

FINDING NEW LINKS – FISHER’S EQUATION OF EXCHANGE & NEWCOMB’S EQUATION OF SOCIETARY CIRCULATION

MICHAEL CURRAN

Senior Sophister

The Quantity Theory of Money, though admittedly controversial, is widely accepted as one of the cornerstones of modern economic thought. Michael Curran traces the development of this prominent theory by examining the works of Simon Newcomb and Irving Fisher. In a fitting tribute to two of our great economic theorists, he shows how Fisher’s equation of exchange has built on Newcomb’s equation of societal circulation, ultimately propelling the QTM to the influential position it holds today.

Introduction

The Quantity Theory of Money (hereafter QTM) has appeared sporadically: ‘dating back at least to the mid-sixteenth century Spanish Scholastic writers of the Salamanca School’ (Humphrey, 1997: 71). In 1522, Nicolaus Copernicus first explained the principles on which to base a currency. A more complex version of Copernicus’ simple QTM was provided by the French social philosopher Jean Bodin in 1568. Classical economists stressed the application of the ordinary theory of supply and demand to money in the QTM; given real demand for money, an increase in the nominal supply of money will lower the value of goods that each unit of money can purchase. Irving Fisher emphasised the inverse relationship between this value, i.e. the purchasing power of money, and the quantity of money.

This paper investigates the familiar equation of exchange arising from Fisher’s 1911 *The Purchasing Power of Money* (PPM). The equation of societal circulation, anticipated by Newcomb in *Principles of Political Economy* (1885), is also discussed.

Irving Fisher

Paradoxically popular both at Yale and Chicago today, the theorist-reformer polymath Irving Fisher (1867–1947) chose economics as a career path over mathematics, like Milton Friedman. Fisher’s was the first Yale PhD in pure economics, albeit it was awarded by the faculty of mathematics. His tutors, or advisors, included Willard Gibbs; physicist, and William Graham Sumner; economist.

Irving Fisher’s interest in solving monetary problems led to his developments in econometrics and statistics.¹ Fisher was the ‘greatest expert of all time on index numbers’ (Tobin, 1987: 369) By collecting data globally, Fisher’s Index Number Institute produced price indices from 1923 to 1936. His dedication to increasing the availability of statistical data foreshadowed the emergence of the Penn World Tables in the 1980s.

Robbins (1998) claims that Fisher’s most important work was carried out before the First World War. Despite the originality and innovative nature of Fisher’s work in the 1920s, such as his theory on the affect of the rate of change of prices on output and employment, it failed to attract contemporary attention. This was possibly due to the fact that he published many of these later articles in obscure journals, when highly technical economics had not yet become mainstream (Blaug, 1992).

The Purchasing Power of Money

The purpose of Fisher’s PPM was to explain the five determinants of the purchasing power of money and then apply the theory to the study of historical changes in this purchasing power.² It is a restatement of the QTM, which he asserted as dogma. He discredited economists who questioned the validity of the QTM, e.g. Laughlin, head professor of political economy at Chicago. At the 17th annual meeting of the AEA in Chicago, December 1904, Fisher gave credit to Newcomb: ‘The purchasing power of money is dependent on what Professor Newcomb calls ‘the equation of societary circulation’ (Fisher, 1905: 122). He fervently promoted the QTM:

¹ Some of Fisher’s analyses contain probably the first use of distributed lags in economics.

² Fisher’s *PPM* was dedicated: ‘To the memory of Simon Newcomb ... Great Scientist, Inspiring Friend, Pioneer in the Study of Societary Circulation’.

‘The real problem to be settled is not the quantity theory, which, in the sense that I have described, seems to me, should be accepted at the outset but to proceed further and discover the other quantities in this equation’ (ibid: 124).

Friedman dubbed the transactions version of the quantity equation as the most famous and claims that Newcomb ‘formulated’ it and Fisher ‘popularised’ it (Friedman, 1987). The equation:

$$MV = PT \quad [1]$$

relates the circular flow of money, over a specified period of time in a given economy, to the circular flow of goods. Money is a stock, M , the dimensions of which are dollars. The dimension of V is the number of turnovers per unit time, so MV is a flow. The real value of money-using transactions, T , is a flow since its units are the number of unit quantities per unit time, while P represents the price level. The left-hand side of the equation can be further expanded into payments using either currency, MV or deposits, $M'V'$. The choice of this subdivision depends on whether or not deposits (in addition to currency) are included and on the availability of data on $M'V'$. Fisher identifies five direct influences on the general price-level P : M , M' , V , V' and T . The price-level, P , is the only dependent variable in the equation of exchange:

$$MV + M'V' = PT \quad [2]$$

To derive the QTM from the equation of exchange, Fisher argued the following: T is exogenous; velocities (V and V') are functions of institutions and habits and are independent of the other variables; the relation between M and M' is fairly stable and is also independent of the other variables; and finally, that exogenous changes in currency supply are the principal source of shock. As a result of these conditions, changes in the currency supply move P proportionately. Fisher’s belief in the slowness of institutional change helped to support his notion that the velocities are stable.

Fisher explained his monetary transmission mechanism in *The Purchasing Power of Money* (1911). If the ratio T/V is fixed, raising the money supply will cause the supply of money to exceed demand. People will dispose of their excess supplies of money by increasing their demand for every good. The result is a price rise for all goods, and thus P rises. This process continues until the demand and supply of money are equalised. Fisher’s explanation rationalised

the left-to-right causation whereby prices rise proportionately to meet the higher money supply; this is Fisher's identification of the QTM (Fisher, 1911b). Interestingly, it is the interaction of markets, similar to Keynes' approach, through which an excess supply of money leads to excess demand for commodities.

Two particularly strong assumptions underlie the equation of exchange: first, that the economy is at the natural rate of unemployment; secondly, that V is stable – predictable, but not necessarily constant. The implication of these two assumptions, combined with the equation of exchange, is that 'inflation is always and everywhere a monetary phenomenon' (Friedman and Schwarz, 1963: 592). The policy implications of this analysis, while predating Friedman, may suggest monetary targeting. Firstly, the authorities ought to control the rate of change of money supply. Secondly, with a stable $V = PT/M$, PT should be controlled via M . However, there are two significant problems with this approach. One concerns the stability of V ; if V is unstable, it becomes difficult to control PT via M . The other pertains to problems of reverse causation with M being endogenous, or, even simultaneity – two way causation.

By studying price data, Fisher knew that in reality prices are imperfectly flexible, meaning that T would adjust, absorbing some of the changes on the left-hand side of the equation of exchange. Fisher also discusses non-neutralities of real interest rate movements on the real economy; however, these transitional effects are not emphasised, so as not to detract from his conclusion. Schumpeter (1951) believed that 'the scholar was misled by the crusader'; to promote the compensated dollar, Fisher needed a simple plan for stabilizing purchasing power:

'Had Fisher pulled these strands together into a coherent theory, he could have been an American Keynes. Indeed the 'neoclassical synthesis' would not have had to wait until after World War II. Fisher would have done it all himself' (Tobin 1987: 376).

While Fisher's work is a stepping stone from money to employment, he did not fully integrate his theory of M with that of P and distributive shocks. In order to advocate the QTM, he disguised his recognition of the fact that fluctuations in money temporarily influence V ; hence his hypothesis was that V is an institutional constant. The specific factors determining P were relegated to the background. He did not ignore the volatility of V ; however, P varies directly with M only if V and T are constant and varies in the same proportion only in the 'ultimate' and 'normal' sense.

Much of Fisher's *The Purchasing Power of Money* is devoted to a quest of aggregation, specifically that of making equation [1]³ compatible with:

$$MV = \sum p_i Q_i \quad [3]$$

where p_i and Q_i are individual prices and quantities. Fisher recognized the heterogeneity of transactions. He wanted to find aggregate indexes P and T such that the two forms of the equation would be consistent. His pioneering work in this area led him to choose the Paasche price index in 1911, which is based on future consumption:

$$P_1 = \frac{\sum p_1 Q_1}{\sum p_0 Q_1} \quad [4]$$

over the Laspeyres price index:

$$L_1 = \frac{\sum p_1 Q_0}{\sum p_0 Q_0} \quad [5]$$

Challenged by Cambridge school economists, the popularity of Fisher's *The Purchasing Power of Money* waned soon after it was published. However, Trautwein supports the notion that recent decades have seen a revival of Fisher's ideas: 'Fisherian concepts ... now permeate much of modern macroeconomics, finance and econometrics' (Trautwein, 2007: 609). The issues of index numbers Fisher was concerned with do not appear as important today according to Tobin (1987); similar to Kenneth Arrow's seminal Impossibility Theorem, in 1931 Frisch proved that there cannot exist a price index satisfying the axioms that Fisher believed were sensible. However, there is resurgence in this field; recent works display interest in this area, e.g. Somerville (2004).

³ T is a measure of all transactions involving the offer of money: intermediate as well as final goods and services, old and new goods, financial assets as well as goods. Fisher's preference for a comprehensive measure and concept of T has not been developed to any significant extent by later writers.

Simon Newcomb

Simon Newcomb (1835–1909) was a world-leading astronomer⁴, and a major American mathematical economist preceding Fisher. His interest in economics was first sparked in 1854 by reading Say's *Political Economy*, eventually lecturing in the subject at Harvard. In an attempt to explain why Newcomb's work didn't attract the attention it deserved, Fisher conjectured that:

‘once a man's name becomes associated with a particular department of knowledge like astronomy, any attempts to contribute to other departments encounter a prejudice which it is difficult to overcome’ (Fisher, 1909: 641).

Transforming Newcomb's Equation of Societary Circulation into Fisher's Equation of Exchange

The P in Newcomb's equation of societal circulation:⁵

$$VR = KP \quad [6]$$

refers to the scale of prices, as distinct to particular prices, and hence anticipates Fisher's emphasis on this difference. Instead of Newcomb's ‘rapidity’ of circulation, R, apparently coined by Thornton, Fisher uses ‘velocity’, which suggests natural stability. Newcomb's total volume of currency, V, which is the sum of coins, paper money and deposits, was transformed by Fisher into M and M' with corresponding velocities, V and V', respectively⁶. Emphasised by empirical estimates (Fisher, 1911a, 1911b, 1912, 1913), Fisher's measure of T is implicitly broader than Newcomb's K. He used bank clearings as a measure of M'V'; this measure included large volumes of transactions in financial assets. He mostly discusses changes in T, which refers to changes in output and employment (Fisher 1911a). Newcomb excluded borrowing and lending from his measure of the transactions as well as speculative transactions (Newcomb, 1885).

The national income interpretation is plausible for Newcomb; his identification of K sounds like national output, or income. However, the central theme of his book concerns the nature, determinants and consequences of

⁴ Mentioned in H.G. Wells' *The Time Machine* (1895).

⁵ Fisher's $MV = PT$.

⁶ Bordo (1987) incorrectly refers to Newcomb's V as the total ‘value’ of currency.

production. As an illustration of Newcomb's national income orientation, if there is a one per cent fall in expenditure flow: '... one per centum of the industrial population would be thrown out of employment so long as the scale of prices remained the same as before' (Newcomb, 1885). In contrast, an income interpretation of Fisher's work is not easy to support. Fisher never incorporated national income data into the equation of exchange. The equation is still in transactions form in his *Booms and Depressions* (Fisher, 1932).

For a monetary transmission model, in particular to look at how changes in V affect P , Newcomb created an aggregate demand function:

$$D = \frac{NF}{P} \quad [7]$$

where the flow of the currency, F , is defined as:

$$F = VR \quad [8]$$

Substituting the expression for F into the aggregate demand function yields the equation:

$$D = \frac{NVR}{P} \quad [9]$$

where D is the quantity of goods demanded and N is a fixed constant; hence D is directly proportional to V/P and does not depend on equiproportionate changes in both V and P (Newcomb, 1885). Thus, an increase in V initially leads to a rise in real demand, D , which forces a rise in P and eventually the initial expansion of V causes P to rise by the same proportion; hence, real demand, D , returns to its original level. Money is neutral and the QTM is satisfied since the proportionate change in V and P are the same, with DP responding to DV . V has no effect on the steady state values of the real variables K and R .

Although Newcomb promoted the QTM, he stated the necessary condition that the theory holds only if prices are flexible. If prices are sticky monetary non-neutralities occur as a result of K needing to adjust to bear some of the change in M . Newcomb noted that holding R and K constant, an exogenous rise in price would lead a compensatory fall in K . Despite this, he warned policy makers not to respond to these price increases to guarantee full employment by expanding the money supply, lest inflation would follow. Retrospection suggests an anticipated corollary of this – the short-run Philips curve.

Conclusion

Irving Fisher, the most cited economist in the world in the early twentieth century,⁷ has contributed prodigiously to modern economics. Surprisingly his work has often been regurgitated without accolade.⁸ The quantity equation, as espoused by Newcomb, owes its dominant position in popularity over all other quantity equations to Fisher. Its re-discovery has coloured the field of monetary economics. On the future of the debate concerning the QTM, Friedman's conclusion seems apt:

‘One thing is certain: the quantity theory of money will continue to generate agreement, controversy, repudiation, and scientific analysis, and will continue to play a role in government policy during the next century as it has for the past three’ (Friedman, 1987: 19).

Bibliography

Blaug, M. 1992. *Pioneers in Economics Vol. 41*. Aldershot: E. Elgar.

Bordo, M.D. 1987. ‘Equation of Exchange’ in *The New Palgrave: A Dictionary of Economics* 2:175–177.

Dimand, R.W. and Geanakoplos, J. (eds) 2005. *Celebrating Irving Fisher: The Legacy of a Great Economist*. Malden, MA, Oxford, and Victoria: Blackwell Publishing.

Fisher, I. 1905. ‘Discussion of the theory of money, 17th Annual Meeting of the AEA December 28–30 1904’ reported in *Publications of the AEA 3rd Term* Vol:VI:1:122–5.

Fisher, I. 1909. ‘Obituary: Simon Newcomb’ *Economic Journal* 19:76:641–644.

⁷ See Dimand and Geanakoplos (2005) on different studies of Fisher's rankings in citations.

⁸ The chapter on capital markets in Gravelle and Rees (2004) offers an excellent exposition of an area of Fisher's theory including the ‘Fisher separation theorem’; alas, they have severed his name tag from the entire chapter.

- Fisher, I. 1996. [1911a]. 'The Purchasing Power of Money: Its Determination and Relation to Credit Interest and Crisis' in W.J. Barber (ed.) *The Works of Irving Fisher*. London: Pickering and Chatto.
- Fisher, I. 1911b. 'The Equation of Exchange, 1896-1910'. *American Economic Review* 1:2:296-305.
- Fisher, I. 1912. "'The Equation of Exchange for 1911", and Forecast'. *American Economic Review* 2:2:302-19.
- Fisher, I. 1913. "'The Equation of Exchange" for 1912, and Forecast'. *American Economic Review* 3:2:341-5.
- Fisher, I. 1996. [1932]. 'Booms and Depressions' in W.J. Barber (ed) *The Works of Irving Fisher*. London: Pickering and Chatto.
- Friedman, M. 1987. 'Quantity Theory of Money' in *The New Palgrave: A Dictionary of Economics* 2:3-20.
- Friedman, M. and Schwartz, A.J. 1963. *A Monetary History of the United States, 1867-1960*. Princeton: Princeton University Press.
- Gravelle, H. and Rees, R. 2004 [1981]. *Microeconomics*. Harlow: Pearson Education.
- Humphrey, T.M. 1997. 'Fisher and Wicksell on the Quantity Theory'. *Federal Reserve Bank of Richmond Economic Quarterly* 83:4:71-90.
- Newcomb, S. 1966. [1885]. *Principles of Political Economy*. New York: Harper's.
- Robbins, L. 1998. *A History of Economic Thought: The LSE Lectures*. Oxford: Princeton University Press.
- Schumpeter, J.A. 1956. [1951]. *Ten Great Economists: From Marx to Keynes*. London: Allen and Unwin.

Somerville, R.A. 2004. 'Changes in relative consumer prices and the substitution bias of the Laspeyres price index: Ireland, 1985–2001'. *Economic and Social Review* 35:1:55–82.

Tobin, J. 1987. 'Fisher, Irving' in *The New Palgrave: A Dictionary of Economics* 2:369–76.

Trautwein, H-M. 2007. 'Book review: Dimand & Geanakoplos (eds) 'Celebrating Irving Fisher'' *History of Political Economy* 14:3:607–11.