Allocation Mechanisms, Incentives, and Endemic Institutional Externalities

Peter J Hammond

(This paper also appears as Warwick Economics Research Papers series No: 1162)

April 2018 (revised October 2018) No: 42
Now published
https://link.springer.com/chapter/10.1007/978-3-319-93809-7_10

Allocation Mechanisms, Incentives, and Endemic Institutional Externalities

Peter J. Hammond: p.j.hammond@warwick.ac.uk
Department of Economics, and CAGE (Competitive Advantage in the Global Economy), University of Warwick, Coventry CV4 7AL, UK

Abstract: Whether an economic agent's decision creates an externality often depends on the institutional context in which the decision was made. Indeed, in orthodox economics, a technological or exogenous externality occurs just in case one agent's economic welfare or production possibilities are directly affected by the market decisions of other agents. A pecuniary externality occurs just in case one consumer's economic welfare or producer's profit is affected indirectly by price changes caused by changes in other agents' decisions. Similarly, an institutional or endogenous externality may arise whenever allocations are determined by a mechanism that is not strategyproof for some agent. Then even a resource balance constraint creates an institutional externality except in special cases such as when no individual agent's action can affect market clearing prices — i.e., there are no pecuniary externalities.

Keywords: Externalities, pecuniary externalities. strategyproof mechanisms, institutional externalities.

JEL Classification: D63, D70, D90, Q54, Q56

1 Introduction

1.1 Hurwicz on Mechanism Design

Much of Leo Hurwicz's long and distinguished career was devoted toward discovering how market and other economic institutions could be designed in order to improve the effect of individual agents' economic decisions on the well-being of society.

Leo's early work on this topic appeared as Hurwicz (1960, 1972), much of which was synthesized in Hurwicz (1986) — see also Arrow and Hurwicz (1977). Late enough in his life for him to have been invited to deliver the Richard T. Ely Lecture to the American Economic Association, Hurwicz (1973) did a great deal to promote the systematic exploration of incentive compatible allocation mechanisms for resource allocation. This was very

useful to me when working on Hammond (1979), especially the typical incentive incompatibility of lump-sum redistribution of the kind needed to support typical first-best Pareto efficient allocations. This and the earlier articles by Hurwicz were a source of inspiration for many of the other contributions to the *Review of Economic Studies* "Symposium on Incentive Compatibility" that I edited, including *inter alia* Hurwicz (1979) and Dasgupta *et al.* (1979).[1]

1.2 Hurwicz on Institutions and Externalities

Several years later Leo Hurwicz (1995, 1999) wrote specifically about externalities, including the Coase theorem. In Hurwicz (1996) he wrote about "institutions as families of game forms", and in Hurwicz (1998) on "the design of mechanisms and institutions", which appeared in a volume with the title "designing institutions for environmental and resource management." In his Nobel Memorial Prize lecture, Hurwicz (2008), he revisited this idea of the link between institutions and game forms.

I take this background as inspiration for using this opportunity to write about externalities and mechanism design, though from a perspective that is no doubt very different.

1.3 Outline

The purpose of this paper is to relate different concepts of externality to the economic institutions which determine, or at least influence, what outcome to the participating agents emerges.

As argued in Section 2, classical externalities come about as a departure from the standard "neoclassical" institutional framework, with complete and perfectly competitive markets for private goods.

Next, Section 3 considers pecuniary externalities. As Laffont (2008) correctly observes, unlike classical externalities, they do nothing to upset the usual efficiency properties of equilibrium allocations in competitive markets. They do, however, have a significant influence on gains from trade results.

[1] A confession may be in order. As the deadline for sending the papers for the symposium to the production editor loomed, there was only a still incomplete version of Leo's contribution sitting on my editorial desk. In particular, there was no introduction, though fortunately a first footnote provided most of what was needed. So, in an era when even transatlantic phone calls remained rare and expensive, Leo's paper appeared without his formal approval of this last minute change. I have heard that Leo, as one might have expected, was amused rather than offended by this course of action.

Section 4 introduces the concept of an institutional externality. Like classical and pecuniary externalities, it captures the idea that one agent's actions can influence the possibilities open to other agents. With institutional externalities, however, the influence is more subtle. The idea is that, except when the institution can be modelled as a game form in which agents can choose dominant strategies, one agent's strategy choice can influence what other agents will want to choose. This is what we call an "institutional externality".

Hurwicz, of course, demonstrated that such strategy-proof mechanisms fail to exist in many economic environments. In this sense, institutional externalities are endemic. Nevertheless, Section 4 concludes with some prominent examples of economic environments in which institutional externalities can be avoided.

The final Section 5 attempts to put these results in a general perspective.

2 Classical Externalities as Constraints

2.1 Defining Classical Externalities

In what has become the standard textbook for graduate courses in microeconomic theory, Mas-Colell, Whinston and Green (1995, p. 351) write:

> Surprisingly, perhaps, a fully satisfying definition of an externality has proved somewhat elusive.

As a "serviceable departure," they offer this as a definition:

> An *externality* is present whenever the well-being of a consumer or the production possibilities of a firm are directly affected by the actions of another agent in the economy.

They also offer this additional "subtle point":

> When we say "directly," we mean to exclude any effects that are mediated by prices.

This use of the key word "directly" contrasts markedly with the word "indirect" that is used in the definition provided at the head of Laffont's (2008) entry in the *New Palgrave Dictionary of Economics*:

> Externalities are indirect effects of consumption or production activity, that is, effects on agents other than the originator of such activity which do not work through the price system.

> In a private competitive economy, equilibria will not be in general Pareto optimal since they will reflect only *private* (direct) effects and not *social* (direct plus indirect) effects of economic activity.

2.2 Externalities and Constrained Efficiency

Laffont (2008) goes on to write:

> In a private competitive economy, equilibria will not be in general Pareto optimal since they will reflect only *private* (direct) effects and not *social* (direct plus indirect) effects of economic activity.

Indeed, there is the well-known relation between perfectly competitive markets for private goods, with or without lump-sum wealth redistribution, and the Pareto efficient allocation of private goods. On this topic, this is not the occasion to try to add to the survey chapter Hammond (2011). In the presence of externalities or public goods, however, given any competitive market allocation of private goods, there will usually be Pareto superior reallocations of private goods and externalities together. Thus, even perfect markets for private goods achieve at best a constrained notion of Pareto efficiency, along the lines of Hammond (1995) or Hammond and Sempere (2009).

2.3 Additional Markets for Externalities

It is commonly suggested that, even in the presence of externalities, unconstrained Pareto efficiency could be achieved by creating new markets for those externalities, with prices (positive or negative) that correspond to the appropriate Pigou subsidy or tax. This suggestion loses much of its persuasive power once one realizes that, as Starrett (1972) observes, negative externalities typically give rise to "fundamental non-convexities", which prevent existence of competitive equilibrium in a system of markets that allows externalities to be priced.

Nevertheless, the suggestion leads one to realize that the distinction between private goods and externalities, or public goods, really depends on the institutions that determine which goods are traded, and which are not. This, of course, introduces some ambiguity into the closely related definitions presented in Section 2.1. Looked at this way, it is institutions rather than tastes and technology that create externalities.

3 Pecuniary Externalities

3.1 Definition

In the first paragraph of his short subsection on pecuniary externalities, Laffont (2008) wrote as follows:

> During the 1930s, a confused debate occurred between economists on the relevance of pecuniary externalities, that is, on externalities which work through the price system. A quite general consensus was that pecuniary externalities are irrelevant for welfare economics: the fact that by increasing my consumption of whisky I affect your welfare through the consequent increase in price does not jeopardize the Pareto optimality of competitive equilibria.

In the penultimate sentence of the subsection, he wrote:

> When agents affect prices, they affect the welfare of the other agents by altering their feasible consumption sets or their information structures. Pecuniary externalities matter for welfare economics.

3.2 Limits to Gains from Liberalization

As an example of how pecuniary externalities can matter, it is worth considering gains from trade in international economics, notably the literature inspired by the classical results due to Samuelson (1939, 1962) and Kemp (1962). In general, moves toward freer trade are particular instances of economic liberalization or supply side policy reforms where, given a status quo allocation which would result in the absence of any liberalizing reform, there are moves away toward a more extensive market system — see, for example, Hammond and Sempere (1995).

Any such liberalizing reform typically changes the prices of goods, including the wages of workers. Such price changes will typically make some agents better off, and others worse off. To that extent, they are pecuniary externalities. The early literature often applied the Kaldor–Hicks compensation test, claiming that a reform would be beneficial provided the gainers could compensate the losers in a way that would make all agents better off. Such compensation tests are not only ethically indefensible because they do nothing to ensure that losers actually get compensated. As Scitovsky (1941) and Gorman (1955) pointed out, they can also be logically inconsistent —

see also Chipman's (2008) survey. Instead of relying on any compensation test, the real issue is whether a liberalizing reform can be made "credible" by linking it to suitably chosen policy instruments intended to limit the damage arising from negative pecuniary externalities — see Hammond (1993).

3.3 No Adverse Pecuniary Externalities

In order to ensure that there are no adverse pecuniary externalities, the classical literature on the gains from trade due to Samuelson and Kemp largely confines itself to two special cases.

In the first of these, there is a finite collection of trading nations, in each of which there is a single representative consumer. Moreover, the status quo allocation is taken to be autarkic, without any international trade. This ensures that whatever equilibrium prices result from free international trade in world markets, there can be no deterioration in any country's terms of trade. So no nation's representative consumer can be made worse off by trade; moreover, except in the special case when the status quo allocation is already Pareto efficient, at least one nation's representative consumer will be strictly better off.

The second special case occurs when a single nation with just one representative consumer is a "small country", in the technical sense that its trade policy has no effect on prevailing world market prices. In this case there are no pecuniary externalities at all because if the small nation liberalizes by moving to free trade at world prices, by definition this has no effect on world prices. So, except in the special case when the status quo is already a competitive equililbrium at world prices, the small nation's lone representative consumer will gain.

3.4 Mitigating Pecuniary Externalities

Though negative pecuniary externalities may be inevitable outside the two special cases just discussed, there are three particular kinds of mitigating policy that have received attention in the theoretic literature on economic liberalization. All of these mitigating policies work, moreover, without the need to assume any kind of representative consumer.

Following the work of Grandmont and McFadden (1972) in particular, the first kind of mitigating policy involves using lump-sum wealth redistribution. The idea is first to compensate each consumer for any adverse price movement, and then to share among all consumers any surplus generated by moving to a perfectly competitive allocation. Unless the status quo is

already a Pareto efficient allocation, standard assumptions ensure that this surplus will be positive. So the allocation after the reform, including this redistribution, makes every consumer strictly better off provided they all have monotone preferences.

This kind of lump-sum redistribution, however, is typically incentive incompatible because it encourages agents to exaggerate the minimum compensation they need to ensure that they are no worse off than in the status quo, where there has been no reform. Following the ideas of Diamond and Mirrlees (1971) on optimal commodity taxation, Dixit and Norman (1986) discussed a second way to mitigate price changes. This involved fixing consumer prices at their status quo levels, while letting commodity tax rates and associated producer prices adjust to clear markets. This would then allow any surplus due to efficiency gains to be spent on a *uniform* lump-sum subsidy that is the same for all individuals. For details, see for example Hammond and Sempere (1995).

A third way of mitigating pecuniary externalities arises when the status quo has publicly known fixed quantities, as might be the case in a command economy such as China during the Maoist era. Such a status quo offers the scope for "dual-track liberalization" of the kind discussed by Lau, Qian, and Roland (1997, 2000) and by Che and Facchini (2007). The first track is the specified status quo allocation in the command economy; the second track is a competitive market economy. The two tracks are combined by first insisting that each agent receives the consumption goods and also supplies whatever is specified under the status quo. Agents, however, are also allowed to trade freely at market prices in order to determine whatever additional supply vector they want to offer in exchange for any additional consumption, etc. In effect, this dual-track policy determines a particular version of the lump-sum wealth redistribution rule considered by Grandmont and McFadden (1972), where each agent's wealth endowment equals the net value at the liberalized market prices of the fixed status quo allocation specified for them in the command economy.

4 Institutional Externalities

4.1 Strategyproof Allocation Mechanisms

An *economic environment* can be defined as a collection of economic agents, each of whom has a specified *individual characteristic* in the form of preferences and an endowment — possibly in the form of a production set — within a given finite dimensional commodity space. Then an *allocation rule*

can be defined as a mapping from a given domain of possible economic environments to a co-domain of allocations that are feasible in the relevant environment.

Hurwicz (1960, 1972, 1973) did much to initiate the systematic study of such allocation rules, and the information that would be needed to reach a satisfactory allocation — especially an allocation that is Pareto efficient — in each relevant environment. He considered a *principal* or *mechanism designer* who is granted the power to construct a *game form* or *allocation mechanism* in which each agent is required to send a signal from a suitably specified *signal space*, whereupon each possible profile of agents' signals is mapped into a feasible economic allocation. Notice that, when combined with agents' preferences for the economic allocation, and assuming these take the form of an expected utility function, the game form defines a game of incomplete information where each agent's payoff function is replaced by their expected utility.

A special case of particular interest is when every agent in every permissible economic environment has a dominant strategy which depends only on their own characteristic. In this case, one has a *dominant strategy* game form. The almost trivial theorem 4.4.1 of Dasgupta *et al.* (1979) proves that, in this case, there is an *equivalent direct mechanism* in which each agent's message is a direct signal of their individual characteristic; moreover, this direct mechanism is *strategyproof* in the sense that a dominant strategy for each agent is to announce their true characteristic.

4.2 Why Strategyproofness?

During the 1970s, Gibbard (1973) and Satterthwaite (1975) proved the general impossibility of constructing a strategy-proof social decision mechanism. Leo Hurwicz helped reinforce these negative results by considering when they held in specific economic environments, with or without public goods. Along with Groves and Ledyard (1977), Maskin (1999) and many others, he initiated the search for mechanisms whose Nash equilibria would yield Pareto efficient allocations.

Implementation in Nash equilibrium, however, can be criticized on methodological grounds. Let us exclude the very special case when a principal who is designing a mechanism lacks information which is common knowledge to all the agents who participate in the mechanism. Outside this case, it would seem that the relevant game form should involve incomplete information, thus suggesting Bayesian Nash equilibrium as a solution concept. Furthermore, it follows from Theorem 5.1 of Dasgupta *et al.* (1979) that, if a

mechanism is not strategy-proof, then the outcome it generates will be sensitive to agents' beliefs about each other — see also Ledyard (1978). Hence, except in rare cases, a mechanism that is implemented in Nash equilibrium rather than in dominant strategies generates allocations that depend not just on agents' tastes and endowments, but also on their beliefs. These beliefs, moreover, concern not just other agents' tastes and endowments, but also their beliefs about how these other agents will play the game form.

4.3 Strategyproof Exchange: When Is It Possible?

For the case of an exchange economy with two individuals, Hurwicz (1972) proved that any strategyproof allocation rule yielding Pareto efficient outcomes must be dictatorial. Satterthwaite and Sonnenschein (1981) explored the difficulties in extending this result beyond two individuals. Serizawa (2002), along with Serizawa and Weymark (2003), showed that, even if they do not have to be dictatorial, nonetheless Pareto efficient strategyproof rules always involve allocations that are close to being extreme — i.e., close to dictatorial. Finally, Barberà and Jackson (1995) characterized strategyproofness in general exchange economies with finite numbers of agents and goods, and showed how limited they must be even if one does not insist on Pareto efficient outcomes.

Even so, there are some particular economic environments where strategyproof exchange is possible. Apart from trivial cases, these environments have the key property that changes in agents' characteristics have no influence on the competitive equilibrium price, at least if the changes are small. It follows that institutional externalities are merely endemic, rather than universal.

4.4 Strategyproof Mechanism 1: An Islands Model

The first example is a static microeconomic version of the islands model, which is well known to macroeconomists following the work of Lucas (1972). There is a finite set of islands, each with a lone representative consumer. There is no possibility of trade between the islands, so each island has its own distinct commodity space of located goods specific to that island. Nor are the preferences or welfare of the representative consumer in any one island affected at all by the allocation in any other island. In this case, an obvious mechanism is to select an isolated optimal allocation separately within each island. This mechanism is clearly strategyproof because no

agent's incentives are affected at all by the allocation that is chosen in any other island.

This example shows that the institutional externality that prevents strategyproof exchange can be ascribed to the resource balance constraints that arise in a general exchange ecoomy. In the special case of the islands model, agents are so separated that these constraints have force only within each island, so strategyproofness is possible.

4.5 Strategyproof Mechanism 2: Local Independence

The first case where the independence property mentioned in Section 4.3 holds, at least locally, is discussed by Makowski, Ostroy and Segal (1999). They assume that at least one agent has a flat indifference surface in some neighbourhood of a Walrasian equilibrium allocation. While the economy has a Walrasian equilibrium allocation which remains in this neighbourhood, price ratios in this particular equilibrium are determined by the normal to this flat surface. Provided that this is the equilibrium chosen by the mechanism, individual agents cannot manipulate prices except by distorting their desired trades so much that they become worse off.

Section 7.5.2 of Hammond (2011) describes a second case of local independence, which holds if there is a linear technology. A particular example is when the "non-substitution theorem" holds. In its simplest form, this theorem relies on the assumptions that the economy's production possibilities are described by a finite collection of activities exhibiting constant returns to scale, a single common primary factor of production, and no joint production. These assumptions imply that equilibrium prices are independent of demand as long as demand does not change so much as to alter the pattern of goods that are inputs and goods that are outputs in any activity.

4.6 Strategyproof Mechanism 3: Infinitely Many Agents

The main case when strategyproof exchange is possible, however, is when there are infinitely many agents. As acknowledged in Hammond (1979), it was Hurwicz (1972) himself who observed that the competitive mechanism is incentive compatible in a large economy. Sections 14 and 15 of Hammond (2011) are devoted to a survey of the results that hold in such environments. There is a broad class of environments in which strategyproof exchange is possible, even in the presence of tax mechanisms such as those studied in Guesnerie (1995). Since that survey was written, the paper Hammond (2017) has appeared. It considers the complications involved in devising

mechanisms that remain strategyproof even when not only are agents privately informed of their endowments, but also any contracts to supply goods fail to be self-enforcing.

5 Concluding Remarks

The first part of this paper focused on both classical and pecuniary externalities, emphasizing their links to institutional features of the economic system in which they arise. Later, the paper went on to explore some implications of viewing any institution that is modelled by a game form that is not strategy-proof as giving rise to institutional externalities. Specifically, as with both classical and pecuniary externalities, they arise when an agent's choice of action in the game form affects other agents' incentives.

Leo Hurwicz's early work on the difficulties of constructing strategy-proof mechanisms shows that institutional externalities, understood in this way, are endemic. The paper also explores a few very special cases where there will be no institutional externalities. Typically, these involve purely static economic environments with only private goods and: either many economic agents, as Hurwicz (1972) himself had suggested; or other special environments where no individual agent has an influence over prices, such as when the non-substitution theorem holds.

Acknowledgements

I had the privilege and pleasure of meeting Leo Hurwicz on several occasions, notably at summer workshops organized by the economics section of the Institute of Mathematical Studies in the Social Sciences at Stanford University. My last conversation with him, however, took place during the summer 2000 meeting of APET (The Association for Public Economic Theory) at the University of Warwick. During that meeting, Leo gave a talk on externalities which seems related to Hurwicz (1999). Thoughts provoked by his presentation may have helped me prepare an after dinner talk entitled "What *isn't* an Externality?" for a conference on "Modelling public goods and public policy: Past, present and future prospects" organized by Monique Florenzano and Sylvie Thoron at C.I.R.M. (Centre International de Rencontres Mathématiques) in Marseille-Luminy. This was held almost immediately after I took up my current position at Warwick on 1st April 2007. My thanks to the audience in Luminy for encouraging me to share

more widely a significantly revised version of my remarks on that occasion, and also to Walter Trockel for providing a suitable outlet.

References

Arrow, Kenneth J., and Leonid Hurwicz (eds.) (1977) *Studies in Resource Allocation Processes* (Cambridge University Press).

Barberà, Salvador, and Matthew O. Jackson (1995) "Strategy-Proof Exchange" *Econometrica* 63 (1): 51–88.

Che, Jiahua, and Giovanni Facchini (2007) "Dual Track Reforms: With and Without Losers" *Journal of Public Economics* 91: 2291–2306.

Chipman, John S. (2008) "Compensation Principle" in *New Palgrave Dictionary of Economics, 2nd. edn.* Edited by Steven N. Durlauf and Lawrence E. Blume.

Dasgupta, Partha, Peter Hammond and Eric Maskin (1979) "The Implementation of Social Choice Rules: Some General Results on Incentive Compatibility" *Review of Economic Studies* 46: 185–216.

Diamond, Peter A. and James A. Mirrlees (1971) "Optimal Taxation and Public Production, I and II" *American Economic Review* 61: 8–27 and 261–278.

Dixit, Avinash, and Victor Norman (1986) "Gains from Trade Without Lump-Sum Compensation" *Journal of International Economics* 21: 99–110.

Gibbard, Allan (1973) "Manipulation of Voting Schemes: A General Result" *Econometrica* 41 (4): 587–601.

Gorman, William M. (1955) "The Intransitivity of Certain Criteria Used in Welfare Economics" *Oxford Economic Papers* 7 (1) : 25–34.

Grandmont, Jean-Michel, and Daniel McFadden (1972) "A Technical Note on Classical Gains from Trade" *Journal of International Economics* 2: 109–25.

Groves, Theodore and John Ledyard (1977) "Optimal Allocation of Public Goods: A Solution to the 'Free Rider' Problem" *Econometrica* 45 (4): 783–809.

Guesnerie, Roger (1995) *A Contribution to the Pure Theory of Taxation* (Cambridge: Cambridge University Press).

Hammond, Peter J. (1979) "Straightforward Individual Incentive Compatibility in Large Economies" *Review of Economic Studies* 46: 263–282.

Hammond, Peter J. (1993) "Credible Liberalization: Beyond the Three Theorems of Neoclassical Welfare Economics" in D. Bös (ed.) *Economics in a Changing World, Vol. 3: Public Policy and Economic Organization* (IEA Conference Volume No. 109) (London: Macmillan), ch. 3, pp. 21–39.

Hammond, Peter J. (1995) "Four Characterizations of Constrained Pareto Efficiency in Continuum Economies with Widespread Externalities" *Japanese Economic Review* 46: 103–124.

Hammond, Peter J. (2011) "Competitive Market Mechanisms as Social Choice Procedures" in K.J. Arrow, A.K. Sen and K. Suzumura (eds.) *Handbook of Social Choice and Welfare, Vol. II* (Amsterdam: North-Holland), ch. 15, pp. 47–151.

Hammond, Peter J. (2017) "Designing a Strategy-Proof Spot Market Mechanism with Many Traders: Twenty-Two Steps to Walrasian Equilibrium" *Economic Theory* 63 (1): 1–50.

Hammond, Peter J., and Jaume Sempere (1995) "Limits to the Potential Gains from Economic Integration and Other Supply Side Policies" *Economic Journal* 105: 1180–1204.

Hammond, Peter J., and Jaume Sempere (2009) "Migration with Local Public Goods and the Gains from Changing Places" *Economic Theory* 41: 359–377.

Hurwicz, Leonid (1960) "Optimality and Informational Efficiency in Resource Allocation Processes", in *Mathematical Methods in the Social Sciences, 1959: Proceedings of the First Stanford Symposium* K.J. Arrow, S. Karlin and P. Suppes (eds.) (Stanford University Press) pp. 27–46.

Hurwicz, Leonid (1972) "On Informationally Decentralized Systems" in *Decision and Organization: A volume in honor of Jacob Marschak* C.B. McGuire and R. Radner (eds.) (Amsterdam: North-Holland) pp. 297–336.

Hurwicz, Leonid (1973) "The Design of Mechanisms for Resource Allocation" *American Economic Review, Papers and Proceedings* 63 (2): 1–30.

Hurwicz, L., (1979) "Outcome Functions Yielding Walrasian and Lindahl Allocations at Nash Equilibrium Points" *Review of Economic Studies* 46: 217–225.

Hurwicz, L., (1986) "Incentive Aspects of Decentralization" in *Handbook of Mathematical Economics, Vol. 3* K.J. Arrow and M.D. Intriligator (eds.) (Elsevier) Ch. 28, pp. 1441–1482.

Hurwicz, Leonid (1995) "What is the Coase Theorem?" *Japan and the World Economy* 7: 49–74.

Hurwicz, Leonid (1996) "Institutions as Families of Game Forms" *Japanese Economic Review* 47 (2) : 113–132.

Hurwicz, Leonid (1998) "Issues in the design of mechanisms and institutions" in *Designing Institutions for Environmental and Resource Management* E. T. Loehman and D. M. Kilgour (eds.) (Cheltenham, U.K.: Edward Elgar).

Hurwicz, Leonid (1999) "Revisiting Externalities" *Journal of Public Economic Theory* 1 (2): 225–245.

Hurwicz, Leonid (2008) "But Who Will Guard the Guardians?" in *Les Prix Nobel. The Nobel Prizes 2007* K. Grandin (ed.) (Stockholm: Nobel Foundation), pp. 280–291.

Kemp, Murray C. (1962) "The Gains from International Trade" *Economic Journal* 72: 803–819.

Laffont, Jean-Jacques (2008) "Externalities" in *New Palgrave Dictionary of Economics, 2nd. edn.* Edited by Steven N. Durlauf and Lawrence E. Blume.

Lau, Lawrence J., Yingyi Qian, and Gérard Roland (1997) "Pareto-Improving Economic Reforms Through Dual-Track Liberalization" *Economics Letters* 55: 285–292.

Lau, Lawrence J., Yingyi Qian, and Gérard Roland (2000) "Reform without Losers: An Interpretation of China's Dual-Track Approach to Transition" *Journal of Political Economy* 108: 120–143.

Ledyard, John O. (1978) "Incentive Compatibility and Incomplete Information" *Journal of Economic Theory* 18 (1): 171–l89.

Lucas, Robert E. (1972) "Expectations and the Neutrality of Money" *Journal of Economic Theory* 4 (2): 103–124.

Makowski, Louis, Joseph M. Ostroy, and Uzi Segal (1999) "Efficient Incentive Compatible Economies Are Perfectly Competitive" *Journal of Economic Theory* 85: 169–225.

Mas-Colell, Andreu, Michael D. Whinston and Jerry R. Green (1995) *Microeconomic Theory* (New York: Oxford University Press).

Maskin, Eric (1977, published 1999) "Nash Equilibrium and Welfare Optimality" *Review of Economic Studies* 66 (1): 23–38.

Samuelson, Paul A. (1939) "The Gains from International Trade" *Canadian Journal of Economics* 5: 195–205.

Samuelson, Paul A. (1962) "The Gains from International Trade Once Again" *Economic Journal* 72: 820–829.

Satterthwaite, Mark A. (1975) "Strategy-Proofness and Arrow's Conditions: Existence and Correspondence Theorems for Voting Procedures and Social Welfare Functions" *Journal of Economic Theory* 10 (2): 187–217.

Satterthwaite, Mark A., and Hugo Sonnenschein (1981) "Strategy-Proof Allocation Mechanisms at Differentiable Points" *Review of Economic Studies* 48 (4): 587–597.

Scitovsky, Tibor (1941) "A Note on Welfare Propositions in Economics" *Review of Economic Studies* 9: 77–88.

Serizawa, Shigehiro (2002) "Inefficiency of Strategy-Proof Rules for Pure Exchange Economies" *Journal of Economic Theory* 106 (2): 219–241.

Serizawa, Shigehiro, and John A. Weymark (2003) "Efficient Strategy-Proof Exchange and Minimum Consumption Guarantees" *Journal of Economic Theory* 109 (2): 246–263.

Starrett, David A. (1972) "Fundamental Nonconvexities in the Theory of Externalities" *Journal of Economic Theory* 4 (2): 180–199.