

Ecologies of Construction

Ecological Economics, Dematerialization and Kuznets Curve

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Learning objective

Purpose: To introduce the various topics that have come to be known as environmental economics as well as ecological economics.

Primary reference texts for lecture:

ecological economics *(of human activity)*

I. Efficiency versus consumption

- Jevons

II. Dematerialization

- Cutler, Ayres

III. Economics and exhaustible resources

- Pigou, Coase
- Solow
- Kuznets

IV. Ecological economics

- Ruth

“...as a rule, the new modes of economy will lead to an increase of consumption according to a principle recognized in many parallel instances.... The same principles apply, with even greater force and distinctiveness to the use of such a general agent as coal. It is the very economy of its use which leads to its extensive consumption.”

Williams Stanley Jevons

(1865)

The Jevons Paradox

In order to answer this question it is useful to look at what ecological economists call the Jevons Paradox.* William Stanley Jevons (1835-1882) is best known as a British economist who was one of the pioneers of contemporary neoclassical economic analysis, with its **subjective value theory rooted in marginal utility**. **Jevons first achieved national fame, however, for his work The Coal Question (1865). Jevons argued that British industrial growth had relied on cheap coal and that the increasing cost of coal, as deeper seams were mined, would generate economic stagnation.** Substituting coal for corn, within the general Malthusian argument that says population increases faster than food supply, he observed: "Our subsistence no longer depends upon our produce of corn. The momentous repeal of the Corn Laws throws us from corn upon coal" (The Coal Question, 3rd edition, 194-195). Jevons argued that neither technology nor substitutability (that is, the substitution of other energy sources for coal) could alter this. **Jevons was fabulously wrong in his calculations.** His main mistake was to underestimate the importance of coal substitutes such as petroleum and hydroelectric power. Commenting on Jevons' argument in 1936, Keynes said it was "over-strained and exaggerated" (Essays in Biography, 1951, 259).

But there is one aspect of Jevons' argument that has attracted the admiration of ecological economists. **Chapter Seven of The Coal Question was entitled "Of the Economy of Fuel."** Here he argued that **increased efficiency in using a natural resource, such as coal, only resulted in increased demand for that resource**, not a reduction in demand. This was because such improvement in efficiency led to a rising scale of production (and satisfied "latent" demand – Solow phrase).

"It is wholly a confusion of ideas," Jevons wrote, to suppose that the economic use of fuel is equivalent to a diminished consumption. The very contrary is the truth. As a rule, the new modes of economy will lead to an increase of consumption according to a principle recognized in many parallel instances.... The same principles apply, with even greater force and distinctiveness to the use of such a general agent as coal. It is the very economy of its use which leads to its extensive consumption.... Nor is it difficult to see how this paradox arises.... If the quantity of coal used in a blast-furnace, for instance, be diminished in comparison with the yield, the profits of the trade will increase, new capital will be attracted, the price of pig-iron will fall, but the demand for it increase; and eventually the greater number of furnaces will more than make up for the diminished consumption of each. And if such is not always the result within a single branch, it must be remembered that the progress of any branch of manufacture excites a new activity in most other branches and leads indirectly, if not directly, to increased inroads upon our seams of coal.... Civilization, says Baron Liebig, is the economy of power, and our power is coal. It is the very economy of the use of coal that makes our industry what it is; and the more we render it efficient and economical, the more will our industry thrive, and our works of civilization grow (140-142).

Jevons went on to argue in detail that the whole history of the steam engine was a history of successive economies in its use- and each time this led to further increases in the scale of production and the demand for coal. "Every such improvement of the engine," he observed, "when effected, does but accelerate anew the consumption of coal. Every branch of manufacture receives a fresh impulse-hand labor is still further replaced by mechanical labor" (152-153).

The contemporary significance of the Jevons paradox is seen with respect to the automobile in the United States. The introduction of more energy-efficient automobiles in this country in the 1970s did not curtail the demand for fuel because driving increased and the number of cars on the road soon doubled. Similarly, technological improvements in refrigeration simply led to more and larger refrigerators. The same tendencies are in effect within industry, independent of individual consumption.

**In a competitive economy, decisions
are made in such a way as to
maximize private net product but
not necessarily social net product.**

(1912)

Arthur Cecil Pigou

Internalizing Externalities

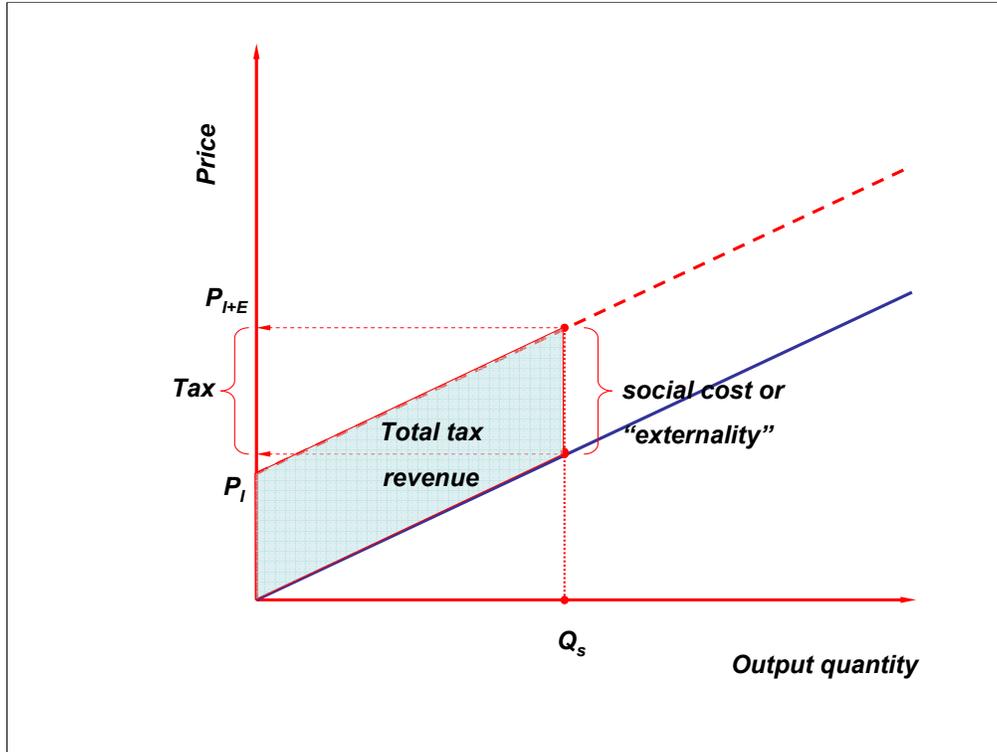
He was a leading exponent of the theory that economic waste due to unemployment, poor health, and poor housing is a responsibility of society, which should bear the costs.

Son of an army officer, A.C. Pigou was born on Nov. 18, 1877. Educated at [Harrow](#) and King's College, Cambridge, he compiled a brilliant record that included numerous prizes. He was made a fellow of King's College in 1902 and, in 1908, succeeded Alfred Marshall in the chair of political economy.

Like Marshall, Pigou felt that the study of economics could be justified only as a means of improving human society. Building upon the base of Marshallian economics, he set out modifying, expanding, and adapting the apparatus so that it could be directly applied to the exploration of ways and means by which social intervention would yield benefits in terms of economic welfare.

Wealth and Welfare (1912) contains, in embryonic form, the central core of Pigou's contribution to economic theory. Beginning from the proposition that economic welfare depends upon the size, the manner of distribution, and the variability of the national dividend, **Pigou carefully analyzed the competitive economic system to find how it falls short of the ideal and the means by which the ideal can be achieved.** The central concept of his analysis was the distinction between private and social net product - private product being the product that accrues to the individual making a decision concerning production, and social net product being the net product that accrues to society as a result of the decision. **In a competitive economy, decisions are made in such a way as to maximize private net product but not necessarily social net product.** Appropriate taxes and subsidies could, however, make private and social net products equal, thus leading each individual to behave in a way that maximizes social welfare. This has led to many debates about the use of taxes to guide behavior.

In 1933 Pigou published *The Theory of Unemployment*, a book that was held in great esteem by orthodox economists. As such, it became a prime target for attack by John Maynard Keynes in his *General Theory of Employment Interest and Money* (1936). Pigou answered with several books and articles in which he attempted to reformulate his position in the light of Keynes's criticisms. In the end, his most lasting contribution was to point out that, as long as wage and price flexibility exists, the value of assets, the prices of which are fixed in money terms, will rise as wages and prices fall, reducing the propensity to save and, consequently, increasing the propensity to consume. It follows from the "[Pigou effect](#)" that Keynes's "under-employment equilibrium" is not a true equilibrium but a state of disequilibrium occasioned by inflexible wages and prices.



Pigovian tax (also spelled **Pigouvian tax**) is a [tax](#) levied to correct the [negative externalities](#) of a market activity. For instance, a Pigovian tax may be levied on producers who pollute the environment to encourage them to reduce pollution, and to provide revenue which may be used to counteract the negative effects of the pollution. Certain types of Pigovian taxes are sometimes referred to as [sin taxes](#), for example taxes on [alcohol](#) and [cigarettes](#).

The diagram to the right illustrates the working of a Pigovian tax. (For an explanation of this type of diagram, see the [social cost](#) article.) A tax shifts the marginal private cost curve (**MPC**) up by the amount of the tax (to **MPC + T**). Faced with this cost increase, the producers have an incentive to reduce output to the socially optimum level (**Q_s**) by reducing the marginal externality to the marginal tax. The total tax revenue (which could be used to mitigate the effect of the negative externality) is equal to the area **OEAB**.

A key problem with Pigovian tax is that of calculating what level of tax will counterbalance the negative externality. Political factors such as lobbying of government by polluters may also tend to reduce the level of the tax levied, which will tend to reduce the mitigating effect of the tax; while lobbying of government by special interests who calculate the negative utility of the externality higher than others may also tend to increase the level of the tax levied, which will tend to result in a sub-optimal level of production.

A Pigovian tax is considered one of the "traditional" means of bringing a modicum of market forces, and thus better market [efficiency](#), to economic situations where [externality](#) problems exist. More recently, particularly in the United States since the late 1970's, and in other developed nations since the 1980's, an alternative to Pigovian taxation has arisen: the creation of a market for "pollution rights." Pollution rights markets are not generally more efficient than Pigovian taxes but are often more appealing to policy makers because giving out the rights for free (or at less than market price) allows polluters to lose less profits or even gain profits (by selling their rights) relative to the unaltered market case. Markets for [emissions trading](#) have been set up to bring better allocative efficiency and improved information sharing to the pollution externality problem. Pollution rights markets are a part of the field of [Environmental Economics](#) generally, and [Free-market environmentalism](#) specifically.

Perhaps the biggest problem with the Pigovian tax is the "knowledge problem" suggested on page 6 of Pigou's essay "Some Aspects of the Welfare State" (1954) where he writes, "It must be confessed, however, that we seldom know enough to decide in what fields and to what extent the State, on account of [the gaps between private and public costs] could interfere with individual choice." In other words, the economist's blackboard "model" assumes knowledge we don't possess -- it's a model with assumed "givens" which are in fact *not* given to anyone. Indeed, usually this is knowledge which could never be provided as a "given" by any present or future "method", due to insuperable cognitive limits on knowledge explored by economists like Friedrich Hayek and researchers in the various fields of nonlinear dynamics. So the limits identified by Pigou are limits which theoretically and empirically could never be remedied by any current or yet to be developed modeling technique.

“Advancing technology is the *permissive* source of economic growth, but it is only a potential, a necessary condition, in itself not sufficient. If technology is to be employed efficiently and widely, and, indeed, if its own progress is to be stimulated by such use, institutional and ideological adjustments must be made to effect the proper use of innovations generated by the advancing stock of human knowledge.”

Prize Speech
(December 11, 1971)

Simon Smith Kuznets

Kuznets is credited with revolutionising [econometrics](#), and this work is credited with fueling the so-called [Keynesian](#) "revolution". An important book of his is *National Income and Its Composition, 1919–1938*. Published in 1941, it is a historically significant work on [Gross National Product](#). His work on the [business cycle](#) and disequilibrium aspects of economic growth helped launch [development economics](#). He also studied inequality over time, and his results formed the [Kuznets Curve](#).

Kuznets was also one of the earliest workers on [development economics](#), in particular collecting and analyzing the empirical characteristics of developing countries (1965, 1966, 1971, and 1979). His major thesis, which argued that underdeveloped countries of today possess characteristics different from those that industrialized countries faced before they developed, helped put an end to the simplistic view that all countries went through the same "linear stages" in their history and launched the separate field of development economics - which now focused on the analysis of modern underdeveloped countries' distinct experiences.

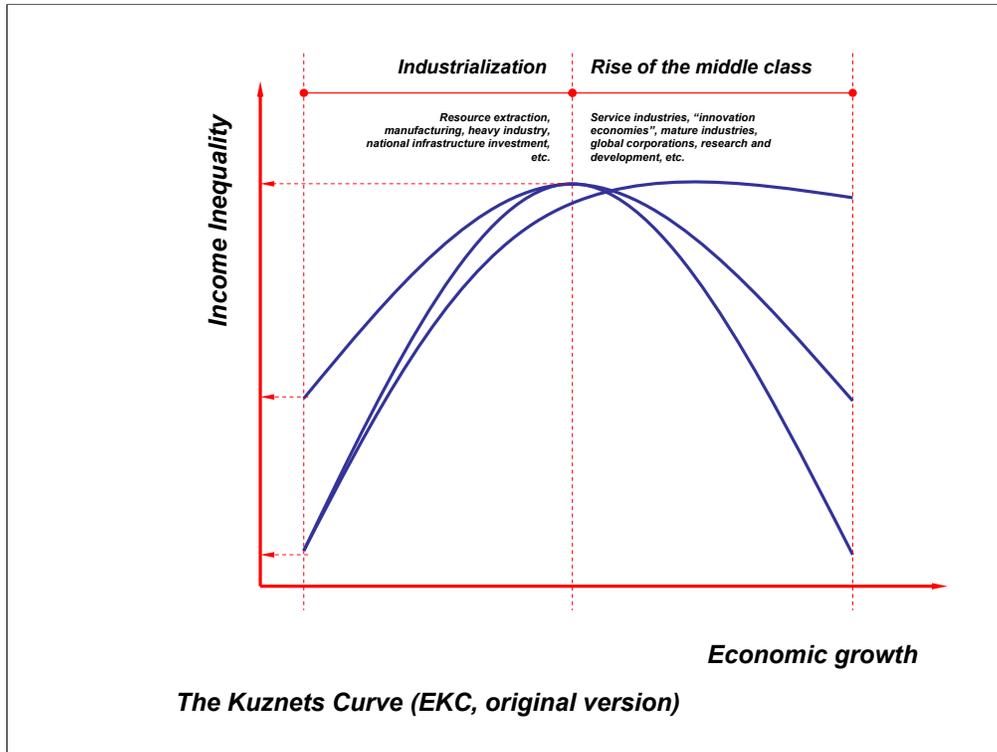
Among his several discoveries which sparked important theoretical research programs was his discovery of the inverted U-shaped relation between income inequality and economic growth (1955, 1963). In poor countries, economic growth increased the income disparity between rich and poor people. In wealthier countries, economic growth narrowed the difference. By noting patterns of income inequality in developed and underdeveloped countries, he proposed that as countries experienced economic growth, the income inequality first increases and then decreases. The reasoning was that in order to experience growth, countries had to shift from agricultural to industrial sectors. While there was little variation in the agricultural income, industrialization led to large differences in income. Additionally, as economies experienced growth, mass education provided greater opportunities which decreased the inequality and the lower income portion of the population gained political power to change governmental policies. He also discovered the patterns in savings-income behavior which launched the [Life-Cycle-Permanent-Income Hypothesis](#) of [Modigliani](#) and [Friedman](#).

modern economic growth *(Kuznets)*

- I. high rates of growth of per capita product and of population in the developed countries,
- II. rate of rise in productivity, i.e. of output per unit of all inputs, is high,
- III. rate of structural transformation of the economy is high,
- IV. the closely related and extremely important structures of society and its ideology have also changed rapidly,
- V. the economically developed countries, by means of the increased power of technology, particularly in transport and communication (both peaceful and warlike), have the propensity to reach out to the rest of the world,
- VI. the spread of modern economic growth, despite its worldwide partial effects, is limited in that the economic performance in countries accounting for three-quarters of world population still falls far short of the minimum levels feasible with the potential of modern technology.

source: Kuznets, S. Prize Lecture (Bank of Sweden Prize in Economic Sciences) Lecture to the memory of Alfred Nobel, December 11, 1971 Modern Economic Growth: Findings and Reflections

Six characteristics of modern economic growth have emerged in the analysis based on conventional measures of national product and its components, population, labor force, and the like. First and most obvious are the high rates of growth of per capita product and of population in the developed countries - both large multiples of the previous rates observable in these countries and of those in the rest of the world, at least until the recent decade or two. Second, the rate of rise in productivity, i.e. of output per unit of all inputs, is high, even when we include among inputs other factors in addition to labor, the major productive factor - and here too the rate is a large multiple of the rate in the past. Third, the rate of structural transformation of the economy is high. Major aspects of structural change include the shift away from agriculture to non-agricultural pursuits and, recently, away from industry to services; a change in the scale of productive units, and a related shift from personal enterprise to impersonal organization of economic firms, with a corresponding change in the occupational status of labor. Shifts in several other aspects of economic structure could be added (in the structure of consumption, in the relative shares of domestic and foreign supplies, etc.). Fourth, the closely related and extremely important structures of society and its ideology have also changed rapidly. Urbanization and secularization come easily to mind as components of what sociologists term the process of modernization. Fifth, the economically developed countries, by means of the increased power of technology, particularly in transport and communication (both peaceful and warlike), have the propensity to reach out to the rest of the world - thus making for one world in the sense in which this was not true in any pre-modern epoch. Sixth, the spread of modern economic growth, despite its worldwide partial effects, is limited in that the economic performance in countries accounting for three-quarters of world population still falls far short of the minimum levels feasible with the potential of modern technology.

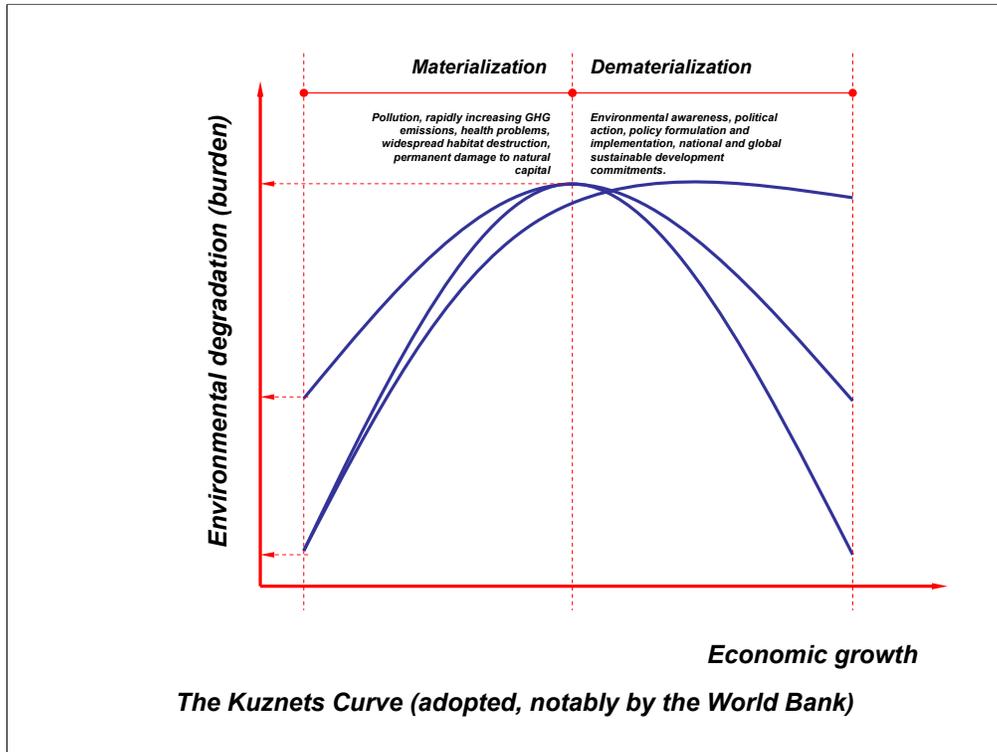


The Kuznets Curve

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This is understood to be an analysis of:

1. Modern economies, with
2. Large populations,
3. Some significant and valuable natural resources,



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economics of sustainability *(Ruth)*

Six challenges to traditional resource and environmental economics

- I. Integration of resource and environmental economics,
- II. Consistency with physical and biological principles,*
- III. Development of a systems perspective,
- IV. Acknowledgement of legacy effects,
- V. Recognition of interdependence of allocation, distribution and scale, and
- VI. Demonstration of policy relevance.

source: Ruth, M. 2006. A quest for the economics of sustainability and the sustainability of economics. *Ecological Economics*, **56**:332–342.

- 1.
2. In the 19th century, Alfred Marshall (pre-Pigou, Keynes, Kuznets) called for economics, in its later stages of development, to be guided by biological principles instead of treating the world like a mechanistic system.
- 3.
- 4.
- 5.
- 6.

product >> service

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carbon offsetting *(of human activity)*

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(carbonfund.org)