

THE ORIGINS OF YIELD CURVE THEORY: IRVING FISHER AND JOHN MAYNARD KEYNES

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The purpose of the paper is to rescue Irving Fisher's theorizing of the yield curve (1896, 1907, 1930) from relative obscurity and to contrast it with the better known and equally pioneering theory of John Maynard Keynes (1930, 1936). The paper also adduces evidence that Fed economists and the U.S. monetary experience in the 1920s greatly influenced these authors, both of whom were concerned with the management of the long-term interest rate.

I. INTRODUCTION

The “yield curve,” as it is commonly called in the contemporary literature, represents the yield of high-quality financial assets maturing at different times but that are otherwise identical in all their economically relevant characteristics. Some of the literature reports that Irving Fisher was a pioneer of this theory (Culbertson 1957, p. 486; Malkiel 1966, p. 17; Bisière 1994, p. 27n8; Dimand 1999, p. 745; Dimand and Gomez Betancourt 2012, p. 189) but incorrectly summarizes Fisher's contribution to the theory.¹ For others, the founder was John Maynard Keynes and no mention is made of Fisher (Hicks 1939;

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¹ Culbertson wrote: “Irving Fisher's *The Theory of Interest* developed the relationship between short-term and long-term rates of interest under conditions of perfect foresight that later became the basis of the expectational theory of the term structure” (1957, p. 486). Culbertson had an incomplete vision of Fisher's contribution to the theory of the term structure of interest rates. A first mistake is that Fisher's theory did not appear initially in *The Theory of Interest* (1930) but in “Appreciation and Interest” (1896). Second, Fisher did not only present a version in which risk is absent. The risk is of an unexpected change in the value of money, as we shall explain in this paper.

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Lutz 1940; Masera 1972; Modigliani and Sutch 1966).² Fisher and Keynes themselves did not dwell on their respective contributions although they both published books in the same year (1930).³

In *The Theory of Interest* (Fisher 1930) and *A Treatise on Money* (Keynes 1930), the authors present their own version of the term structure of interest rates,⁴ without recourse to equations. For both authors, expectations about financial markets occupy a central place: expectation of future monetary policy for Keynes, and expectation of the future purchasing power of money for Fisher. However, their presentations of the yield curve differ. The relation between short- and long-term rates can be measured, for Fisher, when the future value of money is perfectly forecast. The authors seem to share a similar interpretation of premiums. They both study the effect of monetary factors on interest rates. For Fisher, the quantity of money impacts interest rates, whereas for Keynes, interest rates depend on the capacity of financial intermediaries to sell their debt on the money market.

Fisher and Keynes wrote for different purposes and in different historical contexts. Fisher's theory goes back to "Appreciation and Interest" (1896), after a long period of monetary depreciation from the 1870s to the 1890s in the United States. There was no central bank in the United States at the time. In Fisher's theory, by its effect on agents' expectations about the future purchasing power of money, the quantity of money influences both the term structure of interest rates and the level of prices. The term structure occupies a significant place in Fisher's works, and is referred to in his subsequent writings *The Rate of Interest* (1907, pp. 369–373) and *The Theory of Interest* (1930, pp. 99–105). The core of his theory changed little from 1896 to 1930, and the versions of *The Rate of Interest* and *The Theory of Interest* include risk. Despite Fisher's popularity in the United States, he had little influence on the Federal Reserve Board of the Bank (Meltzer 2003, p. 495). The effect of monetary policy on long-term rates was discovered without the help of academics, as we shall see. Ultimately Fisher developed his monetary plans without referring to his theory of the yield curve.⁵ In Britain, Keynes developed his theory in *A Treatise on Money* (1930, vol. II) based on observation of the U.S. money market in the 1920s. Keynes's theory evolved during the economic depression of the 1930s, and another version of the yield curve, incorporating risk, was developed in *The General Theory* (1936). Whereas Fisher's work remained largely academic, Keynes's work on the yield curve contributed to improving monetary practices in Britain through a better understanding of the factors influencing the long-

² For more literature, see Benninga and Protopapadakis (1983), and Balfoussia and Wickens (2005, p. 2).

³ Apart from the yield curve theory, Keynes often refers to Irving Fisher's works in *The General Theory* and in further correspondence. See Kregel (1988) for more details. Keynes also referred to Fisher's Compensated Dollar Plan in 1911 (Keynes [1911] 1983).

⁴ The authors do not use the expression "term structure of interest rates," or "yield curve theory." Instead, Fisher spoke of the "relation between the rates of interest" (1930, p. 39) and "the rates on short-term and long-term loans" (1906, p. 199), whereas Keynes spoke of the "complex of interest rates" (1930, vol. 1, p. 209), "the complex of bank-rate and bond rate" (1930, vol. 1, p. 171), and also the "complex of interest rates for varying maturities" (1936, p. 168). On this point, readers might consult Aspromourgos (2018) and Brilliant (2014).

⁵ The compensated dollar plan, or the 100% money plan, for example, did not rely on the study of interest rates.

term rate of interest (Dostaler 2005; Howson 1975, 1980; Sayers 1956).⁶ Keynes's goal was to design a new monetary tool that the Bank of England could use to influence the level of fixed capital (i.e., investments) and ultimately employment.

This paper also reports Fisher's and Keynes's reactions to the Fed's monetary policy in the 1920s. Whereas it had traditionally dealt with short-term debts, in the 1920s the Federal Reserve Bank first began coordinating its operations on the government bond market (as reported by Elmus Wicker [1965, p. 325]) and managed to influence liquidity on the money market. Direct interventions on long-term bonds therefore proved more effective than the rate of discount. The 1927 report detailing those operations, titled *Hearings before the Committee on Banking and Currency, House of Representatives*, influenced Fisher and Keynes in different ways. Although they both took the view that open-market operations in the market for government debt impacted the liquidity of the money market, only Keynes advocated the need to manage the long-term rate of interest throughout the 1930s and during the Second World War.⁷

The **second section** of this paper presents Fisher's theory from his early writings (1896) until *The Theory of Interest* (1930). The **third section** presents Keynes's theory, which appeared in 1930 and 1936 and established continuity on the issue of the yield curve. The **fourth section** is about Fisher's and Keynes's explanations of the spread—the “premium”—between the yield on long-term and short-term financial assets. The **fifth section** concludes.

II. IRVING FISHER'S THEORY OF THE TERM STRUCTURE OF INTEREST RATES

On Fisher's intellectual journey, it proved necessary to study the term structure of interest in order to understand how the value of money could influence prices. In Fisher's view, the appreciation of the dollar between 1873 and 1896, through its effect on interest rates, discouraged new investments. There was a great deal of monetary instability in the late nineteenth century with discoveries of gold in the Transvaal (1873 to 1896) and in Alaska (1896 to 1913). This certainly explained why Fisher cared so much about the effect of the changing value of money. While the main theorists of the term structure of interest rates emphasized the influence of monetary policy on this structure, Fisher stressed the influence of the value of money. His empirical investigations revealed a close correlation between long-term rates of interest and prices. Influenced by John Rae and Eugen von Böhm-Bawerk, Fisher was a partisan of a real theory of interest rates in which time preferences impact the long-term rate of interest. A low rate of impatience, from a perspective of rising profits, encourages agents to postpone consumption and to make new borrowings and bond issues. Both short- and long-term rates of interest increase, even if individuals have a preference for present consumption. The “rate of impatience for present over future goods” determines individual investment:

⁶ On this matter, Howson and Winch wrote that, during and after the Second World War, “[t]he ‘conversion’ of the Treasury to Keynes's ideas on economic management was apparently complete” (1977, p. 152).

⁷ Asproumouros (2018) is particularly informative on this issue.

Time preference, or impatience, plays a central role in the theory of interest. It is essentially what Rae calls the “effective desire for accumulation,” and what Bohm-Bawerk called the “perspective undervaluation of the future.” It is the (percentage) excess of the present marginal want for one more unit of *present* goods over the *present* marginal want for one more unit of *future* goods. The rate of impatience, or degree of impatience, for present over future goods of like kind is readily derived from the marginal desirabilities of, or wants for, those present and future goods respectively. (Fisher 1907, p. 62)

[T]he rate of interest cannot be raised if the rates of impatience are not raised, and the rates of impatience cannot be raised if, as is assumed, the income stream is increased in size without being altered in other respects. (Fisher 1913, p. 613)

The Term Structure without Arbitrage Opportunity (1896)

In “Appreciation and Interest” (1896) a relationship between different rates of interest appears. The long-term rate, defined as the rate on long-term maturity assets, is equal to the average of the short-term rates during the term of a loan: “The rate for a loan contracted today and payable two years hence is the ‘actuarial average’ of the two previous rates” (Fisher 1896, p. 91).

Fisher took public bonds as his reference for studying the long-term rate of interest because one of their characteristics was that they involved no risk of default. Arbitragers take advantage of gaps between interest rates, as explained in the following quote. The fluctuation of short-term rates acts as an incentive. If short-term rates fall, and remain below the long-term rate, arbitragers can make a profit by borrowing at the short rate and lending at the long-term rate. Those purchases bring the level of the long-term rate to the average of short-term rates:

A government bond, for instance, is a promise to pay a specific series of future sums, the price of the bond is the present value of this series and the “interest realized by the investor” as computed by actuaries is nothing more nor less than the “average” rate of interest in the sense above defined. Of course the investor puts no specific values on the individual yearly rates of interest of which the “interest realized” is the average, but that this interest is truly an average is attested both by the comparative stability of the rate of interest realized on long time bonds as compared with the fluctuations of the rate of interest in the short time money market (a stability which the rate realized on the bonds does not possess when near maturity). (Fisher 1896, pp. 28–29)

The yield curve is flat when foresight is perfect. Expectations of financial investors, following “the prevailing opinion” (see below), influence future interest rates. If the expectation is that short-term rates will fall, purchases of bonds will rise and the long-term rate will fall. The long-term rate reflects expectations of future short-term rates and can be measured as an “actuarial average” of the expected short-term rates:

interest realized on a very long bond, say 50 years, is often lower than on a 25 years’ bond. This is explainable by the prevailing opinion that interest tends to fall, so that if the 50 years’ investment were in two successive bonds of 25 years each, the interest realized in the second would be lower than in the first. The “actuarial average” of the two is equal to the interest realized on the 50 years’ bond. (Fisher 1896, p. 29)

The Purchasing Power of Money *and the Term Structure of Interest Rates* (1907)

Fisher's *Theory of Interest*, published in 1930, returns to the core ideas of his earlier book published in 1907, about which he wrote "no other book of mine has taken so much intellectual labor as *The Rate of Interest*" (1913, p. 617).⁸ *The Rate of Interest* (1907) provides another version of the theory including risk elements affecting the preferences of lenders and borrowers. Those two kinds of agent, dealing on the market for short-term bills, have different "rates of time preference." The stronger the preference for the present, the higher the long-term rate (because the demand for long-term bonds is lower). Prices are constant at this stage in the reasoning. "[T]hose who, having a low rate of preference, strive to acquire more future income at the cost of present income, tend to lower the rate of interest. These are the lenders, the savers, the investors" (Fisher 1907, p. 132).

In chapters 2 and 9 of *The Rate of Interest* (1907), expectations of changing prices, influencing the purchasing power of money, affect the term structure of interest rates. Fisher insists on the relationship between the value of money correctly expected and interest rates. The relationship can be described as follows.

If debtors/borrowers/sellers expect a depreciation in the value of money, they will supply bonds.⁹ On the other side of the market, if creditors/lenders/purchasers also expect a depreciation of money, they will reduce their demand for bonds in order to avoid a loss on such an investment. If prices are perfectly foreseen, an expectation of inflation will then lead to an increase in the supply of bonds from borrowers and a decrease in the demand for them from lenders. The nominal long-term interest rate will rise, but not the real rate.

Symmetrically, if creditors/lenders/purchasers of bonds expect an appreciation of the value of money (i.e., deflation), they will increase their demand for bonds. On the other side of the market, the debtors/borrowers/sellers reduce their supply of bonds to avoid an increase of the debt burden. If prices are perfectly foreseen, the increasing demand for bonds from lenders will be accompanied by a decrease in the supply of bonds from borrowers. The nominal long-term interest rate will decrease, but not the real rate.

Fisher writes that borrowers forecast further rises in prices better than lenders. Consequently, during an episode of inflation, where borrowers increase their supply of bonds, lenders do not reduce their demand for bonds as they should do. The nominal long-term interest rate, and the real rate, will rise less than under perfect forecasts, to the benefit of borrowers and to the detriment of lenders:

It therefore happens that when prices are rising, borrowers are more apt to see it than lenders. Hence, while the borrower is willing to pay a higher interest than before for the same loan, lenders are willing to loan for the same interest as before. This disparity has as its effect that the rate of interest will not rise as high as if both sides saw the conditions

⁸ This was in an article written to defend his theory of interest rates attacked by U.S. economist Henry R. Seager.

⁹ Fisher also presents the behavior of merchants who are encouraged to invest when expecting a rise in prices and profits. This can lead to a rise in borrowing and also a rise in the supply of bonds (Fisher 1930, p. 346). The excess supply of bonds would lead to a decrease in their price, and to a rise in their nominal interest rate. The real rate of interest would also rise if lenders failed to correctly anticipate the rise in prices. Nevertheless, with perfect foresight, the real rate would remain constant.

equally well. It will also cause an increase of loans and investments. This constitutes part of the stimulus to business which takes place in times of rising prices. (Fisher 1907, p. 286)

Fisher on the Long-Term Rate of Interest (1928, 1930, 1932, 1937)

In his writings of the late 1920s and 1930s, Fisher still thought that long-term rates were affected by real forces (the level of investment and savings). Interest rates (long and short) tend to follow the level of prices. The higher the prices, the higher the long-term rate: “The rate of interest tends definitely to be high with a high price level and low with a low-price level.... It is quite definitely demonstrated that, in times of marked price changes, as in the world war period, the effects of price movements are felt rather quickly upon the rates of interest, even in the case of long-term bond yields” (Fisher 1930, p. 438).

Ralph Hawtrey, with whom Fisher corresponded (Fisher 1930, p. 441), supported these empirical findings in his *A Century of Bank Rate* (1938). According to Hawtrey, real forces affect both short- and long-term rates of interest. Expectations of rising prices and profits encourage merchants to increase their production, which increases the demand for credit and affects bank reserves and ultimately the discount rate. Merchants are encouraged to sell financial assets in order to invest, and this leads to a decrease in the price of those assets and an increase in their return. However, unlike Fisher, Hawtrey considered that short-term and long-term markets were separate markets (see Brilliant 2018). In “Interest and Bank Rate” (1939) published by the Manchester School of Economics and Social Studies and also in his subsequent writings (until *Income and Money*, 1967), Hawtrey remained convinced that arbitrages do not make the connection between short-term and long-term rates.

What could be considered as new, since 1928, was Fisher’s emphasis on the monetary factors affecting the long-term rate. This change in thinking occurred in a context of growth in the public debt holding on the balance sheet of reserve banks since the First World War. Credit conditions, decided by the central bank, were indirectly affecting the long-term rate of interest. As mentioned by Don Patinkin (1993, p. 22), Fisher considered in the late 1920s and 1930s that credit controls were superior to the control of the money issue in *Money Illusions* (Fisher 1928).¹⁰

The central bank can impact the long-term rate of interest via two channels. The first channel deals with the discount rate of interest, managed by the central bank. In *Booms and Depressions*, Fisher wrote: “[B]y operating not only the rediscount rate but also the open market policy, the 12 Reserve Banks can powerfully regulate the volume of the country’s deposit currency—for good or ill” (Fisher 1932, p. 130). Low discount-rate policies led to a reduction of the yield on bonds and therefore of the long-term rate of interest. Here is the only reference we have found so far about the effect of the discount

¹⁰ “When my *Stabilizing the Dollar* was written, I relegated credit control to the Appendix, assuming that all banking, even central banking, would still be conducted purely for private profit. My aim was to make the whole plan of stabilization—both control and credit control—as ‘automatic’, that is as free from discretion, as possible. Since that time, however, as has been shown in this book, discretionary credit control has actually come into existence. This, when duly perfected and duly safeguarded, will greatly simplify and improve the technique of stabilization and will make gold control secondary to credit control” (Fisher 1928, pp. 192–193).

rate on long-term assets in Fisher's writings.¹¹ This quote is interesting because Fisher mentions the effect of the rediscount rate on the price of bonds, a relationship that Keynes was to develop in both *A Treatise on Money* and *The General Theory*. Even if Fisher is not as explicit as Keynes, the following quote suggests that short-term rates controlled by the central bank can influence long-term rates, in Fisher's thought. In the case of a reduction of the "rediscount rate": if agents expect a reduction of the rediscount rate, and therefore a reduction of the value of money, the demand for bonds and their price will rise, and the long-term rate of interest will fall. However, if expectations fail to follow monetary policy, this mechanism will not occur:

The third level is the rediscount rate, changing the rediscount rate. That was used by Governor Strong when he was the first to attempt to stabilize the dollar, and the reason it was discontinued after his death was very largely because the bankers and other Wall Street men interested in the so-called money market, the lending of money, did not like the disturbance in the price of bonds and the rate of interest such as was created by this process of changing the rediscount rate, and it doesn't seem to me it is a proper thing to come into the money problem. (Fisher 1937, p. 293)

Fisher supported, as from 1928 (pp. 125–143) and 1930 (pp. 121–142), another channel of transmission of monetary policy: the coordinated operations of reserve banks on long-term bonds, managed under Benjamin Strong's governance. As a reminder, from October 1921 to May 1922, the twelve reserve banks bought about \$400 million of government securities. Randolph Burgess, working for the Federal Reserve Bank of New York, wrote that those purchases led to a fall of indebtedness of reserve banks with the Fed from \$1 billion to \$400 million (Burgess [1927] 1964, p. 220). In agreement with Winfield Riefler (member of the Federal Reserve Board), Burgess explained that the short-term rates on the money market also fell, and this helped to reflate the prices of commodities (Riefler 1930, p. 180; Burgess [1927] 1964, p. 220). The authors confirmed that the coordination of open-market operations by reserve banks was a new tool to impact the liquidity of the money market.¹² Those massive purchases were followed by a meeting of a special committee of the directors of the twelve reserve banks. As Burgess wrote, this was the first attempt to coordinate open-market policies on long-term bonds, which led to an intervention on the public bond market between December 1923 and September 1924 (Burgess [1927] 1964, p. 221). Before 1922, banks were reluctant to purchase long-term bonds, which were thought riskier. The preference went to short-term assets, which were viewed as more liquid and less risky. The monetary techniques employed by the Fed in the 1920s, i.e., the sales and purchases of long-term bonds, inspired Fisher, who wrote that this "supplementary instrument works faster" (1932, p. 128). Interestingly, as he reckoned, Fisher did not know of the existence of those operations when they were first implemented by the banks: "In 1923, I did not know that Governor Strong of the Federal Reserve Bank of New York had quietly taken in hand the then threat of inflation by starting his now famous, but unofficial, Open Market

¹¹ I thank Samuel Demeulemeester for sharing this information with me.

¹² Milton Friedman and Anna Schwartz wrote on this issue that "[t]heir uncoordinated operations disturbed the government securities market." This event raised awareness of the impact of open-market policies on long-term bonds and encouraged reserve banks to coordinate their open-market policies (1963, p. 251n15).

Committee which headed off inflation by selling bonds, thereby withdrawing money from circulation” (Barber, Dimand, and Foster [1996] 2016, p. 113).

III. KEYNES’S THEORY

Before Keynes, only a small number of British economists inquired into the term structure of interest rates.¹³ Neither Alfred Marshall nor Arthur Pigou, two eminent economists in Keynes’s time, studied it. Instead, two young Cambridge economists, T. T. Williams (1912) and Frederick Lavington (1924) did so. Williams and Lavington observed a correlation in the trend of short- and long-term rates of interest. Ahead of his time, Williams wrote that Consols were the most liquid financial assets and “alternatives to” commercial bills. He explained that “the yield on Consols tends to follow the market rate of discount” (p. 391), thanks to the speculative activities of banks choosing to purchase Consols or commercial bills according to the level of the rate of discount, managed by the Bank of England.

Unlike Fisher, who did not much influence Fed economists in the 1920s, Keynes exerted a considerable influence on the British monetary authorities during his lifetime (Howson 1980, 1988; Howson and Moggridge 1974; Howson and Winch 1977; Sayers 1976). As Howson and Moggridge wrote, “[t]he monetary authorities did not grasp the importance of these problems until after Keynes reentered the Treasury in 1940”—these problems being “how changes in short-term rates could affect the historically stable long-term rate” (Howson and Moggridge 1974, pp. 234–235). In addition to sitting on numerous key committees,¹⁴ Keynes built a theory of the yield curve, providing continuity between his two major books *A Treatise on Money* (1930) and *The General Theory* (1936).

Keynes’s project was to improve central banking practices, which were directed too much at the rediscounting of short-term bills, as he explained in *The General Theory*: “The monetary authority often tends in practice to concentrate upon short-term debts and

¹³ Howson and Moggridge also made this observation: “Keynes was faced with the problem of explaining how changes in short-term rates could affect the historically stable long-term rate—hence the introduction of a theory of the term structure of interest rates. Such problems had not been extensively discussed before, as Keynes was well aware” (1974, pp. 234–235).

¹⁴ Keynes had an active role on the Macmillan Committee (1929; see Dostaler 2005, p. 210) and the Committee on Economic Information, where he “dominated its meetings and reports” (Howson and Moggridge 1974, pp. 238–239). According to Howson and Moggridge, this committee was Keynes’s most important channel for influence in the years until the Second World War. In July 1939, the 27th Report of the Committee presented a plan for defense expenditures, including interest rate controls through the management of the maturity composition of the public debt (Howson 1988, p. 250), which corresponds to certain passages of *The General Theory*. Keynes also managed to influence Treasury officials to the point that “[t]he ‘conversion’ of the Treasury to Keynes’s ideas on economic management was apparently complete” (Howson and Winch 1977, p. 152). Keynes was also on the National Debt Enquiry (1945) and in favor of low interest rates in order to encourage investments (Howson 1988, p. 250). In 1945, Chancellor of the Exchequer Hugh Dalton wanted to take further the recommendation from the national enquiry (which concentrated on short-term interest rates) and reach 2.5% instead of 3.5% long-term rate interest (Howson 1988, p. 261). He announced, “by smooth words and by rough words,” a decrease in discount rates (Sayers 1976, vol. 1, p. 235), which engendered a fall in long-term rates. The Chancellor impacted the entire structure of interest rates because arbitragers on financial markets believed in his policy.

to leave the price of long-term debts to be influenced by related and imperfect reactions from the price of short-term debts;—though here again there is no reason why they need to do so” (Keynes 1936, p. 206).

Keynes observed, like Fisher before him, that interest rates and prices seem to move together. In Britain, more specifically, prices followed the movement of the discount rate of the Bank of England, which itself depended on the state of the balance of payments. A deficit in the balance of payments, if followed by a decrease in the exchange rate below the point of export of gold, sent a signal to the Bank of England to increase its discount rate. Keynes deplored such reactions of the Bank of England, which, protecting its gold reserve by reducing its discounting of bills, led to a rise of the long-term rate of interest, which discouraged new investments by firms. The long-term rate of interest is central in Keynes’s theory. As noted by David Laidler, Keynes’s emphasis on the long-term rate of interest is a breaking point with the dominant thinkers of his time (1999, p. 138).¹⁵ For Marshall or Hawtrey, for example, it is the short-term rate of interest that impacts investment and production, whereas the long-term rate plays only a minor part. In *A Treatise on Money* (1930, vol. I), Keynes challenges Marshall’s and also Hawtrey’s theories, which, he claims, belong to the past and fail to explain how the central bank can affect investment and then prices.¹⁶ Knut Wicksell’s contributions in “Interest and Prices,” according to Keynes, are better suited to understanding this relation, in focusing on the long-term rate of interest in the theory of the economic cycle (Keynes 1930, vol. I, pp. 175–176). The variations in the long-term rate—defined as the “bond rate” (Wicksell [1898] 1962, p. 89)—influence new investment in fixed capital: “Almost the whole of the fixed capital of the world is represented by buildings, transport and public utilities; and the sensitiveness of these activities even to small changes in the long-term rate of interest, though with an appreciable time-lag, is surely considerable” (Keynes 1930, vol. II, p. 326).

However, Wicksell left aside the forces connecting short- and long-term rates without developing the working of arbitrage operations (Wicksell [1898] 1962, p. 75; and see also Laidler 1999, p. 138). Keynes completed Wicksell’s analysis by providing a theory of the yield curve, where the central bank can indirectly impact the long-term rate by managing its discount rate: “[E]xperience shows that, as a rule, the influence of the short-term rate of interest on the long-term rate is much greater than anyone who argued on the above lines would have expected” (Keynes 1930, vol. II, p. 316).

Unlike Fisher (1896), Keynes did not present a mathematical form of the theory of the term structure, in which the long-term rate equals the average of expected short-term rates when the future is perfectly forecast. Keynes did not find inspiration in Fisher’s works about the yield curve, but in the works of American Fed economist Winfield Riefler, whom he met in New York in the 1930s (as Moggridge wrote [1992, p. 582]), and also Governor Strong, who supervised the first Federal Open Market Committee

¹⁵ Marshall established a direct relation between the discount rate of banks and investments. A fall in the discount rate thus leads to rising investments and rising prices. Keynes quoted Marshall in *A Treatise on Money*: “there is more capital in the hands of speculative investors, who come on the market for goods as buyers, and so raise prices” (Marshall 1923, p. 256; and see also Marshall, Gold and Silver Commission no. 9677, Official Papers, p. 49, quoted in Keynes 1930, pp. 166–197, “Modus Operandi of Bank-Rate.”

¹⁶ Like Marshall, Hawtrey underlined the role of traders who borrow to purchase securities when the discount rate decreases (Hawtrey 1919).

(FOMC). Keynes was well aware of the report published in 1927, entitled *Hearings before the Committee on Banking and Currency, House of Representatives*, in which Governor Strong and other Fed economists expressed their view about the monetary policy of the 1920s. The document detailed the coordination of reserve banks on the government debt market, which reinforced the power of the Fed over the money market. Keynes starts his Chapter 37 with a long quote from this document. He was particularly interested in the reserve bank's capacity to intervene in the market for government debt:

I believe it would be found, both in Great Britain and in the United States, that the purchase and sale of securities by the banks for their own account have been the dominating factor in determining the turning-points in the price level of bonds. For they hold a very large volume of such securities—in the United States of the order of \$10,000 million, in Great Britain of the order of £250 million—so that any considerable changeover on their part between short-term assets and long-term assets has an important effect on the price of the latter. (Keynes 1930, vol. II, p. 321)

He thereafter used Riefler's graphs showing a correlation between short- and long-term rates of interest—the long-term rate defined as the “average of sixty high-grade bonds,” and the short-term rates being the “weighted average of various typical short-term rates” (Keynes 1930, vol. II, pp. 316–317). Keynes reckoned that central banks were reluctant to directly purchase long-term assets, because of the associated risk. He explained that financial intermediaries, such as “banks, insurance offices, investment trusts, finance houses, etc.” are more willing to take this risk, if they are well financed (Keynes 1930, vol. II, p. 320). For example, when expecting a decrease of short-term rates (managed by the central bank), financial intermediaries are encouraged to sell short-term debt and buy long-term assets. Those purchases affect the price of long-term assets, which increases, and the yield on long-term assets, which decreases. That decrease encourages new investments by firms. The gap between the long-term rate and the short-term is an incentive to make an arbitrage, as Keynes wrote. The central bank can affect new investment by reducing its discount rate to finance financial intermediaries, as Keynes explained in *A Treatise on Money* (1930):

[A] change of 2 per cent in bank rate, if continued for a year, may be capable of effecting a change in the cost of long-term borrowing (assuming fluctuations round 5 per cent as the basic rate) of as much as 10 to 20 per cent.... The effect of ‘cheap money’ on the price of bonds is a commonplace of the investment market. What is the explanation? ... If the running yield on bonds is greater than the rate payable on short-term loans, a profit is obtainable by borrowing short in order to carry long-term securities, so long as the latter do not actually fall in value during the currency of the loan. Thus the pressure of transactions of this kind will initiate an upward trend, and this, for a time at least, will confirm the investor in a ‘bullish’ feeling towards the bond market. When short-term yields are high, the safety and liquidity of short-term securities appear extremely attractive. But when short-term yields are very low, not only does this attraction disappear, but another motive enters in.... A point comes, therefore, when they hasten to move into long-dated securities; the movement itself sends up the price of the latter. (Keynes 1930, vol. II, pp. 319–320)

In *The General Theory* (1936), Keynes simplified his monetary theory and downplayed the role of banks as liquidity providers on the money market. He put the emphasis on the

demand for money from individuals, choosing between holding bonds or money (those agents replace the banks in the *Treatise*). The demand for money directly impacts the level of prices. However, there is continuity between *A Treatise on Money* and *The General Theory* concerning the theory of the structure of interest rates. The role of the money market, where financial intermediaries sell their short-term debt in order to purchase long-term securities, is crucial in both books.

However, in 1936, Keynes focused on situations where the long-term rate fails to respond to variation of the short-term rate (called “liquidity traps”).¹⁷ Through their transactions, banks shape the long-term rate of interest in accordance with the prevailing monetary policy. The problem of the 1930s, due to the economic depression, was the reluctance of the banking system to take risks on longer-term bonds. In such a situation, Keynes encouraged direct purchases of long-term bonds by the Bank of England.

In normal circumstances the banking system is in fact always able to purchase (or sell) bonds in exchange for cash by bidding the price of bonds up (or down) in the market by a modest amount; and the larger the quantity of cash which they seek to create (or cancel) by purchasing (or selling) bonds and debts, the greater must be the fall (or rise) in the rate of interest. (Keynes 1936, p. 197)

Like Fisher and many other economists of the time, Keynes supported Strong’s monetary policy in the 1920s. In an obituary note published on October 28, 1928, Keynes credits Strong with a superior understanding to academic opinion about “the regulation of credit” (Keynes [1928] 2010, p. 323). Keynes refers explicitly to the development of open-market operations, without specifying the nature of financial assets concerned by the operations. Keynes’s view is clearer in a passage of *A Treatise on Money*, referring to open-market sales of government securities in a quote from Strong from the *Hearings before the Committee on Banking and Currency, House of Representatives* (1927).

While Fisher’s and Keynes’s theories differ in a context of certainty, there are similarities in their explanations of the spread between short-term and long-term interest rates.

IV. THE “PREMIUMS” ON FINANCIAL ASSETS

Fisher

Fisher introduces elements of risk into the arbitrage operation in *The Rate of Interest* (1907), a book that was republished in 1930 under the title *The Theory of Interest, as Determined by Impatience to Spend Income and Opportunity to Invest It* (1930). The term “premium” is used to refer to the reward of delaying consumption: “[t]he premium of exchange of this year’s income in terms of next year’s income” (Fisher 1907, p. 379).

¹⁷ Culbertson wrote, “In *The General Theory*, however, in recognition of the reluctance of long-term rates to decline in the 1930s, he [Keynes] abandoned his doctrine” (1957, p. 486). In my view, this is more about a change of political advice than a change of “doctrine.” Even if Keynes was in favor of a prolonged cut in short-term rates to encourage arbitrageurs to purchase bonds, he recommended a stronger monetary policy with direct purchases of bonds in 1936.

The term “risk premium” does not occur in Fisher’s writings (he uses the word “see-saw”), but the concept is very much present. A “see-saw” between short-term and long-term rates can be understood as a risk premium. In the two scenarios presented by Fisher in the following quote, a risk premium exists only when the long-term rate exceeds the average of expected short-term rates. The risk deals with the variability of short-term rates, which can cause a capital loss for an investor having purchased long-term bonds while selling funds on the short-term loan market. Here is one risk relating to the purchase of long-term financial assets. Fisher refers to confidence about future rates (“when the future is regarded as safer than usual”), which can encourage investors to engage in longer contracts than usual and take more risks. The determination of the “norm” of the long-term rate is not present in this quote but can be found in Fisher’s works. The “norm” depends on agents’ time preferences. If the present becomes preferred to the future, individuals will sell bonds in order to consume. The long-term rate will rise.

The period of time a loan or bond runs is also an important factor as regards risk. There is a see-saw between the rates on short-term and long-term loans. That is, if the short-term rate is greatly above the long-term, it is likely to fall, or if greatly below, to rise. The long-term rates thus set a rough norm for the short-term rates, which are much more variable. When the future is regarded as safer than usual, loan contracts tend to be longer in time than otherwise. In a stable country like the United-States, railway and government securities are thus often drawn for half a century or more. There is also a variability according to the degree of liquidity. A call loan which may be recalled on a few hours’ notice has a very different relation to risk than does a mortgage, for instance. (Fisher 1930, pp. 209–210)

The spread between the expected short-term rate and the long-term rate is not due to a lack of arbitrage but to an “endless variety in the confrontation of income streams” on the side of lenders. Undertaking an arbitrage operation, consisting in borrowing short in order to buy a long-term bond, is risky. If lenders decide to sell short-term assets, short-term rates will increase. In this case short-term borrowers will incur a capital loss. Fisher introduces limits to the activity of arbitrageurs, who are also subject to time preferences. Interest rates are the result of agents’ time preferences, some preferring to purchase short-term assets and others long-term ones. Preferences impact the demand for bonds and lead to an increase in yields and to reductions in prices. Preference for long-term bonds will lead to purchases and to a rise in the price of long-term bonds, and will reduce the yield of those assets. The long-term rate will fall. However, Fisher explains clearly that arbitrages cannot completely erase the gap between short and long-term rates, without giving further explanations:

This divergence [between the rate for short-terms and long-terms] is not merely due to an imperfect market and therefore subject to annihilation by arbitrage transactions, as Bohm-Bawerk, for instance, seemed to think. They are definitely and normally distinct and due to the endless variety in the conformations of income streams. *No amount of mere price arbitrages could erase these differences.* (Fisher 1930, p. 313; italics added)

Fisher’s reasoning includes a large variety of financial assets of differing maturity and risk. Given the multiplicity of financial instruments, money can take different forms. While Keynes reduces the relations on the money market with the possibility of holding

riskless money or risky bonds in *The General Theory* (1936), Fisher produces a theory in which holding money can be risky (Dimand 2014, p. 12).

Keynes

The concept of risk premium is presented on the market for goods in a *Treatise on Money* (1930). Keynes defines “backwardation” as a situation where forward prices—decided today for a future delivery of goods—are lower than spot prices—determined by the supply and demand for goods. The difference between spot and forward prices comes from the behavior of producers who hedge their sales against the risk of selling at a future date at a lower price. Producers prefer agreeing today on a lower future price in order to be sure of selling their production, instead of being uncertain about making a loss if choosing to sell at a spot price that may drop in the future (determined by future supply and demand). Keynes does not extend his theory of backwardation to the financial markets, which could help in defining risk premiums on bonds. “If supply and demand are balanced, the spot price must exceed the forward price by the amount which the producer is ready to sacrifice in order to ‘hedge’ himself, i.e. to avoid the risk of price fluctuations during his production period. Thus in normal conditions the spot price exceeds the forward price, i.e. there is a backwardation” (Keynes 1930, p. 143).

However, Keynes also does not extend the concept of risk premium to the financial market, where he refers to an “insurance premium” (1936, p. 202). The return on an asset must encourage investors to take the risk of holding long-term assets instead of holding money (1936, pp. 168–169). However, Keynes does not consider that risk can be calculated, which may explain why he does not refer to a risk premium on the financial market (see Fantacci, Marcuzzo, and Sanfilippo 2014 on this question): “The actuarial profit or mathematical expectation of gain calculated in accordance with the existing probabilities—if it can be so calculated, which is doubtful—must be sufficient to compensate for the risk of disappointment” (Keynes 1936, pp. 168–169; italics added).

Keynes also mentions the notion of “liquidity premium,” representing the non-excess returns prevailing on short-term assets such as money. Investors chose to hold money as a response to fundamental uncertainty. One can interpret this premium as follows. The higher the liquidity preference, the higher the liquidity premium on cash, and the higher the long-term rate of interest, which discourages new investments: “it is precisely the liquidity-premium on cash ruling in the market which determines the rate of interest at which finance is obtainable” (Keynes 1937, p. 248). “The amount (measured in terms of itself) which they are willing to pay for the potential convenience or security given by this power of disposal (exclusive of yield or carrying cost attaching to the asset), we shall call its liquidity-premium I” (Keynes 1936, p. 226).

Keynes refers again to liquidity premiums in a correspondence mentioned by Luca Fantacci, Maria Cristina Marcuzzo, and Eleonora Sanfilippo (2014): “As Keynes explained in a letter to Hugh Townshend in 1938, ‘A liquidity premium (...) is a payment, not for the expectation of increased tangible income at the end of the period, but for an increased sense of comfort and confidence during the period’” (Keynes 1938, p. 294, in Fantacci, Marcuzzo, and Sanfilippo 2014, p. 1106).

Considering themselves as Keynesians, several economists defined the notions of risk and liquidity premiums. Nicholas Kaldor wrote that “Mr. Keynes’ liquidity premium on the holding of short-term assets is merely the *negative* of our marginal risk premium on

the holding of long-term bonds” (1939, p. 14). Rainer Masera, one of John Richard Hicks’s doctoral students, wrote that a positive risk-premium on securities would imply a negative liquidity-premium on money, and symmetrically, a negative risk-premium on securities would reflect a positive liquidity-premium on money.¹⁸ On the notion of risk premium, Hicks extended Keynes’s theory of backwardation on financial markets in *Value and Capital* (1939). Ignoring Keynes’s reluctance to use the term “risk premium” on financial assets, Hicks considered that risk premiums are included in forward rates (“forward short rates ... equal expected rates plus a risk-premium”), defined as the rates of future borrowing contracted today (Hicks 1939, p. 281n). The existence of risk on long-term lending explains why lenders prefer investing on the short-term market for loans in order to enjoy faster access to liquidity. Long-term lending is riskier than short-term lending. The risk is of making a capital loss if, for a liquidity need, money is withdrawn before the financial asset matures. If the market price has fallen, a capital loss would occur when selling the bond. It is this risk that explains why long-term bonds have a higher yield than shorter ones. While Hicks’s definition of risk premium suggests that risk can be calculated—in *Value and Capital* (1939, p. 145) a mathematical form of the yield curve theory is presented—Keynes never goes so far. This is due to the uncertainty linked to the future value of financial assets, which cannot be measured according to Keynes (as explained by Fantacci, Marcuzzo, and Sanfilippo 2014).

V. CONCLUSION

The theory of the term structure of interest rates that contemporary literature commonly calls the “yield curve theory” seems to have first appeared in Fisher’s “Appreciation and Interest” (1896). Fisher presented an initial version of the theory without the opportunity of arbitrage, the long-term rate being equal to the average of short-term rates. Later, Wicksell’s *Interest and Prices* (1962 [1898]) placed particular emphasis on the importance of the long-term rate of interest affecting new investments, but it failed to explain why short-term rates could influence long-term ones. Without reference to Wicksell, Fisher provided another version of the term structure of interest rates in the 1907 and 1930 editions of *The Rate of Interest*. Despite the development of a new monetary tool by the Fed—the coordination of open-market operations on long-term bonds, affecting the entire span of the yield curve—Fisher did not hear of this policy until the 1930s. Those operations seem therefore to have developed in the United States without the help of academics. The experience was different in Britain. Influenced by the U.S. experience, Keynes developed his own theory of the yield curve and studied its effects on macroeconomic variables. Although some Cambridge economists had already studied the relationship between interest rates (Williams 1912; Lavington 1924), no one drew up a control scheme like Keynes’s. According to Keynes, in 1930, the central bank could

¹⁸ “[W]e may refer to risk-premia if he [*the marginal investor*] is in bonds and the difference between forward and expected rates is taken to measure the pecuniary return for the risk he incurs by holding bonds: the spot short rate which, under the present assumptions, involves no risk-taking is taken as the base; or (b) to liquidity premia if he is in bills and the difference between forward and expected rates is considered to measure the non-pecuniary return that he receives by avoiding risk: the spot bond rate, implying risk taking, is taken as the base” (Masera 1972, p. 19; italics added).

influence the long-term rate by altering the supply of bonds of different maturities, because of investors' different maturity preferences. Nevertheless, he lost his optimism between his *Treatise* and the *General Theory*, in which he introduced premiums on bonds linked to risky arbitrage operations, which weaken the transmission of monetary policy to the long-term rate. However, the essence of the theory remains unchanged in *The General Theory* and some continuity can be traced with *A Treatise on Money*. With a careful study of the monetary improvements made by the Fed in the 1920s, Keynes believed that the Bank of England could follow such policies by influencing the entire structure of interest rates, and not only short-term rates. The British monetary authorities followed Keynes's advice in the hope of reducing the long-term rate (Sayers 1976, pp. 446–447).

While similarities can be observed between Fisher's and Keynes's theories (the role of arbitrages, the existence of premiums on bonds, their respective support for Strong's monetary policy), their theories remain different with respect to the determinant of the interest rate, as do their policy recommendations. On this issue, Keynes was far more committed than Fisher to the necessity of managing the long-term rate of interest and was much more involved in the decision-making sphere of institutions. Fisher, unfortunately for him, did not influence the Fed despite being the originator of the yield curve theory.

COMPETING INTERESTS

The author declares no competing interests exist.

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