MPhil (Econ.) & MSc (Political Economy)

Dept. of Economics

National and Kapodistrian University of Athens

Lecture 9: The consolidation of neoclassical economic theory

Nicholas J. Theocharakis

Objectives of the lecture

- To demonstrate the consolidation of neoclassical economic theory in Europe and America in the first decades after the marginal revolution
- To show the specific forms in which neoclassical theory developed in different countries, particularly in the European Union and in the European Union.
- To in the United Kingdom, the United States, Italy, Sweden and Austria

Contents

- **UK**
  - A. Marshall * F.Y. Edgeworth * Ph. Wicksteed * A.C. Pigou
- **USA**
  - J. B. Clark * I. Fisher
- **Italy**
  - M. Pantaleoni * E. Barone * V. Pareto
- **Sweden**
  - K. Wicksell * G. Cassel
- **Austria**
  - F. v. Wieser * E. v. Böhm-Bawerk

Belle époque

Belle époque
1871-1914

Queen Victoria
1837–1901

Edward VII
1901-1910

Expo Universelle 1901

Wilhelm I
1861-1888

Wilhelm II
1888-1918

Gilded Age

What an extraordinary episode in the economic progress of man that age was which came to an end in August 1914! The greater part of the population, it is true, worked hard and lived at a low standard of comfort, yet were, to all appearances, reasonably contented with this lot. But escape was possible, for any man of capacity or character at all exceeding the average, into the middle and upper classes, for whom life offered, at a low cost and with the least trouble, conveniences, comforts, and amenities beyond the compass of the richest and most powerful monarchs of other ages. The inhabitant of London could order by telephone, sipping his morning tea in bed, the various products of the whole earth, in such quantity as he might see fit, and reasonably expect their early delivery upon his doorstep; he could at the same moment and by the same means adventure his wealth in the natural resources and new enterprises of any quarter of the world, and share, without exertion or even trouble, in their prospective fruits and advantages; or he could decide to couple the security of his fortunes with the good faith of the townspeople of any substantial municipality in any continent that fancy or information might recommend. He could secure forthwith, if he wished it, cheap and comfortable means of transit to any country or climate without passport or other formality, could despatch his servant to the neighbouring office of a bank for

such supply of the precious metals as might seem convenient, and could then proceed abroad to foreign quarters, without knowledge of their religion, language, or customs, bearing coined wealth upon his person, and would consider himself greatly aggrieved and much surprised at the least interference. But, most important of all, he regarded this state of affairs as normal, certain, and permanent, except in the direction of further improvement, and any deviation from it as aberrant, scandalous, and avoidable. The projects and politics of militarism and imperialism, of racial and cultural rivalries, of monopolies, restrictions, and exclusion, which were to play the serpent to this paradise, were little more than the amusements of his daily newspaper, and appeared to exercise almost no influence at all on the ordinary course of social and economic life, the internationalisation of which was nearly complete in practice.

THE ECONOMIC CONSEQUENCES OF THE PEACE

BY
JOHN MAYNARD KEYNES, C.B.
FELLOW OF KING'S COLLEGE, CAMBRIDGE

Neoclassical economics

Thorstein Veblen (1900): "The Preconceptions of Economic Science, III", *Quarterly Journal of Economics*, 14(2): 240-269

Tony Aspromourgos (1986): "On the origins of the term 'neoclassical'", Cambridge Journal of Economics, 10(3): 265–270

Neoclassical economics

This revision of the cost-of-production doctrine whereby it takes the form of a law of reciprocal demand is in good part effected by a consistent reduction of cost to terms of sacrifice,—a reduction more consistently carried through by Cairnes than it had been by earlier hedonists, and extended by Cairnes's successors with even more far-reaching results. By this step the doctrine of cost is not only brought into closer accord with the neo-hedonistic premises, in that it in a greater degree throws the stress upon the factor of personal discrimination, but it also gives the doctrine a more general bearing upon economic conduct and increases its serviceability as a comprehensive principle for the classification of economic phenomena. In the further elaboration of the hedonistic theory of value at the hands of Jevons and the Austrians the same principle of sacrifice comes to serve as the chief ground of procedure.

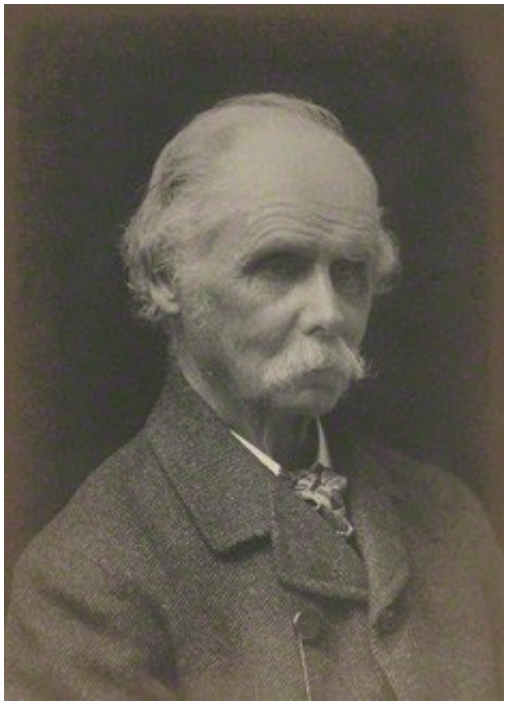
Of the foundations of later theory, in so far as the postulates of later economists differ characteristically from those of Mill and Cairnes, little can be said in this place. Nothing but the very general features of the later development can be taken up; and even these general features of the existing theoretic situation can not be handled with the same confidence as the corresponding features of a past phase of speculation. With respect to writers of the present or the more recent past the work of natural selection, as between variants of scientific aim and animus and between more or less divergent points of view, has not yet taken place; and it would be over-hazardous to attempt an anticipation of the results of the selection that lies in great part yet in the future. As regards the directions of theoretical work suggested by the names of Professor Marshall, Mr. Cannan, Professor Clark, Mr. Pierson, Professor Loria, Professor Schmoller, the Austrian group,—no off-hand decision is admissible as between these candidates for the honor, or, better, for the work, of continuing the main current of economic speculation and inquiry. No attempt will here be made even to pass a verdict on the relative claims of the recognized two or three main "schools" of theory, beyond the somewhat obvious finding that, for the purpose in hand, the so-called Austrian school is scarcely distinguishable from the neo-classical, unless it be in the different distribution of emphasis. The divergence between the modernized classical views, on the one hand, and the historical and Marxist schools, on the other hand, is wider,—so much so, indeed, as to bar out a consideration of the postulates of the latter under the same head of inquiry with the former. The inquiry, therefore, confines itself to the one line standing most obviously in unbroken continuity with that body of classical economics whose life history has been traced in outline above. And, even for this phase of modernized classical economics, it seems necessary to limit discussion, for the present, to a single strain, selected as standing peculiarly close to the classical source, at the same time that it shows unmistakable adaptation to the later habits of thought and methods of knowledge.

United Kingdom

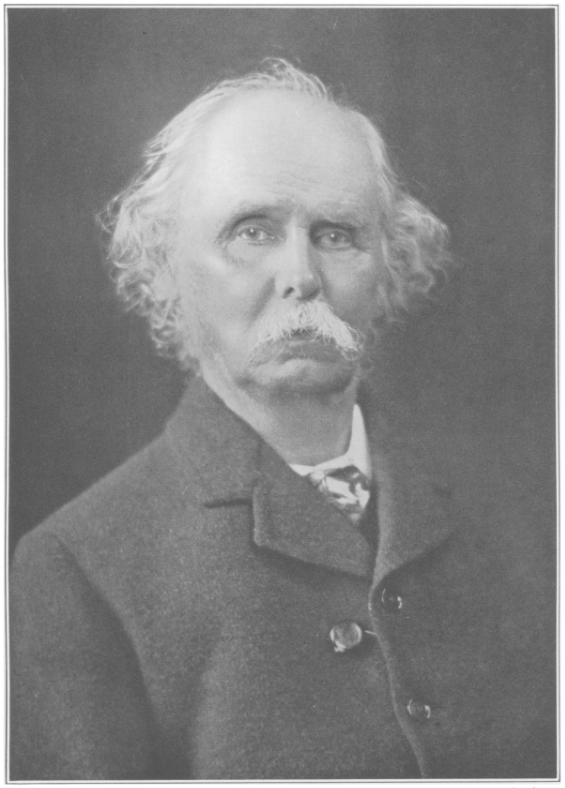
Alfred Marshall (1842-1924)

Alfred Marshall, First professor of political economy and first principal of University College Bristol

Photo: University of Bristol Library, Special Collections

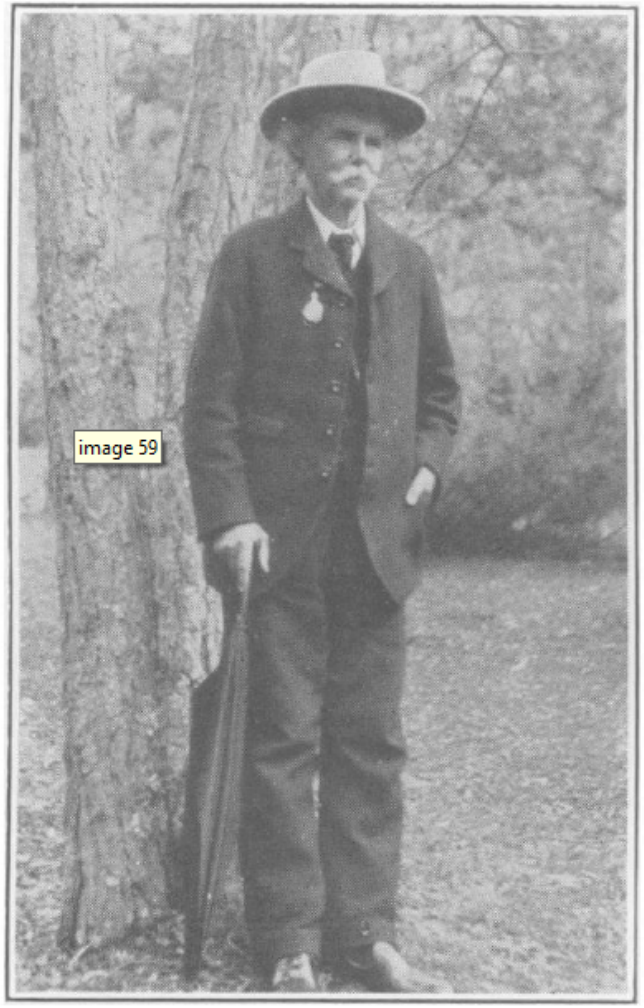


by Walter Stoneman
platinum print, 1917, NPG

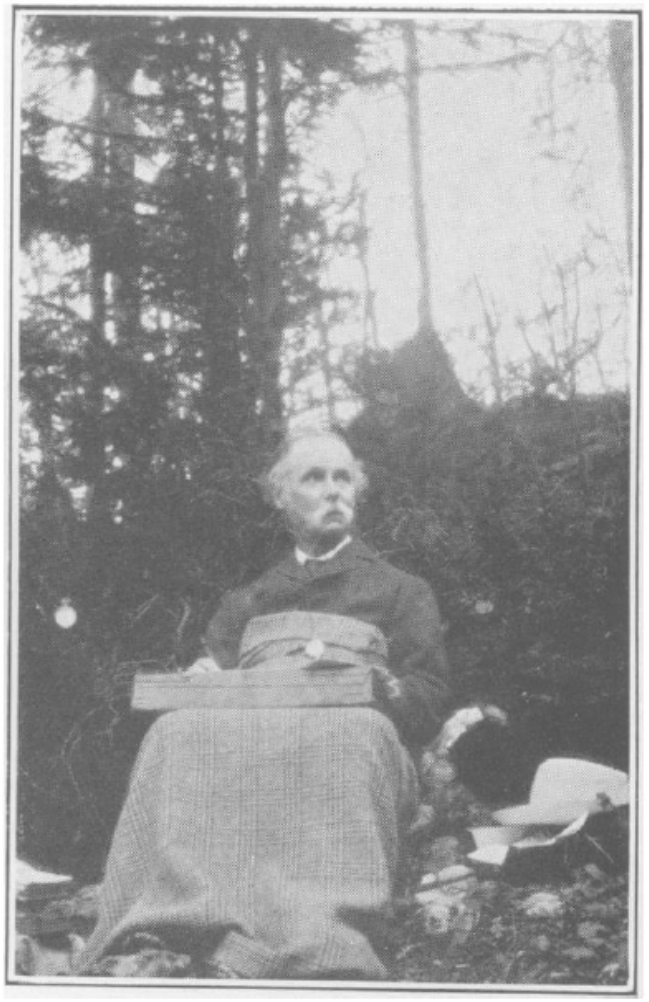


Frontispiece.

ALFRED MARSHALL, 1921.



1913.



(In the Tyrol) 1909.

ALFRED MARSHALL.

Alfred Marshall (1842-1924)

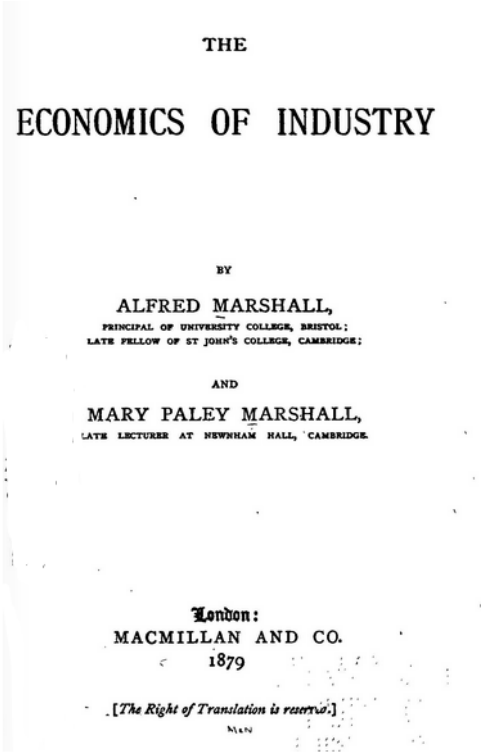
1865 Cambridge Mathematical Tripos
Fellow St John's College
1868 College Lecturer in Moral Sciences
1879 *Economics of Industry* with Mary Paley
1879-1881 Professor of Political Economy &
Principal at University College Bristol
1884 Cambridge Professor of Political Economy
1890 *Principles of Economics*
1919 *Industry and Trade*
1923 *Money, Credit and Commerce*

Mary Paley
Marshall
(1850-1944)

Royal Economic Society
Women and University
Economics Tripos

St John's College, Cambridge

Alfred Marshall (1842-1924)



THE

ECONOMICS OF INDUSTRY

BY

ALFRED MARSHALL,

PRINCIPAL OF UNIVERSITY COLLEGE, BRISTOL;
LATE FELLOW OF ST JOHN'S COLLEGE, CAMBRIDGE;

AND

MARY PALEY MARSHALL,

LATE LECTURER AT NEWNHAM HALL, CAMBRIDGE.

London:
MACMILLAN AND CO.
1879

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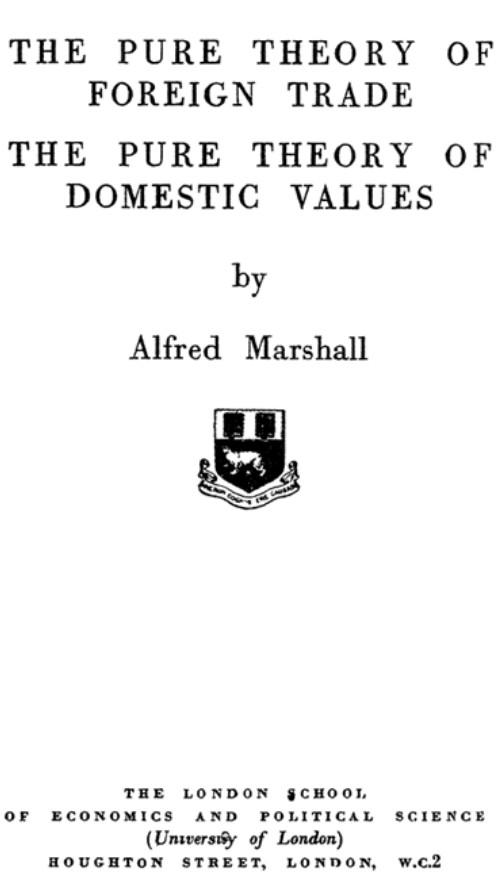


THE PURE THEORY OF
FOREIGN TRADE

THE PURE THEORY OF
DOMESTIC VALUES

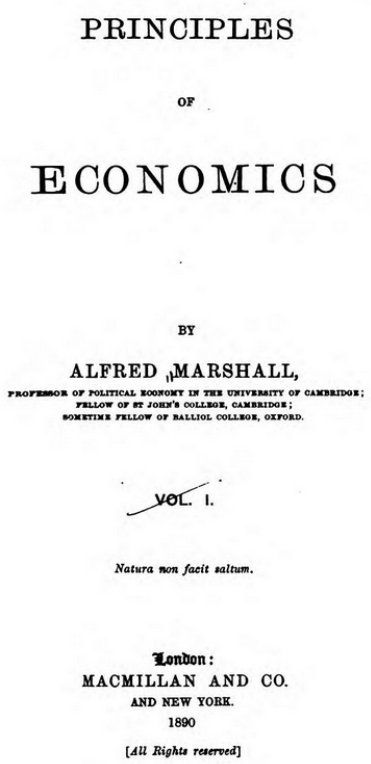
by

Alfred Marshall

THE LONDON SCHOOL
OF ECONOMICS AND POLITICAL SCIENCE
(*University of London*)
HOUGHTON STREET, LONDON, W.C.2

1879

Alfred Marshall (1842-1924)



PRINCIPLES

OF

ECONOMICS

BY

ALFRED MARSHALL,

PROFESSOR OF POLITICAL ECONOMY IN THE UNIVERSITY OF CAMBRIDGE;
FELLOW OF ST JOHN'S COLLEGE, CAMBRIDGE;
SOMETIME FELLOW OF BALLIOL COLLEGE, OXFORD.

VOL. I.

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London:
MACMILLAN AND CO.
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1890

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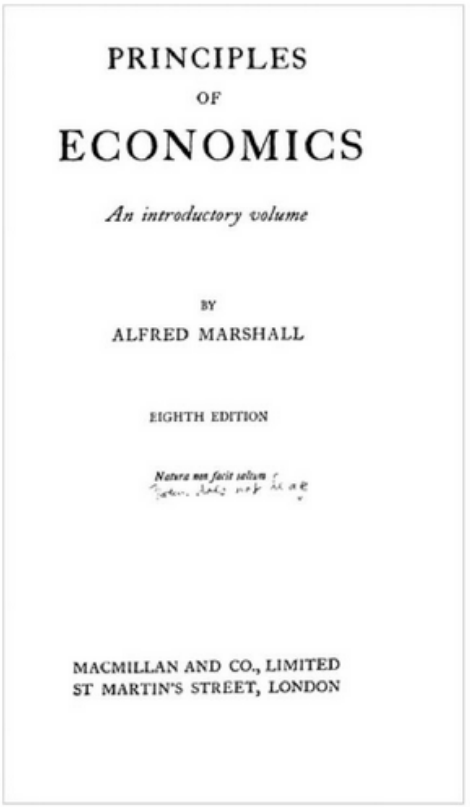
1890
1st edition



PRINCIPLES

OF

ECONOMICS

An introductory volume

BY

ALFRED MARSHALL

EIGHTH EDITION

Natura non facit saltum

MACMILLAN AND CO., LIMITED
ST MARTIN'S STREET, LONDON

1920
8th edition

Alfred Marshall (1842-1924)

INDUSTRY AND TRADE

A study of industrial technique and business organization ; and of their influences on the conditions of various classes and nations

BY

ALFRED MARSHALL

The many in the one, the one in the many

MACMILLAN AND CO. LIMITED
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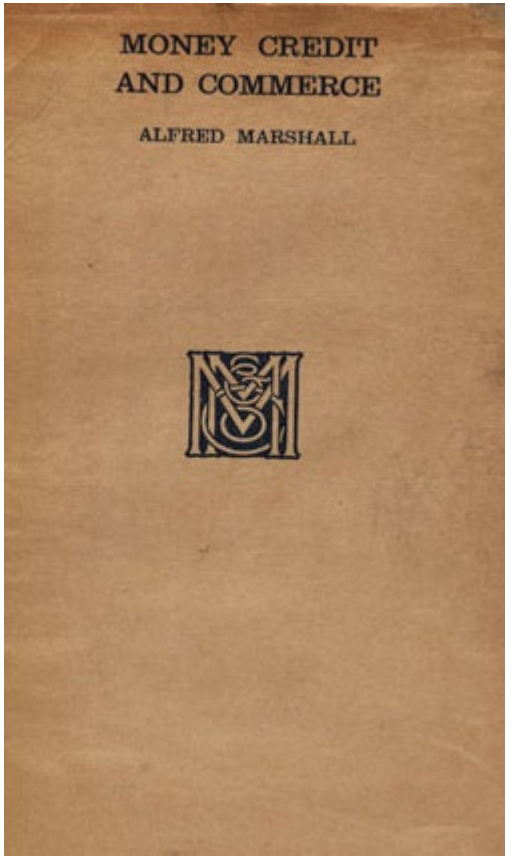
1919



1923

Alfred Marshall (1842-1924)

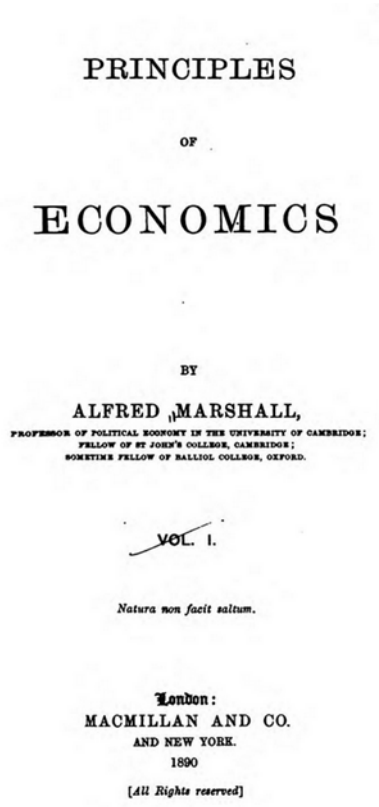
It will be my most cherished ambition, my highest endeavour, to do what with my poor ability and my limited strength I may, to increase the numbers of those, whom Cambridge, the great mother of strong men, sends out into the world with cool heads but warm hearts, willing to give some at least of their best powers to grappling with the social suffering around them; resolved not to rest content till they have done what in them lies to discover how far it is possible to open up to all the material means of a refined and noble life.

VI

THE PRESENT POSITION OF ECONOMICS (1885)[1]

[1] An inaugural lecture given by Professor Marshall after election to the professorship at Cambridge in 1885 in succession to Professor Fawcett.

Alfred Marshall (1842-1924)



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1890

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Equilibrium between supply and demand

Economic realism: A theory useful to laymen

Olive branch to the classics

Alfred Marshall (1842-1924)

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BOOK I.

PRELIMINARY SURVEY.

CHAPTER I.

INTRODUCTION.

BOOK I. CH. I.

§ 1. POLITICAL ECONOMY, or ECONOMICS, is a study of man's actions in the ordinary business of life; it inquires how he gets his income and how he uses it. Thus it is on the one side a study of wealth and on the other, a more important side, a part of the study of man. For man's character has been moulded by his every-day work, and by the material resources which he thereby procures, more than by any other influence unless it be that of his religious ideals. In fact the two great forming agencies of the world's history have been the religious and the economic. Here and there the ardour of the military or the artistic spirit has been for a while predominant: but religious and economic influences have nowhere been displaced from the front rank even for a time; and they have nearly always been more important than all others put together. Religious motives are more intense than economic; but their direct action seldom extends over so large a part of life. For the business by which a person earns his livelihood generally fills his thoughts during by far the greater part of those hours in which his mind is at its best; during them his character is being formed by the way in which he uses his faculties in his work, by the thoughts and the feelings which it suggests, and by his

Economics is on one side a study of wealth and on the other a branch of the study of man.

The history of the world has in the main been shaped by religious and economic forces.

Man's character formed by his daily work.

M. 1

Alfred Marshall (1842-1924)

Ricardo's theory of cost of production in relation to value occupies so important a place in the history of economics that any misunderstanding as to its real character must necessarily be very mischievous; and unfortunately it is so expressed as almost to invite misunderstanding. In consequence there is a widely spread belief that it has needed to be reconstructed by the present generation of economists. Cause is shown in Appendix I for not accepting this opinion; and for holding on the contrary that the foundations of the theory as they were left by Ricardo remain intact; that much has been added to them, and that very much has been built upon them, but that little has been taken from them. It is there argued that he knew that demand played an essential part in governing value, but that he regarded its action as less obscure than that of cost of production, and therefore passed it lightly over in the notes which he made for the use of his friends, and himself; for he never essayed to write a formal treatise: also that he regarded cost of

Ricardo's theory of value.

Pace Jevons, Marshall does not think that Ricardo was wrong

Alfred Marshall (1842-1924)

Role of mathematics

In contrast, we have the famous letter to Arthur Bowley of 27 February 1906:

> But I know I had a growing feeling in the later years of my work at the subject that a good mathematical theorem dealing with economic hypothesis was very unlikely to be good economics: and I went more and more on the rules—(1) use mathematics as a short hand language, rather than as an engine of inquiry. (2) Keep to them till you have done. (3) Translate into English. (4) Then illustrate by examples that are important in real life. (5) Burn the mathematics. (6) If you can't succeed in four, burn three. This last I did often. . . . I think you should do all you can to prevent people from using mathematics in cases in which the English language is as short as the mathematical. (Groenewegen 1995, 413)

Although Marshall was a great mathematician, he did not believe that mathematics has a dominant role in economic theory

Alfred Marshall (1842-1924)

MATHEMATICAL APPENDIX.

NOTE I. (p. 93). The law of diminution of marginal utility may be expressed thus:—If u be the total utility of an amount x of a commodity to a given person at a given time, then marginal utility is measured by $\frac{du}{dx}.\delta x$; while $\frac{du}{dx}$ measures the *marginal degree* of utility. Jevons and some other writers use "Final utility" to indicate what Jevons elsewhere calls Final degree of utility. There is room for doubt as to which mode of expression is the more convenient: no question of principle is involved in the decision. Subject to the qualifications mentioned in the text $\frac{d^2u}{dx^2}$ is always negative.

NOTE II. (p. 96). If m is the amount of money or general purchasing power at a person's disposal at any time, and μ represents its total utility to him, then $\frac{d\mu}{dm}$ represents the marginal degree of utility of money to him.

If p is the price which he is just willing to pay for an amount x of the commodity which gives him a total pleasure u, then

$$\frac{d\mu}{dm}\Delta p = \Delta u; \text{ and } \frac{d\mu}{dm}\frac{dp}{dx} = \frac{du}{dx}.$$

If p' is the price which he is just willing to pay for an amount x' of another commodity, which affords him a total pleasure u', then

$$\frac{d\mu}{dm}.\frac{dp'}{dx'} = \frac{du'}{dx'};$$

and therefore

$$\frac{dp}{dx}:\frac{dp'}{dx'} = \frac{du}{dx}:\frac{du'}{dx'}.$$

The Mathematical Appendix:
Principles of Economics

Alfred Marshall (1842-1924)

Figures relegated to footnotes

outrun the difficulties of some very real and practical problems of value. For indeed the demand and supply schedules do not

[1] Compare V. I. 1. To represent the equilibrium of demand and supply geometrically we may draw the demand and supply curves together as in Fig. 19. If then *OR* represents the rate at which production is being actually carried on, and *Rd* the demand price is greater than *Rs* the supply price, the production is exceptionally profitable, and will be increased. *R*, the *amount-index*, as we may call it, will move to the right. On the other hand, if *Rd* is less than *Rs*, *R* will move to the left. If *Rd* is equal to *Rs*, that is, if *R* is vertically under a point of intersection of the curves, demand and supply are in equilibrium.

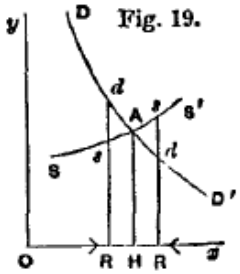

Fig. 19.

This may be taken as the typical diagram for stable equilibrium for a commodity that obeys the law of diminishing return. But if we had made *SS'* a horizontal straight line, we should have represented the case of "constant return," in which the supply price is the same for all amounts of the commodity. And if we had made *SS'* inclined negatively, but less steeply than *DD'* (the necessity for this condition will appear more fully later on), we should have got a case of stable equilibrium for a commodity which obeys the law of increasing return. In either case the above reasoning remains unchanged without the alteration of a word or a letter; but the last case introduces difficulties which we have arranged to postpone.

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V, III, 6.

The famous Marshallian cross: equilibrium of supply and demand. Note the reversal of axes

Alfred Marshall (1842-1924)

The demand curve is derived from the constant marginal utility of money

$$\frac{\frac{\partial U}{\partial x}}{P_x} = \frac{\partial U}{\partial m} \Rightarrow P_x = \frac{\frac{\partial U}{\partial x}}{\frac{\partial U}{\partial m}}$$

Alfred Marshall (1842-1924)

Application of the equi-marginal principle

CHAPTER II.

TEMPORARY EQUILIBRIUM OF DEMAND AND SUPPLY.

V, II, 1.

A simple instance of equilibrium between desire and effort.

§ 1. THE simplest case of balance or equilibrium between desire and effort is found when a person satisfies one of his wants by his own direct work. When a boy picks blackberries for his own eating, the action of picking is probably itself pleasurable for a while; and for some time longer the pleasure of eating is more than enough to repay the trouble of picking. But after he has eaten a good deal, the desire for more diminishes; while the task of picking begins to cause weariness, which may indeed be a feeling of monotony rather than of fatigue. Equilibrium is reached when at last his eagerness to play and his disinclination for the work of picking counterbalance the desire for eating. The satisfaction which he can get from picking fruit has arrived at its *maximum*: for up to that time every fresh picking has added more to his pleasure than it has taken away; and after that time any further picking would take away from his pleasure more than it would add[1].

The boy in the forest stops picking blackberries when the marginal fatigue from picking equals the pleasure of the marginal blackberry

Alfred Marshall (1842-1924)

From a purely subjective theory of value to a theory of supply and demand equilibrium at normal prices.

Utility is mainly relevant for the **consumer surplus**

Elasticity of demand

And as with the demand of one person so with that of a whole market. And we may say generally:—The *elasticity* (or *responsiveness*) *of demand* in a market is great or small according as the amount demanded increases much or little for a given fall in price, and diminishes much or little for a given rise in price[1].

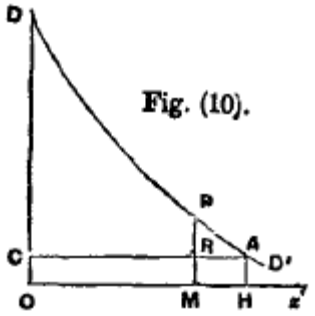
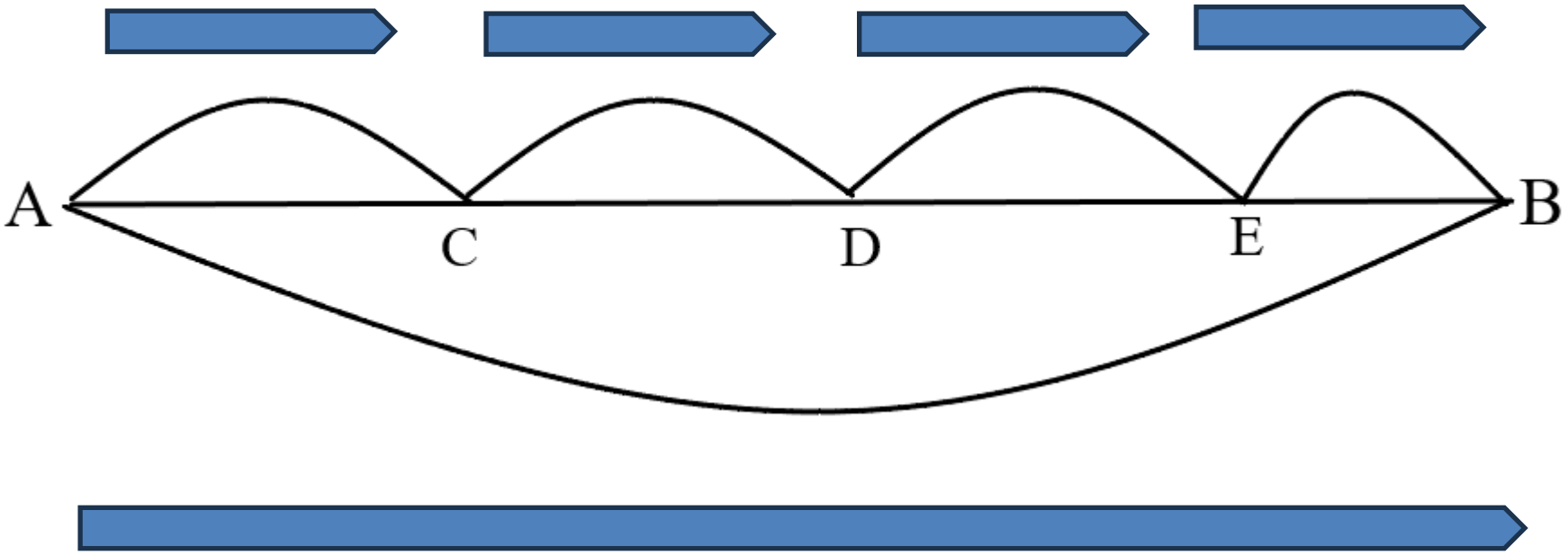


Fig. (10).

The excess of the price which he would be willing to pay rather than go without the thing, over that which he actually does pay, is the economic measure of this surplus satisfaction. It may be called *consumer's surplus*.

Alfred Marshall (1842-1924)



Other things being equal
Ceteris paribus
Partial equilibrium

Alfred Marshall (1842-1924)

§ 3. The function then of analysis and deduction in economics is not to forge a few long chains of reasoning, but to forge rightly many short chains and single connecting links. This however is no trivial task. If the economist reasons rapidly and with a light heart, he is apt to make bad connections at every turn of his work. He needs to make careful use of analysis and deduction, because only by their aid can he select the right facts, group them rightly, and make them serviceable for suggestions in thought and guidance in practice; and because, as surely as every deduction must rest on the basis of inductions, so surely does every inductive process involve and include analysis and deduction. Or to put the same thing in another way the explanation of the past and the prediction of the future are not different operations, but the same worked in opposite directions, the one from effect to cause, the other from cause to effect. As Schmoller well says, to obtain "a knowledge of individual causes" we need "induction; the final conclusion of which is indeed nothing but the inversion of the syllogism which is employed in deduction....Induction and deduction rest on the same tendencies, the same beliefs, the same needs of our reason."

The work of analysis and deduction Explanation and prediction are the same operation in opposite directions.

Alfred Marshall (1842-1924)

NOTE XIV.

It would be possible to extend the scope of such systems of equations as we have been considering, and to increase their detail, until they embraced within themselves the whole of the demand side of the problem of distribution. But while a mathematical illustration of the mode of action of a definite set of causes may be complete in itself, and strictly accurate within its clearly defined limits, it is otherwise with any attempt to grasp the whole of a complex problem of real life, or even any considerable part of it, in a series of equations. For many important considerations, especially those connected with the manifold influences of the element of time, do not lend themselves easily to mathematical expression: they must either be omitted altogether, or clipped and pruned till they resemble the conventional birds and animals of decorative art. And hence arises a tendency towards assigning wrong proportions to economic forces; those elements being most emphasized which lend themselves most easily to analytical methods. No doubt this danger is inherent in every application not only of mathematical analysis, but of analysis of any kind, to the problems of real life. It is a danger which more than any other the economist must have in mind at every turn. But to avoid it altogether, would be to abandon the chief means of scientific progress: and in discussions written specially for mathematical readers it is no doubt right to be very bold in the search for wide generalizations.

General Equilibrium

Alfred Marshall (1842-1924)

There is no sharp division between long and short periods.

§ 8. Of course there is no hard and sharp line of division between "long" and "short" periods. Nature has drawn no such lines in the economic conditions of actual life; and in dealing with practical problems they are not wanted. Just as we contrast civilized with uncivilized races, and establish many general propositions about either group, though no hard and fast division can be drawn between the two; so we contrast long and short periods without attempting any rigid demarcation between them. If it is necessary for the purposes of any particular argument to divide one case sharply from the other, it can be done by a special interpretation clause: but the occasions on which this is necessary are neither frequent nor important.

Classification of problems of value by the periods to which they refer.

Four classes stand out. In each, price is governed by the relations between demand and supply. As regards *market* prices, Supply is taken to mean the stock of the commodity in question which is on hand, or at all events "in

Time periods in economic analysis: Four classes

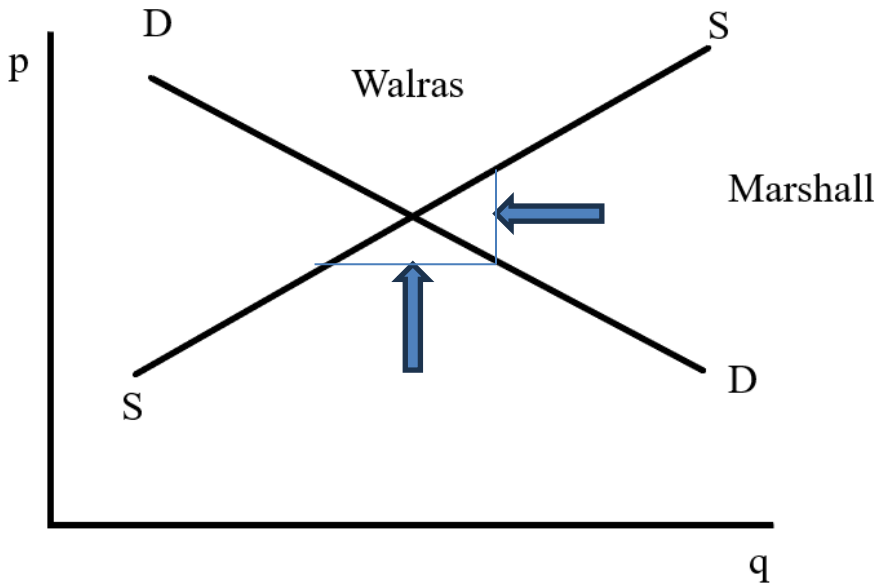
Alfred Marshall (1842-1924)

V, v, 8.

sight." As regards *normal* prices, when the term Normal is taken to relate to *short* periods of a few months or a year, Supply means broadly what can be produced for the price in question with the existing stock of plant, personal and impersonal, in the given time. As regards *normal* prices, when the term Normal is to refer to *long* periods of several years, Supply means what can be produced by plant, which itself can be remuneratively produced and applied within the given time; while lastly, there are very gradual or *Secular* movements of normal price, caused by the gradual growth of knowledge, of population and of capital, and the changing conditions of demand and supply from one generation to another[1].

Market, Short-run, Long-run, Secular

Alfred Marshall (1842-1924)



In Walras the return to the equilibrium point is through a change in prices, in Marshall through a change in quantities which are the independent variable, hence the demand and supply curves have quantities on the horizontal axis and prices on the vertical.

Alfred Marshall (1842-1924)

We might as reasonably dispute whether it is the upper or the under blade of a pair of scissors that cuts a piece of paper, as whether value is governed by utility or cost of production. It is true that when one blade is held still, and the cutting is effected by moving the other, we may say with careless brevity that the cutting is done by the second; but the statement is not strictly accurate, and is to be excused only so long as it claims to be merely a popular and not a strictly scientific account of what happens.

Alfred Marshall (1842-1924)

- Increasing returns to scale
  - Internal
  - External
- Representative firm
- Biological metaphors

Alfred Marshall (1842-1924)

A summary of the later chapters of this Book.

Looking more closely at the economies arising from an increase in the scale of production of any kind of goods, we found that they fell into two classes—those dependent on the general development of the industry, and those dependent on the resources of the individual houses of business engaged in it and the efficiency of their management; that is, into *external* and *internal* economies.

But here we may read a lesson from the young trees of the forest as they struggle upwards through the benumbing shade of their older rivals. Many succumb on the way, and a few only survive; those few become stronger with every year, they get a larger share of light and air with every increase of their height, and at last in their turn they tower above their neighbours, and seem as though they would grow on for ever, and for ever become stronger as they grow. But they do not. One tree will last longer in full vigour and attain a greater size than another; but sooner or later age tells on them all. Though the taller ones have a better access to light and air than their rivals, they gradually lose vitality; and one after another they give place to others, which, though of less material strength, have on their side the vigour of youth.

And as with the growth of trees, so was it with the growth of businesses as a general rule before the great recent development of vast joint-stock companies, which often stagnate, but do not readily die. Now that rule is far from universal, but it still holds in many industries and trades. Nature still presses on the private business by limiting the length of the life of its original founders, and by limiting even more narrowly that part of their lives in which their faculties retain full vigour. And so, after a while, the guidance of the business falls into the hands of people with less energy and less creative genius, if not with less active interest in its prosperity. If it is turned into a joint-stock company, it may retain the advantages of division of labour, of specialized skill and machinery: it may even increase them by a further increase of its capital; and under favourable conditions it may secure a permanent and prominent place in the work of production. But it is likely to have lost so much of its elasticity and progressive force, that the advantages are no longer exclusively on its side in its competition with younger and smaller rivals.

CHAPTER VI.

JOINT AND COMPOSITE DEMAND: JOINT AND COMPOSITE SUPPLY.

BOOK V. CH. VI.

Derived demand and joint demand.

§ 1. THE demand for producers' goods, or goods of the second and higher orders, as we have termed them, is indirect; it is *derived* from the demand for consumers' goods, or goods of the first order, towards the production of which they contribute; or, in other words, the demands for all the various factors of production of a finished commodity are joined together in the JOINT DEMAND for it. Thus the demand for beer is direct, and is a joint demand for hops, malt, brewers' labour, and the other factors of production of beer: and the demand for any one of them is an indirect demand derived from that for beer. Again there is a direct demand for new houses; and from this there arises a joint demand for the labour of all the various building trades, and for bricks, stone, wood, etc., which are factors of production of building work of all kinds, or as we may say for shortness, of new houses. But the demand for any one of these, as for instance the labour of plasterers, is only an indirect demand.

Illustration taken from a labour dispute in the building trade.

Let us take an illustration from a class of events that are of frequent occurrence in the labour market; the period over which the disturbance extends being short, and the causes of which we have to take account as readjusting demand and supply being only such as are able to operate within that short period.

Alfred Marshall (1842-1924)

In another respect the diversity of his nature was pure advantage. The study of economics does not seem to require any specialised gifts of an unusually high order. Is it not, intellectually regarded, a very easy subject compared with the higher branches of philosophy and pure science? Yet good, or even competent, economists are the rarest of birds. An easy subject, at which very few excel! The paradox finds its explanation, perhaps, in that the master-economist must possess a rare *combination* of gifts. He must reach a high standard in several different directions and must combine talents not often found together. He must be mathematician, historian, statesman, philosopher—in some degree. He must understand symbols and speak in words. He must contemplate the particular in terms of the general, and touch abstract and concrete in the same flight of thought. He must study the present in the light of the past for the purposes of the future. No part of man's nature or his institutions must lie entirely outside his regard. He must be purposeful and disinterested in a simultaneous mood; as aloof and incorruptible as an artist, yet sometimes as near the earth as a politician. Much, but not all, of this ideal many-sidedness Marshall possessed. But chiefly his mixed training and divided nature furnished him with the most essential and fundamental of the economist's necessary gifts—he was conspicuously historian and mathematician, a dealer in the particular and the general, the temporal and the eternal, at the same time.

[2] Professor Planck of Berlin, the famous originator of the Quantum Theory, once remarked to me that in early life he had thought of studying economics, but had found it too difficult! Professor Planck could easily master the whole corpus of mathematical economics in a few days. He did not mean that! But the amalgam of logic and intuition and the wide knowledge of facts, most of which are not precise, which is required for economic interpretation in its highest form, is, quite truly, overwhelmingly difficult for those whose gift mainly consists in the power to imagine and pursue to their furthest points the implications and prior conditions of comparatively simple facts which are known with a high degree of precision.

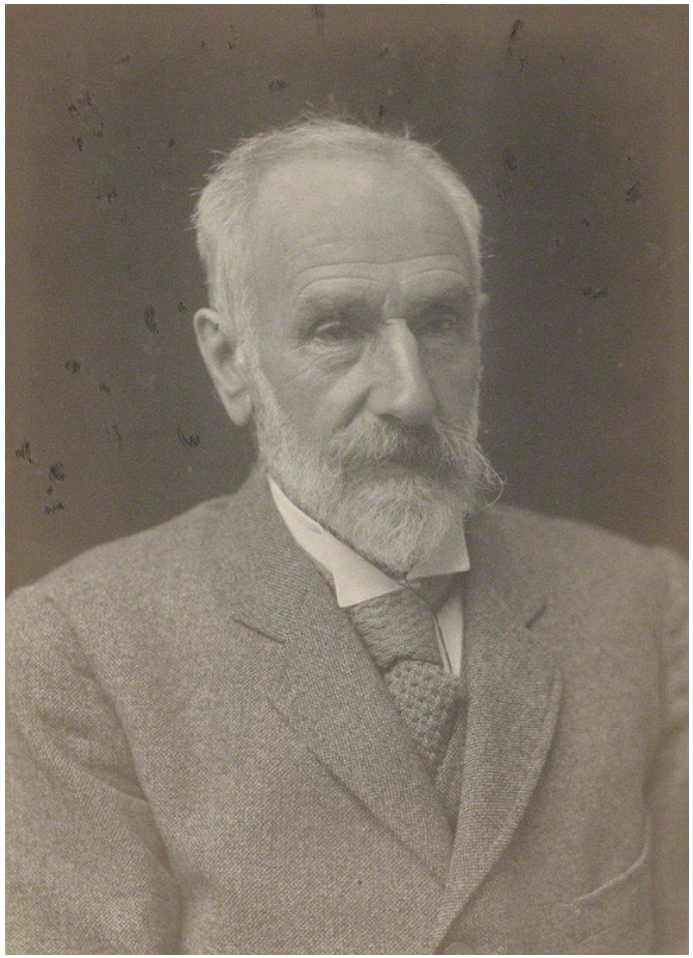
THE ECONOMIC JOURNAL

SEPTEMBER, 1924

ALFRED MARSHALL, 1842–1924[1]

J. M. KEYNES

Francis Ysidro Edgeworth (1845-1926)



by Walter Stoneman, bromide print, 1917, NPG

Francis Ysidro Edgeworth (1845-1926)

wick in *Mind* for 1877. Edgeworth's peculiarities of style, his brilliance of phrasing, his obscurity of connection, his inconclusiveness of aim, his restlessness of direction, his courtesy, his caution, his shrewdness, his wit, his subtlety, his learning, his reserve—all are there full-grown. Quotations from the Greek tread on the heels of the Differential Calculus, and the philistine reader can scarcely tell whether it is a line of Homer or a mathematical abstraction which is in course of integration. The

It is narrated that in his boyhood at Edgeworthstown he would read Homer seated aloft in a heron's nest. So, as it were, he dwelt always, not too much concerned with the earth.

J. M. KEYNES

OBITUARY

FRANCIS YSIDRO EDGEWORTH
1845–1926

Francis Ysidro Edgeworth (1845-1926)

MATHEMATICAL PSYCHICS

AN ESSAY ON THE
APPLICATION OF MATHEMATICS TO
THE MORAL SCIENCES

BY
F. Y. EDGEWORTH, M.A.
BARRISTER-AT-LAW

LONDON
C. KEGAN PAUL & CO., 1 PATERNOSTER SQUARE
1881

PAPERS RELATING TO
POLITICAL ECONOMY

BY
F. Y. EDGEWORTH
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VOLUME III

Published on behalf of the Royal Economic Society by
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ST. MARTIN'S STREET, LONDON
1925

Francis Ysidro Edgeworth (1845-1926)

MATHEMATICAL PSYCHICS

ECONOMICAL CALCULUS.

DEFINITIONS.—The first principle of Economics[2] is that every agent is actuated only by self-interest. The workings of this principle may be viewed under two aspects, according as the agent acts *without*, or *with*, the consent of others affected by his actions. In wide senses, the first species of action may be called *war*; the second, *contract*.

The *field of competition* with reference to a contract, or contracts, under consideration consists of all the individuals who are willing and able to recontract about the articles under consideration.

Francis Ysidro Edgeworth (1845-1926)

There is free communication throughout a *normal* competitive field. You might suppose the constituent individuals collected at a point, or connected by telephones—an ideal supposition, but sufficiently approximate to existence or tendency for the purposes of abstract science.

A *perfect* field of competition professes in addition certain properties peculiarly favourable to mathematical calculation; namely, a certain indefinite *multiplicity* and *dividedness*, analogous to that *infinity* and *infinitesimality* which facilitate so large a portion of Mathematical Physics (consider the theory of Atoms, and all applications of the Differential Calculus). The conditions of a *perfect* field are four; the first pair referrible [1] to the heading *multiplicity* or continuity, the second to *dividedness* or fluidity.

I. Any individual is free to *recontract* with any out of an indefinite number, *e.g.*, in the last example there are an indefinite number of Xs and similarly of Ys.

II. Any individual is free to *contract* (at the same time) with an indefinite number; *e.g.*, any X (and similarly Y) may deal with any number of Ys. This condition combined with the first appears to involve

Francis Ysidro Edgeworth (1845-1926)

the indefinite divisibility of [1] each *article* of contract (if any X deal with an indefinite number of Ys he must give each an indefinitely small portion of x); which might be erected into a separate condition.

III. Any individual is free to *recontract* with another independently of, *without the consent* being required of, any third party, *e.g.*, there is among the Ys (and similarly among the Xs) no *combination* or precontract between two or more contractors that none of them will recontract without the consent of all. Any Y then may accept the offer of any X irrespectively of other Ys.

IV. Any individual is free to *contract* with another independently of a third party; *e.g.*, in simple exchange each contract is between two only, but *secus* in the entangled contract described in the example (p. 17), where it may be a condition of production that there should be three at least to each bargain.

Francis Ysidro Edgeworth (1845-1926)

There will be observed a certain similarity between the relation of the first to the second condition, and that of the third to the fourth. The failure of the first involves the failure of the second, but not *vice versâ*; and the third and fourth are similarly related.

A *settlement* is a contract which cannot be varied with the consent of all the parties to it.

A *final settlement* is a settlement which cannot be varied by recontract within the field of competition.

Contract is *indeterminate* when there are an indefinite number of *final settlements*.

Francis Ysidro Edgeworth (1845-1926)

The PROBLEM to which attention is specially directed in this introductory summary is: *How far contract is indeterminate*—an inquiry of more than theoretical importance, if it show not only that indeterminateness tends to prevent widely, but also in what direction an escape from its evils is to be sought.

DEMONSTRATIONS.[1]—The general answer is—(α) Contract without competition is indeterminate, (β) Contract with *perfect* competition is perfectly determinate, (γ) Contract with more or less perfect competition is less or more indeterminate.

And it is to be observed, in passing, that the direction in which X will *prefer* to move, the line of force or *line of preference*, as it may be termed, is perpendicular to the line of indifference. Similar remarks apply to Π. If then we enquire in what directions X and Y will consent to move *together*, the answer is, in any direction between their respective lines of indifference, in a direction *positive* as it may be called *for both*. At what point then will they refuse to move at all? When their *lines of indifference* are coincident (and *lines of preference* not only coincident, but in opposite directions); whereof the *necessary* (but *not sufficient*) condition is

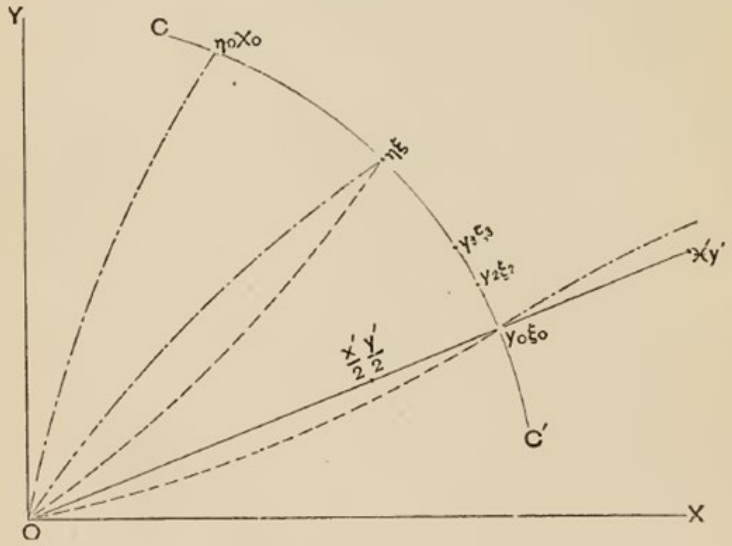
$$\left(\frac{d\mathrm{P}}{dx}\right)\left(\frac{d\Pi}{dy}\right)-\left(\frac{d\mathrm{P}}{dy}\right)\left(\frac{d\Pi}{dx}\right)=0.$$

Line of indifference

To original Edgeworth box

It is not necessary for the purpose of the present study to carry the analysis further. To gather up and fix our thoughts, let us imagine a simple case—Robinson Crusoe contracting with Friday. The *articles* of contract: wages to be given by the white, labour to be given by the black. Let Robinson Crusoe = X. Represent y, the labour given by Friday, by a horizontal line measured *northward* from an assumed point, and measure x, the remuneration given by Crusoe, from the same point along an *eastward* line (See accompanying figure 1.). Then

FIG. 1.



any point between these lines represents a contract. It will very generally be the interest of both parties to vary the articles of any contract taken at random. But there is a class of contracts to the variation of which the consent of *both* parties cannot be obtained, of *settlements*. These settlements are represented by an *indefinite number* of points, a locus, the *contract-curve* CC′, or rather, a certain portion of it which may be supposed to be wholly in the space between our perpendicular lines in a direction trending from south-east to north-west. This available portion of the contract-curve lies between two points, say $\eta_0 x_0$ north-west, and $y_0 \xi_0$ south-east; which are respectively the intersections with the contract-curve of the *curves of indifference*[1] for each party drawn through the origin. Thus the utility of the contract represented by $\eta_0 x_0$ is for Friday zero, or rather, the same as if there was no contract. At that point he would as soon be off with the bargain—work by himself perhaps.

This simple case brings clearly into view the characteristic evil of indeterminate contract, *deadlock*, undecidable opposition of interests, ἀκριτὸς[2] ἔρις καὶ ταραχὴ. It is the interest of both parties that there should be *some settlement*, one of the contracts represented by the contract-curve between the limits. But *which* of these contracts is arbitrary in the absence of arbitration, the interests of the two *adversâ pugnantia fronte* all along the contract-curve, Y desiring to get as far as possible south-east towards $y_0 \xi_0$, X north-west toward $\eta_0 x_0$. And it further appears from the preceding

Indiscriminate strife and confusion

Francis Ysidro Edgeworth (1845-1926)

DEMOSTHENES, *Orations 18. On the Crown*

θεωρῆτε.

18 Τοῦ γὰρ Φωκικοῦ συστάντος πολέμου, οὐ δι' ἐμέ (οὐ γὰρ ἔγωγ' ἐπολιτευόμην πω τότε), πρῶτον μὲν ὑμεῖς οὕτω διέκεισθε ὥστε Φωκέας μὲν βούλεσθαι σωθῆναι, καίπερ οὐ δίκαια [231] ποιοῦντας ὁρῶντες, Θηβαίοις δ' ὁτιοῦν ἂν ἐφησθῆναι παθοῦσιν, οὐκ ἀλόγως οὐδ' ἀδίκως αὐτοῖς ὀργιζόμενοι· οἷς γὰρ ηὐτυχήκεσαν ἐν Λεύκτροις, οὐ μετρίως ἐκέχρηντο· ἔπειθ' ἡ Πελοπόννησος ἅπασα διειστήκει, καὶ οὔθ' οἱ μισοῦντες Λακεδαιμονίους οὕτως ἴσχυον ὥστ' ἀνελεῖν αὐτούς, οὔθ' οἱ πρότερον δι' ἐκείνων ἄρχοντες κύριοι τῶν πόλεων ἦσαν, ἀλλά τις ἦν ἄκριτος καὶ παρὰ τούτοις καὶ παρὰ τοῖς ἄλλοις ἅπασιν 19 ἔρις καὶ ταραχή. ταῦτα δ' ὁρῶν ὁ Φίλιππος (οὐ γὰρ ἦν ἀφανῆ),

When the Phocian war began—not by my fault, for I was still outside politics—you were at first disposed to hope that the Phocians would escape ruin, although you knew that they were in the wrong, and to exult over any misfortune that might befall the Thebans, with whom you were justly and reasonably indignant because of the immoderate use they had made of the advantage they gained at Leuctra. The Peloponnesus was divided. The enemies of the Lacedaemonians were not strong enough to destroy them; and the aristocrats whom the Lacedaemonians had put into power had lost control of the several states. In those states and everywhere else there was indiscriminate strife and confusion. Philip, observing these conditions, which were apparent enough,

Francis Ysidro Edgeworth (1845-1926)

Equilibrium at perfect competition

Edgeworth's limit theorem

"Core" of the game
Replica economies

INTERNATIONAL ECONOMIC REVIEW
September, 1963
Vol. 4, No. 3

A LIMIT THEOREM ON THE CORE OF AN ECONOMY*

BY GERARD DEBREU AND HERBERT SCARF[1]

This being premised, let us now introduce a second X and a second Y; so that the field of competition consists of two Xs and two Ys. And for the sake of illustration (not of the argument) let us suppose that the new X has the same requirements, the same nature as the old X; and similarly that the new Y is equal-natured with the old.

Then it is evident that there cannot be equilibrium unless (1) all the field is collected at one point; (2) that point is on the *contract-curve*. For (1) if possible let one couple be at one point, and another couple at another point. It will generally be the interest of the X of one couple and the Y of the other to rush together, leaving their partners in the lurch. And (2) if the common point is not on the contract-curve, it will be the interest of *all parties* to descend to the contract-curve.

Philip Henry Wicksteed (1844 –1927)

THE ALPHABET

OF

ECONOMIC SCIENCE

BY

PHILIP H. WICKSTEED

PART I

ELEMENTS OF THE THEORY OF VALUE OR WORTH

London

MACMILLAN AND CO.

AND NEW YORK

1888

THE COMMON SENSE

OF

POLITICAL ECONOMY

INCLUDING A STUDY OF

THE HUMAN BASIS OF ECONOMIC LAW

BY

PHILIP H. WICKSTEED, M.A.

L'analyse économique proprement dite ne me semble pas devoir finalement être conçue ni cultivée, soit dogmatiquement, soit historiquement, à part de l'ensemble de l'analyse sociologique, soit statique, soit dynamique.—AUGUSTE COMTE.

MACMILLAN AND CO., LIMITED

ST. MARTIN'S STREET, LONDON

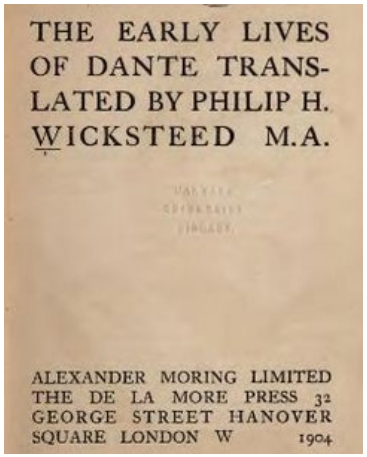
1910

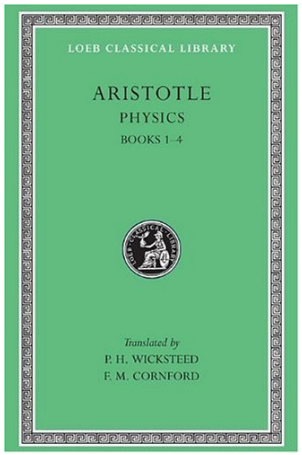
Philip Henry Wicksteed (1844 –1927)

Classicist, student of Dante, translator of Aristotle. In 1882 he became involved in economics. Pure marginalist, the only true disciple of Jevons. Criticism of Marx from Jevons' point of view..

We can now see how "cost of production," which is simply and solely "the marginal significance of something else," directly affects the quantity of anything produced, and thereby indirectly affects its price, so that there is a constant tendency for prices to conform to cost of production; that is to say, for the price of the thing I make and the price of the thing I might have made instead of it to coincide; for, obviously, I shall always embrace that one of the alternatives still open that offers the best result, and I shall thus increase the supply and lower the marginal significance of the best, and reduce the supply and raise the marginal significance of the others, till they balance.

The cost of production of one thing is the marginal value of another thing.





Philip Henry Wicksteed (1844 –1927)

The Product being a function of the factors of production we have

$$P = f(a, b, c, ...)$$

and the form of the function is invariably such that if we have:

$$\Pi = f(\alpha, \beta, \gamma, ...)$$

we shall also have:

$$\nu\Pi = f(\nu\alpha, \nu\beta, \nu\gamma, ...)$$

Marginal productivity
Law of product exhaustion
Euler's theorem for homogeneous functions (in this case of first degree)

Each factor being remunerated not in accordance with the *nature* of the service it renders, but in accordance with the (marginal) *rate* at which its unit is rendering such service, and a practical method of testing and estimating that rate having been discovered, it remains to enquire, whether from the known properties of F, we can deduce the property $\frac{dP}{dA} \cdot A + \frac{dP}{dB} \cdot B + \frac{dP}{dC} \cdot C + ... = P$. For it can be shown that the formula $\frac{dF}{dK} \cdot K$ really defines the share of the product which will fall to any factor K, and if it can be further shewn that when each of the factors has received its share the whole product is exactly accounted for, we shall then have accomplished our task of co-ordinating the laws of distribution.

Note: Euler's theorem for homogeneous functions

Let $x = (x_1, \ldots, x_n) \in \mathbb{R}^n_+$ $f(x)$

Then a function $f(x)$ is homogeneous of degree k,
if

$\forall \lambda > 0, \; f(\lambda x) = \lambda^k f(x)$

Euler's theorem for homogeneous functions states that

$$\frac{\partial f(x)}{\partial x_1} x_1 + \ldots + \frac{\partial f(x)}{\partial x_n} x_n = k f(x)$$

For k=1 then $\frac{\partial f(x)}{\partial x_1} x_1 + \ldots + \frac{\partial f(x)}{\partial x_n} x_n = f(x)$

If $f(x)$ is a production function with constant returns to scale - *i.e.*, if it is homogeneous of degree one - and each factor of production is paid its marginal product, then the value of the product is equal to (exhausted by) the sum of the rewards of the factors of production

Exhaustion of the product: Euler's theorem

$$Q = F\left(K, L\right)$$

$$\lambda Q = F\left(\lambda K, \lambda L\right) \quad \forall \lambda > 0 \Rightarrow Q = \frac{\partial Q}{\partial K} K + \frac{\partial Q}{\partial L} L$$

$$\frac{\partial Q}{\partial K} = r, \frac{\partial Q}{\partial L} = w$$

$$Q = \frac{\partial Q}{\partial K} K + \frac{\partial Q}{\partial L} L = rK + wL$$

Exhaustion of the product: Euler's theorem

$$Q = AK^{\alpha}L^{1-\alpha}$$

$$\left.\begin{aligned}\frac{\partial Q}{\partial K} &= A\alpha K^{\alpha-1}L^{1-\alpha}\\ \frac{\partial Q}{\partial K} &= A(1-\alpha)K^{\alpha}L^{-\alpha}\end{aligned}\right] \Rightarrow \frac{\partial Q}{\partial K}K + \frac{\partial Q}{\partial L}L = \left(A\alpha K^{\alpha-1}L^{1-\alpha}\right)K + \left(A(1-\alpha)K^{\alpha}L^{-\alpha}\right)L =$$

$$\alpha AK^{\alpha}L^{1-\alpha} + (1-\alpha)AK^{\alpha}L^{1-\alpha} = \alpha Q + (1-\alpha)Q = Q$$

Example: Cobb-Douglas production function

Laws of distribution

According to the interpretation which has been suggested, the new law of distribution would be fulfilled by an adjustment of the quantities involved,[2] the amount of each factor, not simply in virtue of the relation which subsists between the product and the factors of production.[3] The sense in which the law is fulfilled is otherwise conceived by a distinguished mathematical economist, Mr. Wicksteed, who regards the law as following from "the modern investigations into the theory of value,"[4] and

[1] Mainly and apart from "rents" of the order of quantity called by Mangoldt *Unternehmerlohn*.

[2] *Cp.* p. 169, above.

[3] The form of a function such as that represented by *f* in a preceding note (p. 167), or rather what that function becomes when the work of the entrepreneur enters as a variable.

[4] *Essay on the Co-ordination of the Laws of Distribution* (1894), § 2, and prefatory note.

Edgeworth, F. Y. "The Theory of Distribution." *The Quarterly Journal of Economics* 18, no. 2 (1904): 159–219

Laws of distribution

seems to treat it as a clue whereby to investigate the nature of the relation between the product and the factors of production, including the work of the entrepreneur.[1] In fact, he finds that the product depends upon the factors by a relation which mathematicians designate a "homogeneous function of the first degree."[2] This is certainly a remarkable discovery; for the relation between product and factors is to be considered to hold good irrespectively of the play of the market: "an analytical and synthetical law of composition and resolution of industrial factors and products which would hold equally in Robinson Crusoe's island, in an American religious commune, in an Indian village ruled by custom, and in the competitive centres of the typical modern industries."[3] There is a magnificence in this generalization which recalls the youth of philosophy. Justice is a perfect cube, said the ancient sage; and rational conduct is a homogeneous function, adds the modern *savant*. A theory which points to conclusions so paradoxical ought surely to be enunciated with caution.

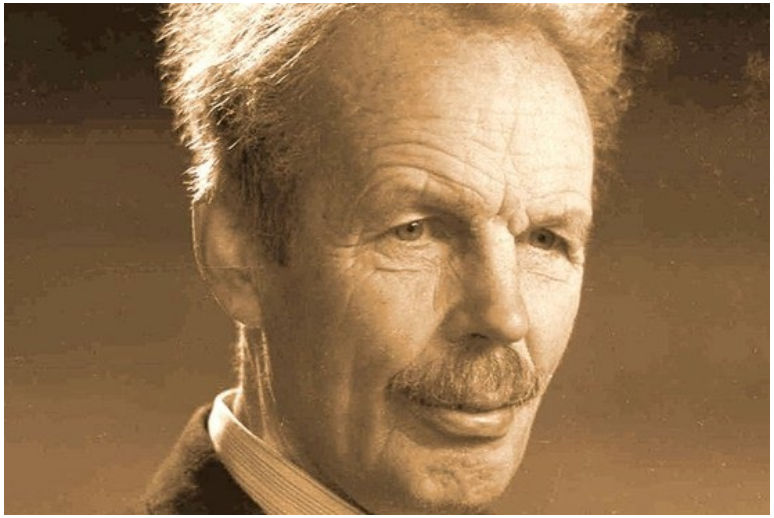
To sum up this criticism, as Distribution is a species of Exchange, it seems undesirable to employ a phrase so foreign to the general theory of Exchange as the dictum

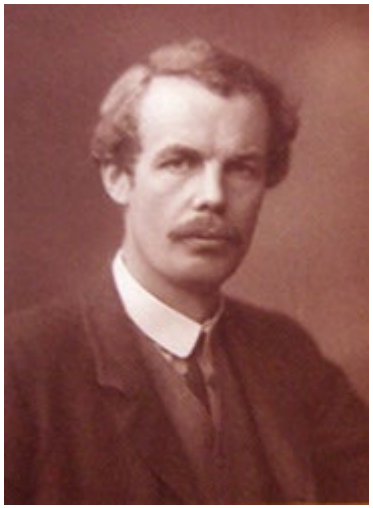
[1] The product being a function of the factors of production, we have $P = f(a, b, c, \ldots)$; and the form of the function is invariably such that, if we have $\pi = f(a, \beta, \gamma, \ldots)$, we shall also have $\nu\pi = f(\nu a, \nu\beta, \nu\gamma, \ldots)$ (*loc. cit.*, p. 4).

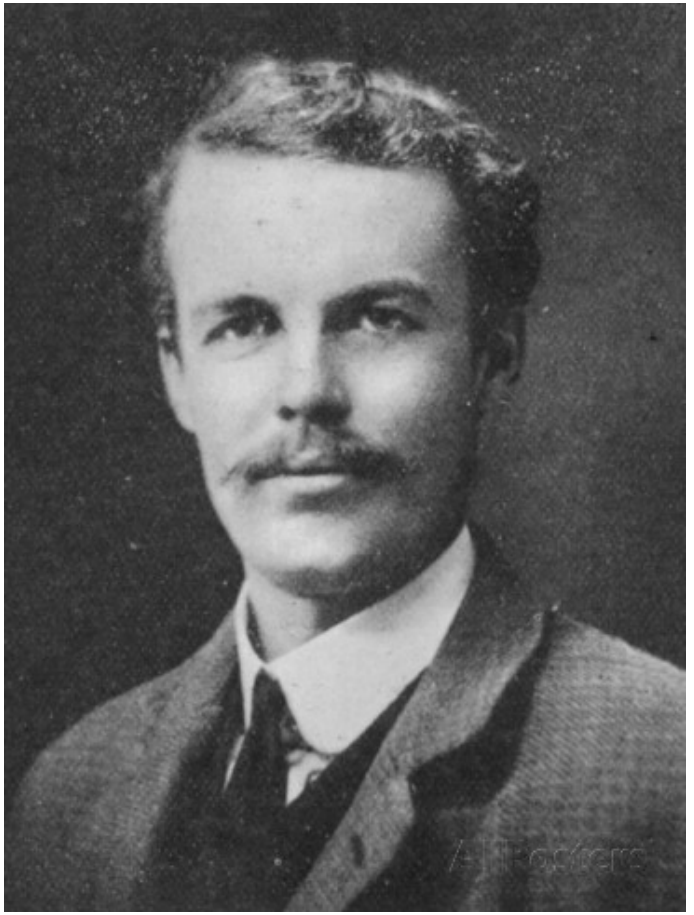
"Let the special product to be distributed (P) be regarded as a function (F) of the various factors of production (A, B, C, . . .)" (*loc. cit.*, p. 8).

$$\frac{dP}{dA}A + \frac{dP}{dB}B + \frac{dP}{dc}C + \ldots = P$$

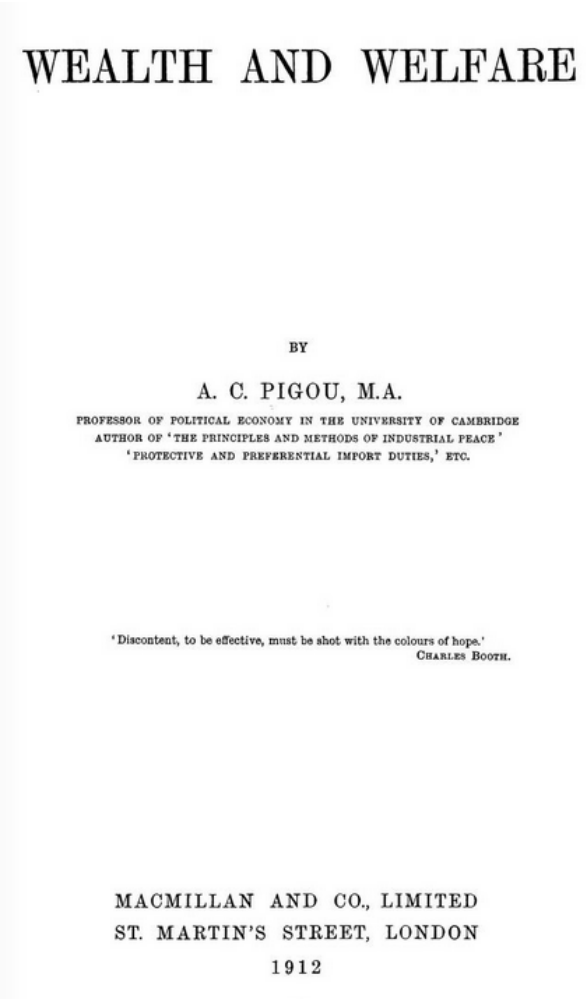
Arthur Cecil Pigou (1877 –1959)







Arthur Cecil Pigou (1877 –1959)



WEALTH AND WELFARE

BY

A. C. PIGOU, M.A.

PROFESSOR OF POLITICAL ECONOMY IN THE UNIVERSITY OF CAMBRIDGE
AUTHOR OF 'THE PRINCIPLES AND METHODS OF INDUSTRIAL PEACE'
'PROTECTIVE AND PREFERENTIAL IMPORT DUTIES,' ETC.

'Discontent, to be effective, must be shot with the colours of hope.'
CHARLES BOOTH.

MACMILLAN AND CO., LIMITED
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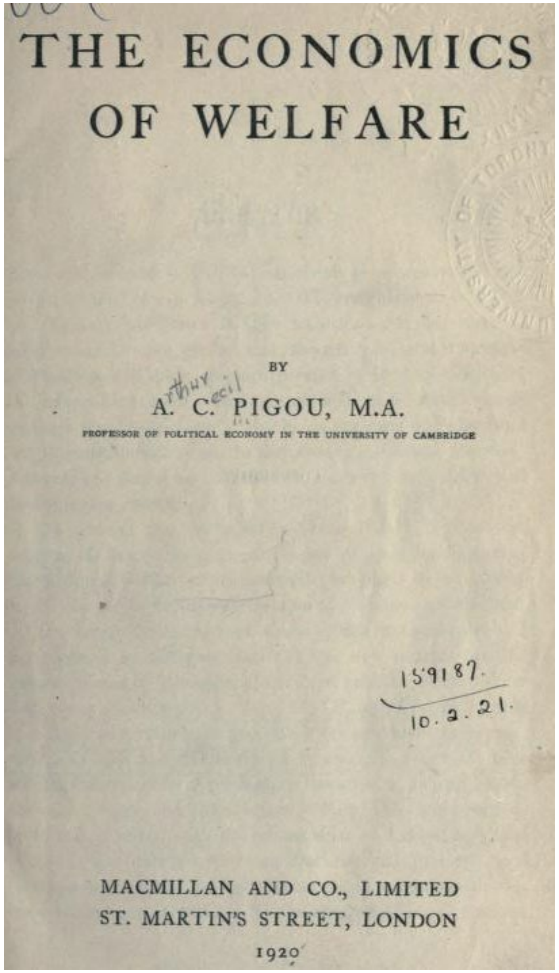

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BY

A. C. PIGOU, M.A.

PROFESSOR OF POLITICAL ECONOMY IN THE UNIVERSITY OF CAMBRIDGE

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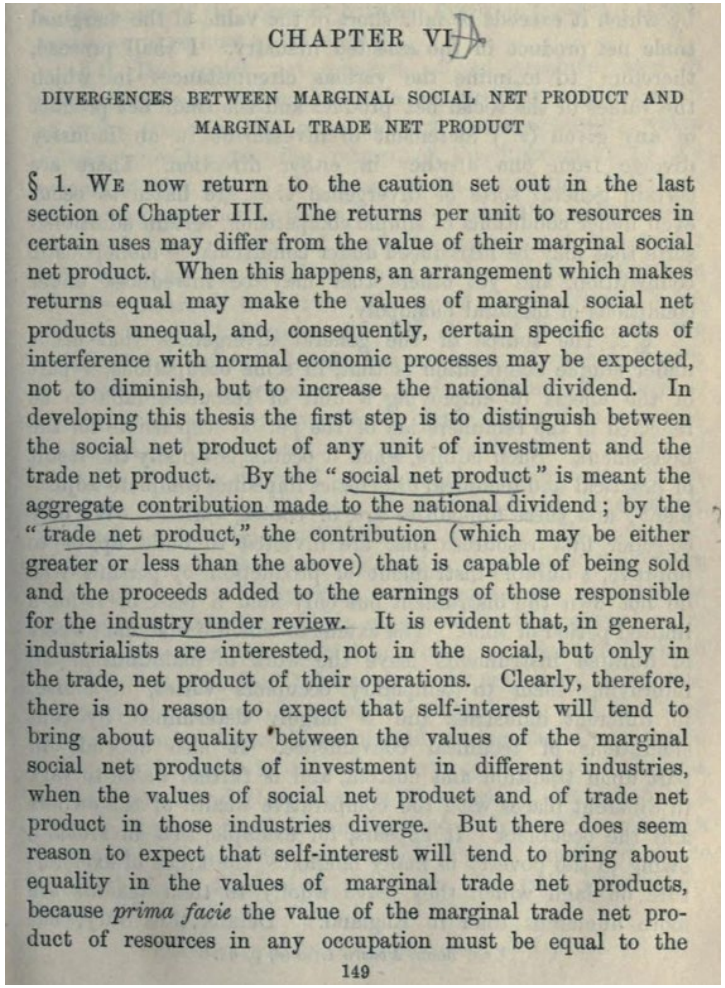
Arthur Cecil Pigou (1877 –1959)



CHAPTER VI

DIVERGENCES BETWEEN MARGINAL SOCIAL NET PRODUCT AND MARGINAL TRADE NET PRODUCT

§ 1. We now return to the caution set out in the last section of Chapter III. The returns per unit to resources in certain uses may differ from the value of their marginal social net product. When this happens, an arrangement which makes returns equal may make the values of marginal social net products unequal, and, consequently, certain specific acts of interference with normal economic processes may be expected, not to diminish, but to increase the national dividend. In developing this thesis the first step is to distinguish between the social net product of any unit of investment and the trade net product. By the "social net product" is meant the aggregate contribution made to the national dividend; by the "trade net product," the contribution (which may be either greater or less than the above) that is capable of being sold and the proceeds added to the earnings of those responsible for the industry under review. It is evident that, in general, industrialists are interested, not in the social, but only in the trade, net product of their operations. Clearly, therefore, there is no reason to expect that self-interest will tend to bring about equality between the values of the marginal social net products of investment in different industries, when the values of social net product and of trade net product in those industries diverge. But there does seem reason to expect that self-interest will tend to bring about equality in the values of marginal trade net products, because *prima facie* the value of the marginal trade net product of resources in any occupation must be equal to the

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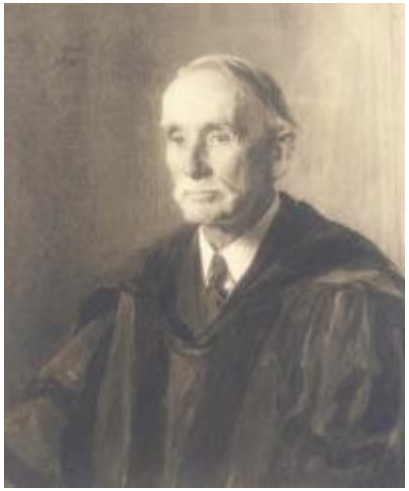
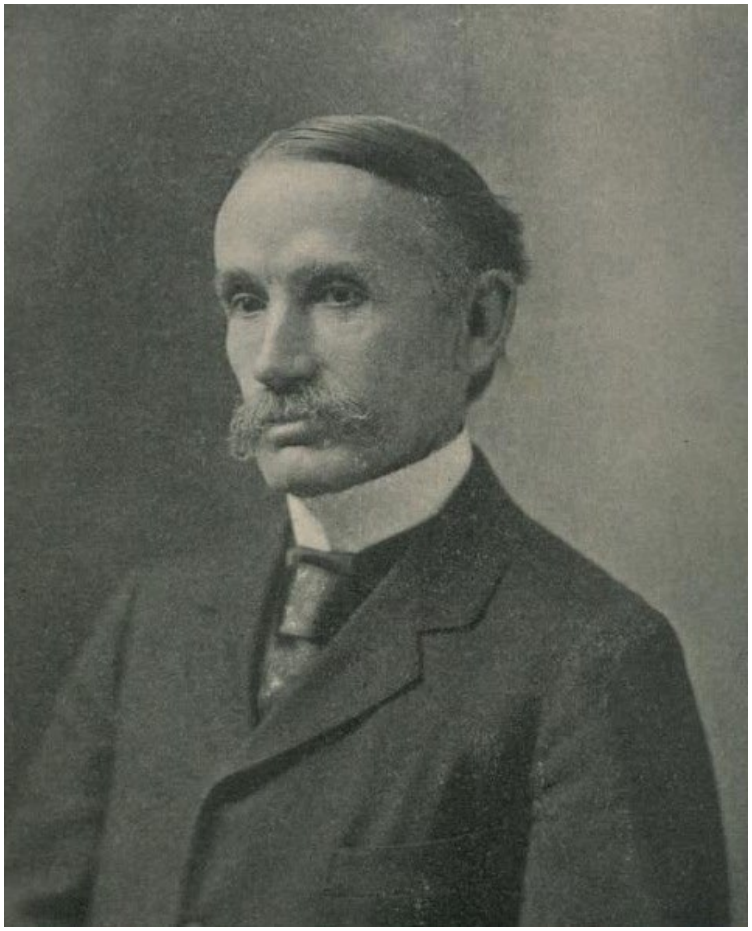
Externalities: difference between private and social cost or benefit

United States of America

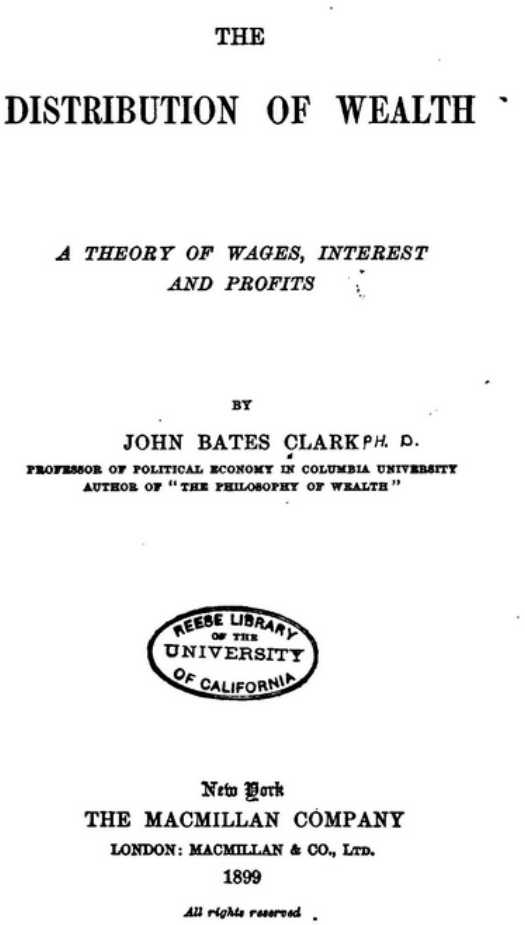
John Bates Clark (1847 –1938)





John Bates Clark (1847 –1938)

J.B. Clark was born in Providence, Rhode Island. He graduated from Amherst in 1872, with postgraduate studies in Germany and Switzerland. His first book *The Philosophy of Wealth* (1886) shows the influence of the German Historical School, and he was sympathetic to Christian Socialism. His major work, *The Distribution of Wealth* (1899), addresses the principle of marginal productivity by generalizing Ricardo's theory of land rent. He was the first important American economist of international stature and one of the founders of the *American Economic Association* in 1885, which honoured his memory with the J.B. Clark Medal for the best economist under 40.


THE

DISTRIBUTION OF WEALTH

A THEORY OF WAGES, INTEREST AND PROFITS

BY

JOHN BATES CLARK PH. D.

PROFESSOR OF POLITICAL ECONOMY IN COLUMBIA UNIVERSITY
AUTHOR OF "THE PHILOSOPHY OF WEALTH"

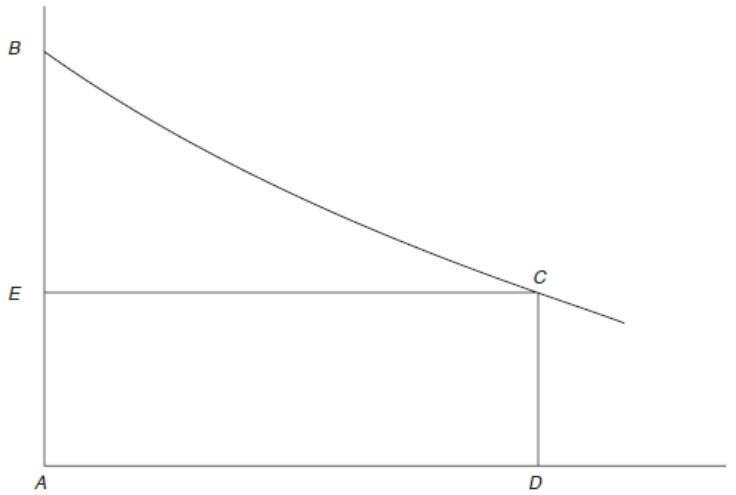
New York
THE MACMILLAN COMPANY
LONDON: MACMILLAN & CO., LTD.
1899

Distribution as Determined by a Law of Rent
John B. Clark
The Quarterly Journal of Economics, Vol. 5, No. 3 (Apr., 1891), pp. 289-318

John Bates Clark (1847 –1938)

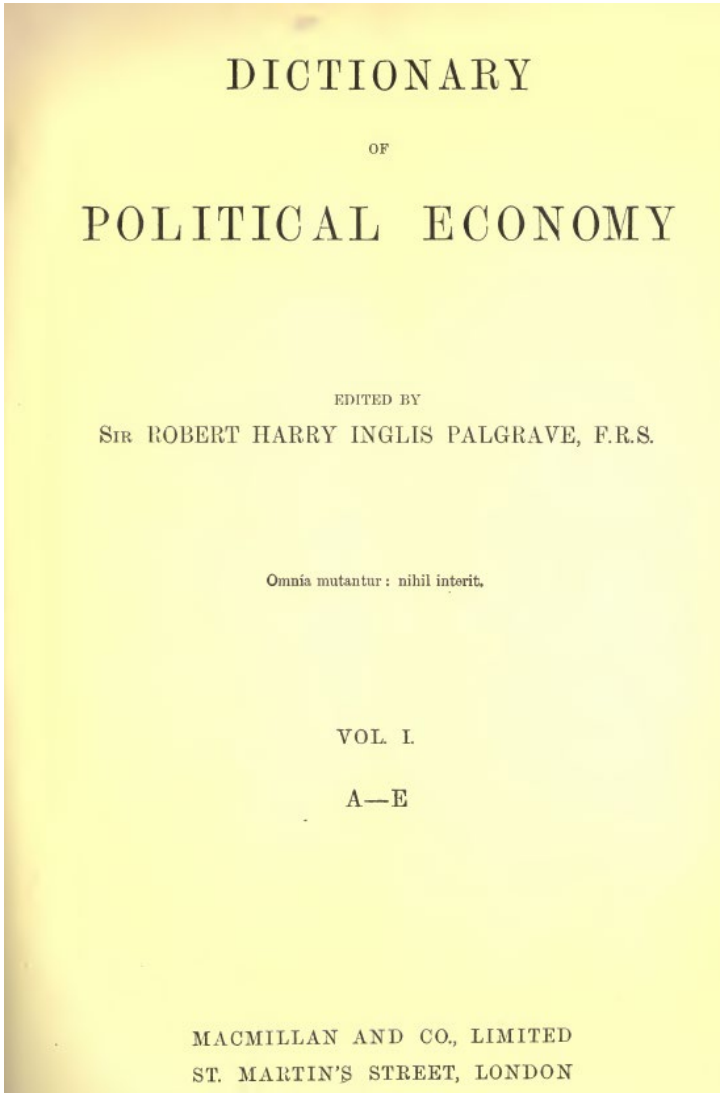
So far as the men in an employer's service are thus interchangeable, it makes no difference to him which of them it is that leaves his service. If the man who departs has been doing some kind of work that is quite necessary in conducting the business, the employer has only to put in his place the man who has been doing the work that is least needed. The work that is left undone in consequence of one man's departure is always of the marginal kind. The men in a mill arrange themselves in different classes, in the order that expresses the importance of the work that they are doing. The first class does something that is indispensable, the second, something that is highly important but less so than that which is done by the first, etc. The last class does a kind of work that contributes least of all to the productiveness of the business. If a man belonging to the first class leaves his employment, the master has only to put into his place a man taken from the last class. It is the least needed work that will remain undone. The *effective* importance to his employer of any of these interchangeable men is measured by the *absolute* importance of the one that does the least necessary work.

The principle of effective productivity.



On the horizontal axis we measure units of labour and on the vertical axis we measure the marginal product of labour. The total of the workers' wages is AECD, *i.e.*, the number of workers (AD) times the marginal product of the last worker (CD). The area (EBC) pays the other factor of production, *i.e.*, capital

John Bates Clark (1847 –1938)



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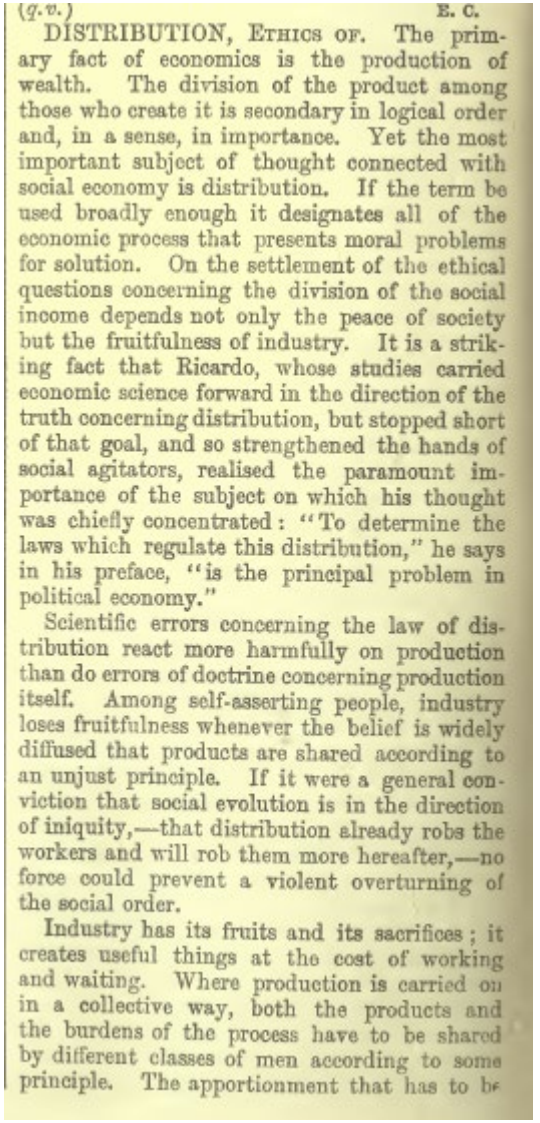


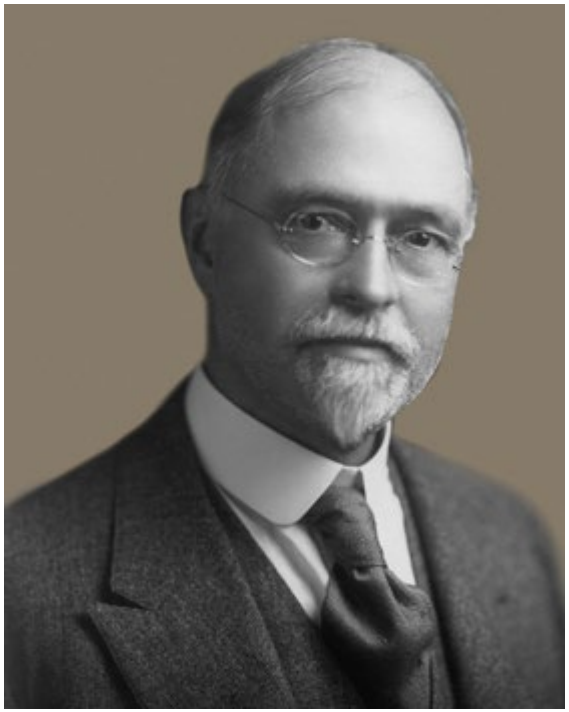
(q.v.) E. C.

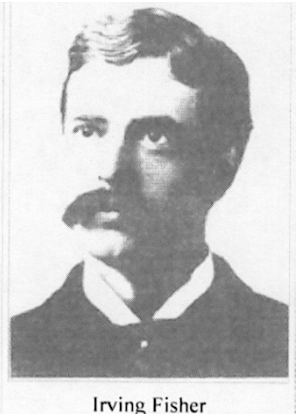
DISTRIBUTION, ETHICS OF. The primary fact of economics is the production of wealth. The division of the product among those who create it is secondary in logical order and, in a sense, in importance. Yet the most important subject of thought connected with social economy is distribution. If the term be used broadly enough it designates all of the economic process that presents moral problems for solution. On the settlement of the ethical questions concerning the division of the social income depends not only the peace of society but the fruitfulness of industry. It is a striking fact that Ricardo, whose studies carried economic science forward in the direction of the truth concerning distribution, but stopped short of that goal, and so strengthened the hands of social agitators, realised the paramount importance of the subject on which his thought was chiefly concentrated: "To determine the laws which regulate this distribution," he says in his preface, "is the principal problem in political economy."

Scientific errors concerning the law of distribution react more harmfully on production than do errors of doctrine concerning production itself. Among self-asserting people, industry loses fruitfulness whenever the belief is widely diffused that products are shared according to an unjust principle. If it were a general conviction that social evolution is in the direction of iniquity,—that distribution already robs the workers and will rob them more hereafter,—no force could prevent a violent overturning of the social order.

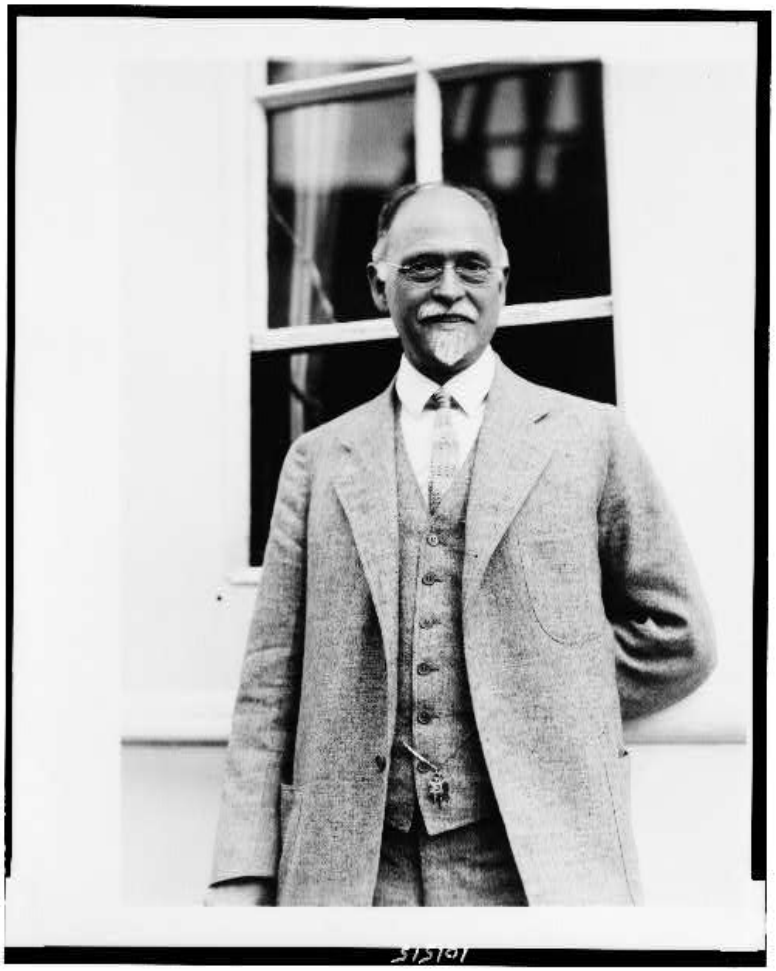
Industry has its fruits and its sacrifices; it creates useful things at the cost of working and waiting. Where production is carried on in a collective way, both the products and the burdens of the process have to be shared by different classes of men according to some principle. The apportionment that has to be

Irving Fisher (1867–1947)





Irving Fisher



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[The following memoir is in substance the writer's thesis for the degree of Ph.D. at Yale University, 1891.]

I.—MATHEMATICAL INVESTIGATIONS IN THE THEORY OF VALUE AND PRICES.

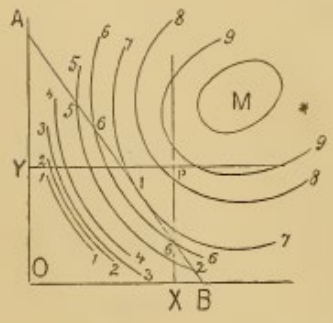
By Dr. IRVING FISHER.

[Read April 27, 1892.]

A_1 and B_1.

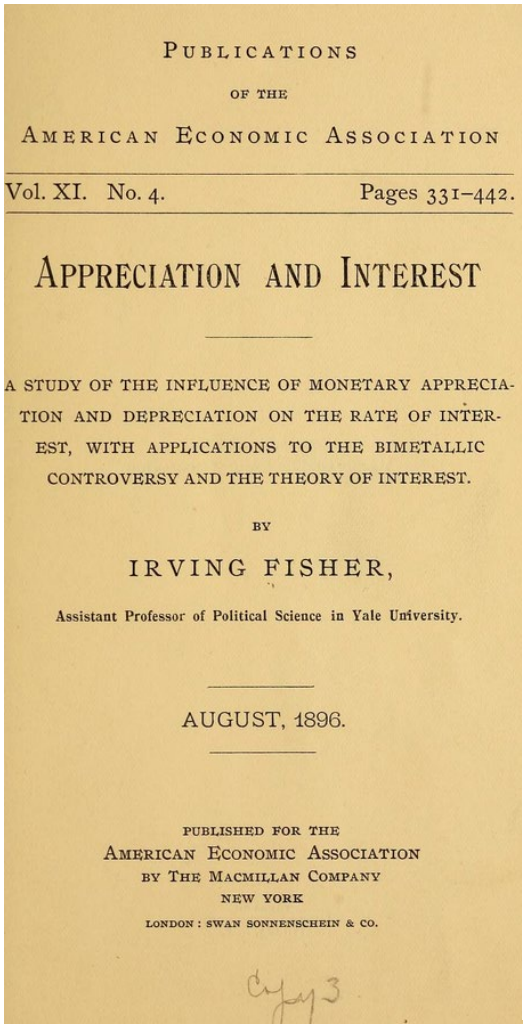
In fig. 18 let the abscissa OX represent the quantities B_1 of (*b*) and the ordinates (OY) the quantities A_1 of (*a*). Any point P by its co-ordinates represents *a possible combination* of quantities A_1 and B_1 consumed by I. By varying point P all possible combinations of A_1 and B_1 are represented. At P erect a perpendicular to the plane of the page whose length shall represent the marginal utility of A_1 for the combination, that is, the degree of utility of a small addition of A_1, (B_1 *remaining the same*). If P assumes all possible positions, the locus of the extremity of this perpendicular will be a surface.

18.



The first doctorate in economics from Yale University

Irving Fisher (1867–1947)



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A STUDY OF THE INFLUENCE OF MONETARY APPRECIATION AND DEPRECIATION ON THE RATE OF INTEREST, WITH APPLICATIONS TO THE BIMETALLIC CONTROVERSY AND THE THEORY OF INTEREST.

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IRVING FISHER,

Assistant Professor of Political Science in Yale University.

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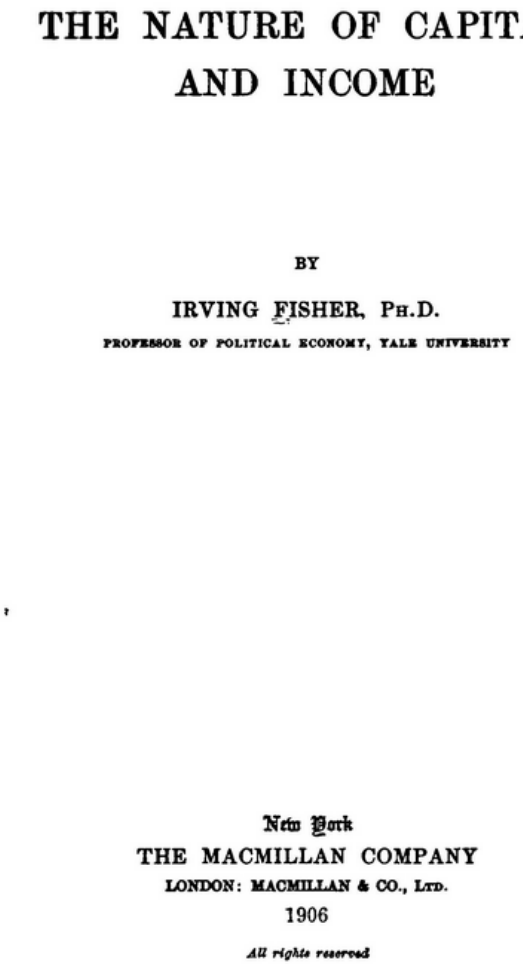

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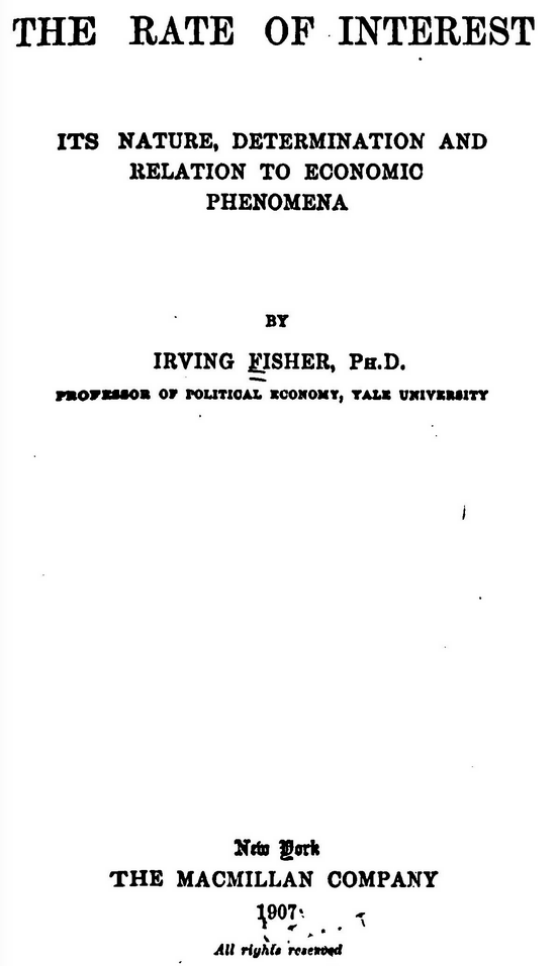

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THEORY OF INTEREST

As Determined by
IMPATIENCE
To Spend Income
and
OPPORTUNITY
To Invest It

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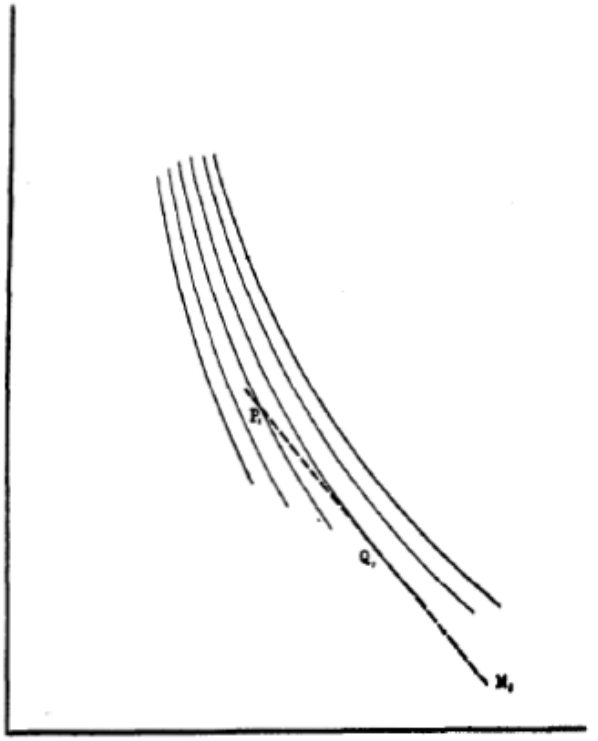
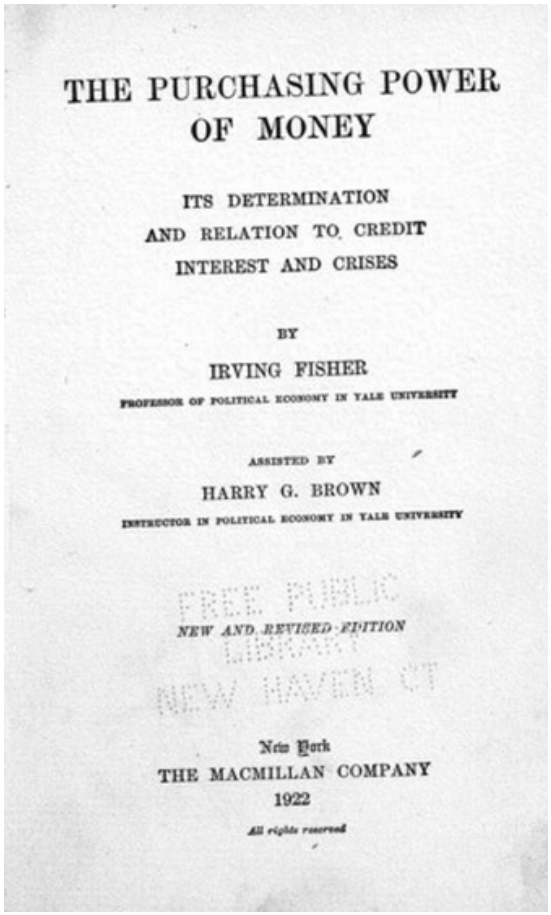


CHART 34
The Final Income Position (Q_1) of Individual *1* Fixed by Tangency of the W_1 Line to the M_1 Line at Q_1.

Irving Fisher (1867–1947)



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ITS DETERMINATION AND RELATION TO CREDIT INTEREST AND CRISES

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ASSISTED BY

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$$MV = \Sigma pQ.$$

Quantity Theory of Money

$$MV=PQ$$

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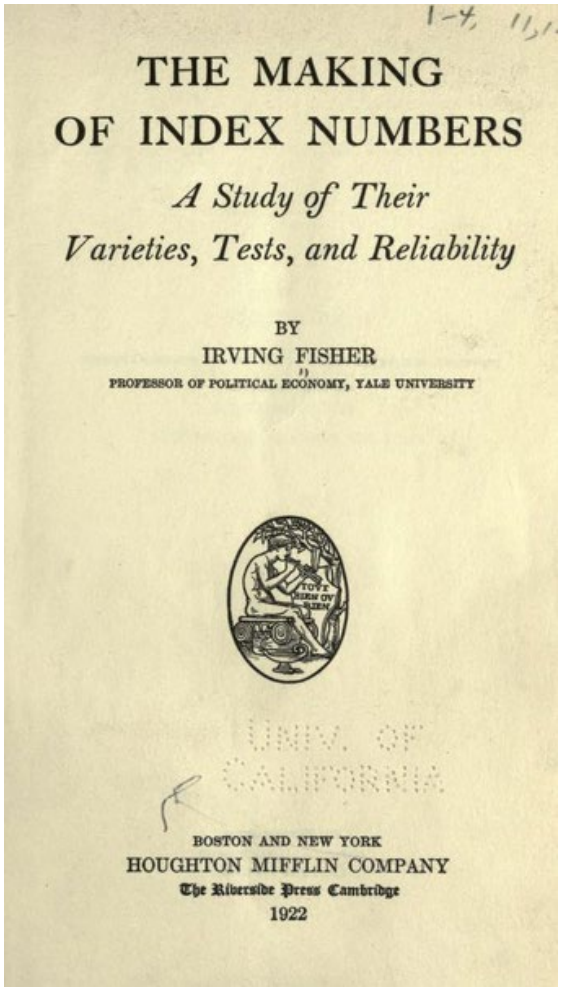

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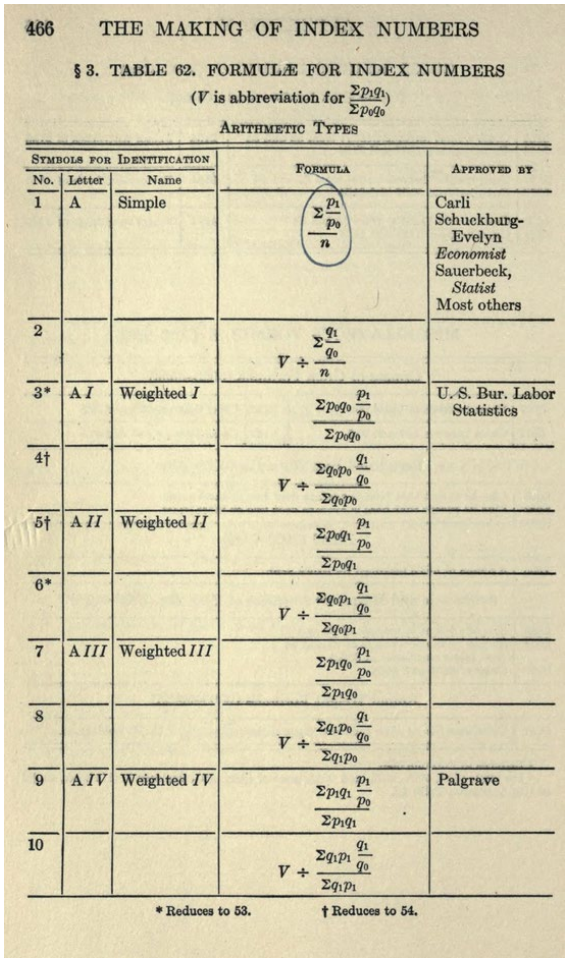


466 THE MAKING OF INDEX NUMBERS

§ 3. TABLE 62. FORMULÆ FOR INDEX NUMBERS
(V is abbreviation for $\frac{\Sigma p_1 q_1}{\Sigma p_0 q_0}$)

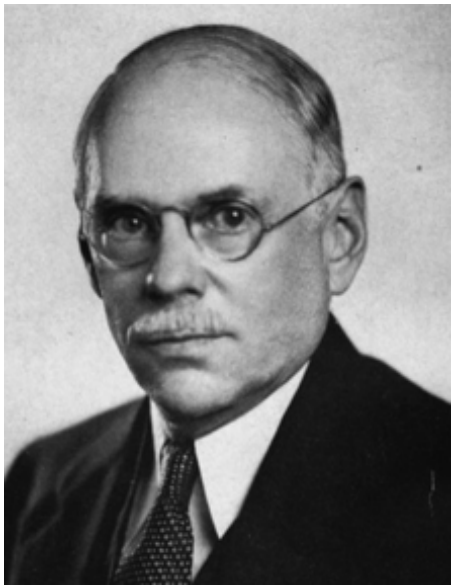
ARITHMETIC TYPES

SYMBOLS FOR IDENTIFICATION			FORMULA	APPROVED BY
No.	Letter	Name		
1	A	Simple	$\frac{\Sigma \frac{p_1}{p_0}}{n}$	Carli Schuckburg-Evelyn *Economist* Sauerbeck, *Statist* Most others
2			$V \div \frac{\Sigma \frac{q_1}{q_0}}{n}$	
3*	A *I*	Weighted *I*	$\frac{\Sigma p_0 q_0 \frac{p_1}{p_0}}{\Sigma p_0 q_0}$	U. S. Bur. Labor Statistics
4†			$V \div \frac{\Sigma q_0 p_0 \frac{q_1}{q_0}}{\Sigma q_0 p_0}$	
5†	A *II*	Weighted *II*	$\frac{\Sigma p_0 q_1 \frac{p_1}{p_0}}{\Sigma p_0 q_1}$	
6*			$V \div \frac{\Sigma q_0 p_1 \frac{q_1}{q_0}}{\Sigma q_0 p_1}$	
7	A *III*	Weighted *III*	$\frac{\Sigma p_1 q_0 \frac{p_1}{p_0}}{\Sigma p_1 q_0}$	
8			$V \div \frac{\Sigma q_1 p_0 \frac{q_1}{q_0}}{\Sigma q_1 p_0}$	
9	A *IV*	Weighted *IV*	$\frac{\Sigma p_1 q_1 \frac{p_1}{p_0}}{\Sigma p_1 q_1}$	Palgrave
10			$V \div \frac{\Sigma q_1 p_1 \frac{q_1}{q_0}}{\Sigma q_1 p_1}$	

* Reduces to 53. † Reduces to 54.

Other American neoclassicals

Frank William Taussig
(1859-1940)



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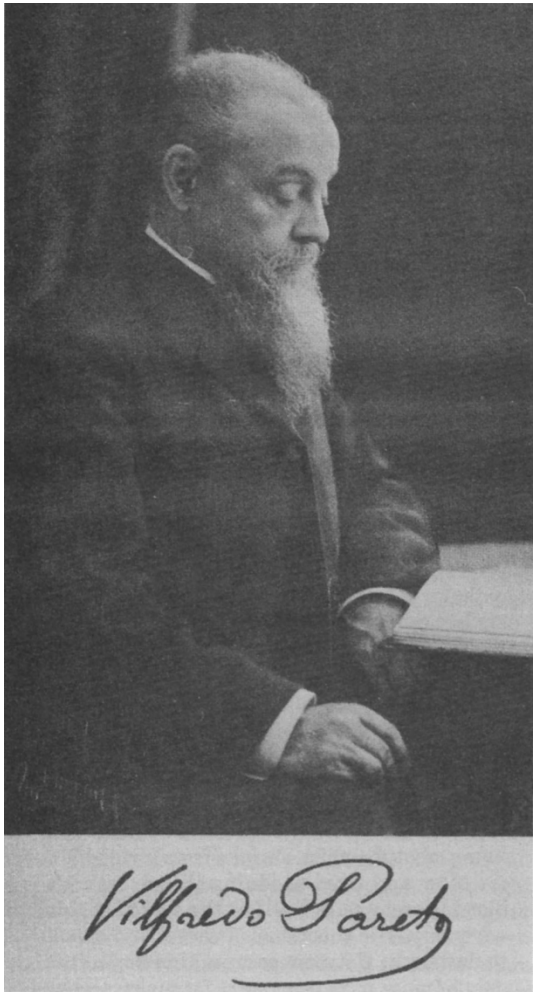

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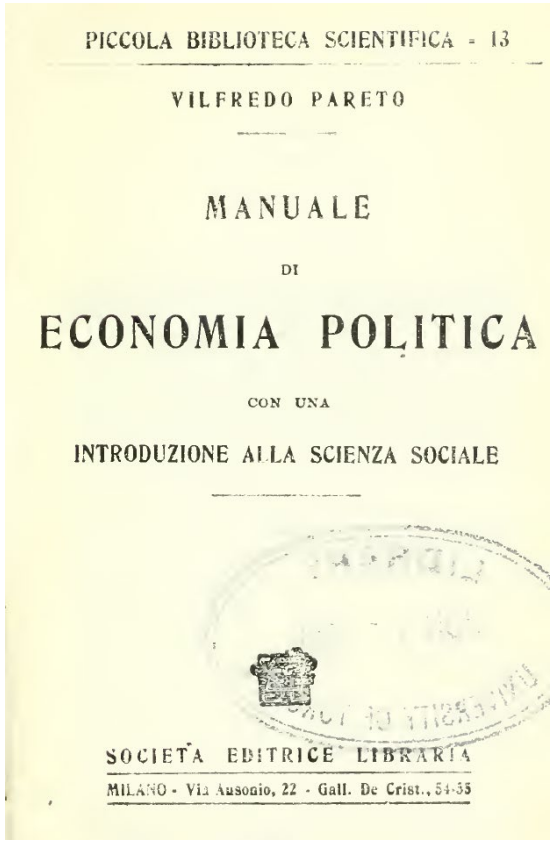
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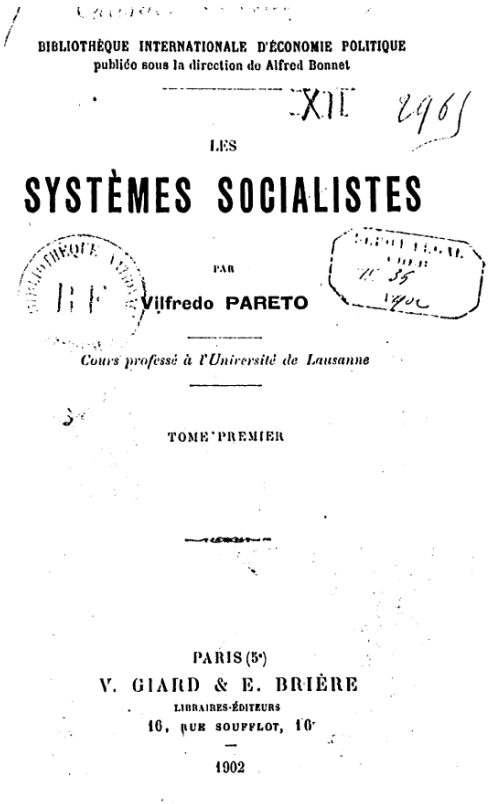

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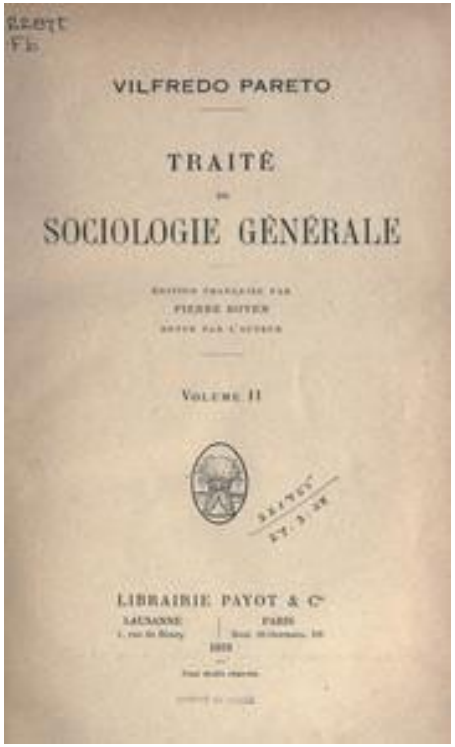

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Vilfredo Pareto (1848 –1923)

1869 PhD Turin (Engineering) "The basic principles of equilibrium in solid bodies"
Civil Engineer at the Railways,
1880 Director General at the *Società delle ferriere italiane*
1886 Lecturer in economics and management at the University of Florence
1889 Death of his parents. Marries Alessandrina Bakunin
1893 Succeeds Walras in Lausanne.
1923 Mussolini's Senator. Marries Jeanne Regis

Vilfredo Pareto (1848 –1923)

53. L'argomento diventa molto più facile ad intendersi mediante figure grafiche.

Tiriamo due assi ortogonali, OA, OB; su OA portiamo le quantità di pane, su di OB le quantità di vino. Per esempio *oa* figura uno di pane, *ob* figura uno di vino; il punto *m* che ha quelle due coordinate indica la combinazione 1 kg. di pane e 1 kg. di vino.

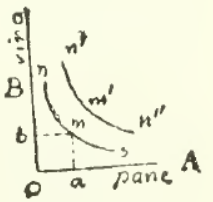


Fig. 5.

54. Così s'intende che potremo rappresentare tutta la serie precedente, ed unendo insieme i punti di quella serie con una linea continua, avremo la linea *n m s* che dicesi LINEA D'INDIFFERENZA O CURVA DI INDIFFERENZA (1).

(1) Questo nome è dovuto al prof. F. Y. Edgeworth. Egli supponeva che esistesse *l'utilità* (ofelimità), e ne deduceva le curve di indifferenza; invece io prendo come dato di fatto le curve di indifferenza, e da esse traggo quanto occorre per la teoria dell'equilibrio, senza che occorra considerare l'ofelimità.

Mathematization of economics

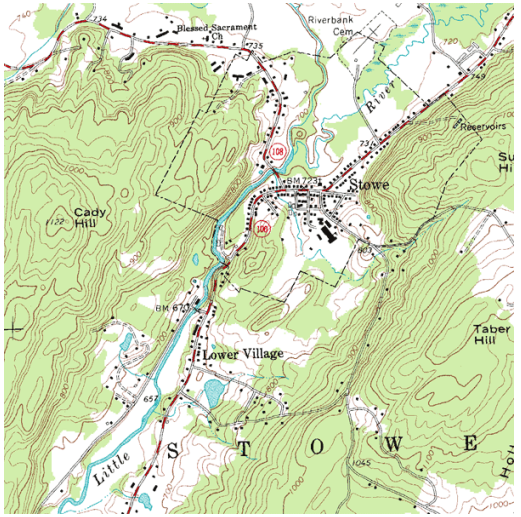
Indifference curve

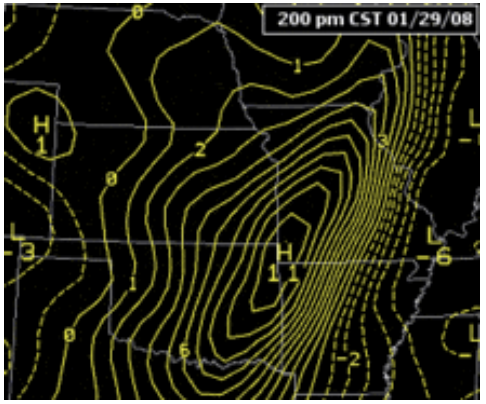
Vilfredo Pareto (1848 –1923)

Ophelimity

Non-measurable utility

Cardinal vs Ordinal





Vilfredo Pareto (1848 –1923)

Pareto optimum

Vilfredo Pareto (1848 –1923)

$$\overline{F}(x) = \Pr(X > x) = \begin{cases} \left(\frac{x_{\mathrm{m}}}{x}\right)^{\alpha} & x \geq x_{\mathrm{m}}, \\ 1 & x < x_{\mathrm{m}}. \end{cases}$$

11. Répartition des revenus (1). — Par analogie avec des faits de même espèce, il est probable que la courbe des revenus doit avoir une forme semblable à celle de la *fig.* 54. Si nous faisons *mo* égal à un certain revenu x, *mp* égal à 1, la surface *mnqp* nous donne le nombre d'individus qui ont un revenu compris entre x et $x + 1$.

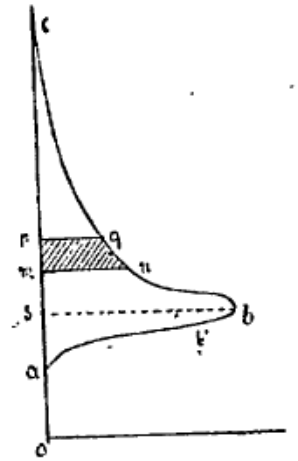
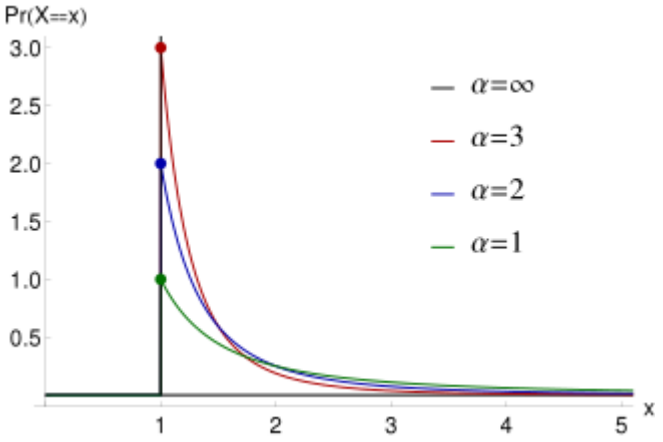


Fig. 54.

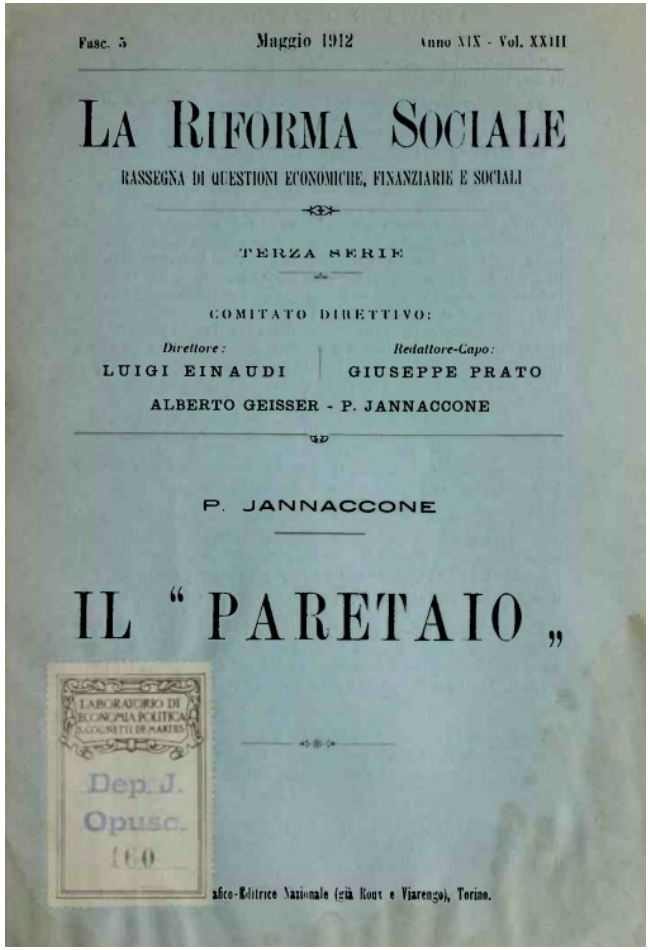
Mais pour les revenus totaux, la statistique ne nous fournit de renseignements que pour la partie *cqb* de la courbe, et peut-être, dans un très petit nombre de cas, pour une petite portion *bb'* de l'autre partie ; la partie *ab'*, ou mieux, *ab* reste purement hypothétique.



Pareto's law for the distribution of income

Pareto distribution

Vilfredo Pareto (1848 –1923)



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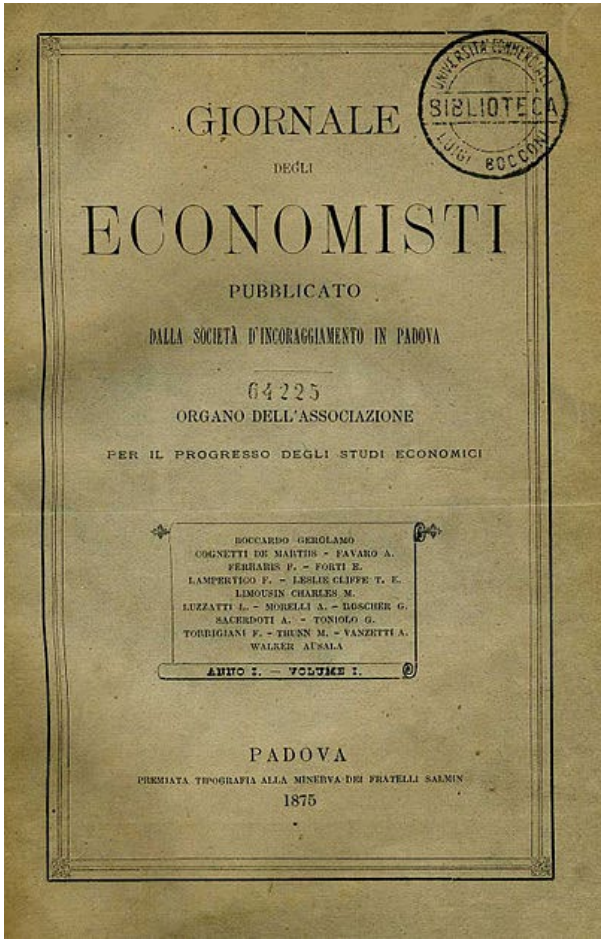
Enrico Barone (1859–1924)

Maffeo Pantaleoni



Enrico Barone

Maffeo Pantaleoni (1857–1924)
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PURE ECONOMICS

BY

PROFESSOR MAFFEO PANTALEONI

TRANSLATED BY

T. BOSTON BRUCE, Esq.

OF THE MIDDLE TEMPLE; BARRISTER-AT-LAW

London

MACMILLAN AND CO., LIMITED

NEW YORK: THE MACMILLAN COMPANY

1898

PRINCIPII

DI

ECONOMIA PURA

PER

MAFFEO PANTALEONI

DIRETTORE DELLA R. SCUOLA SUPERIORE DI COMMERCIO

IN BARI.

FIRENZE,

G. BARBÈRA, EDITORE.

1889.

IL MINISTRO DELLA PRODUZIONE NELLO STATO COLLETTIVISTA

IL MINISTRO DELLA PRODUZIONE NELLO STATO COLLETTIVISTA

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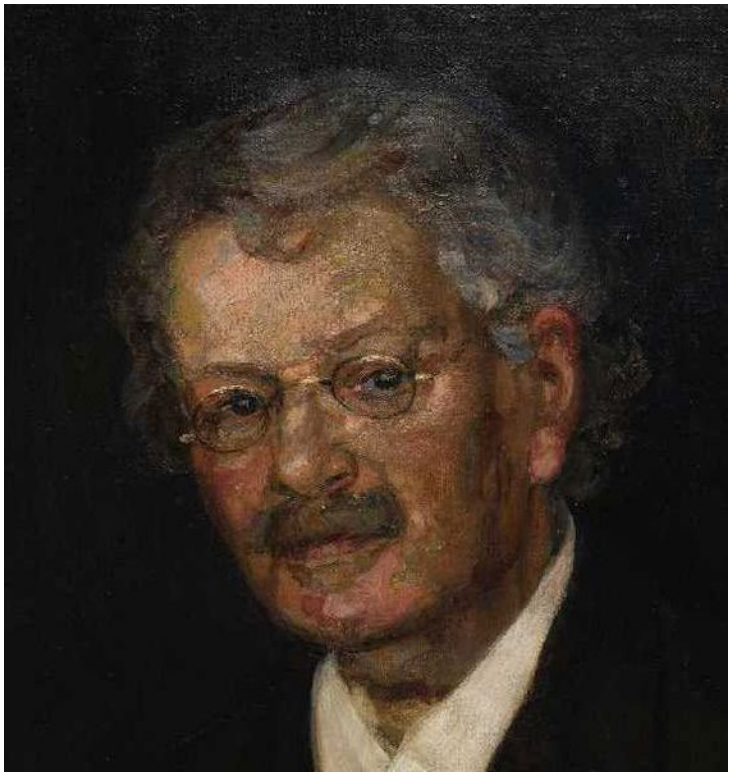

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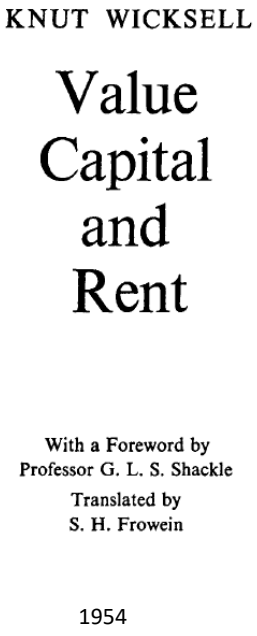
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1954

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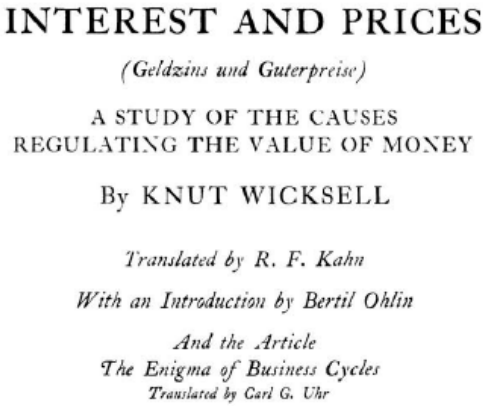
Über Wert, Kapital und Rente nach den neueren nationalökonomischen Theorien. Jena. 1893.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(Geldzins und Guterpreise)

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By KNUT WICKSELL

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With an Introduction by Bertil Ohlin

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Translated by Carl G. Uhr

Original publication date: 1898

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Finanztheoretische Untersuchungen nebst Darstellung und Kritik des Steuerwesens Schwedens. Jena: G. Fischer. 1896

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By
KNUT WICKSELL

TRANSLATED FROM THE SWEDISH BY
E. CLASSEN
AND EDITED WITH AN INTRODUCTION BY
LIONEL ROBBINS
Professor of Economics in the University of London

VOLUME ONE
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MONEY

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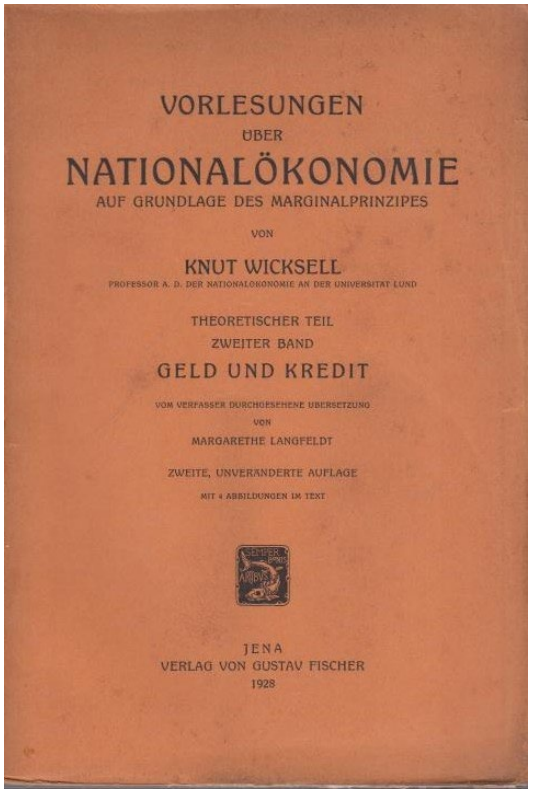

Föreläsningar i nationalekonomi.
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- Cumulative process
- Capital time structure
- Theory of money

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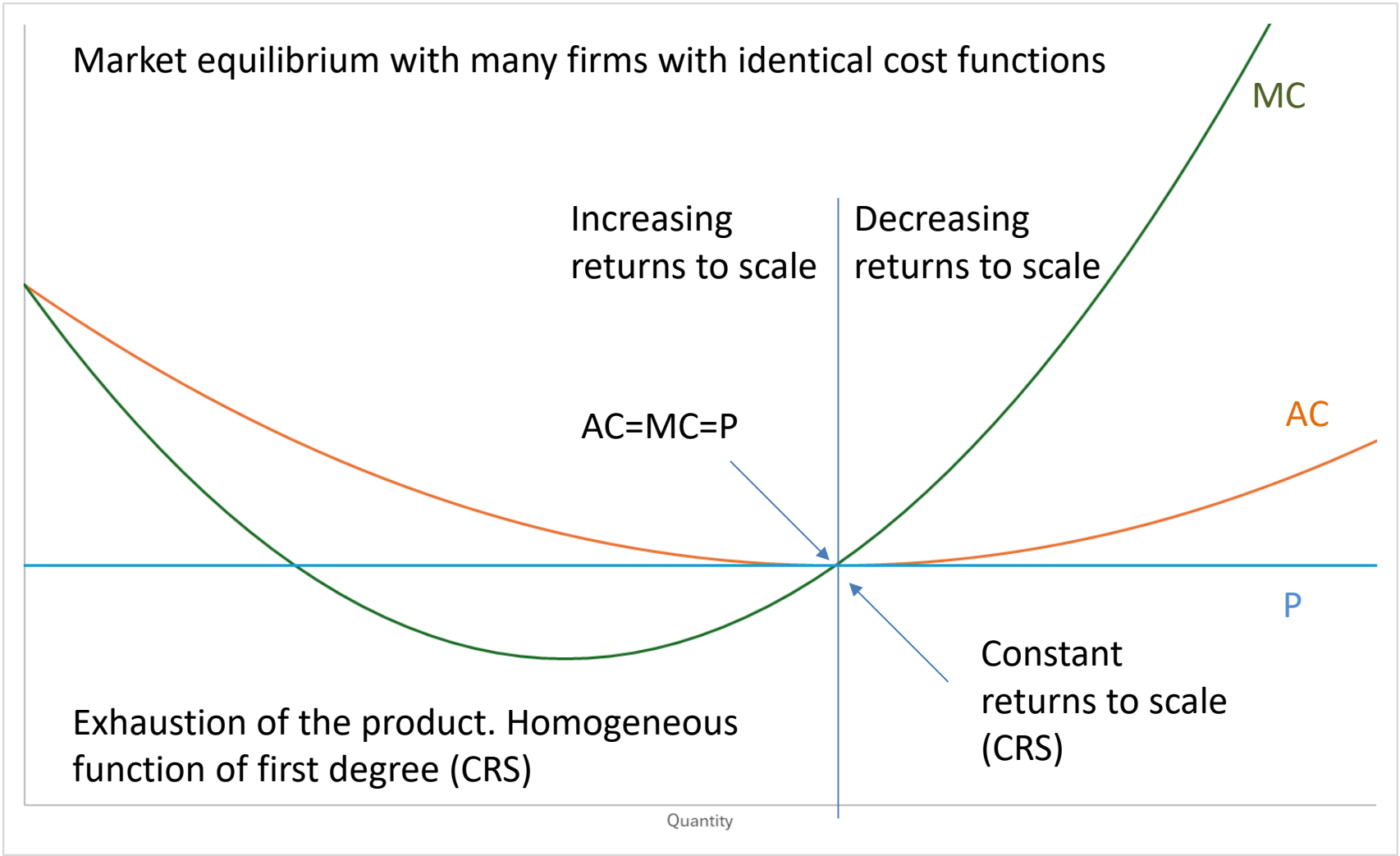

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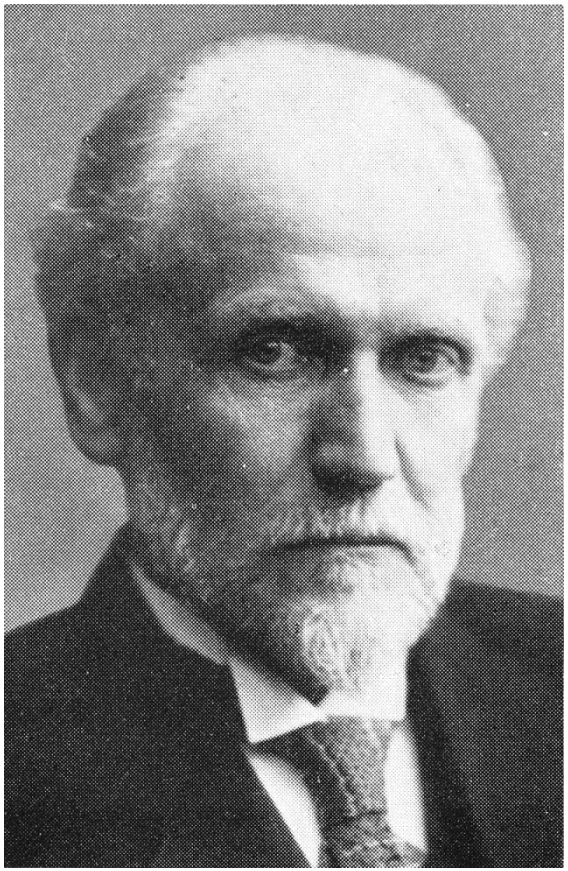

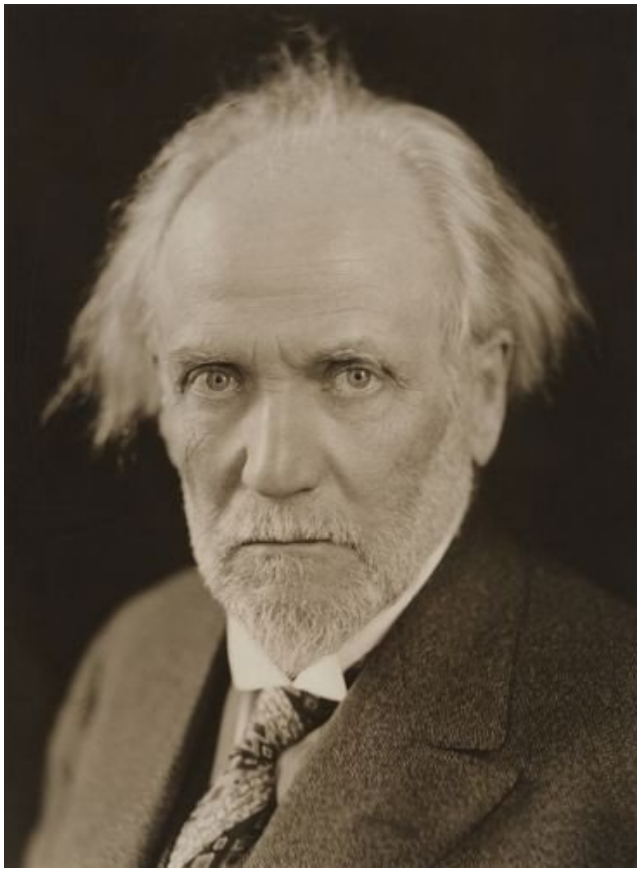

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Theoretische
Sozialökonomie

Gustav Cassel

Theoretische Sozialökonomie,
Leipzig, C. F. Winter. 1918

THE THEORY OF SOCIAL ECONOMY

By GUSTAV CASSEL

Professor at the University of Stockholm

Translated by JOSEPH McCABE

VOL. I.

T. FISHER UNWIN, LTD.
LONDON: ADELPHI TERRACE

demand of the whole of the consumers, for any particular article is settled. If we call the total demand for the n goods during the relevant period $D_1, D_2 \ldots D_n$, we can give these magnitudes as functions of the n prices, thus:

$$(1)\quad \begin{aligned} D_1 &= F_1(p_1 \ldots p_n) \\ D_2 &= F_2(p_1 \ldots p_n) \\ &\cdots\cdots\cdots \\ D_n &= F_n(p_1 \ldots p_n) \end{aligned}$$

$p_1 \ldots p_n$ being the prices of the n goods.

But in the equilibrium of the economy the demand for each individual article must be in harmony with the supply of it, as the fixing of prices in accordance with the principle of scarcity has to restrict the demand until it can be met out of the available supply of commodities. Consequently:

$$D_1 = S_1,\ D_2 = S_2 \ldots D_n = S_n$$

and so according to (1):

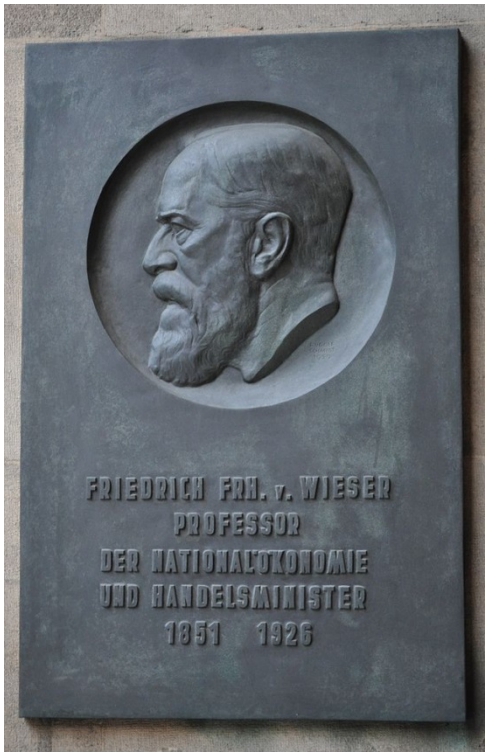
$$(2)\quad \begin{aligned} F_1(p_1 \ldots p_n) &= S_1 \\ F_2(p_1 \ldots p_n) &= S_2 \\ &\cdots\cdots\cdots \\ F_n(p_1 \ldots p_n) &= S_n \end{aligned}$$

Hence to solve the pricing problem in the simple case we are considering, we have only to regard the n prices as the unknown quantities of the problem, and take them as given in the usual mathematical way. We are then in a position to express the demand for the n goods in these prices according to equations (1), and equations (2) then follow as a consequence of the principle of scarcity.

Schumpeter: 90% Walras, 10% water.

Austria

Friedrich Freiherr von Wieser (1851 –1926)



Friedrich von Wieser (1851 –1926)

- *Grenznutz* marginal utility
- *Zurechnung* Imputation
- Opportunity cost

SOCIAL
ECONOMICS

By
FRIEDRICH von WIESER

Translated by
A. FORD HINRICHS
Assistant Professor of Economics, Brown University

With a Preface by
WESLEY CLAIR MITCHELL

ADELPHI COMPANY
NEW YORK

DER

NATÜRLICHE WERTH.

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PROFESSOR AN DER DEUTSCHEN UNIVERSITÄT IN PRAG.

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DES

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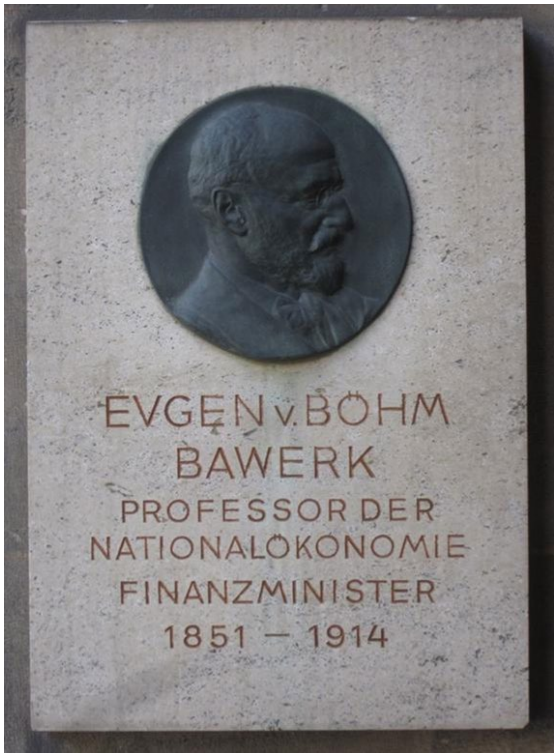

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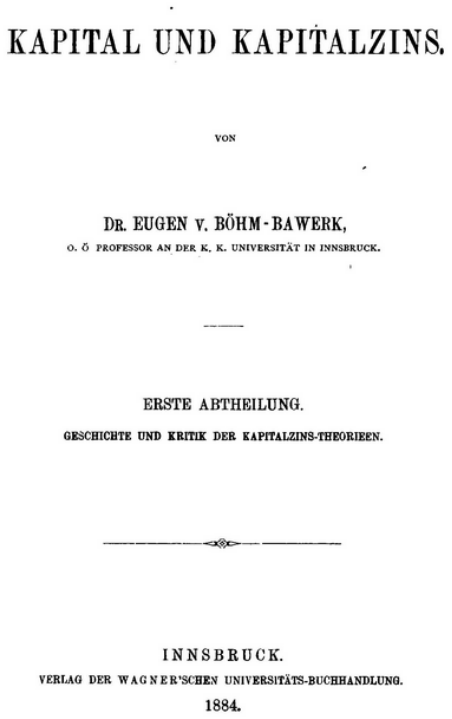

KAPITAL UND KAPITALZINS.

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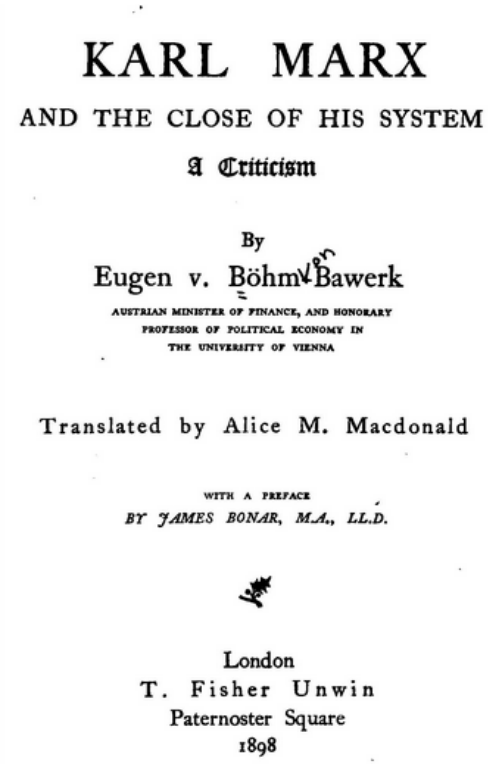

KARL MARX

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Eugen v. Böhm-Bawerk

AUSTRIAN MINISTER OF FINANCE, AND HONORARY PROFESSOR OF POLITICAL ECONOMY IN THE UNIVERSITY OF VIENNA

Translated by Alice M. Macdonald

WITH A PREFACE BY JAMES BONAR, M.A., LL.D.

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1898

Eugen von Böhm-Bawerk, "Zum Abschluß des Marxschen Systems", in *Staatswissenschaftliche Arbeiten. Festgaben für Karl Knies*, hrsgb. von Otto von Boenigk, Haering: Berlin 1896, S. 87-205.

Critique of Marx on the transformation of labour values into production prices: Valid only for a stable organic composition of capital

Eugen von Böhm-Bawerk (1851 –1914)

(1) the justified expectation of an objectively more abundant satisfaction of future needs; (2) the subjective underestimation of future needs or overestimation of future resources, due to incorrect calculations or weakness of will which causes the apparent superiority of present over future goods; and (3) the technical superiority of present goods (including present productive goods) over those in the future.

Theory of interest rate and capital

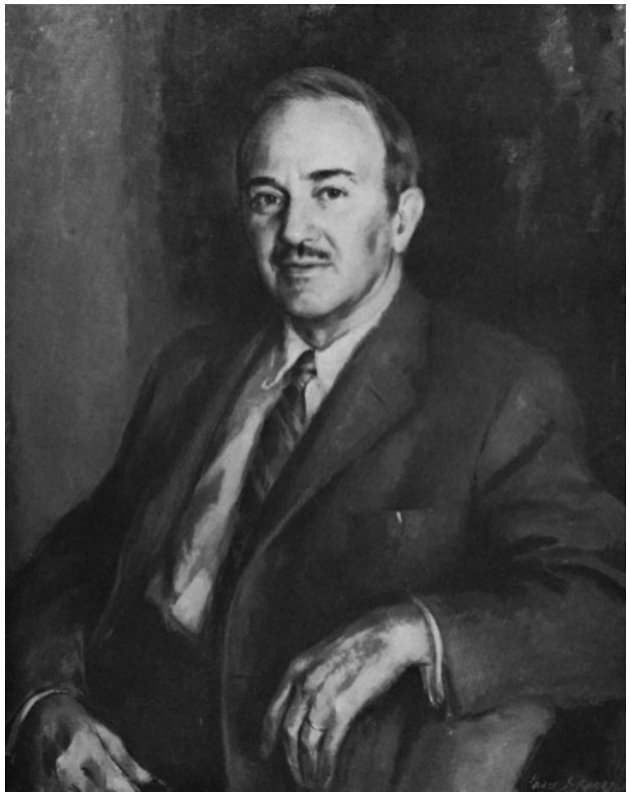
Imperfect competition

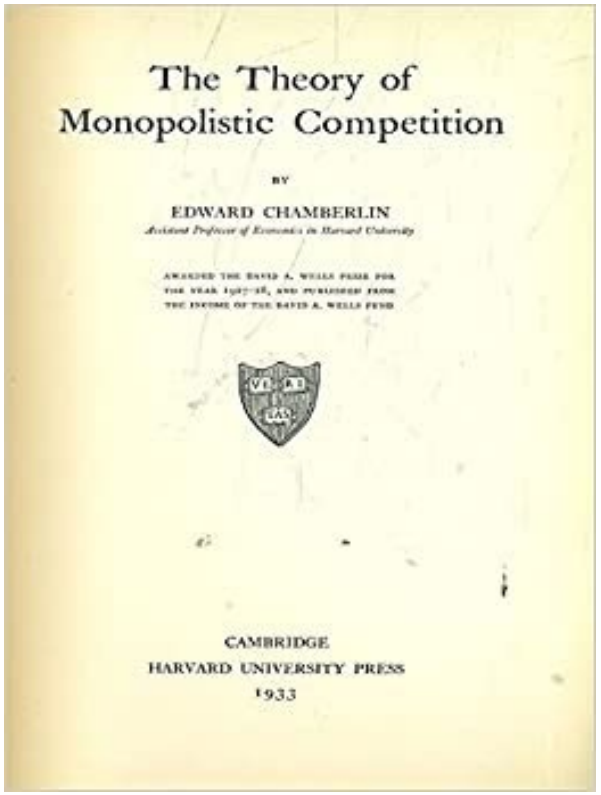
- Piero Sraffa (1898-1983)
- Edward Chamberlin (1899-1967)
- Joan Robinson (1903-1983)

Piero Sraffa (1898-1983)

"Sulle relazioni tra costo e quantità prodotta»,
Annali di economia, II, 1925
"The Laws of Returns under Competitive Conditions",
Economic Journal, 1926, 36(144)

Edward Chamberlin (1899-1967)





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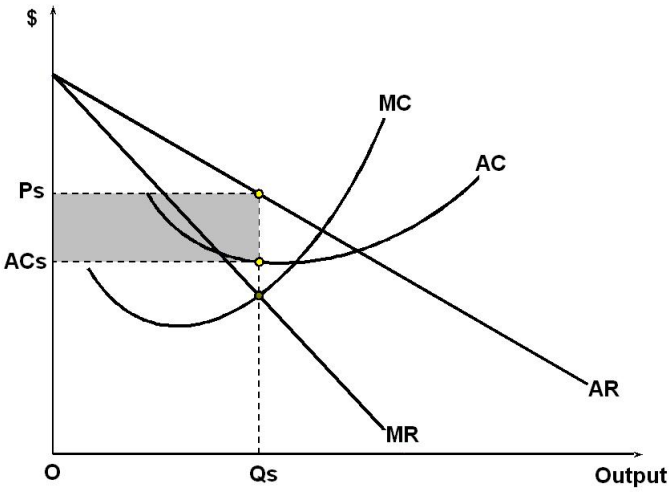

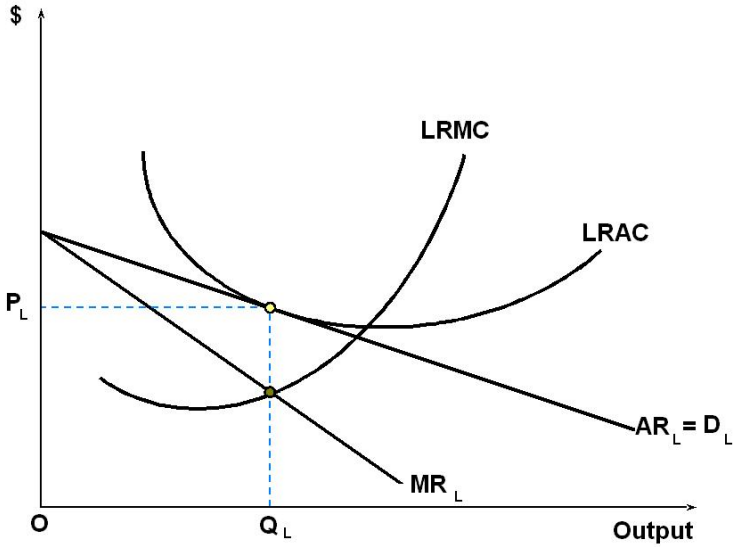

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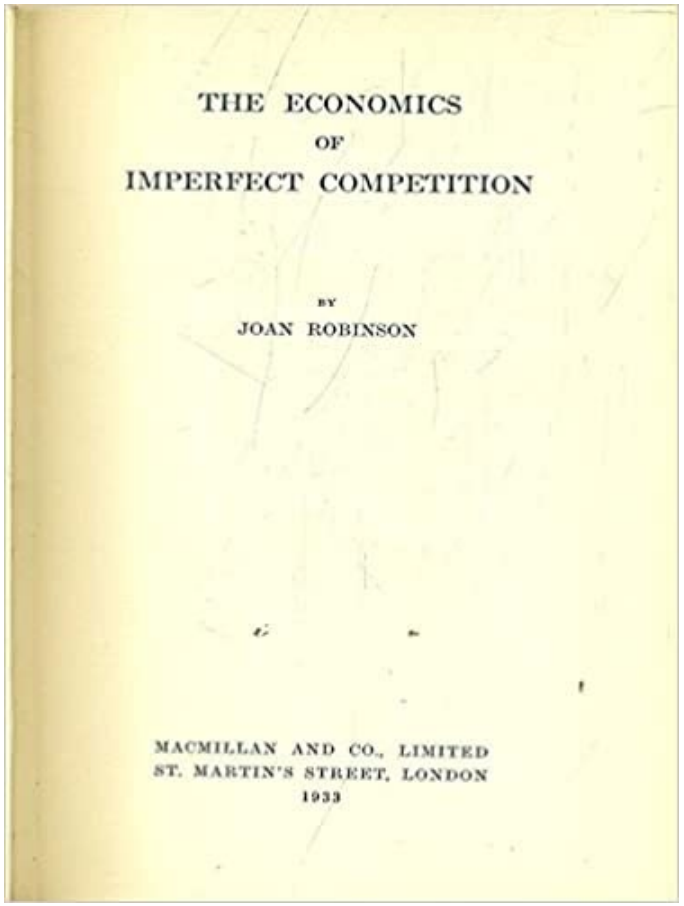

Joan Robinson (1903-1983)

OM is the total output, and is equal to $OM_1 + OM_2$.
MC is the marginal cost of the output OM.

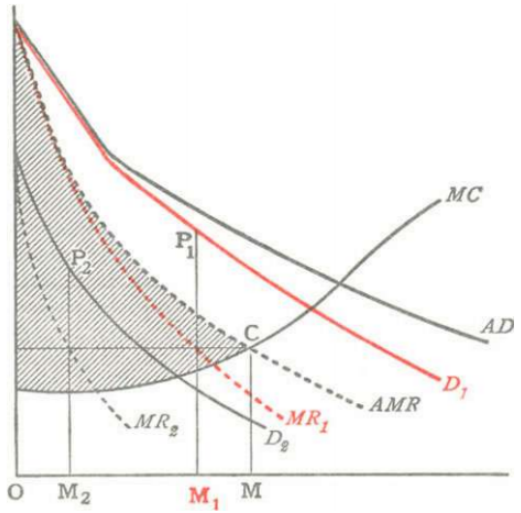

FIG. 61.

OM_1 is sold at the price M_1P_1 in market I. OM_2 is sold at the price M_2P_2 in market II. The shaded area shows the monopoly revenue, which is equal to the area lying under the aggregate marginal revenue curve (total revenue) *minus* the area lying under the marginal cost curve (total costs).

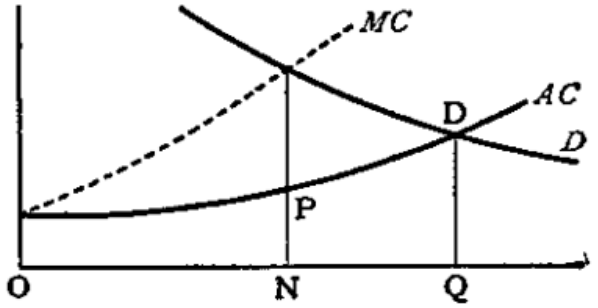

FIG. 66.

MC is the marginal cost curve to the industry, and this is the marginal cost curve from the point of view of the monopsonist.
AC is the average cost curve of the industry, or the supply curve.
The monopsonist will buy that output (ON) at which marginal utility (or competitive demand price) is equal to marginal cost, and he will pay NP, the supply price for that output, which is less than the competitive price (QD).

Institutionalist School

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- Wesley Clair Mitchell (1874-1948)

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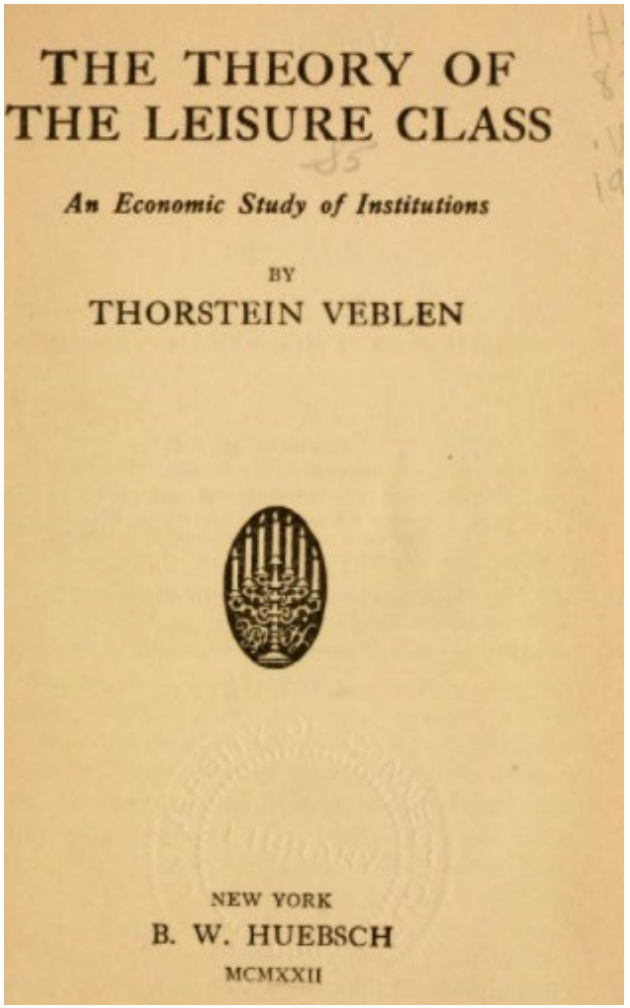

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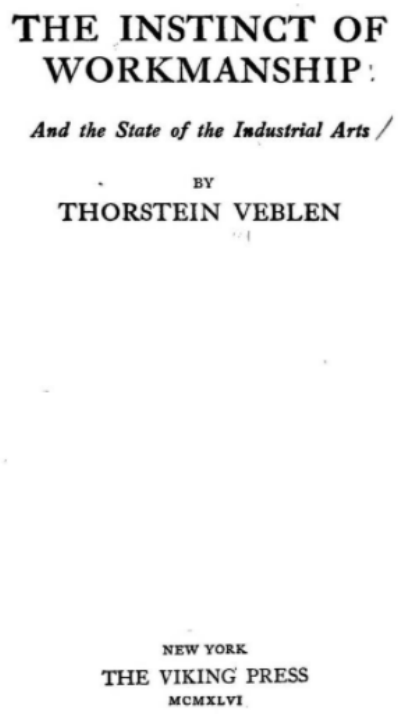
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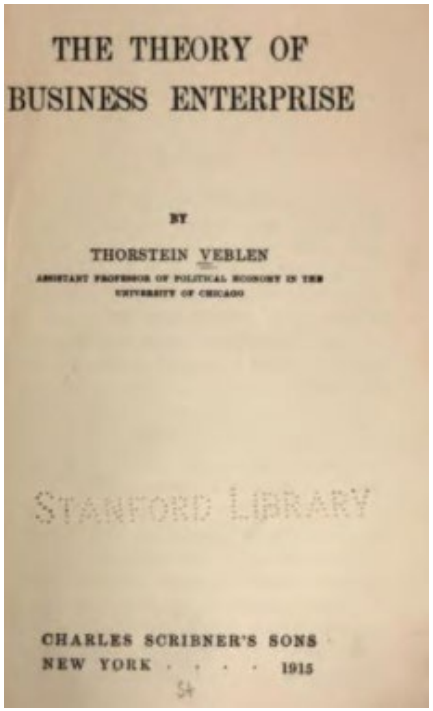
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NEW YORK 1915

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— (1899). *The Theory of the Leisure Class*. New York: MacMillan.
— (1904). *The Theory of Business Enterprise*. New York: Scribner.
— (1914). *The Instinct of Workmanship and the State of the Industrial Arts*. New York: MacMillan.
— (1915). *Imperial Germany and the Industrial Revolution*. New York: MacMillan.
— (1917). *An Inquiry into the Nature of Peace and the Terms of Its Perpetuation*. New York: MacMillan.
— (1918). *The Higher Learning In America*. New York: Huebsch.
— (1919). *The Place of Science in Modern Civilisation and Other Essays*. New York: Huebsch.
— (1919). *The Vested Interests and the Common* Man. New York: Huebsch.
— (1921). *The Engineers and the Price System*. New York: Huebsch..
— (1923). *Absentee Ownership and Business Enterprise in Recent Times: The Case of America*. New York: Huebsch.

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INSTITUTIONAL ECONOMICS

An institution is defined as collective action in control, liberation and expansion of individual action. Its forms are unorganized custom and organized going concerns. The individual action is participation in bargaining, managing and rationing transactions, which are the ultimate units of economic activity. The control by custom or concerns consists in working rules which govern more or less what the individual can, must, or may do or not do. These are choices, resolved into performance, forbearance or avoidance while participating in transactions. The working rule of the Supreme Court is due process of law. The universal principles, that is, similarities of cause, effect, or purpose, discoverable in all transactions, are scarcity, efficiency, futurity, working rules and limiting factors under volitional control. These reveal themselves in a negotiational, or behavioristic, psychology of persuasion and coercion in bargaining transactions, command and obedience in managerial transactions, argument and pleading in rationing transactions.

Transactions determine legal control, while the classical and hedonic economics was concerned with physical control. Legal control is future physical control. The three social relations implicit in transactions are conflict, dependence and order. Social philosophies differ economically according to the kind of transactions which they place uppermost.

American Economic Review (1931), 21 (4), pp. 648-657

John R. Commons (1862–1945)

LABOR
AND
ADMINISTRATION

BY
JOHN R. COMMONS
PROFESSOR OF POLITICAL ECONOMY, UNIVERSITY OF WISCONSIN
FORMERLY DIRECTOR OF THE MILWAUKEE BUREAU OF ECONOMY AND EFFICIENCY AND MEMBER OF THE INDUSTRIAL COMMISSION OF WISCONSIN

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INSTITUTIONAL
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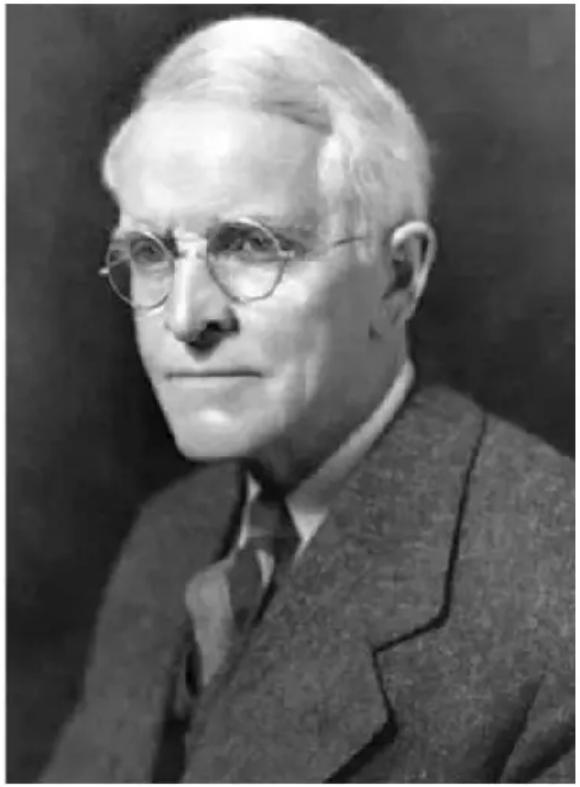

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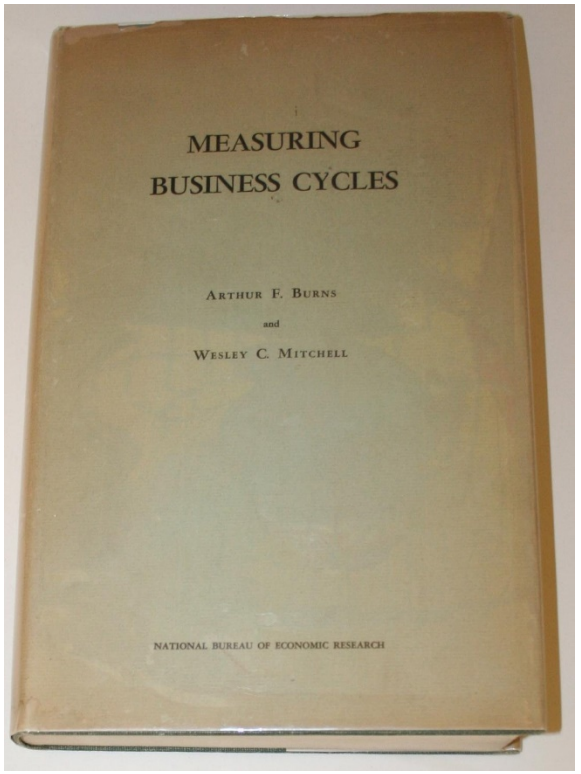
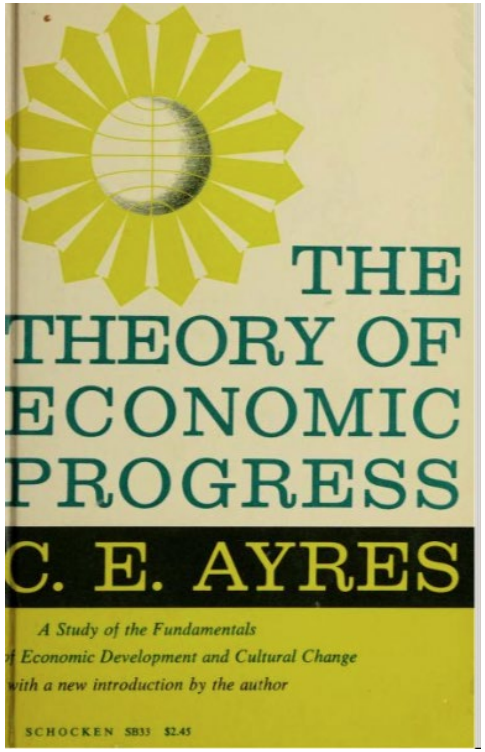
The Problem and Its Setting

WESLEY C. MITCHELL

NATIONAL BUREAU OF ECONOMIC RESEARCH, INC.
NEW YORK



Clarence Edwin Ayres (1891-1972)



End of Lecture