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A Reconsideration of the role of forward-market arbitrage in Keynes's and Hicks's theories of the term structure of interest rates

Lucy Brilliant

"It is these professional investors, operating upon the whole gamut, and paying close attention to small differences in rates, who provide most of the logic of the interest system." (Hicks, 1939a, p.169)

"The long rate is an average, not of expected short rates, but of forward short rates, which equal expected rates plus a risk premium." (Hicks, 1939a, p.281)

Abstract:

This paper develops the relationship between Hicks's and Keynes's writings on the theory of the term structure of interest rates, and shows in detail how Hicks built on and extended Keynes's account. According to this theory, the level of the long-term interest rate is determined by expectations of future short-term rates. Keynes's thinking contained several notions – such as the preferred habitat of lenders, the theory of forward markets, and risk-premiums – which Hicks used to give a more complete theory of the term structure of interest rates. Besides implementing these notions in his own theory, Hicks introduced the concepts of the preferred habitat of borrowers, the liquidity risk premium, and arbitrageurs who can take advantage of spreads between spot and forward rates and eliminate risk premiums.

Key words: arbitrageurs, borrowers, forward rates, expected short-term rates, lenders, risk premium, long-dated securities, preferred habitat, term structure of interest rate

1. Introduction

This paper studies the working of the term structure of interest rates in John Maynard Keynes's and John Richard Hicks's theory. Keynes provided a first version in his *Treatise on Money* (1930) and a second in *The General Theory* (1936). Hicks, influenced by Keynes, elaborated his theory a few years later in *Value and Capital* (1939a). In these author's thought, operations of arbitrage and preferred habitats determine the term structure of interest rates. It is worth precisizing that neither Keynes nor Hicks used the term of "preferred habitat" per se. Franco Modigliani and Richard Sutch labelled this theory in 1966. However, as we shall see, the concept of preferred habitat is part of Keynes's and Hicks's theories. Hicks's theory has been extensively tested empirically from the sixties to nowadays by David Meiselman (1962), Modigliani and Sutch (1966), Rainer Masera (1972), Dimitri Vayanos and Jean-Luc Vila (2009) and Robin Greenwood and Vayanos (2010). Some refer to the "expectation theory", others to the "liquidity-risk premium model" (Cultbertson, 1957; Malkiel, 1967, p.17 and p.24; Meiselman, 1962, p.45; Modigliani and Sutch, 1966, p.182; Masera, 1972, p.17; Bisière, 1994, p.32). This literature utilizes Hicks framework without attributing to him and Keynes the elaboration of the preferred habitat notion, and the role of arbitrageurs (in addition to primary lenders and borrowers). The paper intends to rebuild Hicks's theory, inspired by Keynesian concepts, to promote their contributions which impacted so much the contemporary literature.

The second part of our research focuses on Keynes's theory of the term structure of interest rates. In a *Treatise on Money* Keynes wrote that short-term rates of interest can be transmitted to long term rates of interest¹. This connection is rendered possible thanks to the operations of arbitrageurs. This theory can be assimilated to what the actual literature calls the "Pure Expectations Theory". When agents expect with certainty the future course of short-term rates of interest, the long-term rate is equal to the average of current and expected

¹ Donald Moggridge and Susan Howson (1974, pp.234-235) explain that Keynes is one of the first thinkers to consider a relation between interest rates of different terms. One anonymous referee suggested quoting Irving Fisher's contributions to the theory of the term structure of interest rates (1896, 1906, and 1930). However, because neither Keynes nor Hicks refer to Fisher, we prefer not integrating his theory in this paper.

short/spot rates of interest. The central bank can influence the long-term rates by influencing short term rates. In the context of certainty, Hicks's theory reaches the same conclusion than Keynes. However, Keynes's and Hicks's view on the connection between interest rates differ in a context of uncertainty.

The third part deals with the risk of liquidity affecting bonds' holders that Keynes introduces in *The General Theory* (1936). Because of this risk, lenders prefer buying short-dated securities, i.e. they have a short-term preferred habitat. The risk premium on long-term bonds is ascribed to lenders' short-term preferred habitat. As explained by Culbertson (1957, p.486), Keynes extended his theory of the term structure in the *General Theory* (1936) to explain the situations of liquidity trap (i.e. when long-term rates do not respond to movements of short-term rates). If arbitrageurs are reluctant to buy bonds, the level of the long-term rate would reflect a risk premium². In this situation, the monetary policy cannot hope to influence long-term rates.

The fourth part is about Hicks's theory of the term structure of interest rates. Hicks criticizes the way Keynes determines the risk premium on loan markets, and wrote that Keynes's theory of the term structure "hang[s] by its own bootstraps". Hicks gives another theory of the term structure of interest rates. In his theory, Hicks applies the Keynesian theory of forward markets for commodities to the loan market. Hicks's main point is that long-term rates of interest depend on the liquidity preferences of both lenders and borrowers on loans market. Furthermore, the term structure of interest rates is determined by the supply of and demand for long and short term securities by primary borrowers and lenders. The upward sloping shape of the term structure of interest is due to the preferred habitat of lenders and borrowers.

The fifth part sheds light on the role of 'professional investors' in Hicks's theory. In his article *The term structure of interest rates* (1957), Culbertson explains that " 'arbitrages' of dealers and professional investors [are] an important factor affecting the behaviour of the term

² Looking for solutions to stir the economy from the depression, Keynes underlined the limits to the monetary policies and arbitrages. Hicks provided as well interesting elements on this issue. We emphasize this side of Keynes's and Hicks's thoughts in a separate paper entitled "Limits to arbitrage and interest rates: a debate between Hawtrey, Hicks and Keynes" (Brillant, 2015)

structure” (1957, p.499). We observe however that the literature of the 60’s does not refer to Hicks’s contribution to arbitrage. As we shall see, in Hicks, “professional investors” are arbitrageurs who “operat[e] on the whole gamut and pa[y] close attention to small differences in rates” (Hicks, 1939a, p.169). They are the counterpart of hedgers (lenders and borrowers), and they can be more willing to take risks than common lenders on the market for long term maturities. Arbitrageurs, as we shall see, are important in Hicks’s theory, because they “provide most of the logic of the system of interest rates” (Hicks, 1939a, p.169). The sixth part concludes.

2. The term structure of interest rates in certainty

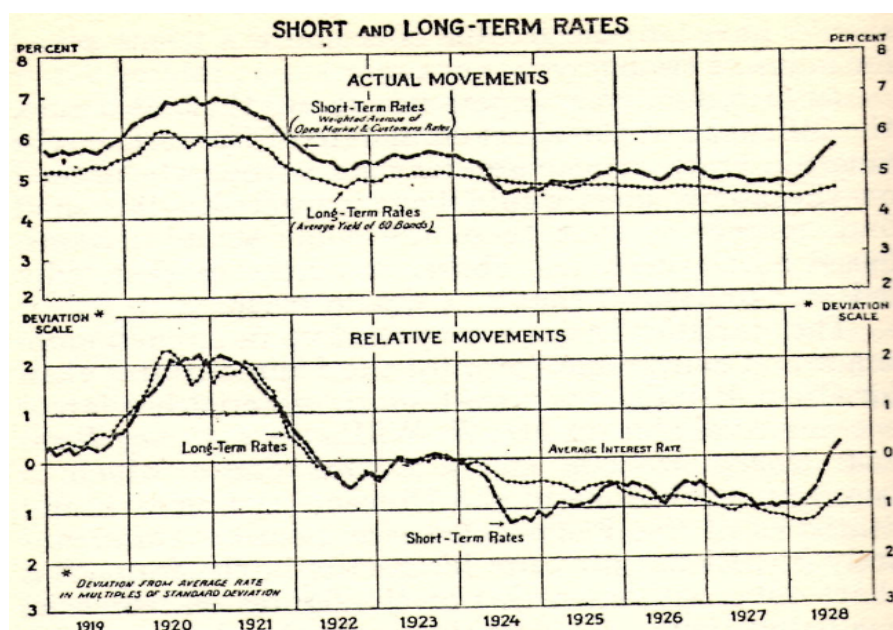
When agents expect with certainty future short-term rates of interest, the level of the long-term rate of interest reaches the average of expected short-term rates³. This is stressed by Keynes in *A Treatise on Money* (1930). In this book, there is already the notion of liquidity

³ The reader can refer to de Boyer (2002, p.198), where there is a short discussion about the term structure of interest rates in a context of certainty only, without incorporating risk-premiums

preference developed six years later in *The General Theory*. Keynes is convinced, in 1930, of a connection between short-term and long-term rates of interest:

... experience 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, II p.316)

Keynes supports his theory with a graph made by economist Winfield Riefler⁴. The graph illustrates a relation between short and long-term rates of interest from 1919 to 1928 in the United States⁵:



(Keynes, 1930, II, p.317)

Short and long-term rates of interest are connected thanks to the operations of arbitrageurs – such as “banks, insurance offices, investment trusts, finance houses, etc.” (Keynes, 1930, II, p.320):

In the modern world the volume of long-term borrowing for purposes of new investment depends most directly on the attitude of the leading issue houses and

⁴ Donald Moggridge (1992, p.582) writes that Keynes and Riefler, a Fed economist, met in New York in the Twenties.

⁵ “The long-term rates are measured by the average yield of sixty high-grade bonds, and the short-term rates by a weighted average of various typical short-term rates.” (Keynes, 1930, II, p.316). The curve representing the short-term rate is higher than curve representing the long term rate because the short-term rate contains a credit risk.

underwriters, who act as middlemen between the ultimate borrowers and lenders.
(Keynes, 1930, II, p.329-330)

We can illustrate the connection of interest rate to which Keynes refers with the following example:

Case [1]:

Assume the following hypothesis: if the current rate for a one-year loan and the expected short-term rates for a one-year loan in a year's time are $r_1 = 1\%$ and $r_2^e = 1\%$ then the long-term rate for a two-year loan $R_2 = 1\%$, where this last rate is given by the following formula: $R_2 = [(1 + r_1)(1 + r_2^e)]^{1/2} - 1$. If arbitrageurs expect a fall of expected short-term rates from 1% to 0.65%, the long-term rate of interest R_2 will be 0.825%. Thus, the long-term rate of interest will fall from 1% to 0.825%. The mechanism explaining the fall of the long-term rate of interest is the following: if arbitrageurs expect a fall of the rate payable on short-term loans (called by Keynes a "bullish" feeling on bond markets), the long-term rate of interest will fall because arbitrageurs will supply short-term debts and will demand long-term bonds; there will be an excess demand for bonds on markets. Inversely, if arbitrageurs expect a rise of the rate payable on short-term loans ("bearish" feelings) (from 1% to $r_2^e = 2\%$), $R_2 = 1.498\%$; the long-term rate of interest will rise from 1% to 1.498%.

This theory is significant *à propos* the possibility for a central bank to influence the determination of long term interest rate through its short term rate policy⁶. In a context of certainty, if the central bank announces a reduction of the short-term rate r_1 to 0,25%, the long term rate R_2 will drop to:

- ✓ $R_2 = 0.25\%$ if the CB announces that, in t_2 , it will put the rate r_2 to 0,25%
- ✓ $R_2 = 0.37\%$ if the CB announces that, in t_2 , it will put the rate r_2 to 0,5%
- ✓ $R_2 = 0.62\%$ if the CB announces that, in t_2 , it will put the rate r_2 to 1%

Reciprocally, in the context of uncertainty about the level of r_2 in t_2 , the efficiency of monetary policy to influence the determination of the long term interest rate could be weak. If this case happens, it means that the central bank's announcement is not credible (Keynes, 1930)⁷. Or

⁶ We suppose that this passage deals with the term structure of interest rate as a monetary phenomenon »

⁷ Cf. de Boyer (2003, p.202-204).

“if interest-expectations are rigidly inelastic” (Hicks, 1939a, p.260)⁸. However, in this paper we do not discuss these special cases⁹. Instead, we focus on the term structure of interest rates that Keynes provides in his *Treatise on Money* (1930) and then in *The General Theory* (1936), and Hicks contributions a few years later in *Value and Capital* (1939a). The formation of a risk premium is a consequence of the uncertainty on future short term rates of interest, as it is developed in the next parts.

In a controversy with Ralph G. Hawtrey, Hicks endorses, like Keynes, the existence of agents who arbitrate between short and long-term maturities and also a connection between interest rates:

... short and long loans are closely similar things, and one would expect to find them being close substitutes for important classes of borrowers and lenders... That hypothesis would explain why short and long rates should tend to rise and fall together... (Hicks, 1939c, p.154)

Hicks explains, like Keynes again, that agents’ expectations of the future short term rates of interest determine the long term rate of interest:

... if high or low money rates are expected to continue for a long period, the price of consols expected to rule in the future will be affected by the continuance-and the present price of consols will be affected much more than it could have been affected by a change in short rates which was not expected to continue for long (Hicks, 1939b, p.26)

Following Keynes, Hicks (1939a, p.145) also studies the term structure of interest rates in a context of certainty. However Hicks refers to forward rates (rf)¹⁰, (which are expected rates plus a risk premium, as we shall see in the third part of this paper):

The long rate is an average, not of expected short rates, but of forward short rates... (Hicks, 1939a, footnote, p.281)

Forward short rates are rates decided at date t_1 for a loan delivered at date t_2 .

However, in a context of certainty, forward rates are equal to expected short-term rates: $rf_1 = r_2^e$. Therefore, Hicks reaches the same conclusion as Keynes: when expectations are

⁸ A referee underlines that Hicks also introduces this elasticity hypothesis which deals with the inefficiency of monetary policy.

⁹ “The effectiveness of the rate of interest as a stabilizer depends not only upon the extent to which changes in short rates are transmitted to long rates (a point about which we cannot be very optimistic)...” (Hicks, 1939a, p.262). This interesting topic is the purpose of the next chapter of my thesis, “Limits to arbitrage and interest rates, a controversy between Hawtrey, Hicks and Keynes”.

¹⁰ « ...forward short rates: rates for loans of one week, to be executed not in the current week, but in some future week. » (Hicks, 1939a, p. 146-147)

perfect, the long term rate of interest is equal to the average of expected short term rates (Hicks, 1939a, p.145). This relation can be represented for two periods as follow:

$$R_2 = [(1 + r_1)(1 + rf_1)]^{1/2} - 1$$

However, as we will see in the third part of our paper, Hicks disagrees with Keynes on the relation between interest rates in a context of uncertainty, and more specifically on the determination of the risk premium and arbitrages.

3. Keynes's risk-premium

In 1936, Keynes introduces elements of risk in the theory of the term structure of interest rates¹¹. In a context of uncertainty, lenders on bond markets do not expect perfectly “the complex of rates of interest for varying maturities which will rule at future dates...” (Keynes, 1936, p.168). This uncertainty leads lenders to have what Modigliani and Sutch call a “short-term preferred habitat”¹². It means that when there is equality of return between long-term and short-term loans, lenders prefer lending on the short-term. This idea is briefly expounded in 1930, but Keynes does not give much emphasis to this: “Now banks above all prefer short-term assets if they can afford them.” (Keynes, 1930, II, p.321). He does not give in his *Treatise* a theory explaining these preferences; he does in *The General Theory*. Lenders have a short-term preferred habitat because they are affected by a “risk of a loss” (Keynes, 1936, p.168-169), or a “risk of disappointment” (Keynes, 1936, p.169) when investing in long-term loans. If a lender needs cash before the date of maturity of a loan, and exchanges the

¹¹ Culbertson notices a change in Keynes's thought from a *Treatise on Money* to the *General Theory*: “In the *General Theory*, however, in recognition of the reluctance of long-term rates to decline in the 1930's, he [Keynes] abandoned his doctrine.” (Culbertson, 1957, p.486)

¹² These authors elaborated a model in which the term structure of interest rates is determined by agents' expectations and the distribution of preferred habitats. In their model, they relax the Hicksian assumption that lenders have a short-term preferred habitat and borrowers' a long-term one.

bond against cash before maturity, there is a risk of a loss because market rates may have risen since the time the investment was made:

Thus if a need for liquid cash may conceivably arise before the expiry of n years, there is a risk of a loss being incurred in purchasing a long-term debt and subsequently turning it into cash, as compared with holding cash. (Keynes, 1936, p.168-169)

Considering this risk affecting long-term lenders, an excess return prevails on long-term loans.

Arbitrageurs can thus make a profit:

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. (Keynes, 1930, II, p.319-320)

A higher nominal rate of return – or risk-premium¹³ – must offset the “risk of disappointment” (Keynes, 1936, p.169) being a rise of long term market rates of interest. The risk-premium depends on arbitrageurs’ expectations on future rates of interest. If a majority of arbitrageurs expect bond prices to fall – a bearish sentiment prevails on bond markets –, they will stay in their short-term preferred-habitat. In this passage, Keynes defines the risk-premium prevailing on long term loans as:

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, p.169).

Therefore, the long-term rate of interest is the average of current and expected short-term rates plus a risk premium. The long-term rate of interest in Keynes’s theory can be presented as follow:

$$R_2 = [(1 + r_1 + \alpha)(1 + r_2^e + \alpha)]^{1/2} - 1$$

Where α is Keynes’s risk-premium.

Hicks disagrees with the way Keynes determines the risk premium. Indeed, Hicks explains that in *The General Theory*, the long-term rate of interest is determined partly by expected short-term rates and by a risk-premium (α), which is itself determined by expectations on future

¹³ Inversely, a liquidity-premium is the non-excess return prevailing on short-term assets. Keynes defines it in 1936 as: “The amount (measured in term 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 l .” (Keynes, 1936, p.226)

interest rates. This is what leads Hicks to write that Keynes's theory of the term structure of interest rates "hang[s] by its own bootstraps"¹⁴:

... to say that the rate of interest on perfectly safe securities is determined by nothing else but uncertainty of future interest rates seems to leave interest hanging by its own bootstraps; one feels an obstinate conviction that there must be more in it than that. Let us try to discover what that something more can be. (Hicks, 1939a, p.164)

4. Hicks's risk premium and the preferred habitat of borrowers

Hicks's theory is different from Keynes's one. Indeed, by applying the theory of the forward markets on the loan market, Hicks determines the risk premium in another way than Keynes. Also, before the operation of arbitrages, the term structure of interest rates is upward sloping in Hicks's theory because of a "constitutional weakness" on loans markets which come from the demand for/ supply of short-term and long-term loans from primary lenders and borrowers. Then, it is determined by arbitrageurs' expectations on future short-rates (called "professional investors", as studied in the fourth part of this paper). Whereas in Keynes's, the long-term rate exceeds this average either if arbitrageurs expect a rise of these short rates, or if arbitrageurs do not want to buy bonds by borrowing at the decreasing short rate.

Hicks applies Keynes's theory of the forward market¹⁵ on the term structure of interest rates. This has been already explained by Meiselman (1962, p.12-13), Gordon Malkiel (1967, p.24-25), Masera (1972, p.18 and Christophe Bisière (1994, p.33). On commodity markets, there is a spread between forward prices – prices decided in date t for commodities delivered at date $t+1$ – and expected spot prices – the expected price of commodities decided and delivered at date $t+1$. This theory is developed in *A Treatise on Money* (1930):

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

¹⁴ Like Meiselman (1962, p.30), we consider that this passage deals with the term structure of interest rate as a monetary phenomenon.

¹⁵ Keynes studied the theory of forward markets on the commodity markets called the "organized markets for staple raw materials" (Keynes, 1930, II, p.127). Luca Fantacci, Maria Cristina Marcuzzo and Eleonora Sanfilippo (2010) wrote an article on this side of Keynes's thought.

fluctuations during his production period. Thus in normal conditions the spot price exceeds the forward price, i.e. there is a backwardation. (Keynes, 1930, II, p.128).

This spread is due to the behavior of producers of goods. These producers want to hedge their sales. Indeed, they prefer selling at a forward price instead of selling at an uncertain expected spot price. The excess supply of forward contracts in comparison with the demand explains why forward prices are lower than expected spot prices.

... they [the hedgers] know that the demands and supplies which can be fixed up in advance for any particular date may have little relation to the demands and supplies which will actually be forthcoming at that date ... (Hicks, 1939a, p.137).

An analogy has to be made, according to Hicks, on loan markets. Borrowers on loan markets are hedgers. They prefer borrowing at the forward rate – the expected short-rate of interest fixed in the present for a loan to be executed at a future date – instead of renewing their loan at uncertain short/spot interest rates. By hedging forward, they avoid the risk and uncertainty of a rise of spot rates of interest. Borrowers have a long-term preferred habitat:

They may be embarking on operations which take a considerable time to come to fruition; or they may merely be laying down plans for continuous production, in the form of a long series of planned inputs and outputs, which it will not be easy to break off at any particular point. These persons will want to hedge their future supplies of loan capital, just as they will want to hedge their future supplies of raw materials. They will have a strong propensity to borrow long... Many borrowers would desire the additional security that comes of borrowing for longer periods. (Hicks, 1939a, p.146-150)

Because of borrowers' preferred habitat, there is an excess supply of forward loans in comparison with the forward demand of lenders. Borrowers must attract lenders by paying higher rates:

Borrowers would thus tend to offer better terms in order to persuade lenders to switch over into the long market (that is to say, enter the forward market)... (Hicks, 1939a, p.148)

On the other hand, on loan market, there is an excess demand for short-term loans. Like Keynes, Hicks explained that it comes from the short-term preferred-habitat of lenders¹⁶:

As soon as a lender begins to envisage the possibility that he may want his capital back in conceivable cases – and it is hard to believe that this idea is ever wholly absent – the drawback

¹⁶ Hicks explains also that lenders can have a long-term preferred habitat. Indeed, the size of a class of lender who prefer long-dated securities is an empirical question: "On the other side, there may be a certain class of lenders who would be content with indefinite lending - those whose object is simply to derive a regular income

of indefinitely long lending begins to be evident. As we have seen, the rate of interest which can be earned on a loan of any finite duration, by investing in undated debentures, is always highly conjectural. If there is a serious rise in the long-term rate of interest, the effective yield may be completely wiped out. (Hicks, 1939a, p.151)

As Keynes, Hicks emphasized a connection between interest rates. But Hicks put an emphasis on forward rates:

The long rate is the arithmetic average between the current short rate and the relevant forward short rates. (Hicks, 1939a, p.145)

Because lenders and borrowers have a preferred-habitat leading to an excess supply of long term bonds, forward rates are higher than expected spot/short rates. Hicks characterized this situation as a “normal backwardation”. Indeed, he explained that in normal time the loan market is characterized by an excess supply of forward loans in comparison with the demand. He makes here the assumption that there is an excess supply of long-term debt on loans

from their capital, and have no thought of anything else. How large this class is can be disputed (broad historical movements may well have changed its size very drastically); nevertheless, in any circumstances the qualification - they *have no thought of anything else* - is important.” (Hicks, 1939, p.151).

markets. Because lenders prefer investing in short-dated securities, there is a weakness on the demand side for long-dated securities:

... in all forward markets there is likely to be a tendency for hedgers to predominate on one side or the other over long periods. (Hicks, 1939a, p.138fn)

Borrowers expect future short/spot rates, but decide to issue bonds at the forward rate. There is therefore an excess offer of forward contract. The forward short rate is thus higher than the expected short rate. According to Hicks, this spread is a “*risk-premium*”:

The forward short rate will thus exceed the expected short rate by a risk-premium which corresponds exactly to the ‘normal backwardation’ of the commodity markets. (Hicks, 1939a, p.148)

As Hicks wrote, risk-premiums are part of forward rates:

... forward short rates ... equal expected rates *plus* a risk-premium. (Hicks, 1939a, p.281n.)

The determination of the long-term rate in Hicks’s thought can be represented in a two period’s framework as follow:

$$R_2 = [(1 + r_1)(1 + r_2 + \rho_1)]^{1/2} - 1$$

$$\text{Where the risk-premium is } \rho_1 = rf_1 - r_2^e$$

This brings us to case [2].

Case [2]:

If the current and expected short-term rates are $r_1 = 1\%$ and $rf_1 = r_2^e + \rho_1$ with $r_2^e = 1\%$ and $\rho_1 = 2\%$, then the long-term rate is $R_2 = 1.99\%$.

If the market supply of long loans increases in comparison with the demand, the risk-premium contained in the forward rate would increase from 2% to 3%. The long-term rate could then rise up to the level of $R'_2 = 2.49\%$.

Here, the long-term rate of interest would become higher than the average of expected short term rates because it would contains a risk-premium.

Hicks interpreted the spread between forward and expected spot/short rate as a “*constitutional weakness*” on the long side of markets. Borrowers hedge themselves from the

liquidity risk of borrowing at the short term interest rate r_2^e , by contracting at the forward rate. And the risk-premium is included in the forward rate.

To sum up, Hicks's theory of the term structure of interest rates is different from Keynes's one. Indeed, the risk premium results from the supply of and demand for long and short term loans by borrowers and lenders (who are not arbitrageurs), and not only from lenders' liquidity preferences. These preferences engender a natural upward sloping shape of the term structure of interest rates in Hicks's theory, even without introducing arbitrageurs.

The next (fourth) section shows that risk premiums are, for arbitrageurs, an opportunity to make profits. Indeed, according to Hicks:

...the forward market for loans (like the forward market for commodities) may be expected to have a constitutional weakness on one side, a weakness which offers an opportunity for speculation. (Hicks, 1939a, p.146).

5. The 'professional investors'

Hicks, like Keynes, introduces a third kind of agent: the "professional investors" who "provide most of the logic of the interest system" (Hicks, 1939a, p.169). These agents are "Banks themselves, financial houses, public institutions, large industrial and commercial firms" (Hicks, 1939a, p.169). Arbitrageurs can take advantage of the "constitutional weakness" of markets for loans without having a preferred-habitat like common lenders or borrowers. In this sense, Hicks describes "professional investors" as agents "operating on the whole gamut, and paying close attention to small differences in rates" (Hicks, 1939a, p.169)¹⁷. They are the counterpart of hedgers, and they can be more willing to take risks than common lenders on the market for long term maturities:

it is the essence of speculation, as opposed to hedging, that the speculator puts himself into a more risky position as a result of his forward trading. (Hicks, 1939a, p.138)

As seen in the previous (third) section, Hicks explains that the equations giving the long term rate contains a risk-premium $\rho_1 = rf_1 - r_2^e$ because lenders and borrowers have different preferences on loan markets. These different preferences are reflected by an expected

¹⁷ Hicks compares arbitrageurs on loans markets to "... professional arbitrageurs who provide most of the logic of the system of foreign exchange rates." (Hicks, 1939a, p.169).

short/spot rate lower than the forward rate. Given this structure, an operation of arbitrage could be to buy long-term bonds at the forward rate (rf) and to borrow at the spot rate (r_2^e).

We now present Case [3] to illustrate the implication of the operations of arbitrage in an economy with primary lenders and borrowers¹⁸:

Consider the initial structure of interest rates in the Case [2], where $r_1 = 1\%$ and $r_2^e = 1\%$. If the risk-premium is 2%, $rf_2 = 3\%$. This risk-premium reflects an excess supply of long term bonds of borrowers – hedging at the forward rate. If the current short/spot rate $r_1 = 1\%$, the long term rate R_2 would be 1.99%. Arbitrageurs could make a profit with the following strategy. At date t_0 , they can issue short term bonds at the short/spot rate of 1%, and expect to issue bonds again at date t_1 at the expected short/spot rate of 1% in order to buy long term bonds at the long term rate of 1.99%. If the amount invested in t_0 was 100€, arbitrageurs could expect to reimburse 102.01€ and would earn 104.03€ in t_2 . At this date, arbitrageurs would have made a profit of 2.01€. Purchases of long term bonds would lead to an increase of their price and then to a drop of the long rate of interest until it reaches the level of 1%, which corresponds to the average of current and expected short/spot rates. Therefore, the level of the long term rate of interest would have decreased thanks to the operations of arbitrageurs; it was initially $R_2 = 1.99\%$, and after the occurrence of arbitrages the level of the long term rate would be $R'_2 = 1\%$.

To sum up, in Hicks's economic framework, arbitrageurs can eliminate risk premiums and therefore, they may bring the long term rate to the average of expected short term rates. On loan markets, the level of the long term rate of interest could thus be lower with the presence of arbitrageurs than the one prevailing on a market solely composed of primary lenders and borrowers. However, Hicks raised concerns about the limits to arbitrage; he indeed wrote that "the extent to which changes in short rates are transmitted to long rates" is "a point about which we cannot be very optimistic" (Hicks, 1939a, p.262). The limits to arbitrages in Keynes and Hicks thought is analyzed in the next chapter of my thesis, called

¹⁸ It is important to note that Hicks does never assert that arbitrages eliminate entirely the risk premium, but they still have the power to do it.

« Limits to arbitrage and interest rates: a controversy between Hawtrey, Hicks and Keynes »
(Brillant, 2015).

6. Conclusion

Keynes and Hicks stressed in different manners a link between the short-term rate and the long term rate of interest. We saw in a first part the functioning of the term structure of interest rates in a context of certainty. In such a context, thanks to arbitrages, the long-term rate of interest reflects the average of current and expected short-term rates of interest. Because the short-term rate of interest is influenced by the central bank, it is a monetary phenomenon in Keynes's thought. Then, in a second and third part, we have considered a context of uncertainty. In uncertainty, Keynes's and Hicks's view differ on the risk premium. According to Keynes, it is the average of expectations on the short-term rate of interest plus a risk premium which determines the long-term rate. The risk-premium comes from the preferred-habitat of lenders. According to Hicks, the long-term rate of interest is determined by the average of current short-term and forward rates. The risk premium is characterized by the spread between expected short/spot rates and forward rate. This spread is engendered by the preferred habitat of lenders and borrowers and reflects a "constitutional weakness" on the market for long maturities. Indeed, the forward rate is higher than the expected short/spot rates. Hicks called this situation a "normal backwardation" on loan markets, which is characterized by a higher level of forward rates in comparison to expected short/spot rates. In the fourth section, we see that Hicks introduced a third kind of agent, the "professional investors" (1939a, p.169) who are arbitrageurs. These agents can advantage on spreads between expected short/spot rates and forward rates. Indeed, because of the "constitutional weakness" of markets associated with the preferred-habitat of lenders and borrowers, arbitrageurs can realize profits when expected short/spot rates are lower than forward rates. Through these arbitrages, the level of the risk-premium can be reduced. As a consequence, the average of current short rate and forward rates diminishes. Therefore, the long-term rate of interest falls.