History of public economics: The historical French school

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Abstract

After having recalled the birth and development of the modern field of public economics, this article focuses on the centuries-old invention, development and application of the basic concepts of public economics by the bodies of French technical civil servants. This includes, among others, the normative criteria implied by the various forms and uses of the concept of the surplus, public pricing and the theory of value constraints, and the mixed or intermediate structures between public and private goods. The social, moral and technical reasons for these discoveries are explained. Conclusions for the present choices between private and public management are drawn.

Keywords: public economics; history; schools of thought.

The mathematician Henri Poincaré wrote, in his book *La Science et l'hypothèse* (*Science and Hypothesis*): "A science which disregards its history is like a ship without a steering wheel: It can go fast, but where?"[1]

After having recalled the origins of modern public economics (and of this expression) in the 1960's, this text will present the centuries-old history of contributions to and applications of public economics by technical civil servants in France. Although it will focus on economic concepts such as the meaning and applications of surplus theory, public

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marginal cost pricing and second best, or the theory of mixed or intermediate public and private goods, this text will have to be as much ethical and sociological history as economic history because this is what explains the contributions in question. This will in particular shed light on the debated issue of the relevance of normative concepts in the economic study of the public sector. This presentation will conclude, following Poincaré's advice, by trying to draw the lessons of history for the present fate of the organization and policies of public services, regulation, and "natural monopolies".

1. Modern public economics

When I first went to the United States, at Harvard and MIT, in 1963-4, I was asked, as usual, "What are you working on?" When I answered "public economics", nobody understood. This includes my two most steady interlocutors, Paul Samuelson and Richard Musgrave. They understood the topic, of course. Samuelson had written his first articles on public goods, and Musgrave had published his volume *The Theory of Public Finance*.

I used the term "economics" to emphasize that the concern was the scientific analysis of the topic. The expression caught on rapidly. In 1963, I published my lecture notes as *The Foundations of Public Economics*.[2] In 1965, Leif Johansen, whom I had met, published a book entitled *Public Economics*.[3] The first conference with the title Public Economics was then held in 1966 in Biarritz (Southern France), organized by Samuelson and Musgrave, under the joint auspices of the French National Center of Scientific Research and the International Economic Association. This conference opened or renewed a number of fields in the domains of public goods, planning, optimum distribution, inequalities, public utilities, etc. Its participants included Samuelson, Musgrave, Lindbeck, Lundberg, Sen, Dorfman, Malinvaud, Sheshinski, Margolis, Marglin, Posner, Turvey, Robinson, Peston, Guitton and James (Musgrave told me that Samuelson had just forgotten to invite Jim Buchanan).[4, 5] The volume of the collected papers was published in book form in 1968 in French by the CNRS as *Economie Publique*, and in 1969 in English by Macmillan under the title *Public Economics*. Interestingly, the volume in English was announced by the one in French as due to be entitled *Analysis of the Public Economy*, and it finally had the subtitle "An analysis of public production and consumption and their relations to the private sector". This shows that the expression *Public Economics* was not yet well settled.

About this time, I gave a series of lectures on public economics, published in five volumes under this title. A permanent structure called the "International seminar in public economics" was founded in Paris (at the Commissariat Général du Plan) at the initiative of Richard Musgrave and it planned a series of meetings on public economics. I organized the initial conference at the Abbey of Royaumont near Paris – with Buchanan this time, but not Samuelson, yet with Joe Stiglitz – and the second was held in Siena. A few years later, Tony Atkinson organized other meetings on the topic (Essex, Torino) and founded the *Journal of Public Economics*. An Institute of Public Economics, a journal, and large yearly meetings were founded in Marseilles. The next major institutional step was probably the foundation of the *Journal of Public Economic Theory* by Myrna Wooders, John Conley and Frank Page and the associated much attended yearly conferences.[6] The present network and series of conferences on public economics are in this tradition.

2. The historical French school of public economics

2.1. The basic issue: moral, not political

Of course, public economics as theoretical reflection on the economic role of the public sector existed much before these crystallizations into denominations and scholarly institutions.

Louis Armand[7] once said: "I will speak of French physics when I see a blue, white and red electron". Nevertheless, historical contributions to public economics divide well into schools and traditions pertaining to different cultures. There neatly has been, for instance, an Italian school, a Scandinavian school, probably a German school, perhaps an American school, and a French school. The latter is characterized by several features: its length in duration (several centuries), its homogeneity and continuity, its theoretical contributions, and its direct relation to application both for raising questions and for applying the obtained solutions. These aspects are directly related to the fact that this thought did not develop in the traditional academic world but in the technical public service (including what Americans call "public utilities").

My topic here is what can be called public *economics*. It is not the field of "public finance" as it developed in academic and administrative circles, the best part of which is much more subtle and perceptive than economists (and engineers) usually are on the essential moral

dimension. The emphasis will be on scientific contributions. This will include a number of topics such as the criteria of public choice and the reasons for and developments of the theories of the "surplus"; optimum taxation and pricing of public utilities; the case of goods which are, in various ways, both public and private, and in particular the pervasive relevance of the general theory of "congestion"; the theory of second-best "value constraints"; the various interferences of distributive justice; and so on. Of course, space precludes any technical treatment or presentation of these issues which have all to be present. We thus have to rely on basic economic knowledge and on sufficient brief explanations.[8] Rather, the emphasis will be on the less busy path of the social reasons for these questions and solutions. Therefore, this presentation has to be ethical and institutional history as much as the history of technical economic thinking which, however, is our ultimate concern.

The issue is the choice of actions of the public sector. Such choices have two aspects: an understanding of the relevant technical and economic facts – such as the structure of the consumption of public goods or the effects of the price system –, and the criterion or principle of the choice – in particular the political or moral objective. The latter aspect depends on the social setting in which the choice is made. The crucial point in the case considered here is that public choices had to be made by a body of people who were not led by the objectives of keeping political power or of gaining personal income or power. Therefore, they had to find or invent the criterion of choice. That is, they had to make such a meta-choice the nature of which is moral, in the field of social ethics. This is for instance the case concerning the various concepts and applications of the surplus criterion, the choice of public investments, marginal cost pricing and its applications, optimum taxation, or the management of externalities and congestion. This led to considerations concerning welfare, liberties, distribution, fairness, social efficiency and its meanings, and also objectives that are not – or not directly – individualistic such as the independence or the "greatness" of the nation.[9] Such public choices are at odds with the model of public choices resulting from the choices of purely self-interested individuals, as they were developed, notably, by Jim Buchanan and the school of Public Choice he founded. Buchanan, by the way, understood that. He once told me that his model does not apply to the countries which have a strong tradition of civil service, such as England and France.

2.2. The social reasons and setting

Therefore, we first have to see the causes of this particular situation of public choices in France. This is due to the social and historical setting which is quite different from that of other nations, even otherwise comparable ones. Two not unrelated facts are crucial: a structural one, the long-standing and steady centralization, and a historical one, the (1789) Revolution. The former led to bodies of permanent and de facto powerful public administrators. The second posed the question of what is the right public action for the sake of the people – its happiness, liberty or fair treatment – in a way which was abrupt (even violent) and all-encompassing, but was also prepared by, and immersed in, elaborate philosophical reflections.

France is, and especially was, a very centralized country, from, say, the 15th century (with an acceleration in the 17th).[10] Moreover, the publicly managed part of its economy was particularly large for a market economy. The State was in particular much involved in economic progress, including in innovations and manufacturing in addition to infrastructure, for instance in the 17th and, in a different way, the 19th centuries.[11] What is called in the US "public utilities" were public services, largely centralized ones. The very conception of the nature of the public sector differs from that prevailing in some other countries such as the US. This is revealed in the vocabulary. Speaking of the general role of institutions, where others say "the government" the French say "l'Etat", the State, with a capital initial. This has a normative collective connotation.

This public action is carried out by a public administration which is important, often powerful, and in the motivations of which an ethics of the "public service" has a notable or important place.[12] Such a motive is usually shared by most agents, but the association of the motive and of the power is a characteristic of the higher public administration (say the officers). At the top, there may be the highly praised classical figure called the *grand commis de l'Etat* – the "great servant of the State".

These civil servants have tenure. They are generally there for life. They cannot be fired (except for misdemeanor). They do not change when the political party in power changes – there is no "spoil system" for the higher public administration as in the US. They are very much more stable than government members. Salary and promotion are essentially by seniority (and not, or very little, according to performance). Civil servants are recruited through competitive examinations. For the higher public administration – our sole concern

here – this process (on the whole a series of eliminations and rankings) intends to be very selective. These people are trained in special schools sometimes very ancient (16th century for that concerned with civil engineering, equipment and transportation), but, for most of them, set up by the Revolution. Other students, for the private sector, came to attend some of these schools, and the existence of these more or less prestigious *grandes écoles*, different from the universities and parallel to them, is still the hallmark of the French system of higher education (with sociological functions analogous to those of the hierarchy of universities in other countries).[13]

2.3. The unavoidability of a moral choice

A characteristic of public economics as it developed is its frequent normative dimension. It would even make sense intellectually and be faithful to the history of ideas to classify theories of public action as "public economics" when they are applied social ethics and as "public choice" when they consider self-interested agents only. However, there are situations in which the person who chooses the public action has to make a choice which has a social ethical dimension and to find a criterion for it. Specifically, imagine one of the people described having to take a decision, for instance Achille-Nicolas Isnard about setting a transportation or communication network, Jules Dupuit about digging a waterway, Augustin Fresnel about erecting a light-house (the classical paragon of a public good), Claude Navier about building a bridge, Emile Cheysson about building a road, Clément Colson about the construction of a railway, Pierre Massé about building a dam, Marcel Boiteux about selling electricity, François Divisia or René Roy being asked about land use or real estate policy, Claude Abraham or Jacques Thédié about public safety, or Maurice Allais or Jacques Lesourne about industrial policy.[14] According to which criteria should they choose?

Since they are civil servants, they just have to obey their boss, the politician. However, for a large scope of issues the politician does not know what to answer. His short-run political interest does not provide all the answers. Most of the noted choices concern long-term policy. In the leeway left by his electoral interest, he may want to underwrite the socially-morally best policy. His electorate may also value his implementing such criteria. In fact, he often himself asks the administration he is heading what should be done. Moreover, does the political system that selects the politician make the best choice for society? Markets are imperfect, but, compared to them, the political system often seems substantially more

imperfect. This may be too critical and pessimistic, however. The most emphasized quality of markets (besides freedom of exchange) is the realization of Pareto efficiency by the appropriate ones (perfect competition, perfectly discriminating monopolies, efficient collusion or agreements). Yet, competitive electoral democracy has the same virtue. Indeed, if a political power does not implement Pareto efficiency, a competing party can propose an alternative program which will win the elections by the unanimity of votes. However, questions of information hamper this theorem, Jean-Jacques Rousseau has remarked that "The English are free one day every seven years, the day they vote", and Pareto-efficiency leaves the issue of distribution and distributive justice open. Hence, the political system is certainly imperfect. Therefore, the duty of the civil servant may be to take the political and the politician's choice as (1) an unavoidable constraint on his own choices, and (2) one source of information about people's preferences among others, and to make the best choice given this constraint and this information. As we have noted, this constraint often leaves important domains of choice, notably for long-term and infrastructure policies. As for the information, one of its defects is that the "one man, one vote" principle of electoral democracy does not take the intensity of people's preferences into account (weighting votes by these intensities measured by willingness to pay or money equivalent transform majority voting into the surplus principle, and this result and actual vote coincide only with a particular, but not infrequent, symmetrical structure of the distribution of individuals' willingness to pay). Then, what should the principle of choice be?

2.4. Which public principles?

The kings' objectives were their self (or dynastic) interests only, with few exceptions (famously Henry IV). The kings' advisers advised about that only, including the "great servants" (*grands commis*, such as Colbert), with few exceptions (such as the military engineer Vauban, about taxes). These very rare exceptions cared about people's welfare. Then came the marvelous late 18th century, the enlightenment, and the Revolution. During the last few decades of the 18th century, the standard reference for "public works" became their "utility". Simultaneously, the flow of public debates, pamphlets and philosophical works about utilitarianism, liberties, equality and people's sovereignty exploded. However, when the Sovereign becomes the people, how do you know his Will? The guru of the time was Jean-Jacques Rousseau. He saw the problem of a society of free and equal individuals as technically a problem of voluntary contributions to a public good: each gives to all and

benefits from the efforts of all. The corresponding collective choice results from the collective agreement of a free but hypothetical social contract. Free riding is avoided by these individuals becoming citizens wanting the terms of the contract which become the general will, and, practically, this virtue results from the moral education described in *L'Emile* – of which the *Social Contract* is but an appendix. However, how can one find out what this general will is for application to public choices? The idea was that, in a large society, the people elect representatives as the specialists of this task. The divergences in their opinions are seen as revealing their imperfect information about the general will hypostasized into a Platonian concept. Then, the role of votes in their assemblies is to minimize the probability of mistakes, that Condorcet sought to compute. Yet, assemblies soon became something else: the aggregation of the interests of voters rather than that of information about the social good, with the political system as we know it.

Nevertheless, besides these collective choices, the main revolution was the advent of the twin individualistic values of happiness ("a new idea in Europe", according to Saint-Just) and liberty, and of their distribution according to the relevant equalities. They were also seen by some (e.g. Isnard) as the actual individualistic alternatives to the impotence and dangerousness of Rousseau's concept of the general will. This liberty, indeed, was not only the civic or republican liberty of participating to political decisions (Benjamin Constant's "liberty of the ancients") – that Rousseau deviated into the abdication of their will into the General Will by citizens who demand to be "forced to be free" – , but also the "liberty of the moderns" of individual "freedom from" including freedom of exchange and property rights. Protective rights are taken to be the basic value, and yet their Declarations say that they are for "the happiness of all" in 1789 (preamble) whereas their derivation from the requirement of happiness is systematic in the text of 1793. Happiness, however, also depends, trivially, on its material basis, welfare. There remained to translate these individualistic values into meaningful and operational principles of public choice.

3. Surpluses

3.1. Dupuit's surplus principle

An important test came with the 19th century development and its need for infrastructure built by *public works*. Waterways provided the first challenge. An upsurge of their building

occurred around 1820 "for completing the network". Ten years later, however, it was clear that those built were of little use, while the industrialization of France was starting up. Hence a search for a criterion of the utility of the projects, and a lively debate about it. Against the academic economist Jean-Baptiste Say's ideas which discarded Smith's value in use and equated utility with exchange value or cost, and their application by the public engineer Claude-Henri Navier, a former student of Navier, Jules Dupuit, proposed the criterion of the surplus which still is the basic (and unavoidable) principle of benefit-cost analysis everywhere.[15] The surplus is the excess of the willingnesses to pay of the users, or of the money equivalent of the use for them, over the cost. Equivalently, bringing notionally the costs back to their source, it is the algebraic sum of everybody's willingness to pay (with sign minus for required compensation) for the project, or similarly of the money equivalents of it. (Using willingness to pay or money equivalent makes a difference which was dealt with later). In his article of 1844, *On the measurement of the utility of public works*, Dupuit proposes that this utility be measured by the surplus. In another article, of 1849, he studies the question of the "revelation" of the users' willingnesses to pay in order to estimate it for computing the surplus or for demanding differentiated tolls for financing the service or equipment. Both articles were published in the journal of Dupuit's administration, the *Annales des Ponts et Chaussées*.[16]

The surplus uses the area below the demand curve, and the discovery of a demand curve by Augustin Cournot (with a neighbouring formation) for determining the monopoly supply price of the Périer spring water, in 1838, was de facto simultaneous. Hence, since the "public works" had dimensions of public goods and were sometimes pure ones, the demand curve for private and public goods was discovered practically simultaneously.[17]

The application of the surplus principle consisted in choosing projects to realize by maximizing the surplus (and, to begin with, in retaining projects that yield a positive surplus only). A number of qualifications, noted below, were introduced later.

3.2. Meanings of and reasons for the surplus

The possible justification of the surplus principle came to be the conflation of several social ethical possible reasons.

3.2.1. Practical utilitarianism

For Dupuit, the surplus of a public work measures its social utility. Since it is the sum of the money value of the project for the individuals, each of these numbers may measure the utility for the individual. Utilitarianism as maximizing the sum of individuals' utilities was a known principle from various writers from the 16th century (all inspired by stoician philosophy),[18] and a normal interpretation of the revolutionary demand for the happiness of all. Bentham had stated that, for lack of an available better alternative, one should measure individual utilities in the utilitarian sum in money terms, "or bid adieu to moral". It is, indeed, rather difficult to imagine purely psychological items meaning pleasure or pain that could be "added" as numbers are (although some possibility may be offered by the fact that one sometimes compares variations of happiness or pain across individuals).

3.2.2. A weighted majority principle

The public projects can be chosen by majority voting, and they sometimes are. However, Condorcet had shown that this often does not permit to say that a possible choice is better than every other. Borda and Laplace have proposed criteria of choice that remedy this obstacle, but these criteria make no distinction between people who are almost indifferent between two alternatives and others for whom it makes a very large difference. Majority voting also has the same vice, in addition. A straightforward solution consists in weighting the votes of the individuals by their willingness to pay or money equivalent. Then, the number of favourable votes minus the number of hostile ones becomes the surplus. A negative willingness to pay or money equivalent is, with sign minus, a cost or a required compensation.

3.2.3. Free exchange or putative one (a local social contract)

Besides happiness or welfare, the other individualistic value is the liberty expressed by the basic rights, which includes freedom of exchange. If the access to the facility in question can be forbidden costlessly, so that a price can be demanded for it, and if one can know and demand the highest price or toll they are ready to pay from all users or at least from those who are ready to pay the least, a profit maximizing choice maximizes the surplus (Dupuit, 1849).

At any rate, if all people concerned could communicate and agree, with beneficiaries contributing to pay the cost, an efficient such agreement maximizes the surplus. However, such an explicit collective decision may not be possible, for instance because of the number and dispersion of the people concerned or because they do not exist at the same time. Nevertheless, one may try to estimate what the results of such an agreement would have been if these obstacles did not exist. Then, implementing these results by the realization of the project financed by taxes equal to what the people would have freely provided for it, realizes, in a sense, people's liberty hampered by the noted practical obstacles. This ethics was very present since it is nothing but a kind of social contract – that is, a putative, hypothetical free agreement –, although one restricted to a public project and to the population it concerns (this came to be called a "liberal social contract", the basic principle of "liberty-based public economics").[19] Apart from errors in estimates, the result is efficient because the putative collective agreement is, by definition, because it assumes away all obstacles to this efficiency (this has to include some kinds of game-theoretic strategies, however). The highest surplus results again from this.

3.2.4. Direct implication of later social ethical principles that imply the surplus

These three types of basic reasons for the surplus principle – the utilitarian-welfarist, the political-democratic, and the liberty-based (actual or as a social contract) – imply directly other social ethical criteria discussed many decades later in various circles, notably the following ones.

(1) The "compensation principle", i.e. the people who gain from the project can compensate those who lose from it.
(2) The highest total social income, i.e. the highest social income counting the money equivalent of all benefits or costs.
(3) The moral individual accountability of the psychological intensity of preferences, tastes or utilities, which justifies replacing, in the utilitarian sum, utilities by willingnesses to pay or money equivalents not as a regrettable but unavoidable approximation (Bentham) but as a principle supported by an explicit ethical reason (willingness to pay or money equivalent is derived from ordinal preferences only, without reference to the amount of satisfaction derived from the bundle of commodities).

(4) As for the famous Marshall surplus, Alfred Marshall (1890) simply credits it to Dupuit (1844) who "published an exact measurement of consumers' rent" (this was the term Marshall first used before reverting to the term surplus).[20]

3.2.5. The efficiency condition for public goods

The surplus principle was commonly applied to public goods. This was, for instance, distance or time saved by an improvement in a transportation system (bridge, road, waterway, railway, harbour), weight or volume permitted for successive users, scope and power of a lighthouse, safety of an equipment, and so on. The corresponding total or marginal individual (money) utility curves were added along the utility axis. This was applied for the choice between variants of a project. It was therefore also applied incrementally: more of the "good" should be produced as long as the surplus of this additional operation exceeds its cost. Then, the quantity, dimension or position finally chosen is such that the sum of the marginal willingnesses to pay equals the marginal cost. This is the condition for the Pareto-efficiency of the public good made famous by Paul Samuelson but applied long before (also foreseen later for two consumers by Wicksell and Lindahl).

Note that marginal economic reasoning was not born in the 1870's with Walras, Jevon or Menger, as usually presented. The engineers of the 1830's used it commonly. They continuously used optimization, maximization and derivatives in their work, both in engineering, mechanics and physics (material resistance, fluid dynamics, friction, optics, etc.) and in management and the choice of projects (minimizing costs, distance or time, optimizing maintenance or budget allocation, etc.). Some of them were great engineers or scientists, such as Navier (the critique of whom by Dupuit was the origin of the surplus but who compensated his poor economic reasoning by building not only Paris bridges but also, on scientific grounds, rational mechanics, resistance of materials and fluid dynamics with the famous Navier-Stokes differential equations[21]), Fresnel (the optician, of the Fresnel lens), Prony (of the Prony brake), Cauchy, Gay-Lussac, later Becquerel, and Dupuit himself.[22]

3.2.6. Interdependent surpluses, and Walras

When a railway is built between two cities already connected by a waterway, it is clear that the demand for freight by any mode depends on the price of the other. This "competition"

between modes of transportation (including also road) was a standard question, and the corresponding issue of interdependent and joint surpluses was classical.[23] Actually, the most refined discussion of the interdependence between price, demand and the surplus for various works is certainly Dupuit's (1849) about Paris bridges and their tolls. For all projects, the effects on other prices and on quantities supplied or demanded are taken into account (various examples in Dupuit's writings). More broadly, large "structuring" infrastructure projects inducing industrial changes required the consideration of more general interdependence effects, and a number of studies taking this into account were made for roads, waterways, railways and harbours. On the other hand, when it was clear that a project could reasonably be studied by itself in a more or less partial analysis, because the other prices change little, this simplification was welcome.

Hence, the uncompromising criticism of Léon Walras, playing his role, against their use of partial analysis, made the surplus people rather nervous. Actually, Walras himself was quite nervous because he was very eager about priority and was repeatedly reminded about Dupuit's work on utility. His answer included that Dupuit had mistaken the demand curve for the utility curve. This is a misunderstanding or clear misreading of Dupuit who defines utility as the integral of the demand function – hence the demand function is the derivative of the utility function, the marginal utility measured in money – with the aggregation of users. See Walras's correspondence. In fact, Dupuit proposes assumptions about derivatives of utility up to the fourth, implying, for the utility function $u(q)$ if q is the quantity of the good, $u>0$, $u'>0$, $u''<0$, $u'''>0$ and $u^{IV}<0$ (see his analogy with the heap of canon balls). However, the friction between Walras and the surplus school also had actual dimensions. Walras could accept partial analysis and valued non-competition models, as shown by his appreciative and compromising letters to Augustin Cournot (a schoolmate of his father, the economist Auguste Walras). Yet it seems that he never had the idea of a public good or joint consumption structure. There was, indeed, an opposition with reversed positions. Walras was a socialist who built the basis from which Pareto was to derive the standard welfarist apology of the free market (Walras wanted a nationalization of natural resources and his dream was to find a theorem proving that the optimum size of the public budget equals the rent of these resources). On the other side were government officials acting for the general good, often on issues implying "public good" dimensions, but some of whom were free-market classical liberals for the rest (this largely includes Dupuit himself). Moreover, Walras himself had studied at one of

these engineering schools (school of mines of Paris), but had failed at the Ecole Polytechnique and was not a tenured civil servant.[24] Indeed, he could not even find a position in France.

3.3. Specific applications of the surplus

3.3.1. The negative deviational surplus

A problem of the surplus principle is that it is possible to have a positive sum of willingnesses to pay minus required compensations for something to be done and, when it is done, a positive same sum for undoing it or not having done it. Equivalently, the surplus may give opposite conclusions depending on whether it is the sum of the willingnesses to pay minus required compensations or the algebraic sum of the money equivalents. The reason for these facts is that the money evaluation is made in one case given that the action is taken (e.g. the equipment is built), and in the other case with the opposite assumption. Indeed, the money equivalent is an amount of money received or provided *instead of* the realization of the project, and the willingness to pay or required compensation is an amount provided or received *along with* the realization of the project. The money equivalent to an action is the same, with opposite sign, as the willingness to pay for not having this action when this action is the case. This holds for each individual and hence also for the sum of the corresponding values. This kind of "income effect" entails the possibility of the noted "contradictions".[25]

Practically, in application, estimates using the available information were rarely able to grasp sufficiently the income effects for such contradictions to appear. However, for the few cases in which they could appear, and as a general theoretical stand to make the theory immune to such ambiguities, the full theoretical stand came to be the principle of the "negative deviational surplus". This is: choose a state (e.g. an equipment and its financing) such that both the sum of the willingnesses to pay minus the compensations required for going to any other state is non-positive and the same sum for going to this state from any other is non-negative. Equivalently, in such a state both the sum of the willingnesses to pay (minus the compensations required) to go to, and the sum of the money equivalents of, any other state are non-positive. Locally, these two conditions play the role of both the first and second order conditions of a maximization.[26]

3.3.2. Roy's dual marginal surplus

The economic role of the public administration included not only the control of the provision of public goods but also that of the optimality of the prices of private goods when the question was raised. This included the regulation of monopolies, price controls for various reasons (speculation, exploitative artificial scarcities, asset bubbles, necessary commodities, cost-of-living, inflation, minimum or maximum wages or producers' prices), and the direct administration of prices in situations of major overall crises, notably during the main wars. A successor of Dupuit at his teaching chair, René Roy, dealt with the theory of this problem. The price of a private good is a public good for all the individuals who buy or sell this good. The amount that a buyer of a good is willing to pay for a decrease in the price of this good by a small unit is obviously the quantity he buys of this good. That is, the quantity is the Lindahl price of the price. Then, according to the optimality formula for public goods, for the optimum price the sum of these willingnesses to pay with sign minus (for an increase in the price) is equal to the total quantity of the good if this quantity is given, or to zero if one includes the sellers of this good among the agents in question. Of course, the public good nature of the prices appears neatly when utility functions are written in the indirect form proposed by Roy (as function of prices and income), which gives these willingnesses to pay as rates of substitution.

3.4. The surplus and distributive fairness

3.4.1. Surplus and financing

The surplus method has had several types of implications and applications concerning fairness or distributive justice. When the project can be financed by a toll, price or tax on the beneficiaries, everybody may gain from it, and there may remain an overall surplus to be distributed to the beneficiaries – by a lower tax or a rebate – or to other agents. These payments, however, should a priori and in general be discriminating according to beneficiaries' willingnesses to pay for each unit. Dupuit (1849) provided an early study of this informational problem. This also implies that the theories of the non-discriminating and of the discriminating monopoly (Cournot for the former) were provided about within a decade. At any rate, money equivalents or willingnesses to pay have to be estimated for estimating the surplus. However, a statistical estimate of a demand curve permits the computation of the overall surplus without necessarily providing the information for each specific user. Dupuit

emphasized, in particular, that other things being equal the willingness to pay commonly increases with wealth (if payments relate to it, with regard to conspicuous information people with a hat should be charged more than people with a cap...). However, this soon raised an ethical debate. Is it fair to charge different prices to people who receive the same physical service? Doesn't equity demand that unit prices be the same for all? Or should people be charged "according to their means" as demanded for the public budget by the constitutional Declaration of Rights? This may be because willingness to pay may increase with means, or for a reason of distributive justice about remaining disposable means. In the latter case, however, why not make the poor pay still less? Should, however, specific public services consider such issues of distributive justice? Should not this issue rather be the concern of central national policies only? If so, what is the "neutral" payment for specific services? And what if central policies are not sufficient in this respect? Both politics and the socially minded part of the public administration raised such questions from mid-19th century to present days.[27] This induced, in particular, some analytical advances concerning, respectively, local fairness, overall distributive justice, and the theory of the distributive or moral surplus.

3.4.2. The non-additive surplus principles, the egalitarian surplus

In the choice of a project including its financing, the money equivalent for an individual is a particular specification of the (ordinal) utility of this operation for her. Since this specification has the metric (logical properties) of quantities of the same good, the principle can be the logically meaningful maximization of the sum of these amounts (the classical surplus). However, the maximization of any increasing function of these numbers also gives an efficient result. But the distributive implications are generally different. The solution can equalize the individual equivalents (individual surpluses) or maximize an inequality-averse function of them or be their maximin. This constitutes non-linear or non-additive surplus principles, and notably the egalitarian surplus. This variety of non-additive surplus principles can realize local fairness when applied to specific projects or groups of projects.[28]

3.4.3. Integration in the overall distribution

However, the relevant fairness may be more general than local one only. The overall income distribution may take into account the distributive effects of local decisions for each project or action and compensate them if necessary. The financing of each project may be crucial in this

respect. Local public projects and their financing may also simply duplicate a private expenditure and hence be considered as one. The overall distribution may also be imperfect for various reasons, such as political obstacles or the classical disincentive effects due to difficulties in information. This has led to weighting the money units of the various individuals or categories of individuals by different distributive coefficients in the computation of the surplus.[29]

3.4.4. The distributive or moral surplus

These methods introduced fairness into the definition of the surplus. However, fairness has to be defined, and another use of the surplus was, conversely, to use this principle for defining the distribution that results from people's opinions in this respect. Indeed, people have opinions about the overall distribution of income, notably from opinions about justice, and this distribution is, therefore, a moral public good. This good may in particular be some characteristic or parameter of the distribution. A major problem in this respect is to distinguish people's moral preferences from their self-interested preferences for their own incomes, especially since they may have lexical preferences valuing their own incomes with priority. The method of the direct distributive or moral surplus solves this problem straightforwardly. Indeed, in the sum of everybody's willingnesses to pay for a transfer of one dollar from a person to another, there are, in particular, the self-interested willingnesses to pay of these two people for this transfer, which are precisely one dollar with opposite signs and, therefore, cancel one another out. As a result, there solely remain moral willingnesses to pay, which may be of a smaller order of magnitude than self interest for each person (but a priori there are many people whose values are so added). Then, the surplus theory recommends this transfer if the sum is positive and a reverse transfer if it is negative. In the resulting equilibrium these marginal moral surpluses for all transfers are zero, that is, all individual incomes have the same marginal moral surplus (and marginal overall surplus by adding one to this value). This distribution is determined by people's opinions about it (this is just a sketch of the foundations, developments and applications of this theory).[30]

3.5. Place in the surplus debate

It is probably unnecessary to remark that usual criticisms to the surplus principle found in the economic literature hardly applies to the practices of the tradition under consideration.[31] The

surplus evaluates a change from a Pareto-inefficient state to a Pareto-efficient one (constraints of all types being taken into consideration). Applications to the choice of public projects aim at remedying some market failure. Hence assumption of overall perfect competition is irrelevant. There generally is at least some aspect of a public good. Non-partial analysis with changes in prices is used when relevant. Distribution and fairness is a major concern, with several types of solutions. Money values can be added or compared. By contrast, if "utilities" in present-day sense or their variations are compared or added across individuals, the tangible meaning is making such operations on something like happiness, pleasure or satisfaction. Most often, this does not make sense, although there are some cases of exception, and, at any rate, it cannot be given a sufficiently precise interpretation. This is Bentham's point. As we have noted, he says that we have no other choice but to add money values. He also adds that adding the pleasures of different persons, if they can be known, is at best like adding apples and pears.[32] At any rate, individuals' specific tastes or particular capacities to enjoy, or differences between them, are often deemed irrelevant by everybody for a number of public choices.

4. Social welfare functions

However, in the end the surplus compares individuals' money, not their pleasure or happiness, Bentham notwithstanding. This is perfectly adequate when pleasure is considered a private matter, not an issue for public concern. However, social welfare functions of a more presently classical form have also been used for long, for instance with Maurice Allais's "national happiness" or by François Divisia.[33] The latter is particularly interesting because he perpetuated the concepts of his teacher, Vilfredo Pareto. I remember that he begun his lectures at the Ecole Polytechnique with: "Individuals have two functions, a utility function and an ophelimity function". Ophelimity means welfare in the strict sense, and an individual utility function in Pareto's sense is a function of all individuals' ophelimities. Pareto (and Divisia) considers in addition a social function depending on individuals' such utilities.

It may be worthwhile to recall that the social welfare function was introduced in English-language economics by Abram Bergson's review of Pareto's volumes. However, a Bergson social welfare function is only an individual utility in Pareto's sense: an individual's evaluation of everybody's welfare.

Hence, this view of Pareto, Divisia and their followers included again a representation of people's social sentiments such as altruism or sense of justice, although limited to evaluating people's "ophelimities", hence including the effects of their tastes and capacities to enjoy, and excluding their appreciation of the pleasure people derive from others' pleasure (hence in tune neither with the ulterior John Rawls for the former aspect nor with the earlier Jeremy Bentham for the latter one). These limitations were corrected, and all the possibilities considered, in further works.[34]

5. Marginal cost pricing, deficits, value constraints, optimum taxation[35]

5.1. Efficient pricing and budget balance

Natural monopolies needed an optimization not only of their investment but also of their pricing policy. Pareto had proven (and Gérard Debreu soon confirmed) that perfectly competitive markets are Pareto efficient. This was a reason to mimic perfect markets by producing at minimum cost and selling at marginal cost whatever amount is demanded. Harold Hotelling (1938) rightfully attributes this idea to Jules Dupuit. However, these activities typically present increasing returns to scale, and this is a standard reason for the absence of basic perfect competition in them. This structure manifests a property of public good in this production. Then, marginal cost pricing entails a budget deficit. How should this deficit be financed? Should it be by the general budget with the various political and social effects of taxes, and the economic imperfection of the excess burden of taxation? Hotelling took the French term "*pis aller*" to denote what was later called "second-best". At any rate, for public utilities the political power often chose to demand no deficit (although the administration of finances liked sectorial deficit because it established its power on these public firms). The problem was notably posed to Pierre Massé, président of *Electricité de France*, the public monopoly for electricity, and to his research director (and later successor) Marcel Boiteux. There had been two-part tariffs, but Boiteux did not think they were justified (I disagreed).

Three solutions were considered. One was pricing at long-run marginal cost. This is not fully justified, however. When capacities exceed the short-run demand, the efficient price should a priori be the low short-run marginal cost. The two other solutions proved to be the

source of major advances in public economics: the theory of value constraints and optimum non-linear taxation with uncertain individual preferences.

5.2. Value constraints

One solution was to determine the prices from social optimization under the constraint of budget balance. On analytical and formal grounds (rather than history and actual influence), this is a three-stage story of increasing generalization, with Ramsey (1927), Boiteux (1951) and the general *theory of value constraints*.[36]

A value constraint is a constraint comparing parts of the budget or bearing on prices. There are many examples. Budget balance is one, but there can also be a priori relations between groups of expenditures or of receipts, partial assignments or matchings between receipts and expenditures, upper or lower limits on some prices, given price ratios or indexed prices, and so on. The reasons can refer to organization, rights, fairness, and other issues. Mathematically, a value constraint turned out to be characterized by a "focal point" in the space of quantities of goods such that a small change of prices proportional to their excesses over marginal costs or productivities induces a change of the vector of goods supplied or demanded in the direction of the focal point (the focal point is at infinity in a direction for price constraints). If there are several value constraints, the set of these constraints has a focal point with the same property, which is an adequate barycenter of the focal points of the constraints.

This was applied to many problems. Some were about optimum budgeting for public finance or for particular public services or utilities. Other applications determined optimum custom tariffs for countries submitted to balance of payment constraints (the optimum tariff on each good is the product of two numbers, relative to the good and to the country respectively).

5.3. Optimum non-linear tariffs or taxes

Another solution was to use non-linear tariffs with infra-marginal units charged at a higher price than the marginal ones (again a Dupuit issue). However, customers' preferences between the good and income are far from being perfectly known and, therefore, there is a

risk to exclude pieces of demand that are ready to pay more than their cost – hence a waste. The theory of optimum non-linear tariffs with buyers' preferences imperfectly known by the policy-maker was then developed. For each quantity, an increase in the marginal tariff makes the users who chose this quantity choose less – a social waste if this marginal tariff is above marginal cost – but it takes more from people who choose to buy larger quantities – a gain for the budget, perhaps a lower subsidy from the public budget. The balance of these two effects determines the tariff curve. These effects are in probability for uncertain demands. The larger the quantity, the less numerous are larger consumptions and the smaller the second effect is. This tends to make the marginal tariff decreasing and the tariff curve concave with a marginal tariff tending to the marginal cost. Formally, this is the same problem as optimum income taxation with an a priori general tax schedule. However, this was more refined than the model published by Jim Mirrlees years later and the following literature on two related grounds. The individuals are not assumed to have all the same preferences, and these preferences are not known to the policy-maker who estimates their probability distribution only.

6. Mixed public-private goods

These early studies also brought in many contributions to a basic question of public economics, the nature of goods or services that are "in between" pure public and pure private goods, more exactly the theory of the various types of actual combinations of the public and private aspects of various goods, and their consequences for policies. This is a very general question (the non-quantity characteristics of a private good are public goods for its consumers, each type of good is consumed with goods of the other type as necessary complements) but a few main structures came to the forefront in the management of public services. They were analyzed with respect to their technical and economic properties and their optimality, and resulting policies concerning investment, financing and regulation were applied.

A standard structure consists in the hierarchically dual consumption. There are goods that are privately divided into parts each of which is collectively consumed by the individuals of some collectivity (e.g. local), and, on the contrary, goods that are collective consumption by various groups each of which shares them between its members. An example of the latter case is that of an equipment used by different groups successively but providing facilities shared by the users at each time. Such dual consumption structures can have further levels.

Uncertainty and time provided various structures and degrees of privateness-publicness, with consequences for optimum investment and pricing. Random demands for using a capacity share it privately if they are correlated and enjoy the facilities it provides without rivalry if they are negatively correlated. Correlation then denotes a degree of privateness. In time, peak load implies a private sharing of the available capacity, with a corresponding private price and consequences for investment policy, whereas uses in times of low demand jointly benefit from the facilities of the equipment. In all cases, various demands and uses can be those of the same agent.

The private opposition between consumers may be less brutal than full exclusion, such as some kind of inconvenience or negative externality – including, for instance, delays in use (queuing), smaller space, various inconveniences of crowding, exhaustion of free resources (the "commons"), pollution, environmental deterioration, and so on. This can create a situation of *general congestion* defined as an externality of the group of users on themselves. The structure, the economics and the optimum policy of such situations were the object of early studies, of official instructions of public administrations notably in the departments of public equipment and transportation, and of numerous applications concerning investment, financing, tolls, prices and taxes, notably in the sectors of transportation, urban policy and, later, pollution and river basin management. The externality can be controlled by an efficient price, toll or tax, and the quality (e.g. speed, amenity, availability, etc.) can also be improved by a larger equipment or improvements of the resource. The price produces an income and the equipment or improvement is costly. The question concerned the optimum equipment and price and the financial result. The answer laid in the basic structure of *qualitative returns to scale*, which is constant, decreasing or increasing according as a proportional increase of the capacity and the demand leaves the quality unchanged or worsens or improves it (with constant qualitative returns to scale, the quality is a function homogeneous of degree zero in the quantity of the service and the capacity, and the surface representing this function is a helix). With the optimum policy (equipment and price), the overall financial result is balance, a surplus or a deficit depending on whether qualitative returns to scale are constant, decreasing or increasing. This theory received many applications and came to be known and applied in other countries (England). The ulterior theory of "club goods" (e.g. Buchanan) is different but bears on similar issues.

7. Other contributions

These examples are just instances of contributions to public economics found in the works of these technical administrations and public services. There are various others. A number of them are in the field of the public economics of risk or uncertainty. This included the effects of uncertain demands, with its noted consequences for optimum tariffs and taxes and for the degrees of publicness-privateness according to correlation. Public safety and its consequences for investment and regulation has been the object of important works, based either on aversion for the probability of accident or on evaluations of the social cost of fatalities (a basic motivation was that the expenses for saving a life were extremely different in the various activities, which seemed to denote vast misallocation for this essential "good"). In particular, the safety of public equipments often depends both on investment, management and maintenance on the one hand, and on users' chosen behaviour facing this risk on the other hand (e.g. roads, protection and emergency services, health care, etc.). The optimum public cost of, say, saving a life (in probability) depends on the substitute private cost in this activity (e.g., the difference in the costs of driving more slowly and of moving away from the zone of risk under a dam justifies higher safety costs for dams than for roads – this was later applied for nuclear plants).[37] It thus depends on the activity. Nevertheless, the user's responsibility was discarded in the cost-benefit analysis of the corresponding public investment or policy. The models of users' behaviour for these cases of high risk with low probability (situations of Pascal's bet) duplicated actual behaviour (rather than one of the Bernouilli type). Maurice Allais was questioned about this and this led him to his well-known experiments. Another important application was Pierre Massé's theory (and practice) of indicative planning as uncertainty reducer for palliating the market imperfection of the incompleteness of futures markets.

In another field, François Divisia's economic theory of networks, involving, notably, issues of externalities, public goods, regulation and optimal pricing found important applications in a number of public services such as transportation infrastructures, electricity, gas, telecommunication, postal services, as well as in the theory of the circulation of money.

A number of contributions developed for questions raised by the management of the public economy were in a field at the intersection of economics, applied mathematics and what later came to be called operations research. Constrained maximization was standard for engineers (some of the first ones had been the direct students of Lagrange). This was notably

applied for the optimum allocation of limited public budgets for new or maintenance investments given their respective utilities measured as usual. The above noted value constraints also belong to this category. Investment in electricity production and dam building led Pierre Massé to the early discovery of linear programming and stochastic dynamic programming. Adding time constraint to budget constraint was done by Jacques Lesourne before rediscovery by Gary Becker, and the resulting cost of time was applied by others to the optimisation of public transportation networks.

Finally, in a country with a very large public sector, an important and rather extreme political left, and a strong and lasting influence of the ideology of the revolution with its "passion for equality", issues of fairness and, more specifically, of social justice were more acutely raised than in most other Western societies and market economies. In particular, such questions can be raised about any public measure and policy. Practical public choices, however, required these moral notions to be specified into operational and hence precise concepts of fairness and justice. The above noted egalitarian and moral surpluses belonged to this category. The modern theory of the measure of inequality was initially developed in one of these schools in the early 1950's. Moreover, these public services were keen on Pareto efficiency, and a main concern was the consistency of this property with the various issues of fairness demanded by society and by the political system.

8. Conclusion: the lessons of history

If, coming back to Henri Poincaré's comparison, these sketchy remarks about the history of public economics have given us some sort of a steering wheel, which direction should we take? A number of specific answers can be provided for the various technical lines of study. However, there is a main and basic issue concerning the very nature and existence of the field of studies called public economics. This discipline is essentially normative – contrary to the studies of "public choice" in the view of its founder. If it wants to be useful and applied, as it does, it has to rely on the existence of normatively motivated agents having some power. The noted contributions to public economics have been explained by the historical sociology of France which led to a large public sector and to a body of higher technical civil servants with a selective scientific formation and a motivational and moral formation and tradition inducing a strong "ideology" or ethics of the "public service". These factors, however, have been importantly modified recently by the vast movement of privatization and the shrinking of the

scope of responsibility of the public sector. This evolution, not restricted to France, came under the influence of several related factors: logic, ideology, private interest and the "power of money", and the European construction with the European Union – which has a market but no government – wanting to impose competition and international access to all sectors. A number of conclusions from this process can already be drawn, and the limits and types of relations between the private and public rationales are by no means yet settled.

Logic had its say in sectors with standard competition. There was no particular reasons for Renault, Air France or Total (largely ex-Elf Aquitaine) to remain public (except, possibly, for a limited part)[38]. The case is different for activities serving the general public that are in a situation of natural monopoly, in which the possibilities of competition are limited for any reason, or which create particular external effects such as induced location or risk. The privatized firms have commonly become successful international firms often leaders in their sector.[39] However, the price of the service for the basic consumer has always increased – contrary to promises – and the quality has not unfrequently deteriorated. Water supply has largely been privatized, with a number of scandals about prices and political connections. The city of Paris is now considering the re-municipalization of its water supply. Rail transportation has deteriorated (delays, accidents) following the separation between infrastructure management and transportation by more or less competing firms. The post office may be in the process of privatization with already a decline in the quality of some services (and hence strong public protest). It is by no means established that letting deposit banks – among which the four main ones were public – become the successful international all-purpose banks they now are was good for the general public (and it was not for financial stability). The Channel Tunnel has been built by a private society... which organized full spoliation of small stockholders by the leading banks. The telecommunication firm has also been successful, but, thanks to the suicide-inducing harassment of its personnel which used to be rather devoted to the public service. The European Commission often condemns for lack of competition firms of sectors where it does not work well because there are few firms or because the infrastructure network is managed by the previous monopoly. For instance, the supply of mobile phones has been adjudicated to three firms which have recently been fined for price collusion (which continues). Electricité de France is condemned for preventing competition. I certainly prefer Marcel Boiteux selling me electricity at marginal cost rather than his successor raising his monopoly price in order to buy British Energy or the American Constellation Energy for obtaining a world leading position in atomic energy.[40] And so on.[41]

The choice of the allocation of choices in society between private and public criteria and motivations is a major question for public economics, perhaps the most important one – and one not yet properly scientifically studied. The recent and present experiences should bring a major addition to historical records. The modalities of the interactions, notably the role and possibilities of the public regulation of the private sector, constitute an important part of the question. There have been successes and failures with all types of decisions. Contrary to a common prejudice, public management has had remarkable successes concerning innovations (for instance in the fields of energy, transportation or telecommunication). A key issue concerns the possibilities of the various motivations. Although there are widespread impressive cases of devoted lower-rank public agents, the crucial question concerns the top of the hierarchies. There, the salaries are high in all cases (lifestyles do not change if they are two or three times higher). Then, one can certainly acquire as high a satisfaction and social status by working for the good of society rather than for the dividends of stockholders. Of course, the accusation of a tendency to economic irrationality of the public sector has been the main argument. This is nothing new. It was already very active in the 19th century, notably by comparing the French organization of public works with the English one, and criticizing the former for the excessive splendour of the outcomes. Indeed, this very criticism, relayed by Say for instance, was the specific motive that prompted Dupuit to look for the scientific measure of the utility of public works. Could the present problems induce scientific advances of similar scope?[42]

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[1] I am very grateful to two anonymous readers whose comments and suggestions helped me to improve this text greatly. I am fully responsible for the remaining imperfections.

[2] Among many things (including processes to reveal the willingnesses to pay for public goods), this work included the geometric constructions a small part of which were the various forms of the "public good triangle" (the equivalent of an Edgeworth box for a public good). These representations of the intersections of three families of cylinders and of the corresponding structures in the dual space were an application of the space and differential geometry emphasized in the teaching of the Ecole Polytechnique in the tradition of Gaspard Monge (initially for building fortifications but, in my time,

taught by Maurice d'Occagne and Gaston Julia). One of these figures and triangles was used by Edmond Malinvaud in his *Lectures in Microeconomics* which were translated into English. For the surprisingly rich sequel of applications of this specific simple figure see the very good survey by William Thomson (1999). The complete geometry is also reproduced in my *Lectures in Public Economics*.

[3] I am said that the title of the Norwegian original volume means "administrative economics".

[4] I was the discussant of Sen's paper. My comments (reproduced in the volume) include two remarks that he later made famous. One is that Arrow's "social welfare function" is a *functional* of individuals' utility functions (or preference orderings). The other pointed out to the theory of inequalities at the end of my own contribution to the conference (Sen also came to tell me his interest for this part of my paper, which I explained). No mention of this appeared in following papers and books.

[5] In particular, the reception of the theory of inequalities may interest specialists. Musgrave found it very interesting but did not understand, Malinvaud understood but did not find it very interesting (it seems), Samuelson was perplex, and Erik Lundberg accused it to be "mathematical theology".

[6] With the so-called "Kolm triangle" (see note 2) as official logo.

[7] Former head of the French railways and founder of the resistance movement Résistance-rail.

[8] And on the availability of published syntheses of the technical topics dealt with, including in volumes in French and English by the present writer. This may seem preferable to the use of primitive technical tools in a short historical piece.

[9] These latter criteria had several manifestations through the various political regimes, but let us recall here, in recent history, the unavoidably influential view of Charles de Gaulle whose criterion was "la grandeur de la France" ("the greatness of France" is a literal but pale translation) – this led to major technical choices all of which but one have rather been economic successes (the exception is of course the Concord plane – produced with England – ; other actions were in fields of urban planning, energy, transportation, the constitution of industrial groups of international size, and so on). However, I will consider here only choices led by the individualistic criteria classical in both welfarist and liberal (liberty-based) normative economics.

[10] Say from Louis XI, François 1st and again after the wars of religion.

[11] In the 20th century, the scope of the public sector also vastly expanded with the political events of 1936 (the "popular front" wins the elections) and 1945, and the State felt (and still feels) it has a major responsibility in economic progress.

[12] The graduation discourses at the end of the specialized schools commonly ended with "you owe all your time and efforts to the public service".

[13] Including the "reproduction" of the bourgeoisie masquerading as meritocracy and the production of "cliques" of alumni for mutual support in power positions.

[14] This line continues with younger economists of similar formation who, however, are now integrated in standard academic research.

[15] As Dupuit remarks, the limitations of Say's ideas had already been shown to him by David Ricardo in a correspondence (quoted by Say). Of course, understanding the idea in a market setting requires at least implicitly a marginalist understanding (the two values are indeed equal for the marginal unit).

[16] The contributions have to be found in a varieties of places: this kind of professional journals, academic economic journals (*Le Journal des Economistes* in the 19th century and still existing ones later), and, often, in notes and instructions internal to the various administrations and services.

[17] Relatedly, Cournot and Dupuit respectively discovered the theories of the standard and of the discriminating monopoly. Actually, the standard one-price monopoly is also discussed by Dupuit as one of the cases in his discussion of the price or toll for the service. There seems to have been no relation between the two men although they both lived in Paris at the same time and had affinities in intellectual origin. The same thing was going to happen decades later, in the same domain and place, for the simultaneous discovery of ordinal utility by Pareto on the one hand and by Poincaré in answer to Walras on the other.

[18] See Rosen (2003).

[19] See, for instance, Kolm (1985, 1987).

[20] Schumpeter suspects Marshall to have wanted to hide a little his debt to Dupuit by not mentioning him in the chapter of the Principles devoted to this topic.

[21] The NASA has set up the largest computer in the world to solve these equations which were written for the flow under Paris bridges, more precisely the most graceful of them, the *passerelle des arts* (the toll on which Dupuit discussed and criticized from the surplus viewpoint) – Georges Stokes came 20 years later. The Clay Mathematics Institute offers 1 million dollars for progress in understanding Navier's equations (as for the seven "mathematical problems of the 21th century"). These equations did not prevent the collapse of another Navier bridge because of its positive surplus obtained by undue economies on building costs (a technically innovative suspension bridge in front of the Invalides where traffic was low these days). For the finally steady bridge built at this place, it was decided that it could be justified only if the negative standard surplus resulting from insufficient transportation services for a sufficient building cost could be compensated by an aesthetical merit sufficiently high to certainly induce a positive surplus if its utility could be computed and were added (the result, the Alexander III bridge, is often heralded as a world record from this latter viewpoint).

[22] A number of them were honoured by having their names engraved in large letters on the outside of the Eiffel tower.

[23] See for instance Dupuit (1844) answering to Navier. The issue is digging a waterway when there already is a road.

[24] It is not dishonourable to fail the math examination for this school: it also happened to Evariste Galois.

[25] In English-language academic economics, this effect is generally related to a remark by T. Scitovsky (1941). In addition, the sign of the surplus may depend on the choice of the numéraire for computing it. Tibor Scitovsky may have become the English-language economist the most aware of the thought of the school under consideration (the information of Paul Samuelson was also quite impressive – for instance he once asked me in which of the seven volumes of Clément Colson's work some idea occurs – , all the more so that he did not read French). *I have changed* does *into* did *in the last version of this article*. However, they never saw the various administrative documents in which these ideas were put in form – not to mention oral traditions. Other more recent American commentators of the surplus are not even aware of ideas developed in book form or in academic journals.

[26] See Kolm 1966.

[27] This was induced by a variety and succession of social philosophies, notably of the Second Republic, Saint-Simonians, Second Empire populism, social catholicism, the Third Republic moderate "radical-socialism", "solidarism", and a variety of socialist ideals.

[28] For the complete theory, see Kolm 2004.

[29] For the complete theory and applications see Kolm 1968-1970.

[30] See Kolm 1066. In 1965, I indicated the property of the distribution as a public good to Lester Thurow who was assistant to Richard Musgrave at Harvard University (again, his later publication using this idea bears no trace of that).

[31] As an example see Blackorby and Donaldson (1990).

[32] Kenneth Arrow, who quotes this view of Bentham at the beginning of *Social Choice and Individual Values*, once pointed out to me that, after all, apples and pears have rather similar units. Interpersonal comparison of "happiness" is of course much more shaky, as is any cardinal utility meaning happiness or satisfaction for variations that are not small (see Kolm 1996, pages 360-366).

[33] François Divisia was one of the three co-founders of the Econometric Society and of the review *Econometrica* along with Ragnar Frisch and Jan Tinbergen (he died – from pain because of the separation between France and Algeria – before these two economists were jointly awarded the first Nobel prize in economics for their work in this field).

[34] Kolm 1966. Edgeworth (1881) had considered two individuals with utility-welfare functions u_1 and u_2 maximizing respectively $u_1+\lambda u_2$ and $u_1+\mu u_2$ with $\lambda>0$, $\mu>0$. However, for Pareto and Divisia this externality was a general structure for mankind, something like empathy in Adam Smith's *Theory of Moral Sentiments*.

[35] For the issues of sections 5 and 6, see Kolm 1968-1970.

[36] See Kolm 1968-1970.

[37] The uniquely large French program of nuclear plant bulding motivated, sometimes in polemics, some of the 20th century advances in new issues in benefit-cost analysis, such as those concerning the environment and safety.

[38] The Renault firm was "nationalized" in 1945 because of Louis Renault's collaboration with German occupiers. However, there is some rationale in the public sector keeping some share of very large firms – as is sometimes the case – for keeping some control about the various externalities that these firms' behaviour may create.

[39] For instance, Electricité de France is now the second largest energy firm in the world after Gazprom. Air France is the largest firm in terms of passengers transported and is swallowing other national European companies.

[40] In the case of Constellation Energy by buying stocks at twice their price, thanks to the purposeful competitive bid of Warren Buffet.

[41] A critical evaluation of the effects of the privatizations induced by the European Commission can be found in Flacher, Jennequin and Ugur (2009).

[42] Of course, the members of these public administrations have not been converted into saints solely motivated by the application of scientific social ethics. The very problems of almost two centuries ago are still with us. As an example, when, after school, I joined such a body, my first assignment was to "prove that dam X is profitable" (exactly *rentable*, which admits more types of valid economic reasons). That is, the problem posed was, rather than applying a criterion, or the more interesting moral one of finding the good criteria, the still much more interesting reverse problem of finding a criterion that entails the a priori assigned conclusion. These people were motivated by professional interest, perhaps by scientific (engineering) and social fame. Dam X was a very big dam on one of the three major sahelian rivers (the Aswan dam had just been built from a competition between the USA and the USSR). What I did is another story. Let me just say that it begun with the organization of an extensive study of all aspects of the life of the million people whose traditional existence would have been fully upset and transformed by the dam and the irrigation project (such studies cost a minute part only of the funds available to study such a technical project). The issues were much beyond those of an economic surplus! The conclusion was to do, rather, a large number of small-scale non-disruptive hydraulic and farming improvements, with the possibility of building, decades later, a series of well-

situated dams (some are being built where I said, others where I said they should not be, with the foreseen consequences – such as salt coming up in the delta of the river).

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