Interest and Prices:

Knut Wicksell and Irving Fisher

IN THEIR EFFORTS to understand the workings of the market mechanism, the early marginalist economists focused primarily on the markets for consumption goods. Some qualifications of this statement are obviously in order: we have seen that Alfred Marshall emphasized the distinction between price formation in the short and the long run, so that in a sense he had developed an analysis of how capital investment depended on changes in the demand for consumption goods. However, he did not have a more formal theory of capital, investment, and the rate of interest. Walras developed the elements of a general equilibrium theory for a growing economy, which also contained a theory of capital accumulation, but this is not the part of his work that has had the greatest influence on later theorists. Another characteristic of the early marginalist period was the focus on relative prices, with less attention being paid to the determination of the general price level and the rate of inflation or deflation. To the later generation of marginalists, who did their most important work at the end of the nineteenth and the beginning of the twentieth century, these issues became of greater interest, and the Swedish economist Knut Wicksell and the American Irving Fisher gave important contributions to the theory as we know it today. But their work in the fields of capital and money is only part of the reason why they are remembered in the history of thought. They also contributed to the more general development of what gradually became known as the neoclassical theory, and they did important work in the theory of public finance. In addition, they both took an active part in the economic and social debate in their respective countries, where they acquired a visibility in public life that was very different from that of economists like Marshall and Walras who led the quiet life of the scholar.

KNUT WICKSELL

Knut Wicksell (1851–1926) was born in Stockholm where his father ran a grocery store. He attended the gymnasium (secondary school) in Stockholm, and in 1869 he was enrolled at the University of Uppsala with the aim, according to Gårdlund (1956; 1958), of becoming a doctor of philosophy and eventually professor of mathematics. During his first years at Uppsala he was a hardworking student who made good progress. By January 1872 he had obtained the degree of fil.kand.—corresponding roughly to a B.A.—and continued his studies toward a licentiate degree in mathematics.[1] All seemed set for a promising academic career.

At this time, however, things happened to Wicksell that gradually made him think along very different lines. He abandoned his Christian faith which until that time had been one of the mainstays of his existence. At the same time he began to lead a more active social life and take a stronger interest in social and political questions. One of the results of his new outlook on life was a lecture that he gave in February 1880 on the temperance movement where he surveyed the causes of drunkenness; these he found to be poverty, hunger, poor housing, and prostitution. In Wicksell's opinion, the most important remedy for poverty and social distress was birth control. In this analysis he was indirectly influenced by the thought of Malthus via the so-called Neo-Malthusian movement which was very influential in the public debate at the time. He advanced the view that doctors ought to help people with advice about prevention of pregnancy, since this would lead to a reduction in the number of children and raise the standard of living among the poorest families. At this point, he was not in agreement with Malthus, who had classified prevention as sin (see chapter 4).

This clear talk about issues like prostitution and prevention created a great stir in Swedish society, and in many circles it caused Wicksell to be regarded as a dangerous radical who attempted to undermine the basic institutions of established society. It also led to further detraction from his academic studies. For many years he lived as a freelance journalist and lecturer, and he did not obtain his licentiate degree in mathematics until

---

[1] The licentiate degree marked a step on the road toward a doctorate.

1885, at which time he had long been regarded as an "eternal student." Having passed his examinations he obtained a scholarship for further studies, and it was during a stay in London that he began to study economics in earnest. His social concerns had awakened in him a desire to view the economic problems of society in a wider and more theoretical perspective. Malthus's ideas he knew already, but he now broadened his knowledge by reading Smith and Ricardo, Cournot and Mill, Jevons and Walras. He was attracted by the theoretical approach of the marginalists, although he remained skeptical of those who thought that the unregulated market economy was in the best interest of society. Wicksell also took a long sojourn in Germany, where he made the acquaintance of many of the leading German economists of the time.

On his return to Sweden in 1889 he applied for permission to give lectures in economics at the institution known as Stockholms Högskola—the forerunner of Stockholm University—but the application was turned down. The background for this decision was that the school felt that its relationship to the government authorities could be endangered if it supported someone with Wicksell's convictions. Instead he gave his lectures to the Stockholm working men's association under the title "Value, Capital, and Rent According to Modern Economic Theories." To begin with, the lectures attracted a large audience—perhaps they expected a new scandal—but it diminished as the lectures went on. His lecture notes later grew into his first major book, *Über Wert, Kapital und Rente* (*Value, Capital, and Rent*), which was published in 1893.[2]

1889 was also in other respects a memorable year in Wicksell's life. He met a Norwegian woman, Anna Bugge, who became his lifelong companion although they never married. His radicalism had led him, as a matter of principle, to a rejection of the institution of marriage, and Wicksell was a firm adherent to the view

---

[2] It is of interest to note that Wicksell, whose native language was Swedish, published his most important scientific work in German, not English, which was also a language that he mastered well. One reason for this appears to have been that his first book was strongly inspired by Böhm-Bawerk's capital theory, which made it natural to write in German. But another important and more general reason was that in Wicksell's time both Swedish and other Nordic academics had much closer intellectual contacts with the German universities than with those of the English-speaking world.

that one's convictions ought to guide one's personal life. He became a controversial person in the public life of Sweden, and his tendency to issue provocative statements led to a number of disputes and controversies throughout his life.[3] But the decade of the 1890s was also his most productive scientific period. He obtained his doctorate at Uppsala University in 1895 on the basis of a dissertation on the economics of taxation that was later turned into the book *Finanztheoretische Untersuchungen* (Investigations in Fiscal Theory, 1896). His third major theoretical treatise, *Geldzins und Güterpreise* (*Interest and Prices*), was published in 1898. His last book was *Föreläsningar i nationalekonomi* (*Lectures on Political Economy*), which came out in two volumes in 1901 and 1906. After his retirement he remained active and continued to publish academic articles until the time of his death.

Wicksell's attempts to build an academic career met with a number of difficulties. Having obtained his doctorate, he applied for several university positions in economics, but his applications were turned down on formal grounds. Economics was part of the faculty of law, but as Wicksell did not have a law degree the university regulations did not allow him to be appointed to a professorship in this faculty. When he was at the end of his forties he therefore began to study law and obtained his degree after three terms of study. This removed the formal obstacles to his university career, and in 1899 he was appointed to the chair of economics at Lund University.

Wicksell exerted a great influence on Swedish economists. It was perhaps not so strong during his time in Lund, where he was mostly occupied with undergraduate teaching, but when after his retirement in 1916 he moved to Stockholm he was in close contact with the younger generation of Swedish econo-

---

[3] Here is a couple of examples: In a talk that he gave in 1892 he argued that the economic resources used on Swedish defense was a complete waste, since the country would in any case not be able to withstand an attack from one of the great powers; at the time it was Russia that was thought to be a threat to Swedish independence. Wicksell proposed that the resources used on defense should rather be used on social spending, and that Sweden ought to seek military protection as part of the Russian Empire, where the country would function as a civilizing force. In 1908 he was sentenced to two months' imprisonment for blasphemy, following a lecture where he had ridiculed the relationship between the Virgin Mary and the Holy Spirit.

mists. Among them were Bertil Ohlin, Gunnar Myrdal, and Erik Lindahl, who were central participants in what was to become known as the Stockholm School in macroeconomic theory, and who also made other important contributions in many different areas of economics.

Production and Distribution

The intellectual basis for Wicksell's interest in economics was the issue of population growth and the social problems that he considered to be directly related to it. It was therefore natural for him to emphasize the central place that the population problem ought to occupy in the science of economics. Thus in the first volume of his *Lectures* he writes:

> In actual fact, it is impossible to consider economic problems profitably, whether they are of a practical or theoretical kind, unless we constantly keep population and its changes in view. (Wicksell 1901; 1934, p. 6)

This is clearly an overstatement, and in Wicksell's writings there are many examples of analyses that have no special connection with the problem of population. The quotation should therefore be interpreted as a testimony to Wicksell's deep concern about the problem rather than a statement of research priorities. As a matter of fact, Wicksell's standing in the history of economic thought bears little relationship to his work on population.

One of the key features of the breakthrough of marginalism was the increased interest in the study of consumption demand in contrast to the classical economists' focus on the costs of production as determinants of prices. With the work of Gossen and the later marginalists the analysis of demand was derived from the theory of utility maximization. Gradually, there also emerged a theory of producers as profit maximizing agents, but this part of the theory lagged behind that of the consumer. One of Wicksell's major contributions was to generalize and develop the theory of production and firm behavior, and this also led him to the study of the pricing of the factors of production and the distribution of income in a market economy.

Wicksell's innovations in the theory of production and distribution were first presented in *Value, Capital, and Rent*, and it was

further elaborated in his later work, both in articles and in volume 1 of his *Lectures*. He was among the first to formulate the concept that we now know as the production function: the mathematical representation of the connection between the volume of output and the input of factors of production. Wicksell assumed that this relationship was such that a small decrease in the input of one factor of production could always be compensated by a small increase in the input of another factor so as to hold production constant; in more technical language, he assumed that there was continuous substitution between the factors of production. Taking this as his point of departure, he showed that profit maximization under perfect competition, where the firm takes both commodity and factor prices as given in the market, would imply that the value of the marginal productivity of each factor of production is equal to its price. The assumption of continuous substitution implies that the firm's demand for factors of production will change with even small changes in factor prices, and this perspective on production decisions became established as an important characteristic of marginalist theory. Because both Wicksell and other representatives of this approach emphasized its connection with the economic theory of the classical economists, it became common to refer to the theoretical framework that was worked out around the turn of the nineteenth century as *neoclassical economics*. This framework continues to form the basis of much of modern economic theory.

The condition that the value of the marginal productivity at the optimum of the firm must be equal to the price of the factor of production was also interpreted as a hypothesis about the determinants of factor prices. In particular, it can be read as saying that wage rates for different types of labor are determined by their respective marginal productivities, and in this interpretation it became known as the marginal productivity theory of income distribution. However, it is not a complete theory. The condition can be used to show how firms' demand for labor depends on commodity prices, wages, and the prices of other factors of production, but in order to arrive at a complete theory of wage formation we must also have a theory of the supply of labor—and more generally of the supply of factors of production. As regards the supply side, Wicksell's analysis was less systematic, but there is little doubt that he was aware of the limitations of the

marginal productivity theory. Thus, in his *Lectures* he discusses how technical progress must be assumed to increase the marginal productivity of labor and therefore tend to raise wages. However, he believed that it was doubtful whether there really had been a significant increase in wages over the last two hundred years, and the main reason for this was the growth of population:

> Such an increase [in population] must, other things being equal, continually reduce the marginal productivity of labour and force down wages; or—what comes to the same thing, though the connection is easily overlooked on a superficial view—*prevent* the otherwise inevitable *rise* in wages due to technical progress. (Wicksell 1901; 1934, p. 143)

This argument shows a clear understanding of the interaction between demand and supply in the determination of wages and income distribution. The increase in the marginal productivity of the laborers has led to an increase in the demand for labor, but this has wholly or partly been offset by an increase of labor supply.

Nevertheless, there is no doubt that marginal productivity theory is a central element in the theory of income distribution. Once wages have been determined, the firms' supply of commodities and demand for labor will determine the share of the total value of output in society that will accrue to the various categories of labor and other owners of factors of production such as capital and land. An interesting question is now whether the sum of these shares will be equal to one. In other words, will the total income of factor owners be equal to the value of output, or will some of the value remain in the form of pure profits? The latter alternative is not a very attractive one in the theory of income distribution, for even pure profits must in the final instance be due to some factor of production that should therefore be included in a theory of price formation for the factors of production.

Wicksell pointed out that the sum of factor shares would be equal to one on the assumption that there were constant returns to scale,[4] such that, for example, a doubling of all inputs leads to

---

[4] With constant returns to scale, the production function must in mathematical terms be a linear homogeneous function. Wicksell (1901; 1934, p. 128) takes as an example ("among the infinite number") of such functions $P = a^{\alpha} b^{\beta}$, where

a doubling of output.[5] In this case the average cost will be constant, and then marginal cost will have to be constant also. But if this is the case there is no well-defined optimum for the individual firm; optimal output is either zero, infinite, or indeterminate according to whether the market price of the product is less than, greater than, or equal to the marginal cost. This raises the question of how one can reconcile the requirements for a logical theory of income distribution with the theory of profit maximization at the level of the individual firm.

Wicksell presented an elegant solution to this problem. He assumed that the average cost curve of the individual firm was U-shaped, first decreasing and then increasing. Along the falling part of the curve there will be increasing returns to scale, while along the rising part returns to scale will be decreasing. At the minimum of this curve the average cost is at its lowest level, and *at this point* there are constant returns to scale. But this point is also the one to which competition will force firms to produce, for as long as the price is higher than the minimum of average cost, there will exist pure profits that will encourage new firms to enter the market, causing the price to fall. Therefore, for the industry as a whole, assuming that it consists of firms with identical cost structures, there will in the long run be constant returns to scale, even if the individual firms have U-shaped cost curves.

The equality between wage and marginal productivity is an important element in the theory of wages in a competitive economy. But to *explain* wage formation and income distribution is obviously not the same as *defending* it as a principle of just distribution of resources in society, and Wicksell never used the mar-

---

P is the volume of production, a and b are the inputs of two factors of production, and α and β are positive constants so that $\alpha + \beta = 1$. This is the well-known Cobb-Douglas function, named after two Americans who used it as the basis for an empirical study of productivity as late as 1928. Its name may therefore be considered a historical injustice, but it should be kept in mind that volume 1 of Wicksell's *Lectures* was not translated into English until 1934.

[5] This had also been shown by the English economist Philip Wicksteed (1844–1927), who pointed out that the conclusion could be derived from the mathematical result known as Euler's theorem for homogeneous functions. Stigler (1941; 1994, chapters 3 and 12) surveys Wicksteed's work as well as the discussion between some of the leading economists of the time about the relevance of Euler's theorem in this context.

ginal productivity theory as an ethical justification for the market determination of income distribution. However, the American economist John Bates Clark (1847–1938) actually argued in favor of this view. His contention was that a just distribution of income ought to give to each the fruits of his own labor, and wages that reflect marginal productivity were, he argued, consistent with this principle. Whatever one may think about the ethical premise of Clark's argument, it has some obviously weak points in terms of economics. One problematic aspect is that a person's marginal productivity depends not only on his own labor but also on that of others and on the input of nonhuman factors of production. Does he have the right to the fruits of these inputs as well? In the history of thought, what Clark achieved in terms of original contributions to economic theory has tended to be overshadowed by this confusion of descriptive and normative analysis. He also became a target for those critics of economics who were convinced that economic theory was simply an apology for the institutions of the market economy and the existing distribution of income. These critics would have been led to think differently if they had read Wicksell instead of Clark.

Capital and Interest

When during his visits abroad in the 1880s Wicksell began his systematic studies of economic theory, Böhm-Bawerk's work on capital theory (see chapter 8) made a strong impression on him. However, he was no uncritical admirer of the Austrian economist. He was convinced that the problems that Böhm-Bawerk raised could only be satisfactorily solved by a mathematical approach to the theory. More particularly, he was critical to Böhm-Bawerk's attempts to measure the capital stock of society by calculating the average period of production. Wicksell worked out an alternative theory of capital and investment that laid a more solid foundation for an assessment of the aggregate capital stock of the economy.

In volume 1 of his *Lectures* Wicksell presented the essence of this theory in the form of an example concerning the storage of wine. We are asked to imagine a vineyard where the grapes have just been harvested; through storage a barrel of grape juice will gradually develop into wine. The quality of the wine and there-

fore its price will increase with storage, at least until a certain point in time. The store of wine is accordingly the capital of the vineyard. Let us for the sake of the argument suppose that the owner of the vineyard has financed the cost of the barrel of juice (the purchase of the barrel, the wages of the harvesters etc.) by borrowing the necessary amount of money at a given rate of interest, r. The present value of a barrel of wine that has been stored for T years is the value of the wine at time T, discounted to the present by r. The question now is: How long is the optimum storage time? In other words, what is the most profitable time to sell the wine? Suppose that the percentage rate of price increase is largest in the beginning of the storage period and that it gradually declines. Wicksell showed that the optimal sales time occurs when the percentage increase in value equals the rate of interest. The economic intuition behind this result is obvious: the percentage rate of price increase is the rate of return associated with an extension of the storage process, while the rate of interest represents the cost. The equality between the two can be interpreted as a special case of the equality between the marginal productivity and the factor price.[6] The higher is the rate of interest, the shorter is the period of storage, and the lower is the price of the wine supplied to the market.

The total stock of real capital is the amount of wine that is tied up in the production process. Because the storage time of the wine is determined by the rate of interest, the value of the capital stock also depends on the interest rate: the lower is the rate of interest, the higher is the value of the capital stock.

As a theory of capital and interest, the theory is incomplete. It explains the accumulation of capital in the individual firm—assuming that we may take the wine-growing example as representative of the more general case—but the rate of interest is taken as given outside the model. Wicksell extended the analysis by assuming that the supply of capital for society as a whole was constant. Then the rate of interest will be determined by the con-

---

[6] The assumption of loan finance is not important for this line of reasoning, since the rate of interest in any case represents the alternative cost of the wine grower. At any point in the production process he will have the option of selling the wine and using the proceeds to buy an interest-bearing asset such as a bank deposit.

dition that in equilibrium the demand for capital must be equal to its supply; if demand is greater than supply the interest rate will go up. But the assumption of a given capital stock is a rather special one. In order to explain the size of the stock we have to consider the supply of capital, and this makes it necessary to work out a theory of saving.[7] To do this was one of the main contributions of Irving Fisher, as we shall see below.

Macroeconomic Theories

Wicksell's analysis of the theories of production, income distribution, and capital formation is closely associated with the core of the marginalist theories that emerged at the end of the nineteenth century. More than most of his contemporaries, however, he was also interested in issues that we would now classify as macroeconomic. One of these was the problem of the general price level. The most generally accepted theory of the price level, both among the classical and the neoclassical economists, had since the time of David Hume been the quantity theory. According to this theory the price level was determined by the money supply. The quantity theory also contained a theory of inflation. If the velocity of money is constant the percentage change in the price level will be equal to the difference between the rates of growth of money supply and the national product. For a given rate of growth in the real economy the rate of inflation will accordingly be determined by the rate of growth of money supply.

In his *Interest and Prices* Wicksell proposed an alternative theory of the determination of the rate of change of the price level. In this theory the rate of interest is the main determinant of the price level, and the central element in the theory is the distinction between the natural and the market rate of interest. The natural rate is determined by the real rate of return on capital, which is assumed to be independent of monetary relationships. The market rate, on the other hand, is determined by the banking system.

---

[7] Moreover, the model does not explain the development of the price of wine over time; the nature of the time path is simply assumed. In order to explain this, the model would have to be further extended to include preferences for wine relative to other consumption goods.

If the banks set the market rate equal to the natural rate the price level will be stable and the rate of inflation will be zero. If the market rate of interest is set lower than the natural rate this will induce increased demand for new capital, and this will lead to a positive rate of inflation. This "cumulative process" will continue as long as the market rate is lower than the natural rate of interest. The process will come to a halt if banks increase the market interest rate or—in the long run—if the natural rate falls as a result of a decreasing rate of return on capital.

In *Interest and Prices* Wicksell also discusses the issue of the most favorable rate of inflation for the economy as a whole. He says that there are many who hold the view that the best state of affairs is a slowly increasing price level, because this eases the burden for all those who struggle with a heavy debt that they have incurred because of lack of foresight. However, he points out, if such a low rate of price increase could be predicted with certainty it would be taken into account in all sorts of contractual relationships, and the result would be that it would have no real effects:

> Those people who prefer a continually upward moving to a stationary price level forcibly remind one of those who purposely keep their watches a little fast so as to be more certain of catching their trains. But to achieve their purpose they must not be conscious or remain conscious of the fact that their watches are fast; otherwise they become accustomed to take the few minutes into account and so after all, in spite of their artfulness, arrive too late. (Wicksell 1898; 1936, p. 3)

Wicksell's view was that if it were possible to completely control the development of the price level, the best would be to have a zero rate of inflation, so that changes in relative prices would take place within the framework of a constant price level. His main argument was that the adjustment of contracts to changes in the price level takes time and leads to unintended redistribution of income between groups in society. Price stability would accordingly be in the interest of the great majority of the population, and it ought therefore to be a natural objective of public policy.

His firm belief in price stability as a goal of economic policy led him to lend his support to the politicians who aimed to neu-

tralize the effects of the inflation during the First World War by bringing the price level back to its prewar level through a period of deflation. In newspaper and journal articles Wicksell emphasized the injustice involved in the wartime inflation: persons who before the war had lent money or taken out life insurance to secure the future of their children were forced to realize that their savings had been reduced by more than a half of its original value. This unintended redistribution of wealth ought in his opinion to be reversed, even if the resulting deflation were to lead to new gains and losses that could not be said to be reversals of past injustices. The norm of a stable price level was a central one in his thinking about monetary questions, and it says much about Wicksell's independent and original mind that this "dangerous radical" should put such great weight on the desirability of a stable value of money.

Just Taxation

One part of Wicksell's contribution that in recent decades has received renewed attention is his normative approach to the study of public economics and to the issue of justice in taxation. In his 1896 book *Finanztheoretische Untersuchungen* he took as his point of departure the distinction in the current literature between two approaches to just taxation, known as the benefit principle and the principle of ability to pay. The benefit principle implies that an individual's tax payment ought to reflect his benefits from the provision of public services; taxes were in other words to be considered as payment for services rendered to them by the government. The alternative was to levy taxes on the basis of the taxpayer's ability to pay. Even if this principle was rarely defined in very precise terms it was often interpreted as lending support to the system of progressive income taxation.

Wicksell's main concern was that the public sector should be organized so that expenditure and tax policies were in the citizens' interest. As a basic principle of budgetary policy he maintained that for a public project to be worthwhile its value, as measured by society's aggregate willingness to pay, should be at least as large as its cost. Given that this requirement was satisfied, it ought in principle to be possible to distribute the increased taxes that the project required in such a way that everyone gained from

it; each citizen would then feel that his gain from having the project carried out was at least as large as his loss from the increase in taxation. This corresponds to the benefit principle, and Wicksell argued that if one abstracts from distributional concerns, it must be clear that it is the benefit principle which is the fundamental criterion for justice in taxation:

> At this point the distribution of taxes cannot and need not be influenced by any other notions of justice. No-one can complain if he secures a benefit which he himself considers to be (greater or at least) as great as the price he has to pay. But when individuals or groups find or believe they find that for them the marginal utility of a given public service does not equal the marginal utility of the private goods they have to contribute, then these individuals or groups will, without fail, feel overburdened. It will be no consolation to them to be assured that the utility of public services as a whole far exceeds the total value of the individual sacrifices. (Wicksell 1896; 1958, p. 79)

How is it possible to ensure that just taxation in this sense becomes a reality? According to Wicksell, there is only one solution to this problem. The public projects and their tax finance requirements—in the form of a concrete plan for the distribution of the tax burden—must be approved by democratic institutions on the basis of unanimity. The requirement of unanimity will ensure that the government is forced to find a distribution of tax payments that gives everyone a share in society's gain. Therefore, when a project has been approved we can be sure that all citizens have gained a net benefit from it. The relationship with Pareto's optimality criterion is easy to see, and Wicksell's thoughts were further developed by Erik Lindahl (1919) who in a more formalized way showed theoretically how the supply of collective goods could be combined with taxes that reflected the individual benefits from public expenditure.[8]

The requirement of unanimity may seem surprising, coming from someone with Wicksell's radical leanings. Will not such a

---

[8] This book by Erik Lindahl (1891–1960) is today regarded as a classic in the theory of public economics; a modern exposition of it was provided by Leif Johansen (1965).

rule prevent all attempts at redistribution between social classes via the public budgets? It is important to realize that Wicksell explicitly says that the principle does not take distributional issues into account, and the concept of "just taxation" must therefore be seen as having a special and rather narrow meaning. It follows also that the principle cannot be used to decide on projects that have a purely redistributive purpose. But Wicksell's view was also that the implementation of this view would give the Swedish working class a much-needed protection against paying an unreasonably high share of public expenditure.

In a later chapter of the *Finanztheoretische Untersuchungen* Wicksell comes back to the question of justice in taxation. He points out that the Swedish tax system contains a number of provisions that are difficult to justify, such as tax relief for capital gains on fixed property, and argues that these should be eliminated (although he does not say how the reforms should be implemented). In other respects, however, he is reluctant to recommend radical redistribution of income via the tax system, and once more he comes back to the benefit principle as the fundamental rule for justice in taxation:

> The propertied classes undeniably include a significant share of a nation's intelligence and economic initiative, and in many a case their preferred position is due at least in part to their own efforts. These classes should not be forced by the ill-considered claims of a precipitant democracy to assume the whole burden of the community's tax load. But neither should the members of the poorer classes ... be called upon to pay for expenditures of whose utility and necessity they cannot be convinced, perhaps for very valid reasons. (Wicksell 1896; 1958, pp. 117–118)

As regards his views on economic policy in general, Wicksell is not an easy person to categorize. His blatant and partly provocative radicalism went together with ideas that are more naturally associated with conservative attitudes. This may explain why it is that his writings have also appealed to some later economists who have had quite different philosophical and political convictions. This is true, for example, of the American economist James Buchanan, whose work will be discussed in chapter 17 below.

IRVING FISHER

Irving Fisher (1867–1947) is the first great name in American economics. Although his family background was a difficult one—his father died of tuberculosis when Irving was seventeen—he managed to complete his education at Yale University where he started by studying mathematics. But he soon became convinced that the life of a mathematician would be one of too much isolation from social and economic affairs. He therefore decided to take advantage of his mathematical training in the study of economics, and he obtained his doctorate with a dissertation that built on the insights of the new marginalist theories; in this he was inspired particularly by Jevons (1871; 1970) and Auspitz and Lieben (1889). When his dissertation was published, Fisher was immediately recognized as a promising economist of the new analytical school. At about the same time he married a young lady who came from a very rich family. Her father's wedding present to the young couple consisted of a year's stay in Europe in addition to a large house in New Haven; Fisher had obtained a position at Yale, where he was appointed professor of economics in 1898.

Like Wicksell, Fisher became an intellectual celebrity of his time. This was not because of any political radicalism, but because he had strong views on a number of different questions like teetotalism, eugenics,[9] health food,[10] and environmental protection. In these areas he wrote a large number of articles and books (one was called *How to Live*) which, although not of great academic interest, testify to his strong social concerns and his

[9] Fisher shared his positive view of eugenics with many of his contemporaries, including other economists both in the United States and elsewhere. The condescending attitude to what he conceived as inferior groups and races was part of his intellectual arrogance that was displayed in statements like the following: "The world consists of two classes—the educated and the ignorant—and it is essential for progress that the former should be allowed to dominate the latter." Leonard (2005) provides an interesting account of how attitudes like this influenced the stand that many American economists took on issues like immigration policy and the minimum wage.

[10] His concern with questions of health may be explained by his personal history. He was infected by tuberculosis toward the end of the 1890s, and the doctors' prognosis was to begin with very pessimistic, but over a period of six years Fisher managed to achieve a full recovery.

inexhaustible energy. His activities in some of these areas also materialized in a series of more or less original inventions such as a new type of sundial and a thermostat heated hospital bed. He was also an active investor in the stock market both on his own account and as an advisor through a financial column that he published in a number of American newspapers. During the course of the 1920s his successful speculations made him a multimillionaire, but he lost everything after the great crash in 1929. The same fate was suffered by a number of people (including members of his own family) who had followed the advice that he gave in his column and that turned out to be much too optimistic in relation to what actually happened on the stock exchange. As he became older his private economic adventures and his propaganda for the various causes that were close to his heart took more and more of his time with the result that his academic activities suffered.

Like Walras and Pareto, Fisher was firmly convinced that in the future economic science would have to be based on increased use of mathematical and statistical methods. In 1930, together with a group of economists with similar convictions (among them Joseph Schumpeter and Ragnar Frisch) Fisher founded the *Econometric Society*, an organization whose purpose was to advance the use of mathematical and statistical methods in economics, and he also became its first president.

Fisher was a prolific writer who often published a book per year as well as numerous articles. Many of these were of a popular nature, but his more serious scientific publications are both in terms of quantity and quality more than sufficient to secure him a prominent place in the history of economics.

Consumer and Producer Theory

The history of the marginalist breakthrough contains many examples of theoretical innovations that were achieved at about the same time by several theorists, and Fisher's doctoral dissertation *Mathematical Investigations into the Theory of Value and Prices* (1892) must clearly be regarded as one of the pioneering works of the period. He was one of the first to use indifference curves in economic theory, although Edgeworth was even earlier in introducing this important concept. However, Fisher was the first

283

to draw the now well-known diagram where the indifference curves are combined with the budget line of the consumer, and where the optimum is located at the point of tangency between the budget line and an indifference curve. He also made a similar construction for the production side where he showed that profit maximization implied that the marginal rate of transformation between two goods—the ratio of their respective marginal costs—must be equal to the ratio of their respective prices. Thereby he had in place two central building blocks for a general equilibrium model, and he brought them together using relations that showed the flows of commodities and factors of production in the economy.[11] In some ways, however, the model was incomplete; thus, it did not really take account of price formation in the factor markets, and in this respect it was less satisfactory than the general equilibrium model of Walras.

The model in Fisher's dissertation was set in the framework of a single period. Accordingly, it could not be used to analyze questions regarding the allocation of resources over time, although these are obviously very important for the understanding of the functioning of a market economy. Jevons and Walras had both analyzed such problems; however, Jevons's treatment was very sketchy while that of Walras, on the other hand, was so general that the fundamental ideas were difficult to understand. It was in this field of economic theory that Fisher was to make his most important contribution.

Saving and Investment

Fisher's theory of capital and investment became an important element both in economics in general and more particularly in the field of finance. The theory was developed in three books. In *The Nature of Capital and Income* (1906) he presented the basic theoretical concepts, including the accounting relationship between concepts like capital and investment, current income,

---

[11] He also designed a mechanical construction in the form of a model that was built of glass and filled with water of different colors, intended to show the equilibrium of the economy. By experimenting with shifts of the demand or supply functions one could demonstrate how this led to changes in relative prices and the distribution of income. The model was located in the basement of his house in New Haven where it was displayed to students and colleagues.

and present value. The formal theory of saving and investment decisions and equilibrium in the capital market was contained in *The Rate of Interest* (1907) and *The Theory of Interest* (1930). It is in the latter book that the theory appears in its fully developed form with diagrams and mathematics, detailed interpretations and empirical examples.

Fisher wished to build his theory of saving and investment decisions on the assumption of rational behavior. He therefore started from the analysis of a consumer who has preferences over consumption in different periods of time. He simplifies by assuming that there is only one consumption good, to be considered as an aggregate of all goods that the consumer is interested in, and two time periods. In the simplest version of the theory, there is a given amount of labor income in each of the two periods, while the consumer faces a "perfect" capital market in which he can borrow and lend at the same rate of interest. Fisher shows that these assumptions imply a budget constraint for the consumer, in which the present or discounted value of consumption must be equal to the present value of labor income. The consumer's decision problem is to choose the point on the budget line that maximizes utility, which turns out to be the point of tangency between the budget line and an indifference curve—similar to the general analysis in his *Mathematical Investigations.* At this point the consumer's marginal rate of substitution between present and future goods—his rate of time preference—is equal to the rate of discount, defined as *1/(1+r)*, where *r* is the rate of interest. The rate of discount can be understood as the present price of a dollar's worth of consumption goods one year from now: if the interest rate is 5 percent and we wish to save for the purpose of buying a commodity that next year will cost 1,000 dollars, we have to save 1,000/1.05 which is roughly equal to 950 dollars. The present price of a dollar's worth of consumption next year is therefore approximately 0.95 dollars.

The indifference curves between present and future consumption depict what Fisher called the consumer's rate of time preference, and which he sometimes also referred to as impatience. Previously, Böhm-Bawerk had maintained that human nature was characterized by systematic underestimation of future needs, but Fisher did not take a stand on this issue. He does not exclude that there may be such a tendency, but in his own analysis the

rate of time preference will depend on the time profile of consumption. If one initially finds oneself in a state of high present consumption and low future consumption, one will value an increase in future consumption more highly than if one had been in the reverse situation. As he puts it: "Impatience may be and sometimes is negative!" (Fisher 1930, p. 67). He also offered some speculations about the more fundamental causes that determine people's time preferences. He concluded that

> the rate of interest is dependent upon very unstable influences many of which have their origin deep down in the social fabric and involve considerations not strictly economic. Any causes tending to affect intelligence, foresight, self-control, habits, the longevity of man, family affection, and fashion will have their influence upon the rate of interest. (Fisher 1930, p. 505)

In Fisher's formal analysis the basic motive for saving is to reallocate the income available in the two periods so as to bring them in line with the time preferences. Thus suppose that one has a preference for an even level of consumption over time while one has a high present labor income that is expected to fall in the future. Then it is optimal to save some of one's present labor income because the reduction of present consumption will be more than compensated by the increase of consumption in the future. With this analysis Fisher laid the foundation for modern theories of life-cycle saving and permanent income; current consumption is determined not by income in the same period but by *lifetime* income.

The model can be further extended to include an analysis of investment, and Fisher assumes that the representative consumer can now also invest in real capital. The capital produces consumption goods for the future with a positive but decreasing rate of return. How much is it rational to invest in real capital? Fisher shows that the rational amount of investment—the amount that maximizes consumer utility—is that which maximizes the present value of the investment, which corresponds to the point where the marginal productivity of capital is equal to the rate of interest.[12] An interesting feature of this conclusion is

---

[12] In Wicksell's analysis this corresponds to the case where the percentage increase in the value of wine is equal to the rate of interest.
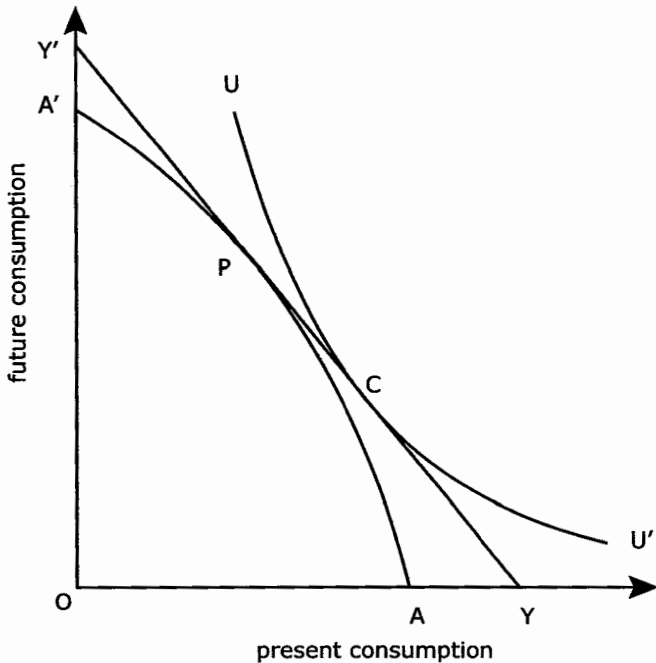
Figure 12.1. Fisher's theory of saving and investment. A consumer with an initial income corresponding to OA can carry out real investment along the curve AA'. When the market rate of interest is given by the slope of the straight line YY', it will be profitable to invest until the point P, where the marginal productivity of capital is equal to the rate of interest. The present value of the consumer's income now and in the future then becomes equal to Y. However, this time profile of income does not yield an optimal time profile of consumption. To achieve this, the consumer will take up a loan, thus moving along the line YY' from P to C, which is the consumption profile that maximizes utility.

that the optimal amount of investment is independent of the consumer's time preferences. If the real investments in the economy are decided by private firms, these will act in the interests of the consumers or owners as long as the objective of the firm is to maximize the present value of its investment; this is the policy that maximizes the individual consumer's lifetime income and thereby his utility.

Fisher completed his analysis by showing that it could also be used to study equilibrium in the capital market. In a closed econ-

omy where there are no financial transactions with foreigners the value of total claims must be equal to the value of debts. The rate of interest is determined by this condition and the marginal productivity of capital. In equilibrium the marginal productivity of capital is equal to the rate of time preference, and both become equal to the rate of interest.

Fisher's formulation of these relationships turned out to be very fruitful in terms of further research. The basic structure of the theory is a simple one and has proven to be easy to adjust to incorporate alternative assumptions to those underlying the original version. In its analysis of the role of capital in the economy it avoids the special features of Böhm-Bawerk's average period of production or Wicksell's wine example, and it does not rest on particular assumptions concerning the time preferences of consumers. When modern students first get acquainted with the theory of saving and investment, it is essentially Fisher's model that they get to study, and the version contained in their textbooks is in fact quite similar to the original one.

The Quantity Theory of Money

The question of the role of money in the economy was one of Fisher's main research interests. With respect to the basic theoretical approach he was an adherent of the quantity theory. This theory found a compact expression in the so-called quantity equation,

$$MV=PY,$$

where M is the quantity of money, P is the price level, and Y is the real value of the national product. V is the velocity of money, the ratio between nominal national income and the amount of money, measured in such a way that it fits with data for the three other factors in the equation. From this point of view the equation is therefore an identity, but it becomes a meaningful theory when one begins to make assumptions about the determinants of the various elements in it.[13] Fisher believed that Y was given by

[13] It is a common belief that Fisher was the first to write down the quantity equation, but the person who should receive the honor for having done this is apparently the American astronomer and economist Simon Newcomb (1835–1909).

the "real" side of the economy, that is, by the production, investment, and consumption decisions of private and public agents. He also thought that V was determined by institutional arrangements like the banking structure and the payments technology, which in his view were likely to stay approximately constant over long periods of time. With these assumptions it followed that the price level was determined by the quantity of money. The adoption of this theory is the natural choice for an economist with a background in general equilibrium theory, since Walras and later Fisher himself had shown that relative prices were determined in an economic model where there was no role for money. The amount of money determined the *absolute* price level, but the price level did not affect the real side of the economy, which was guided by *relative* prices.

For Fisher, however, the simple version of the quantity theory represented only a first approximation to the problem. Fluctuations of the general price level had in his opinion a series of unfortunate consequences for the economy, not least because it led to arbitrary and undesired redistributions of income. Like Wicksell, he believed that a central task for monetary policy should be to hold the price level constant, and with the slogan of "the compensated dollar" he was a keen propagandist for this view.

Fisher also attached great importance to monetary policy for the stabilization of the economy in the face of business cycle fluctuations. With regard to this issue the core concept in his thinking was *the real rate of interest,* which was a measure of the real rate of return on financial assets. This was defined as

real rate of interest = nominal rate of interest - rate of inflation.

The definition could be interpreted in two ways, one backward and one forward looking. The *realized* real rate could be estimated statistically on the background of data for nominal interest rates and the rate of inflation. However, for current decisions about saving and investment the relevant magnitude would be the *expected* real rate, and since this was based on firms' and consumers' views about the future it was not directly observable. On the basis of his studies of historical statistics, Fisher concluded that the realized real rate tended to increase during upturns and decline during downturns·of the business cycle. Ideally, one could imagine that the nominal rate quickly adjusted to changes in the

rate of inflation, so that the real rate would stay constant. But Fisher's view was that this process in fact tended to take considerable time, and he maintained that an important reason why the crisis in the 1930s lasted so long was that the real rate of interest continued to stay at a very high level, acting as a brake on the investment activity in the economy.

Fisher's interest in monetary economics also led him to concern himself with the measurement problems that arise when one works with highly aggregated magnitudes for the economy as a whole, and problems of this kind emerged in particular in the attempts that were made to verify the quantity theory of money. How are we to measure the real value of the national product, Y, and the price level, P, when there are thousands of goods and services in the economy? The only possible answer is that the aggregates must be computed with the aid of price and quantity indices, and Fisher therefore became deeply engaged in the theory of index construction. "Fisher's ideal index" is still a concept that is currently used in the literature in this area.[14]

Income and Taxes

In *The Nature of Capital and Income* Fisher discussed the real content of the concept of income and arrived at the conclusion that the correct definition of income during a given period, such as a year, was the value of consumption. "True income" is equal to money income as we conventionally think of it (with the addition of the current consumption value of durable goods) minus saving. Going even more deeply into the problem, Fisher argues, income is at bottom our standard of living according to our subjective experience ("enjoyment income"), but this is impossible to measure. On the other hand, we are in fact able to measure the cost of our living standard, and this is just our consumption expenditure. To include saving in the concept of income was in Fisher's opinion double counting, for saving leads to an increase in the real capital of society, which in turn generates new income.

[14] Fisher's ideal index is the geometric average of the better-known indices of Laspeyre and Paasche.

This definition may seem paradoxical. Modern economists are used to thinking of income as being by definition equal to consumption plus saving, and to define income as being equal to consumption is therefore likely to create serious confusion. Even if there was less agreement about the precise content of the concept of income at the beginning of the twentieth century, most economists even at that time found it difficult to accept Fisher's definition. However, Fisher stuck to his definition, and in the 1930s and 1940s he used it as justification for his proposal of a tax reform that would abolish the income tax (as conventionally defined), instead introducing a tax on consumption or expenditure, i.e. "true income." His main argument in support of the proposal, which he described in a number of articles and in a book that he wrote together with his brother (Fisher and Fisher 1942), was that the existing income tax involved double taxation of saving. This led to a weakening of the incentives to save, so that the introduction of a tax on expenditure (which is really an income tax with deductibility for saving) would provide better incentives for saving and capital accumulation.[15]

The advantages of such a tax reform have been much discussed in the more recent literature of public economics, and there is no doubt that Fisher's discussion contained a number of good points. There may have been several reasons why he did not gain the support of his contemporary colleagues, but one of them must certainly have been his insistence on the definition of income as consumption. This led to detraction from the main point of the proposal, and there is now general agreement that the argument for allowing deductibility of saving is completely independent of the definition of income. Those economists who have agreed with Fisher in recommending the adoption of an expenditure tax have therefore not joined him in his proposal for a redefinition of income.[16]

Irving Fisher died in the same year as Paul Samuelson published his pathbreaking *Foundations of Economic Analysis* (1947).

[15] We recall that a similar proposal had been made by John Stuart Mill.

[16] This does not imply that the conventional concept of income is uncomplicated and easy to define. Especially in the literature on income taxation the question of the correct definition of income has been the subject of extensive debate. A historical survey of this debate can be found in Wildasin (1990).

It was the end of an extremely active life as an economist that began with his 1892 dissertation, which was published two years after the first edition of Marshall's *Principles of Economics*. This is a long period in the history of economic thought, whether we measure it in years or in the scientific development that lies between the *Principles* and the *Foundations*.

FURTHER READING

Knut Wicksell's *Lectures on Political Economy* are well worth at least a selective reading for modern economists. Obviously, one reads the two volumes today mostly for their historical interest, but the theoretical exposition is so thoughtful and deep that it is unavoidable that one also gets a better understanding of modern economics. One can form a good impression of the wide scope of Wicksell's writings from the selection of his articles that have been translated into English and edited by Erik Lindahl (Wicksell 1958). The most important theoretical parts of *Finanztheoretische Untersuchungen* can be found in English translation in the book by Musgrave and Peacock (1958).

Wicksell's life and academic activities have been described in an outstanding book by Torsten Gårdlund (1956), one of the best biographies of an economist ever written. Gårdlund tells the story of Wicksell's life and work on the background of the social, political, and cultural life in Sweden, but without going into the details of his scientific achievements. A shorter but also very readable biography is Lindahl's introductory chapter in Wicksell (1958).

The Theory of Interest (1930) is Irving Fisher's definitive statement of his capital theory and the best source of forming an impression of his general approach to economics. It builds on his earlier book, *The Rate of Interest* (1907), and also contains a summary of *The Nature of Capital and Income* (1906). It has been written by an author with a great deal of experience in didactic and popular writing: he treats every major problem using a variety of different approaches and often includes summaries that repeat the main points of the foregoing chapters. From a pedagogical point of view, *The Theory of Interest* is a model of good economic writing.

Robert Loring Allen (1993) has written an interesting biography that covers all aspects of Fisher's many-sided activities, and James Tobin has a very good article about him in *The New Palgrave*. An article by Samuelson (1967) presents a personal evaluation of Fisher as an economist, combined with an elegant exposition of his capital theory. Fisher's and other American economists' attitudes to eugenics are described in the fascinating and rather disturbing article by Leonard (2005).