



IRVING FISHER – forerunner of monetarism

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Irving Fisher (1867 to 1947), who J. A. Schumpeter labelled as the greatest theoretical economist of America, significantly contributed to numerous spheres of economic theory and statistics. Perhaps he is most known for his contribution to the development of the modern quantity theory,



the theory of capital and interest, the theory of index numbers and accounting, the "Phillips curve" and economic research methodology.

Fisher was the first American mathematical economist, entrepreneur, reformer and lecturer.

Irving Fisher was born on 27th February, 1867 in Saugerties (New York) and lived in New Haven (Connecticut). Over time Fisher attended gradually schools in Peace Dale (Rhode Island), New Haven (Connecticut) and Saint Louis (Missouri). Just at the time when he had finished secondary school and gained a place at Yale College, his father died, leaving Irving 500 dollars for his college education.

At Yale University he studied mathematics, science, sociology and philosophy. His most eminent teachers were the mathematical physicist J. W. Gibbs, who was most celebrated for his theory of thermodynamics, the sociologist and economist W. G. Sumner, who awakened in Fisher and interest in mathematical economics, and the pioneer in the field of industrial organisation A. T. Hadley. In the third year of his graduate study he completed a dissertation work on the theory of general economic equilibrium, which was evaluated positively by both Edgeworth and Pareto. Fisher was the first to receive at Yale University in 1891 a PhD in pure economics, albeit at the faculty of mathematics. Fisher, in preparing his dissertation work read the works of Jevons, Edgeworth, Menger and Böhm-Bawerk, took a different path in economics than American economists influenced by the German historical school, who in 1887 founded the American Economic Association.

Throughout the whole of his career Fisher stayed at Yale, where he began with teaching mathematics. His first economic lectures concerned the mathematical theory of prices. From 1894 to 1895 he took a sabbatical study tour of Europe, meeting with mainly the leading mathematical oriented economists.

General Equilibrium Theory and the Methodology of Economic Analysis

The first serious question that began to interest Fisher intensively was the theory of general equilibrium, which was in the end to become the topic of his remarkable dissertation work. Fisher's approach was highly original and differed from that of L. Walras's classical theory of general equilibrium. Particular features of Fisher's approach were connected with his interest in the analogy between thermodynamics, which he had learnt of through his teacher J. W. Gibbs, and the economic system. Fisher illust-

He was appointed a full professor of economics in 1898 and worked at Yale University actively up until 1920, afterwards devoting his time mainly to writing books (of his 28 books published 18 dealt with economic theory) and a number of various activities outside the university. He taught only on a part-time basis and therefore had less of an influence on students and, in contrast to other eminent architects of economic science (for example J. M. Keynes); he did not create a distinctive economic school. He finished his limited university teaching activity in 1935.

Biographers of Fisher highlight that he was both an inventor and entrepreneur. His most successful invention was a visible card index system, which he patented in 1913. Financial success led in 1925 to the merger of his firm Index Visible Company with a competitor. Then, however, luck deserted him and in risky operations on the equities market at the end of the Twenties he suffered multi-million dollar losses, threatening, too, his scientific reputation. At the critical time the university granted him financial assistance.

Despite the fact that throughout his life he received significant awards – in 1918 for example he was President of the American Economics Association and in 1930 became the first president of the Econometric Society, which he founded in cooperation with Ragnar Frisch and Charles F. Roos – in the last years of his life his huge contribution to economics and statistics was known only to economic theorists and econometricians; his legacy being resurrected years later in the 1970's by monetarists.

rated the general economic equilibrium system with the aid of a hydraulic-mechanical analogue model, in which he used cisterns, levels, valves, levers and cams. With the aid of this original model he depicted physically how a demand or supply shock in one of tens of mutually interconnected markets changes prices and volumes in all markets and how there thereby occur changes to incomes and consumption preferences of various consumers. Fisher described this model in detail in a publication, though the original as well as the second model of them, which he constructed in 1925, have unfortunately been lost.

Fisher's system of general equilibrium, clarified in his



dissertation work, was a single-period model. Inter-temporal choices were not considered. In his works *The Rate of Interest* (1907) and *The Theory of Interest* (1930) Fisher expanded the theory of general equilibrium to include inter-temporal choices and relations, whereby his model, naturally, became more complex. He therefore abandoned the assumption of the existence of a large number of goods and market participants and proceeded as if there were produced and consumed only the one good in various time periods. In doing so, as well as through his theory of capital and interest, Fisher made a step towards a dynamization of the model of general economic equilibrium.

Fisher mathematically analysed the utility function and its maximisation, where he took into consideration also a corner solution. In his first mathematical approximation as well as in his model he made use additive functions of utility, whereby he attempted to show how this assumption could be used for an empirical measurement of marginal utilities. He later abandoned this approach and began to work from the so-called generalised (Edgeworth) function of utility, which in the end led to a pure logic of choice. From this it resulted that it is necessary to abandon the thesis that the utility of a good depends exclusively on the quantity of the given good: instead, utility depends on the quantity of all goods. The aim of an economist, according to Fisher, is to research the mechanical and mutual interrelationships of the actual process of exchange, and therefore it is sufficient if we start with the objective fact of the existence of prices. In this it is, however, not necessary to deal with the field of ethics and psychology. It is sufficient if there exists a sufficiently large market and the conditions of perfect competition are fulfilled. Fisher's definition of utility did not have a hedonistic character; it merely referred purely to desirability without any tinting by ethics. The significance of Fisher's methodological legacy, its priority in many questions, would however probably have been greater if Fisher had not overloaded his analysis by such a large number of mechanical diagrams.

Fisher's methodological contribution to the field of statistics and accounting was of exceptional significance. For example, he did not see statistics merely as a useful instrument, but rather as an essential component of economic analysis. In his works *The Best Form of Index Numbers* (1921) and *The Making of Index Numbers* (1922) he sought a best index number formula, while he elaborated and classified hundreds of formulas, which he subjected to various tests. Fisher's ideal index was a geometric average of the Laspeyres and Paasche index ($I_F = \sqrt{I_P \cdot I_L}$). As for accounting, J. A. Schumpeter (1967) evaluated highly Fisher's works *Appreciation and Interest* (1896) and *The Nature of Capital and Income* (1906), which he characterized as the first economic theory of accounting ... as the basis of modern income analysis. These works comprise an analysis of continuous and discrete compound interest, nominal and real interest rates, deal with the difference between high and growing prices and its implications in

observing interest rates; differences between interest rates expressed in various numéraires; interest rates for various maturities; expected and unexpected appreciation; concurrent payment flows, etc. Of great benefit for improving the precision of economic analysis was his differentiation between stocks and flows, on the basis of which economics made a further step towards becoming an exact science.

In various works he dealt with the theory of capital and income. He saw the idea of capital in the fact that it brings income. The interrelationship between real capital and the value of capital he determined with the aid of the size of the income and the interest rate. He connected capitalisation of income according to the current interest rate with capital as a fund: the value is according to Fisher determined in the process of discounting to the present. An interesting idea of Fisher is that in actuality there exists no principal difference between interest, rent or other categories of flows.

In his work *The Theory of Interest* (1930) Fisher further elaborated the idea of discounting in time (in connection to this he used the term "impatience") and the concept of investment opportunities. In making a clarification of interest he also used the term "marginal rate of return over cost", which according to Keynes is essentially identical with his own definition of the marginal efficiency of capital.

Monetary theory: the equation of exchange and the quantity theory

In the 1900's Fisher was the foremost American monetary economist. Similarly as in other fields of economics, in his theory of money he linked theoretical analysis with empirical research, this both on a historical, as well as statistical basis, where his theoretical analysis found its form in a proposal for several monetary reforms.

Perhaps most frequently mentioned in economic literature is Fisher's contribution to the development of a quantity theory of money, where his name is linked to the most celebrated version of this theory, i.e. the transaction version. It is true that Fisher, who dealt with these questions in his work, *The Purchasing Power of Money* (1911), was not the first economist in formulating the equation of exchange, which is based on the quantity theory. This prize went to the eminent American mathematician and economist S. Newcomb (1885) and therefore is often called the Newcomb-Fisher equation. This equation links the price level (P) with (1) the quantity of money in circulation (M); (2) its velocity (V) and (3) the physical volume of commercial transactions (T). According to Schumpeter this relationship is expressed as the function $P = f(M, V, T)$.

The Newcomb-Fisher equation is written as

$$\begin{aligned}
 & MV = PT && (1), \\
 \text{or} & MV = M'V' = PT && (2).
 \end{aligned}$$



The equation $MV = PT$ represents an identity, in which the left-hand side corresponds to the transfer of money and the right-hand side describes the flow of goods, services or securities (thus transactions) for a year. The equation of Exchange is according to J. Tobin an identity because it is correct by definition.

Fisher, naturally, realised the heterogeneity of transactions and therefore wrote the equation of exchange also in the form $MV = \sum p_i Q_i$, where p_i and Q_i are individual prices and quantities, each transfer of goods, services and securities is understood as the product of price and quantity – weekly wages times the number of weeks, the price of a good times the number of units of the good, the price of a share times the number of shares, etc. The right-hand side of the equations (1) and (2) is thus an aggregate of payments realised during a given time interval. Fisher's equation of exchange includes all transactions, concerning money, intermediate products and services, old goods, as well as newly produced commodities – thus services, financial assets as well as goods (GDP).

Equation (2) differs from equation (1) in that it divides the quantity of money into two categories – money in circulation (including coins) and checking deposits. Similarly, the velocity of money differs. In equation (2) thus M' again represents the volume of deposits and V' their velocity. Both equations of exchange are identities. They are a special application of double-entry bookkeeping, which records each transaction on both sides of the equation. The distinction of M and M' , or V and V' was a step forwards away from the previous practice, in the case of which this distinction was considered only with government-issued (via central bank) currency as money. (In modern terminology in this connection there is used the term monetary base or high-powered money).

How however is the quantity theory derived from the equation of exchange? Fisher argues that the real volume of transactions T , for which money is necessary is an exogenous constant – velocities are determined by institutions and habits, where these are independent of other variables in the equation; the division of the money supply (i.e. the monetary base in current terminology) into currency and bank reserves is stable and independent of variables in the equation; banks have completely loaned up their free resources, so that deposits M' are a constant multiple of reserves determined by the prudence of banks and regulation; exogenous changes in the money supply itself are the main source of shocks, in consequence of which (if the stated conditions are fulfilled) the price level P changes proportionally.

Fisher undoubtedly deserves the credit for the renaissance of quantity theory, the mathematical form of which

became an important instrument of macro-economic analysis. Fisher highlighted the importance of institutions and habits, which generate demand of a society for transaction resources in relation to the volume of transactions. In this he emphasised correctly that income resources and payments are imperfectly synchronised. He looked for factors determining velocity in the frequency of wage payment and re-payment of bills, as well as in the level of vertical integration of firms. His claim that money velocities are exogenous constants rested on his conviction that institutional changes in the social and economic structure occur very slowly.

Fisher in his work *The Purchasing Power of Money* reached the conclusion on the need to stabilise the value of money, formulating a proposal for the introduction of a so-called compensated dollar. His reform proposal was based on the gold-exchange standard combined with a rule of mandating periodic changes in the official buying and selling prices of gold inverse to changes in a designated price commodity index. In other words, the gold content of the dollar should be changed in accordance with the official price index, in consequence of which the dollar would have the same purchasing power. The compensated dollar should thus have corrected fluctuations in the purchasing power of money under the assumption that the respective international agreements are concluded. (A similar, but less formal proposal than Fisher's for the USA was recommended by J. M. Keynes for the United Kingdom in 1923). Fisher's proposal is interesting also in the fact that it was one of the first examples of an economic-political regulation. The idea of a policy rule at that time was much less popular among Fisher's contemporaries than it is among economists nowadays.

The "compensated" dollar was only one of Fisher's proposals for stabilisation of the price level, or respectively, for ameliorating the effect of unexpected changes in it. In the 1920s Fisher took on a crusading campaign for 100% reserves against checkable deposits. This concerned his work *Stabilizing the Dollar* (1920) and in particular *100% Money* (1935). (Coincidentally, we encounter a similar project in the works of H. Simons and M. Friedman). According to his proposal banks should hold 100% reserves against deposits, which in fact would have limited checkable deposit circulation through a framework of given amounts of monetary cash at banks. Implementation of this plan should have excluded bank collapses and ensured a more thorough control over the quantity of money in the economy. Critics of Fisher's proposal however pointed to the fact that implementing this reform would have led to strong deflation.

Fisher's (similarly as later Friedman's) proposals of monetary reforms did not gain the wide support of the economic public. According to Schumpeter Fisher's enthusiasm for monetary reforms even went so far as to divert attention from his actual scientific proposition.

¹ Despite this Schumpeter (1967) states that this equation does not represent an identity but a condition of equilibrium. He argues that according to Fisher MV is not the same as PT . "The really interesting monetary analysis begins only behind the façade of this equation".

Macro-economics: Business cycles and the Great Depression

Fisher's contribution to macro-economics was by no means limited to his transaction variant of quantity theory. In Fisher's work however we do not find a systematic interpretation of macro-economics, his macro-economic analysis is however much broader in comparison with simple monetarism.

In text books on macro-economics we encounter first and foremost Fisher's equation, which links nominal interest i , real interest r and inflation π .

$$i = r + \pi$$

More often than not the relationship of interest rates and inflation is not understood correctly. Like the equation of exchange this equation is primarily an identity, from which may be calculated, for example, the unobservable (and thus unknown) value r from comparisons of the other two variables. For Fisher, however, it was more interesting to use this relationship as a condition of equilibrium in financial markets. It is true that for this purpose π must be replaced by the expected inflation π^e , which is another unobservable constant. Fisher reached the conclusion that in the long run steady-state equilibrium would also be characterised by equality of actual and expected inflation ($\pi = \pi^e$).

Fisher's equation is today often used in support of the thesis that inflation is completely and immediately fed through into nominal interest rates. Fisher, however, saw this process differently. Firstly neither Fisher's theory of interest nor his research of the respective historic data led to the conclusion that equilibrium real interest rates should be constant. He also believed from publishing his work in 1896 that the adjustment of nominal interest rates takes course over a longer time. This conclusion was supported by his empirical research and regressions, in which he modelled the forming of inflation expectations with the aid of distributed lags of actual inflation. In a transitional period during which adjustment occurs inflation would lower real interest rates, nominal rates would however adjust incompletely. He ascribed the Great Depression to high real interest rates resulting from price deflation.

A thorough analysis of price data demonstrated to Fisher that some prices are more flexible than others, where money wages tend towards the more sticky side of the spectrum. Imperfect flexibility of the price level means that T on the right-hand side of the equation of exchange absorbs some changes on the left-hand side.

In the early 1930s Fisher reached a very modern conclusion regarding the relationship between unemployment and inflation. If the economy adjusts to the level of prices, the real variables such as production and employment, according to Fisher, become independent of the level of prices. They are not however independent of the rate of price changes, they depend positively on the rate of infla-

tion. Through this we, naturally, reach the monetarist form of the Phillips curve, of which Fisher was the first pioneer. In the article A statistical relation between unemployment and price changes (1926) Fisher actually calculated a "Phillip" correlation and approached some way towards an accelerationist position, because he became aware of the difference between the real and expected inflation. His main economic political conclusion was that stabilization of the level of prices enables also the real economy to stabilise.

During the Great Depression, which personally affected him greatly, he formulated a new theory of the business cycle which significantly differed from his older simple monetarist version. He described his new theory as a "debt-deflation theory of depression", the main features of which may be summarised as follows:

Schumpeter's innovations financed by debt stimulate a boom and subsequent recession, which may then change into a depression by means of an unstable interaction between the burden of an excessive real debt and deflation. This approach, naturally, is in contrast to the Pigou effect of real balances, according to which prices declines operate as a mechanism restoring the full employment equilibrium. According to Tobin, Fisher's conception, which creates room for monetary as well as credit cycles, corresponds better to reality. It is true that Fisher's theory was not a purely monetary theory of cycle and in it attention was also paid to important non-monetary sources of disturbance. In his works on capital and interest Fisher laid down the basis for equations of investment and savings, which have a key position in macro-economic models. J. Tobin even goes as far as to say that Fisher could have become an American Keynes', were these conceptions have been joined together into a coherent theory. Neo-classical synthesis would not have had to wait until the post-war period – Fisher would have done everything himself.

In practical terms Fisher's economic political message at the start of the 1930s was less reflation, which should have restored the desirable level and structure of prices .

At the start of his scientific career Irving Fisher rejected the expansion of the economic role of the state – in particular control of corporations, unemployment benefit and other social measures, in which he saw the threat of socialism. His opinions changed only in the 1930s, when he reached a conclusion on the need for a more balanced distribution of incomes and expressed himself as being against the application in economic policy of the pure form of laissez-faire. He did not consider inheritance tax to be an instrument of state subjugation, but rather a path towards the expansion of economic democracy. He viewed in a similar light also the diffusion of share ownership. Although Fisher did not place emphasis in his works on the questi-

² Reflation represents a type of inflation which occurs following the end of a depression or recession. Reflation restores the preceding price structure, which is achieved by means of fall in the purchasing power of money with the aid of monetary policy instruments.



on of ownership and its control, his opinions nevertheless approximated to the idea of a mixed economy.

With regard to the enormous breadth and manifold scope of Fisher's scientific, entrepreneurial and other interests he is sometimes viewed as one having wanted to jump in all directions, at the one time. Despite this, he is one of the most significant personalities of economic science of the last century, where greatest credit must go to his contribution towards the development of a theory of money. We therefore consider him rightly to be the most influential forerunner of monetarism.

Literature

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The most significant economic works of Irving Fisher:

- Mathematical Investigations in the Theory of Value and Prices (1892)
- Appreciation and Interest (1896)
- The Nature of Capital and Income (1906)
- The Purchasing Power of Money (1911)
- Stabilizing the Dollar (1920)
- The Making of Index Numbers (1922)
- A statistical relation between unemployment and price changes (1926)
- The theory of interest (1930)
- Booms and Depressions (1932)
- Inflation? (1933)
- The debt – deflation theory of the great depressions (1933)
- 100% Money (1935)