presidential address to the Atlantic Economic Association is entitled "My Innovative Failures in Economics," and his (1993a) presidential address to the American Economic Association refers to a "notable lack of practical success outside academia."

■ *Jacques H. Drèze is Professor of Economics (retired and visiting), CORE, Université Catholique de Louvain, Louvain-La-Neuve, Belgium.*

emphasis is given to providing students with applications of the tools of economics to economic problems"—a conclusion to which I return at the end.

Starting from these roots, I found the short history of public economics instructive on several issues: the interplay of theory and applications; the usefulness of economic research; and the transfer of knowledge across fields within economics.

Public Economics: A New Field

The term "public economics" has gained acceptance, over the past 20 or 30 years, to designate "the economics of the public sector," as proposed by Atkinson and Stiglitz (1980, p. 3) in their textbook, or the study of "government's effect on the economy," as proposed by Auerbach and Feldstein (1985, p. xv) in their handbook. In the *New Palgrave* entry by Kolm (1987), the origin of the term is dated to his *Fondements de l'Economie Publique* published in 1964, one year before Johansen's (1965) *Public Economics*. The next entry, by Richard Musgrave (1987, p. 1055), is entitled "Public Finance," and notes that "concern with public finance may well be the oldest branch of economics," going back to antiquity. Some essentials of the modern agenda—the criteria for public expenditure and public sector pricing—were pioneered in the nineteenth century by Jules Dupuit (Ekelund, 1987; Vickrey, 1968).

I myself would date the transition from public finance toward public economics around 1950, and refer specifically to three contributions: the collective effort at Electricité de France (EDF) to define tariffs on the basis of rigorous economic reasoning; the proposals by Vickrey for *The Revision of the Rapid Transit Fare Structure of the City of New York* (1952); and what was later described by Paul Samuelson (1964, p. 95) with metaphorical restraint as "a pearl cast before the US Treasury in 1950," namely, his testimony and paper-to-be on the "Theory of Optimal Taxation" (Samuelson, 1986).

These early developments received little immediate notice, for different reasons. The work by Boiteux and others at EDF appeared in French; only in 1964 did translations (Nelson, 1964) and a survey (Drèze, 1964) appear in English. Vickrey's work initially appeared as a "Technical Monograph" (mimeo) for the Management Survey of the City of New York (1952), and was later (1955) summarized in the *Journal of the Operations Research Society of America*. The Samuelson "pearl" remained unpublished until 1986.

Yet, the theory of optimal public sector pricing and of optimal taxation, two topics still central to public economics, had been reborn—25 years after the work of Ramsey (1927) and 15 years after that of Hotelling (1938). More visible developments soon followed, in particular the 3-page paper by Samuelson (1954) on public goods, the equally influential 8-page paper by Tiebout (1956) on local public goods and the Boiteux (1956) paper, about which more below. By then, public economics was no longer an infant but a fast-growing child.

The maturity of the field is often associated with the publication of the paper by Diamond and Mirrlees (1971a, b) on "Optimal Taxation and Public Production," which demonstrated the possibility of approaching within a single unified framework three areas of central interest: taxation, public sector pricing and public goods. In addition, it put the methodology to constructive use in obtaining new results concerning productive efficiency.

But whatever the semantics and the archaeology, "public economics" has now invaded our curricula, libraries and meetings. Recognition as a subject area for second-year field requirements in graduate curricula and existence of textbooks, journals and professional societies converge to qualify public economics as a "field" of economics[2]—on par with labor, international trade, industrial organization or development. "Public economics" as a term is displacing its respectable predecessor, "public finance," and basically choking off welfare economics as a separate field.

Specificity of Public Economics

I associate the shift toward a distinctive field of public economics with a shift in both substantive emphasis and methodology.

The new field is by and large stripped of what had been an important concern of public finance, the macroeconomic stabilization function of government. In his 1959 *Theory of Public Finance*, Musgrave listed this function on a par with the allocative and distributive functions of government. As the public sector grew in scale and scope, the real allocative issues raised by public goods, public utilities, social security and the like received growing attention. Also, a set of new fields emerged, some theoretical, like social choice, others more applied or substantive, like health economics, education, transportation, urban economics, public choice, and so on. Most of the issues captured by these specialized fields have to do with the public sector or with the interface of the public sector and private markets.

These real allocative issues were approached with the tools of theoretical microeconomics, a methodological shift. In the United States, though less so in Europe, emphasis also shifted away from normative issues toward the positive side. The methodological core of this work consists in deriving general qualitative formulae, within the standard Walras-Arrow-Debreu general equilibrium model, extended to encompass public goods and taxation. Further modelling assumptions, about the economy or the policy instruments, are typically needed to deal with such issues as corporate taxes, inheritance taxes, the tax base,

[2]Key references include the textbooks by Atkinson and Stiglitz (1980), Boadway and Wildasin (1984), Laffont (1988), Starrett (1988) or Henry (1989); the *Handbook of Public Economics* (Auerbach and Feldstein, 1985); the two volumes of readings on *Modern Finance* (Atkinson, 1991); and the *Journal of Public Economics*, which has just published its fiftieth volume, with a special editorial (Atkinson, 1993).

capital-income taxation, and so on. Sharp conclusions become model-dependent. At that stage, reference to practical problems can be the saving grace. Very often, the practical problems place further demands on the theory. But it is a rare occurrence that the same persons develop both the applications and the theory itself. The early stages of public economics, in which theory grew out of practical preoccupations, are interesting in that respect.

Practical Preoccupations

Vickrey (1952, 1955) had initially been commissioned to find ways of reducing the fiscal drain of the transit system on the finances of New York City, not to improve the overall economic efficiency of the subway system. Yet, he proceeded to investigate marginal cost pricing, which called for a detailed understanding of technology, an evaluation of the subjective costs of passenger congestion, and an assessment of the costs of fare collection under alternative schemes. Vickrey's intermediate conclusion was that the flat fare was grossly inefficient, and much of the time above marginal cost; as a result, riders who were willing to pay the marginal cost of their passage were not riding the subway. Vickrey calculated that $50 million worth of deadweight welfare losses could be recouped through marginal cost pricing, although the lower fares would create an *additional* deficit of $120 million for the city.[3]

Rather than simply giving up on finding this unpleasant figure, or accepting an arbitrary ceiling on the deficit, Vickrey chose to take into account the distortions associated with realistic methods of collecting municipal taxes. He summarized the burden of these distortions by using a figure of 30 cents on the dollar for the "marginal costs of public funds" (MCPF), a concept already used by James Meade in 1944, and often labelled by more recent writers as the "shadow cost of public funds."[4] Now, the task was to calculate the second-best level of fares, which maximized social welfare, taking into account the 30 percent deadweight loss associated with distortive taxation, which led Vickrey to compute what we call today Ramsey prices.[5] Somewhat luckily, this calculation led to an acceptable fiscal deficit, provided fares could be adjusted to time, origin and destination. This called for a (then) new electromechanical technology of fare collection, for which Vickrey developed a detailed blueprint. Vickrey's suggestions were not implemented, and this piece of work figures prominently among what he calls his "innovative failures."

[3]These figures are 1952 dollars. At current prices, the figures would be roughly six times as high.
[4]I note in passing that the figure advanced by Vickrey in 1952 is precisely the figure arrived at by Ballard, Shoven and Whalley (1985) through general equilibrium computations, and by Hausman and Poterba (1987) through an analysis of household behavior under the Tax Reform Act of 1986.
[5]To calculate the appropriate elasticities, Vickrey made use of a fortunate fare increase, from 5 cents to 10 cents in July 1948, which provided the data for estimating the slopes of linear demand functions (rounded to the next million passengers).

The contrast with the concomitant work in France is interesting. The preoccupations of the engineers at Electricité de France were equally practical. They wanted to operate the recently nationalized utility in a socially efficient and financially sound way. A major problem in the postwar years was to strike a balance between assuring sufficient electrical capacity and limiting the costs of unused capital during off-peak hours. They also had a substantial advantage over Vickrey: as executives of the company, they could implement their own suggestions—which they did. Their system of peak-load pricing was directly inspired by original research, starting with the paper by Boiteux (1949) on peak-load pricing, then relying extensively upon the mathematical investment models of Massé and Gibrat (1957) and others to infer marginal costs (from dual variables at the solution).[6] I note for further reference that peak-load pricing for residential consumption was limited to two time periods, due to the costs of monitoring tariff changes.

The most far-reaching example of interplay between application and theory is the *Econometrica* paper by Boiteux (1956), "Sur la gestion des monopoles publics astreints à l'équilibre budgétaire," which grew out of a consulting mission for the French railroads. The mission called for arbitrating the debate between the railroad management, which adhered to *ad valorem* tariffs (rates proportional to the value of the goods), and Maurice Allais (1948), who advocated rates proportional to marginal costs. Boiteux was "lent" by Electricité de France to the railroads for a few months—and settled the debate conclusively within that time span! He showed how the second-best analysis led to relative departures from marginal costs that are not constant, but inversely related to demand elasticities—for which value of the goods is a rough proxy. His work did have an impact on railroad fares. Boiteux was concerned with a public monopoly operating under increasing returns to scale but required to balance its budget. In this 1956 paper, he states—and solves—the general problem of characterizing Pareto-optimal production and tariffs for the public monopoly, subject to budget balance, under the assumption that the economy is otherwise competitive and that income effects are compensated. This was definitely the most general and rigorous statement of a public decision problem until then; I can remember my excitement when I began realizing what Boiteux was up to. The methodology and results are still relevant, and the paper remains a basic reference today, even if later formulations are more typically cited.[7] The work of Boiteux and his colleagues had the remarkable property of spanning the whole spectrum from practical problems to the most abstract theorizing of the day—a feature too seldom repeated, I am afraid.

[6]Those interested in the details of this work might begin with Nelson (1964) and Drèze (1964) for further references.

[7]For the more complex, but more prevalent case of several public monopolies subject to individual budget constraints, the 1956 paper remains the main reference.

Abstract Theorems

The problems studied by Vickrey and Boiteux arise from the non-convexity of production sets in a situation with high fixed costs and increasing returns to scale. The presumption in this setting was that marginal cost pricing with deficits financed by lump-sum taxes would sustain a first-best efficient allocation, if such an allocation were feasible at all. In other words, the presumption was that an analogue of the first welfare theorem holds for marginal cost pricing equilibria.

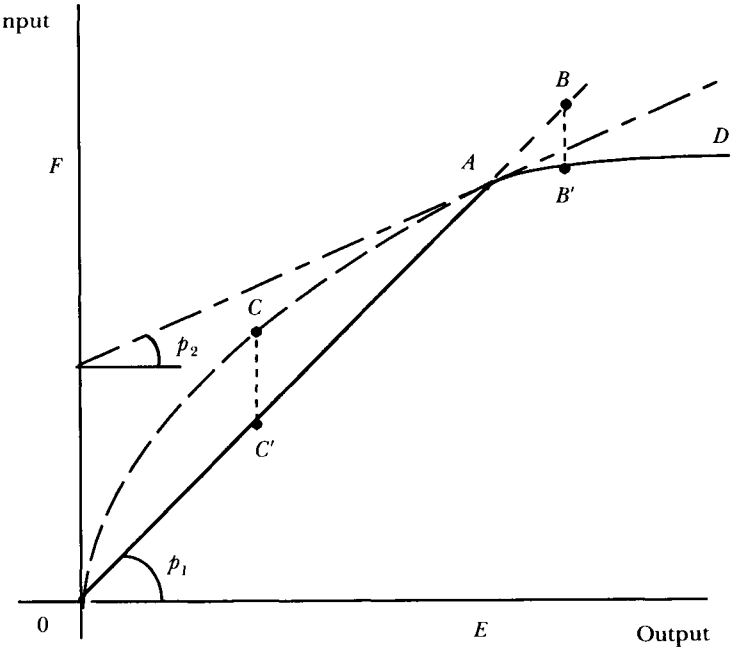
That presumption fails as a general proposition. Examples exhibited by Guesnerie (1975) and then Brown and Heal (1979) in terms of an aggregate production set reveal the possibility that *every* equilibrium violates Pareto efficiency—unless there is a representative consumer. Second, a robust example, constructed by Beato and Mas-Colell (1985) reveals the possibility that, in the absence of specific lump-sum transfers, every decentralized equilibrium violates aggregate productive efficiency—let alone overall Pareto efficiency.

The example shown in Figure 1 involves one input (measured vertically as cost), one output (measured horizontally), and two firms. Firm 1 operates under constant returns to scale, and the frontier of its production set (its cost function) is the line $0C'AB$. Firm 2 operates under increasing returns, and its production set has frontier $0CAD$. An example might be transportation of oil or gas by truck (firm 1) or by pipeline (firm 2). The aggregate production set (the sum of the individual sets) is defined by the solid frontier $0C'AD$, or aggregate cost function using the best technology. Marginal costs (the slopes of the cost functions) are continuous in output for each firm separately, but not for the aggregate production set.[8] The only price ratios supporting point A as a decentralized marginal cost pricing equilibrium are p_1 (with only firm 1 producing and selling at its own marginal cost) or p_2 (with only firm 2 producing). In the example, an intermediate price would be required to decentralize A on the consumption side (to sell the quantity E). The feasible equilibria, in the example, are then at points like B or C on the assumed demand curve (not shown), where aggregate productive efficiency fails. Indeed, the same quantities could be produced more cheaply as B' or C'. Certainly, this type of analysis is relevant to public utility regulation, and should receive due attention from policy analysts.

There is a positive side to the work of these mathematical economists. Starting with a paper in *Econometrica* by Dierker, Guesnerie and Neuefeind (1985), a theory of general equilibrium has developed for economies with non-convex production sets, where firms follow well-defined pricing rules. In particular, existence theorems of increasing generality cover (to some extent,

[8]The example also illustrates the local discontinuity (at A) of the firm-level production plans consistent with aggregate efficiency—a discontinuity discussed by Scarf in the Fall 1994 issue of this journal.

Figure 1
A Decentralized Equilibrium and Productive Efficiency



because of various differences in assumptions) the case of Ramsey-Boiteux pricing. Those interested primarily in applications might express skepticism, perhaps even horrified skepticism, upon realizing that 90 pages of a serious economics journal—a 1988 issue of the *Journal of Mathematical Economics*[9]—were devoted to existence proofs of equilibrium in non-convex economies, under alternative formulations of the assumption that marginal cost pricing entails bounded losses at normalized prices. Still, I think that economic research must cover the whole spectrum from concrete applications to that level of abstraction.

Where Practice and Abstraction Meet

Actually, practice and abstraction can end up rather close to each other. The work of Boiteux (1956) was one example. For another, let me refer to the single notable disagreement between Vickrey and Electricité de France, in the '50s and beyond, as confirmed by two entries in the *New Palgrave, A Dictionary of Economics*. Vickrey (1987), writing on "Marginal- and Average-Cost Pricing,"

[9]That issue contains a useful overall presentation by Bernard Cornet (1988).

advocates prices reflecting continuously (in time) *short-run* marginal social cost. Massé (1987), writing on "Public Utility Pricing," advocates prices reflecting *long-run* marginal cost. The disagreement concerns the extent to which electricity prices should be adjusted continuously in response to imperfectly foreseeable fluctuations in either supply (perhaps resulting from rainfall or plant failures) or demand (extreme temperatures or sports events).[10] The alternatives are relatively stable prices (Massé), leading to inefficient use and occasional quantity rationing, or unpredictable price variations (Vickrey), which entail costs to users like monitoring prices and adjusting quantities.

It is interesting to see how the practice has evolved. After 30 years of experience with peak-load pricing, Electricité de France has introduced two major innovations (Fouquet and Lescoeur, 1986; Husson, 1993). Both reflect the difficulty of forecasting the weather and hence peak loads far ahead, implying the desirability of adjusting tariffs at short notice. A first innovation, offered in 1985 to major customers, stipulates the number of days per year (actually, 22 days) when peak-load prices will be charged, but leaves open the actual dates. These are announced by EDF under short notice, on the basis of prevailing conditions. Customers agree to curtail demand on those days by interrupting production or switching to alternative sources of energy.

A second, more far-reaching innovation was introduced experimentally in 1989 and is now spreading throughout the residential network. Tariffs are differentiated between day (18 hours) and night (6 hours), with three seasonal periods; 22 peak-load days and 43 heavy-load days are announced under short notice. The tariffs vary by a factor of 14 across the six regimes. The novel element is due to electronic technology. Not only has this eliminated the cost of tariff differentiation, it also enables EDF to assume remote control of consumer equipment on the basis of revealed preferences. For instance, a customer chooses individual room temperatures as a function of energy prices, and thermostats are adjusted by EDF through remote control.

From a theoretical viewpoint, these developments correspond to state-contingent pricing, with an implicit insurance contract limiting the frequency of peak prices. (Note that full-price insurance would be inefficient, because it would eliminate the incentives for saving when it is costly.) The rationale for this form of peak-load pricing is that it provides consumers with reliable guidelines for investment decisions, a recurrent concern at EDF. However, I am not aware of a theoretical analysis validating *precisely* that arrangement, as opposed to alternative second-best candidates.

For example, another form of contingent contracts, priority service contracts, specifies the rank order in which customers are served out of the available supply. Wilson (1989) reports theoretical results for such contracts, and notes that the U.S. electric power industry fails to realize the potential

[10]The distinction is of course irrelevant in long-run stationary equilibrium, where the envelope theorem yields equality of the two concepts.

gains from priority service contracts.[11] He also shows that in an oligopolistic industry, firms have an incentive *not* to differentiate their service classes, but rather to build more capacity and charge higher prices. This line of argument is not altogether new, given that rate of return regulation had been recognized as discouraging peak-load pricing, which economizes capacity (Bailey, 1973; Laffont and Tirole, 1993).

In the United Kingdom, power generation has been privatized, with output supplied to the National Grid Company. That company organizes a decentralized spot market, to which producers submit daily price schedules for the next 24 hours. Each day the National Grid Company computes the least-cost solution to meet demand, and suppliers are paid the market clearing spot prices. This corresponds to the theory of "equilibria in supply functions," studied in particular by Klemperer and Meyer (1989). There is no indication that the daily price fluctuations are passed on to residential consumers.

The new practical developments thus force economists into new theoretical developments: equilibrium of state-contingent contracts, priority service contracts or supply functions. These analyses are still in infancy: the papers that I know do partial equilibrium analysis under assumptions of risk neutrality. Some day, these papers will be viewed as early illustrations of a general equilibrium analysis that includes uncertainty and incomplete markets.

Incentive Compatibility

Another area of fundamental relevance to public economics where abstract theorizing, though initially spurred by practical problems, eventually took on a life of its own has to do with incentive compatibility. The theory of incentives is concerned with the design of rules or mechanisms that provide individual economic agents with incentives to adopt a *nonobservable* course of action compatible with overall efficiency, or to reveal truthfully private information that is socially relevant. Information asymmetry is essential. These problems typically belong to the sphere of public economics, because market mechanisms do not provide the required incentives. A standard illustration is the "free rider" problem in choosing an optimal provision of public good, namely a level where the marginal cost of provision is equal to the sum of the so-called "marginal willingness-to-pay" of users. If user charges are based on reported preferences, there is an incentive to underreport; and conversely, if the charges are unrelated to reported preferences.

I have a parochial interest in dynamic procedures for deciding how much should be spent on public goods. The so-called MDP procedures—named after Malinvaud (1971) and Drèze and de la Vallée Poussin (1971)—are decentralized tâtonnement processes converging to an efficient vector of public goods,

[11]See also Wilson (1993) for more theory and examples of nonlinear pricing.

with the incentive property that truthful revelation is a dominant strategy at equilibrium. The abstract properties of MDP and related processes have been studied extensively; see for instance Laffont (1987) or Tulkens (1978). However, practical applications have tended to remain experimental. In one exceptional case, a real-life, real-money experiment involving willingness-to-pay of municipalities for statistical services, Bohm (1984) elicited responses with incentives to overstate for half his sample, to understate for the other half; the spread of the two sample means was only 7 percent. This confirmed the intuition of Leif Johansen (1977) to the effect that untruthful revelation might not be a serious issue. Recently, I have read with much interest a paper by Kaitala, Mäler and Tulkens (1992) applying the MDP procedure to air pollution abatement over seven regions of Finland, Russia and Estonia. Exploiting the simplification of quadratic approximation, the authors reach definite conclusions—thereby putting to practical use what otherwise might have remained an abstract curiosity.

An important step in the understanding of the problem and the development of incentive-compatible mechanisms was the discussion by Vickrey (1961) of the second-price auction. This is a sealed-bid auction, where the award goes to the highest bidder, at the price set by the second-highest bidder. As is readily verified, this procedure provides incentives for each bidder to reveal truthfully that bidder's willingness-to-pay. Laffont (1987) explains how the simple idea provides the gist of the more general (but less directly applicable) mechanisms proposed by Clarke (1971) and Groves and Loeb (1975). Auction theory has developed into a major research area, surveyed for instance by McAfee and McMillan (1987).

Here again, new lines of application keep emerging. A rich example is the auctioning of wavelengths (a pure public good) for personal communication services, like pocket telephones or wireless computer networks. McMillan (1994) reports on the theorists' contributions to the complex design of a battery of auctions for thousands of licenses estimated to be worth over $10 billion. No better illustration could be given of the practical relevance of abstract theorizing.[12]

Dusty Boxes

It is obvious, at least to me, that public economics is not a collection of the once famous "empty boxes" (Clapham, 1922), boxes of theories with the user manual missing and thus without practical application. The field has proven useful, as the area of public sector pricing demonstrates. Another well-known

[12]A more mundane example where theory played less of a role, yet a theorist's viewpoint was decisive, is provided by the auctioning of faculty offices at the economics department of Arizona State University, as recounted by Boyes and Happel (1989) in this journal.

example of applying center-stage public economics is cost-benefit analysis (Jean Drèze and Stern, 1985; Starrett, 1988; Layard and Glaister, 1994).

The problem with public economics might better be described as one of *dusty boxes*—boxes filled with useful material that remain on the shelves year after year awaiting interesting customers. However, I tend to interpret the expressions of frustration recently voiced by Vickrey (1993a, b) as a form of juvenile (!) impatience, since a number of his early suggestions are eventually being implemented, even if not always precisely according to the instructions of the inventor. For example, in 1948, Vickrey was admonishing airlines to adjust prices of advance reservations over time, mimicking the pattern that would emerge in a competitive speculators market.[13] Today, "airlines use computer systems to adjust the number of discount seats they offer according to current reservation levels" (Klemperer and Meyer, 1989, p. 1244), although how much good that does is not clear to me. Resort managers and tour operators likewise offer special discounts when reservations lag behind reference levels. There is at least one box on which dust is no longer settling.

The same can be said about road pricing, a topic launched in the United States by Vickrey (1959) and extended in Vickrey (1969).[14] This idea seems to be nearing adoption. A 2-year study of urban transportation sponsored by the American Academy of Arts and Sciences and the Aspen Institute (Johnson, 1993, p. 9) offers this leading recommendation: "Impose variable charges (and perhaps variable rebates) for the use of arterial roads in high-density areas, with rates based on time of day and location. Road use or congestion pricing is already utilized in Singapore, Oslo, Bergen and (on a much smaller scale, using sophisticated electronic systems) at the Los Angeles International Airport." The Singapore purchasers of that box must have brushed off a lot of dust, as it had been on the shelf since the '50s! Still, road pricing is coming (*The Economist*, 1993; white paper of the European Commission, 1994).

It is useful to reflect on why some obvious gains from improved economic organization are not realized. Time wasted by commuters in traffic bottlenecks adds up, on a world scale, to a staggering welfare loss. In the short term, when household residences, places of employment and transportation infrastructure can be treated as having fixed locations, the nature of the problem is an externality. An additional automobile on a congested road not only suffers from the state of congestion but adds to it, imposing additional congestion costs to other users.[15] Road pricing is a natural way of internalizing the externality. So

[13]It is refreshing to read about "transatlantic plane service in fifty-passenger planes once a day." O Tempora, O more aisles!

[14]Arnott, de Palma and Lindsey (1991) further extend this line of analysis to the spatial pricing of commuter parking.

[15]Let me quote a quantitative example from Vickrey (1969), based on a study of the flow of traffic through Lincoln tunnel in New York City: "An individual who has to take ten minutes longer to make a given trip, than he would if there were no interference from other traffic, causes forty-five vehicle-minutes of delay in the aggregate to other vehicles with whose movement he interferes."

why are acceptance and implementation so slow? I have neither special expertise nor special information to offer, but the work under review suggests four elements of a possible answer.

First, implementation of efficient economic schemes sometimes requires a sophisticated technology. In the cases given here, this can require unique ways of taking tolls in subways, metering residential electricity, or charging for road use. Although some of these difficulties have been addressed, research and development in this area has been pursued erratically, partly by individual firms on their own, partly under public contracts. This seems to be a clear instance of underprovision of a public good (research) due to insufficient cooperation among the myriad of persons or institutions with a stake in the matter. If some method were organized to collect only a fraction of the actual willingness-to-pay of interested parties, we could have funded practical development and had several test applications going today. Perhaps economists should campaign for international initiatives to spur experimental applications of such pricing schemes in selected cities?

Second, economic research is not always carried to the point of operational guidelines, even in areas where technology is not at stake. For instance, I had discovered with interest in Vickrey (1977) one modern formulation of the "Henry George Theorem," to the effect that operating losses of public utilities pricing at marginal cost might add up, over a metropolitan area, to the very same amount as the differential land rents associated with the availability of low-priced services. But I could nowhere find operational guidelines for a scheme of prospective taxation of the capital gains on land values, suitable to finance investments in improved service (Drèze, 1992). Few economists will object to the research agenda of developing operational guidelines, but fewer still will pursue it themselves.

A third difficulty involves sociopolitical acceptance, which falls into the research area of public choice specialists. How can new ideas be implemented and pushed to their operational limits? In a letter to me, Peter Diamond once wrote that his favorite illustration of the lag between academic writing and public action is collecting tolls only one way on bridges and tunnels. Although the idea apparently occurred to transportation specialists in the late '40s, the first U.S. implementation seems to have been at the Bay Bridge in San Francisco in 1965. It took another 20 years for the idea to reach Boston. Hopefully, some public choice specialist will document the record and draw lessons—or has this been done already?

Finally, if you ask colleagues what public economics has accomplished over the past 20 or 30 years toward bringing about better public decisions and management, one frequent answer is that we have taught more relevant theory to a generation of students who will be more effective as decision makers or advisers. In general, I agree. But how many of our students have heard about priority service pricing or road pricing? Not many, I would guess. Textbooks and handbooks do not quite fill the gap. I submit that this kind of applied

public economics deserves more attention than it currently receives in our teaching programs.[16]

Public Macroeconomics

I remarked earlier that public economics does not presently cover what had been an important concern of public finance, namely the macroeconomic stabilization function of government. Nonetheless, I think that a "public economics viewpoint" remains indispensable to macroeconomics. Sandmo (1983, p. 319) took this line as well, when commending Leif Johansen for his broad view of the field: "The broad view may come back into fashion once developments in microbased macroeconomics have been integrated with the analysis of taxation and public expenditure."

Let me explain. To some extent, the traditional field of macroeconomics shares the fate of public finance: it is being invaded by theoretical microeconomics and affected by its methodological trends; it has witnessed the splitting off of separate fields, like finance and labor economics. At this point, most building blocks of macroeconomics have received a microeconomic underpinning, and macroeconomic models devoid of microfoundations have fallen in disrepute. One major difference, however, is that the contribution of theoretical microeconomics has to date been less decisive in the case of macroeconomics than in the case of public economics. The unifying power of the general equilibrium model, extended to public goods and second-best analysis, has no counterpart in macroeconomics, where new classical and new Keynesian schools still compete for the center stage. Moreover, neither school operates yet within a methodology easily integrated with that of public economics. Thus, public economists have largely kept out of macroeconomics. There are, of course, notable exceptions. For instance, the work of Martin Feldstein (1974), Auerbach and Kotlikoff (1987) and others on public pensions and private savings is a significant contribution to public macroeconomics.

When I claim that a "public economics viewpoint" is indispensable to macroeconomics, I express primarily the belief that distributional issues are central to the macroeconomic problems of today, both in Europe and the United States. Policies and institutions aimed at protection of personal income have macroeconomic implications for inflation and employment; in turn, distributive (vertical) equity has implications for wage formation and social endorsement of macroeconomic policies. The macroeconomic objectives of price stability, full employment and growth call for a welfare analysis built on the

[16]Perhaps that attention first requires added familiarity on the part of teachers—the chicken-egg parable. For teachers in search of background and examples, the Summer 1993 issue of this journal has an 8-line entry under "Recommendations for Further Reading" with two references on road pricing.

same foundations as public economics—namely, microfoundations rooted in social choice theory.

One particular aspect to which I have become increasingly sensitive concerns the employment opportunities of low-skilled workers, opportunities that have been undermined by productivity gains in manufacturing, technological trends in services and increased competition from low-wage areas (Drèze and Sneessens, 1994). Policies to alleviate inequality in the United States and unemployment in Europe cannot ignore the weakened position of the low skilled. But a meaningful approach to that problem must search to reconcile employment opportunities, work incentives and income protection.

I thus see as a major challenge to public economics over the next 40 years: the rebuilding of close links to macroeconomics, which are indispensable to a comprehensive, integrated approach to distributive issues and public policy.

Transferring Knowledge

Is road pricing a topic in applied public economics, or a topic in more specialized fields like transportation economics or urban economics? In itself, the question is of little interest. What matters is that the problem be approached in the proper framework and with proper tools. A proper framework will recognize that transportation costs interact with choices of locations for residences and places of employment. These choices in turn bring in other dimensions, like local taxes, land values and local public goods. Models of metropolitan suburbanization, for instance, aim at integrating all these elements (Mieszkowski and Mills, 1993). Proper tools thus include theories of local public goods, clubs and fiscal federalism—which are close to the center stage of public economics. But more remote associations can help, as exemplified by the formal analogy between the non-convexity arising in economies with local public goods, and in economies with incomplete asset markets (Drèze, 1974; Starrett, 1988), which have been the subject of extensive theoretical research (Geanakoplos, 1990; Magill and Shafer, 1991).

The segmentation of fields and subfields is genuine and growing—inescapably, I am afraid. This fragmentation of fields raises problems of how knowledge is to be transferred between them and between theory and practice. A field like public economics can potentially play a useful role in transferring knowledge across the boundaries of specialization. But only if applications from health and transportation economics, urban and public choice economics and other areas are included in standard course work, textbooks and handbooks.

Public Economists

I am impressed by the depth and breadth of knowledge that a serious public economist dreams of commanding. The methodological spectrum in-

cludes at one end practical and institutional aspects of public utility pricing, taxation or health care provision, which give the field its substantive content. The real problems encountered in these and many other areas offer scope for the general equilibrium mathematical analysis of second-best policies. At the far end of the spectrum is abstract modelling of economies with non-convex technologies or uncertainty and incomplete markets. Confronted by this spectrum, duly illustrated here, I feel neither despairing nor resigned to narrow specialization, but probably overextended.

As I reflect upon my own experience, I feel able to identify the institutions that help us live with this situation. First and foremost, a lively and congenial economics department offers many opportunities for keeping indirectly in touch with areas methodologically or substantively remote from our own preoccupations.[17] I had the privilege of holding my first academic job in the late '50s at the Graduate School of Industrial Administration of Carnegie-Mellon University (Carnegie Tech in those days). Direct involvement in the management of a paint factory led to the certainty equivalence theorem for stochastic quadratic programming (Simon, 1956; Theil, 1957); to its application through linear decision rules (Holt et al., 1960); and to the concept of rational expectations (Muth, 1961). There was much more. Never since then have I experienced such intellectual excitement.

That a good economics department should span and integrate the whole spectrum from concrete applications to abstract theorizing matters not only for its academic members; it is crucial for the education of students. According to the COGEE report (Krueger, 1991, p. 1039): "[I]t is an underemphasis on the linkages between tools, both theory and econometric, and real-world problems that is the weakness of graduate education in economics." The report (p. 1047) puts much blame on "an excessively theoretical approach to the substantive fields in the second year, which extend and expand theory but... are less successful in applying and using theory." The perspective presented here leads one to expect that many courses in public economics would be devoted to what I have called the center-stage theory, with limited attention paid to the underlying practical problems, especially those arising in separate fields like health or urban economics. The root cause of the shortcoming identified in the COGEE report lies with the research orientation of teachers and the insufficient interplay of theory and applications in the lives of economics departments.

The young history of the field of public economics suggests to me that researchers who have themselves linked theory to real problems have made significant contributions, worth emulating and teaching. (Notice that the

[17]I also wish to express my indebtedness to the American Economic Association for two very useful and complementary means of transfer of knowledge between theory and applications and across substantive fields: namely, the *Journal of Economic Perspectives* and the *Journal of Economic Literature*. Of the seven journals that I receive directly, these are the two from which I repeatedly read a fair amount. I was initially deterred by the "puzzles" section of *JEP*, but have become a regular reader of "Policy Watch" and "Recommendations for Further Reading."

emphasis is put on linking, not on doing applied or empirical work without the link to theory or the advancement of theory.) I find it gratifying that John von Neumann himself would see a close relationship between real problems and abstract theory as essential to mathematics as well. The following quotation (von Neumann, 1947, p. 9) expresses the point suggestively:

> I think that it is a relatively good approximation to truth—which is much too complicated to allow anything but approximations—that mathematical ideas originate in empirics. . . . As a mathematical discipline travels far from its empirical source, or still more, if it is a second and third generation only indirectly inspired by ideas coming from "reality", it is beset with very grave dangers. It becomes more and more purely aestheticizing, more and more purely *l'art pour l'art*. This need not be bad, if the field is surrounded by correlated subjects, which still have closer empirical connections, or if the discipline is under the influence of men with an exceptionally well-developed taste. But there is a grave danger that the subject will develop along the line of least resistance, that the stream, so far from its source, will separate into a multitude of insignificant branches, and the discipline will become a disorganized mass of details and complexities. In other words, at a great distance from its empirical source, or after much "abstract" inbreeding, a mathematical subject is in danger of degeneration. . . . [W]henever this stage is reached, the only remedy seems to me to be the rejuvenating return to the source: the reinjection of more or less directly empirical ideas. I am convinced that this was a necessary condition to conserve the freshness and the vitality of the subject and that this will remain equally true in the future.

The converse influence of mathematical formulations on economics was suggested in an editorial for the *Journal of Mathematical Economics*, when Truman Bewley and Wayne Shafer (1988, p. 101) took over the editorship:

> Most economists would probably agree that the importance of mathematics to economics stems from its usefulness in developing economic intuitions. A mathematical formulation provides a logical test of an economic intuition. Also, the rigorous development of economic ideas can itself suggest new ones. In these ways, the influence of mathematics on economics is analogous to that of empirical work.

I am not sure that most economists would agree that the influence of mathematics on economics is analogous to that of empirical work. And I note with interest that Bewley himself has recently engaged in a particularly demanding form of empirical work, namely, an interview survey (Bewley and Brainard, 1993). Still, let me pull together the threads of my rambling discussion and summarize.

Starting in the early '50s, microeconomic reasoning invaded the age-old field of public finance. Since then, the new field of public economics has emerged. That central development is flanked on one side by implementable solutions to practical problems, on the other side by the development of a rich abstract framework. The two flanks should come together, but my lifelong observation is that economists doing derivative research based on the literature outnumber those working on problems directly inspired by real-world situations. Their neglect becomes self-perpetuating, because refereeing, hiring, promotions, teaching, advising and so on reflect professional standards, while graduating students bring the standards of their past teachers to their new jobs. Few departments succeed in giving life to the interplay of theory and real problems. Yet it must be the responsibility of economics departments to promote such contributions and their authors.

■ *I am grateful to Richard Arnott, Kenneth Arrow, Robin Boadway, Peter Diamond, Victor Ginsburgh, Jean-Jacques Laffont, Maurice Marchand, Pierre Pestieau, Agnar Sandmo, Carl Shapiro, Henry Tulkens and especially Timothy Taylor for helpful comments. The present paper grew out of a lecture to the annual meetings of the American Economic Association in January 1994, where the collected papers volume edited by Arnott et al. (1994) was presented to its author William Vickrey.*

References

Allais, Maurice, "Le problème de la coordination des transports et la théorie économique," *Revue d'Economie Politique*, March/April 1948, *2*, 212–71.

Arnott, Richard, Kenneth Arrow, Anthony B. Atkinson, and Jacques H. Drèze, eds., *Public Economics: Selected Papers by William Vickrey*. Cambridge: Cambridge University Press, 1994; also listed as Vickrey (1994).

Arnott, Richard, Andre de Palma, and Robin Lindsey, "A Temporal and Spatial Equilibrium Analysis of Commuter Parking," *Journal of Public Economics*, August 1991, *45*, 301–35.

Atkinson, A. B., *Modern Public Finance*. Aldershot, Eng.: Elgar, 1991.

Atkinson, A. B., "The *Journal of Public Economics* at 21 years and 50 volumes: A Personal view," *Journal of Public Economics*, Master Index 1993, 1–7.

Atkinson, A. B., and Joseph E. Stiglitz, *Lectures on Public Economics*. London: McGraw-Hill, 1980.

Auerbach, Alan J., and Martin S. Feldstein, *Handbook of Public Economics*. Amsterdam: North-Holland, 1985.

Auerbach, Alan J., and Laurence J. Kotlikoff, *Dynamic Fiscal Policy*. Cambridge: Cambridge University Press, 1987.

Ballard, Charles, John Shoven, and John Whalley, "General Equilibrium Computation of the Marginal Welfare Costs of Taxes in the United States," *American Economic Review*, March 1985, *75*, 128–38.

Bailey, Elizabeth, *Economic Theory of Regulatory Constraint*. Lexington, Mass.: Lexington Books, 1973.

Beato, Paulina, and Andreu Mas-Colell, "On Marginal Cost Pricing with Given Tax-

Subsidy Rules," *Journal of Economic Theory*, December 1985, *37*, 356–65.

Bewley, Truman, and William Brainard, "A Depressed Labour Market, as Explained by Participants," confidential mimeo, New Haven, Yale University, 1993.

Bewley, Truman, and Wayne Shafer, "Editorial," *Journal of Mathematical Economics*, 1988, *17*:2, 101–2.

Boadway, Robin W., and David E. Wildasin, *Public Sector Economics*. Boston: Little, Brown, 1984.

Bohm, Peter, "Revealing Demand for an Actual Public Good," *Journal of Public Economics*, July 1984, *24*, 135–51.

Boiteux, Maurice, "La tarification des demandes en pointe," *Revue Générale de l'Electricité*, August 1949, *58*, 321–40; translated by H. W. Izzard as "Peak-Load Pricing," *Journal of Business*, April 1960, *33*, 157–79.

Boiteux, Maurice, "Sur la gestion des monopoles publics astreints à l'équilibre budgétaire," *Econometrica*, January 1956, *24*, 22–40; translated as "On the Management of Public Monopolies Subject to Budgetary Constraints," *Journal of Economic Theory*, September 1971, *3*, 219–40.

Boyes, William J., and Stephen K. Happel, "Auctions as an Allocation Mechanism in Academia: The Case of Faculty Offices," *Journal of Economic Perspectives*, Summer 1989, *3*, 37–40.

Brown, Donald J., and Geoffrey M. Heal, "Equity, Efficiency, and Increasing Returns," *Review of Economic Studies*, October 1979, *46*, 571–85.

Clapham, Sir John Harold, "Of Empty Economic Boxes," *Economic Journal*, September 1922, *32*, 305–14.

Clarke, Edward, "Multipart Pricing of Public Goods," *Public Choice*, Fall 1971, *11*, 17–33.

Cornet, Bernard, "General Equilibrium Theory and Increasing Returns: Presentation," *Journal of Mathematical Economics*, 1988, *17*:2–3, 103–18.

Diamond, Peter, and James A. Mirrlees, "Optimal Taxation and Public Production: I. Production Efficiency," *American Economic Review*, March 1971a, *61*, 8–27.

Diamond, Peter, and James A. Mirrlees, "Optimal Taxation and Public Production: II. Tax Rules," *American Economic Review*, June 1971b, *61*, 261–78.

Dierker, Egbert, Roger Guesnerie, and Wilhelm Neuefeind, "General Equilibrium Where Some Firms Follow Special Pricing Rules," *Econometrica*, November 1985, *53*, 1369–93.

Drèze, Jacques H., "Some Postwar Contributions of French Economists to Theory and Public Policy," *American Economic Review*, June 1964, *54*:4(2), 1–64.

Drèze, Jacques H., "Investment under Private Ownership: Optimality, Equilibrium and Statility." In Drèze, J. H., ed., *Allocation under Uncertainty: Equilibrium and Optimality*. London: Macmillan, 1974, pp. 129–66.

Drèze, Jacques H. "La capitale de l'Europe, le marché et les pouvoirs publics locaux: murmures d'analyse et d'anticipation économiques," *Société Royale d'Economie Politique de Belqique*, March 1992, *470*, 3–55.

Drèze, Jacques H., Kenneth Arrow, Anthony B. Atkinson, Kaushik Basu, Seppo Honkapohja, Anne Krueger, Juan-Antonio Morales, and Nicholas Stern, "Report of the IEA Committee on a New School of Economics and Economic Development (SEED) in the Third World," *Journal of Public Economics*, September 1994, *55*, 1–18.

Drèze, Jacques H., and D. de la Vallée Poussin, "A Tâtonnement Process for Public Goods," *Review of Economic Studies*, April 1971, *38*, 133–50.

Drèze, Jacques H., and Henri Sneesens, "Technological Development, Competition from Low-Wage Economics and Low-Skilled Unemployment," *Swedish Economic Policy Review*, Autumn 1994, *1*, 185–214.

Drèze, Jean P., and Nicholas Stern, "Theory of Cost-Benefit Analysis." In Auerbach, A., and M. Feldstein, eds., *Handbook of Public Economics*. Amsterdam: North-Holland, 1985, pp. 909–89.

The Economist, "Electronic Road-Tools; Big Brother is Clocking You," August 7, 1993, *328*:1823, 79–80.

Ekelund, Robert B., "Dupuit, Arsène-Jules-Emile Juvenal." In Eatwell, J., M. Milgate, and P. Newman, eds., *The New Palgrave, A Dictionary of Economics*. Vol. I. London: Macmillan Press, 1987, pp. 943–44.

European Commission, "Croissance, Compétitivité, Emploi." Livre blanc, Bruxelles, CECA-CE-CEEA, 1994.

Feldstein, Martin S., "Social Security, Induced Retirement, and Aggregate Capital Accumulation," *Journal of Political Economy*, September/ October 1974, *82*, 905–26.

Fleming, John M., "Price Output and Policy of State Enterprise: Comment," *Economic Journal*, December 1944, *54*, 328–37.

Fouquet, Denis, and Bruno Lescoeur, "Recent Development in Pricing of Electricity in France." Paper presented at the French Indian Seminar on the Management of the Public Sector (New Delhi), *Département des Etudes Economiques Générales*, Electricité de France, Paris, 1986.

▶**Geanakoplos, John,** "An Introduction to General Equilibrium with Incomplete Markets," *Journal of Mathematical Economics*, 1990, *19*:1–2, 1–38

▶**Groves, Theodore, and Martin Loeb,** "Incentives and Public Inputs," *Journal of Public Economics*, August 1975, *4*, 211–26.

▶**Guesnerie, Roger,** "Pareto Optimality in Non-Convex Economies," *Econometrica*, January 1975, *43*, 1–29.

▶**Hausman, Jerry, and James Poterba,** "Household Behavior and the Tax Reform Act of 1986," *Journal of Economic Perspectives*, Summer 1987, *1*, 101–19.

Henry, Claude, *Microeconomics for Public Policy*. Oxford, Clarendon, 1989.

Holt, Charles C., Franco Modigliani, John F. Muth, and Herbert A. Simon, *Planning Production, Inventories and Work Force*. Englewood Cliffs: Prentice-Hall, 1960.

▶**Hotelling, Harold,** "The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates," *Econometrica*, July 1938, *6*, 242–69.

Husson, Emmanuel, "Tempo: une nouvelle option pour le tarif bleu," *Cahiers*, DEPS-DEGS 24, Electricité de France, Paris, 1993.

Johansen, Leif, *Public Economics*. Amsterdam: North-Holland, 1965.

Johansen, Leif, "The Theory of Public Goods: Misplaced Emphasis?," *Journal of Public Economics*, February 1977, *7*, 147–52.

Johnson, Elmer W., *Avoiding the Collision of Cities and Cars: Urban Transportation Policy for the Twenty-First Century*. Chicago: American Academy of Arts and Sciences, 1993.

Kaitala, Veijo P., Karl-Goran Mäler, and Henry Tulkens, "The Acid Rain Game as a Resource Allocation Process with an Application to the Cooperation among Finland, Russia and Estonia," mimeo, BEIJER International Institute of Ecological Economics, Stockholm, 1992.

▶**Klemperer, Paul, and Margaret Meyer,** "Supply Function Equilibria in Oligopoly under Uncertainty," *Econometrica*, November 1989, *57*, 1243–77.

Kolm, Serge-Christophe, *Les Fondements de l'Economie Publique*. Paris: IFP, 1964.

Kolm, Serge-Christophe, "Public Economics." In Eatwell, J., M. Milgate, and P. Newman, eds., *The New Palgrave, A Dictionary of Economics*. Vol. III, London: Macmillan Press, 1987, pp. 1047–55.

Krueger, Anne O., et al., "Report of the Commission on Graduate Education in Economics," *Journal of Economic Literature*, September 1991, *29*, 1035–53.

Laffont, Jean-Jacques, "Incentives and the Allocation of Public Goods," In Auerbach, A., and M. Feldstein, eds., *Handbook of Public Economics*. Amsterdam: North-Holland, 1987, pp. 537–69.

Laffont, Jean-Jacques, *Fundamentals of Public Economics*. Cambridge: MIT Press, 1988.

Laffont, Jean-Jacques, and Jean Tirole, *A Theory of Incentives in Procurement and Regulation*. Cambridge: MIT Press, 1993.

Layard, P. Richard P., and Stephen Glaister, *Cost-Benefit Analysis*. Cambridge: Cambridge University Press, 1994.

Magill, Michael, and Wayne Shafer, "Incomplete Markets." In Hildenbrand, W., and H. Sonnenschein, eds., *Handbook of Mathematical Economics*. Amsterdam: North-Holland, 1991, pp. 1524–614.

▶**Malinvaud, E.,** "A Planning Approach to the Public Good Problem," *Swedish Journal of Economics*, March 1971, *73*, 96–112.

Massé, Pierre B., "Public Utility Pricing." In Eatwell, J., M. Milgate, and P. Newman, eds., *The New Palgrave, A Dictionary of Economics*. Vol. III, London: Macmillan Press, 1987, pp. 1069–72.

▶**Massé, Pierre B., and Robert Gibrat,** "Application of Linear Programming to Investments in the Electric Power Industry," *Management Science*, 1957, *3*:2, 149–66.

McAfee, R. Preston, and John McMillan, "Auctions and Bidding," *Journal of Economic Literature*, June 1987, *25*, 699–738.

▶**McMillan, John,** "Selling Spectrum Rights," *Journal of Economic Perspectives*, Summer 1994, *8*, 145–62.

▶**Meade, James E.,** "Price and Output Policy of a State Enterprise," *Economic Journal*, December 1944, *54*, 321–8, 337–9.

▶**Mieszkowski, Peter, and Edwin S. Mills,** "The Causes of Metropolitan Suburbanization," *Journal of Economic Perspectives*, Summer 1993, *7*, 135–47.

Musgrave, Richard, *The Theory of Public Finance*. New York: McGraw-Hill, 1959.

Musgrave, Richard, "Public Finance." In Eatwell, J., M. Milgate, and P. Newman, eds., *The New Palgrave, A Dictionary of Economics*. Vol. III, London: Macmillan Press, 1987, pp. 1055–61.

Muth, John F., Rational Expectations and the Theory of Price Movements," *Econometrica*, July 1961, *29*, 315–35.

Nelson, James R., ed., *Marginal Cost Pricing in Practice*. Englewood Cliffs: Prentice-Hall, 1964.

Ramsey, Frank P., "A Contribution to the Theory of Taxation," *Economic Journal*, March 1927, *37*, 47–61.

Samuelson, Paul A., "The Pure Theory of Public Expenditure," *Review of Economics and Statistics*, November 1954, *36*, 387–89.

Samuelson, Paul A., "Principles of Efficiency: Discussion," *American Economic Review*, Papers and Proceedings, May 1964, *54*, 93–6.

Samuelson, Paul A., "Theory of Optimal Taxation," *Journal of Public Economics*, July 1986, *30*, 137–43.

Sandmo, Agnar, "Leif Johansen's Contribution to Public Economics," *Journal of Public Economics*, August 1983, *21*, 317–24.

Scarf, Herbert, "The Allocation of Resources in the Presence of Indivisibilities," *Journal of Economic Perspectives*, Fall 1994, *8*, 111–28.

Simon, Herbert A., "Dynamic Programming under Uncertainty with a Quadratic Criterion Function," *Econometrica*, January 1956, *24*, 74–81.

Starrett, David A., *Foundations of Public Economics*. Cambridge: Cambridge University Press, 1988.

Tulkens, Henry, "Dynamic Processes for Public Goods: An Institution-Oriented Survey," *Journal of Public Economics*, April 1978, *9*, 163–201.

Theil, Henri, "A Note on Certainty Equivalence in Dynamic Planning," *Econometrica*, April 1957, *25*, 346–49.

Tiebout, Charles M., "A Pure Theory of Local Expenditures," *Journal of Political Economy*, October 1956, *64*, 416–24.

Vickrey, William S., "Some Objections to Marginal-Cost Pricing," *Journal of Political Economy*, June 1948, *56*, 218–38; reprinted in Vickrey (1994), pp. 216–39.

Vickrey, William S., "The Revison of the Rapid Transit Fare Structure of the City of New York," mimeo, Technical Monograph n°3, Finance Project, Mayor's Committee for Management Survey of the City of New York, 1952.

Vickrey, William S., "A Proposal for Revising New York's Subway Fare Structure," *Journal of the Operations Research Society of America*, February 1955, *3*, 38–69; reprinted in Vickrey (1994), pp. 277–306.

Vickrey, William S., "Statement on the Pricing of Urban Street Use." *Hearings: US Congress, Joint Committee on Metropolitan Washington Problems*. 1959, 466–77.

Vickrey, William S., "Counterspeculation, Auctions, and Competitive Sealed Tenders," *Journal of Finance*, March 1961, *16*, 8–37; reprinted in Vickrey (1994), 55–84.

Vickrey, William S., "Dupuit Jules," *Encyclopedia of the Social Sciences*, 1968, *12*, 308–11.

Vickrey, William S., "Congestion Theory and Transport Investment," *American Economic Review*, May 1969, *59*, 251–60; reprinted in Vickrey (1994), pp. 320–32.

Vickrey, William S., "The City as a Firm." In Feldstein, M. S., and R. F. Inman, eds., *The Economics of Public Services*. London: Macmillan, 1977, pp. 334–43; reprinted in Vickrey (1994) 339–349.

Vickrey, William S., "Marginal- and Average-Cost Pricing." In Eatwell, J., M. Milgate and P. Newman, eds., *The New Palgrave, A Dictionary of Economics*. Vol. III. London: Macmillan, 1987, pp. 311–18; reprinted in Vickrey (1994), 197–215.

Vickrey, William S., "Today's Task for Economists," *American Economic Review*, March 1993a, *83*, 1–10; reprinted in Vickrey (1994), 432–53.

Vickrey, William S., "My Innovative Failures in Economics," *Atlantic Economic Journal*, March 1993b, *21*, 1–9.

Vickrey, William S., *Public Economics Selected Papers by William Vickrey*. Cambridge: Cambridge University Press, 1994; also listed as Arnott et al. (1994).

von Neumann, John, "The Mathematician." In Heywood, R. B., ed., *Works of the Mind*. Chicago: University of Chicago Press, 1947, pp. 180–96; reprinted in von Neumann, J., *Collected Works*. Vol. 1. New York: Pergamon, 1961, pp. 1–9.

Wilson, Robert, "Efficient and Competitive Rationing," *Econometrica*, January 1989, *57*, 1–40.

Wilson, Robert, *Nonlinear Pricing*. Oxford: Oxford University Press, 1993.

This article has been cited by:

1. C. Vasudevan. 2020. HISTORY AND ORIGIN OF PUBLIC ECONOMICS. *International Journal of Research -GRANTHAALAYAH* **8**:8, 124-131. [Crossref]
2. Emily Brown, Ben McNair. 2020. Energy Pricing Reform in Australia: A Case Study. *Economic Papers: A journal of applied economics and policy* **39**:1, 1-14. [Crossref]
3. Young-Hyun Yeo, Keon-Hyung Lee, Suk-Won Ryu. 2018. Effect of publicness on government control and organizational citizenship behavior: an empirical study from public organizations in Korea and Japan. *International Review of Public Administration* **23**:4, 203-218. [Crossref]
4. Richard Arnott. Vickrey, William Spencer (1914–1996) 14313-14317. [Crossref]
5. Oliver E. Williamson. Interdisciplinary Social Science: The Transaction Cost Economics Project 123-140. [Crossref]
6. Laurent David, Michel Le Breton, Olivier Merillon. Public Utility Pricing and Capacity Choice with Stochastic Demand 57-99. [Crossref]
7. Laurent David, Michel Le Breton, Olivier Merillon. Kolm as a Contributor to Public Utility Pricing, Second-Best Culture, and the Theory of Regulation 19-56. [Crossref]
8. Yahya M. Madra, Fikret Adaman. 2010. Public economics after neoliberalism: a theoretical–historical perspective. *The European Journal of the History of Economic Thought* **17**:4, 1079-1106. [Crossref]
9. Oliver E. Williamson. 2010. Transaction Cost Economics: The Natural Progression. *American Economic Review* **100**:3, 673-690. [Citation] [View PDF article] [PDF with links]
10. Oliver E. Williamson. 2008. TRANSACTION COST ECONOMICS: THE PRECURSORS. *Economic Affairs* **28**:3, 7-14. [Crossref]
11. Richard Arnott. Vickrey, William Spencer (1914–1996) 1-5. [Crossref]
12. Oliver E. Williamson. 2007. Transaction Cost Economics: An Introduction. *SSRN Electronic Journal* . [Crossref]
13. Oliver E. Williamson. 2005. Transaction cost economics and business administration. *Scandinavian Journal of Management* **21**:1, 19-40. [Crossref]
14. Donald C. Shoup. 2004. The ideal source of local public revenue. *Regional Science and Urban Economics* **34**:6, 753-784. [Crossref]
15. Brian Levy. Comparative Regulation 355-359. [Crossref]
16. Robert W. Dimand, Robert H. Koehn. 2000. Vickrey, Eisner, the Budget, and the Goal of Chock-Full Employment. *Journal of Economic Issues* **34**:2, 491-497. [Crossref]
17. Agnar Sandmo,. 1999. Asymmetric Information and Public Economics: The Mirrlees-Vickrey Nobel Prize. *Journal of Economic Perspectives* **13**:1, 165-180. [Abstract] [View PDF article] [PDF with links]
18. Pierre-Henri Derycke. 1998. Road pricing - Analysis and policies (A historical perspective). *Recherches économiques de Louvain* **64**:1, 63-74. [Crossref]
19. William F. Fox, Matthew N. Murray. Intergovernmental Aspects of Growth and Stabilization Policy 241-287. [Crossref]