The Evolution Of Interest Rate Futures And Their Market Functions

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ABSTRACT

This paper provides theoretical description of the evolution and market functions of interest rate futures. The paper contributes to the existing literature by documenting the evolution of interest rate futures and examining their market functions. Interest rate futures and their market functions have evolved on a number of exchanges over the last forty years as a result of worldwide dramatic fluctuations in interest rates. Most of these interest rate futures contracts are usually written on coupon bonds as the underlying assets and interest rate futures have had rapid growth with trading volumes larger than the futures on stock indexes and currencies. The reason behind this growth has been due to the severe impact of the interest rate risks as compared to risks arising from equity prices, exchange rates and commodity prices. The pioneer exchanges for trading financial futures were Chicago Mercantile Exchange and the International Monetary Market followed by others. The paper also discusses the market functions of interest rate futures such as risk reduction through the use of hedging strategies, speculation and arbitrage functions.

Keywords: Derivatives, Interest Rate Futures, Interest Rates, Interest Rate Risk, Speculation, Arbitrage.

1. INTRODUCTION

For over forty years a number of securities markets in the world have seen the evolution of interest rate futures which have a number of market functions. Interest rate futures are a small component of the field of financial futures; the other components being currency futures and stock index futures. All these belong to a bigger class of financial instruments known as derivatives and a number of reasons have been identified as why derivatives are important (Whaley, 2006). One of the reasons is related to the low trading costs of the derivatives compared to the underlying assets creating efficiency in trading. The function of solving trade restrictions problems has been adequately addressed by Whaley (2006) while Vashishtha and Kumar (2010) postulated that derivatives could be used in crop yields uncertainties and price risk management. Many scholars have defined derivatives as instruments that bear the characteristic that they do not possess their own value but their value is dependent on some underlying assets such as stocks, bonds, currency and commodities (Vashishtha and Kumar, 2010; Whaley, 2006 & Edwards and Ma, 1992). Most of the interest rate futures contracts are written on coupon bonds (Chembini and Esposito, 1995) and these interest bearing instruments pay fixed income at predetermined points of time and the principal amount at maturity. A number of misconceptions have been put forward against the use of derivatives and some researchers have blamed the use of derivatives for the 1987 stock market crash (Edwards and Ma, 1992) and the 2008 global crisis (Kozarevic and Jukan, 2011) but derivatives if used in a proper way can provide a number of benefits to organizations. The main contribution of this paper is to address two specific research questions. First what factors have contributed to the evolution of interest rate futures and secondly what are the market functions of
the interest rate futures? These questions are central to the understanding of the evolution of interest rate futures and their market functions. The rest of the paper is organized as follows: Section 2 presents the literature review based on the two themes arising out of the research questions. Section 3 describes the interest rate futures and how they have evolved. Section 4 explains the market functions of interest rate futures. Section 5 concludes the paper.

2. LITERATURE REVIEW

Interest rate futures have evolved since the mid-1960s (Hull, 2010; Edwards and Ma, 1992; Whaley, 2006) and the importance of the topic under discussion lies in the fact that one of the major research questions related to interest rate futures is their evolution and rapid growth with trading volumes larger than the futures on stock indexes and currencies plus their benefits to institutional and individual investors (Edwards and Ma, 1992; Whaley, 2006). The interest rates have exhibited a high degree of volatility since the 1970s leading to increased interest rate risk exposure (Goldfarb, 1987). In light of increased interest rate risk exposure and higher and more volatile interest rates, there has been growing interest in interest rate futures as a tool to manage interest rate risk. For instance Chen (2011); Geczy, Minton, & Schraud (2007); Selvam and Rita (2011); Srivastava, Yadav & Jain (2008) have all been supportive of the risk management function played by derivatives. In the financial intermediaries Goldfarb (1987) has referred to asymmetric risk and symmetric risk as the main components of interest rate risk. Researchers on risk management have shown that the risk arising from market variables such as equity prices, exchange rates, and commodity prices are easier to manage than the interest rate risk (Hull, 2010). Therefore interest rate futures have evolved as an important and strategic area of finance and they are viewed as a crucial component of financial futures markets (Bicksler and Chen, 1986; Goldfarb, 1987). Furthermore interest rate futures have been identified as powerful innovations whose growth has coincided with a period of unprecedented fluctuations in interest rates in many parts of the world- a trend which cannot be taken lightly (Bacon and Williams, 1976; Bicksler and Chen, 1986) because such fluctuations may have a significant impact on the market value of bond portfolios and other interest sensitive securities. Secondly the market functions of the interest rate futures are important to the futures market participants. The various functions of interest rate futures such as risk reduction, speculation and arbitrage functions have been discussed in the futures markets literature particularly in Andersen (2006), Anderson and Danthine (1981); and Hilliard (1984), and in this literature interest rate futures have been viewed as useful tools for banks and other financial institutions with mortgage portfolios in an era of volatile interest rates (Daane and Fredman, 1979).

1 The volumes of commodity futures have also shown explosive growth (Walther, 1982).

2 The market functions of interest rate futures of risk reduction, arbitrage and speculation are discussed in this paper.
3. CONTRIBUTORY FACTORS TO THE EVOLUTION OF INTEREST RATE FUTURES

Interest rate futures are part of the financial futures traded on a number of exchanges. They are financial market products used by investors and financial institutions to transfer financial risks and these products have become handy to many financial institutions and investors due to the dramatic fluctuations in interest rates since the mid 1960’s. As a result of this dramatic fluctuation in interest rates, short term and long-term interest futures have emerged to provide protection against the undesirable changes in investment value due to interest rate risk (Goldfarb, 1987). The three month Eurodollar futures with USD 1,000,000 Eurodollar deposit and three months to maturity constitutes the underlying instrument and they are the most actively traded short-term futures on Chicago Mercantile Exchange (Whaley, 2006). Normal backwardation in short-term interest rate futures markets is the main theme of the Krehbiel and Collier (1996) study where systematic risk premium as a means to clear the futures market is emphasized. Speculators for risk bearing services benefit from the risk premium created as an imbalance in the aggregate positions of hedgers (Krehbiel and Collier, 1996).

Before the emergence of the interest rate futures on a number of capital markets, organized commodity futures trading had already taken place for a long time in many parts of the world (Kozarevic and Jukan, 2011). The first financial futures were the foreign currency futures introduced by the Chicago Mercantile Exchange (CME) International Monetary Market (IMM) division in 1972 and today CME ranks as the number one futures exchange in terms futures volume traded. During the years that followed, trading in other financial futures contracts such as the British pound sterling, Canadian dollar, German mark, Japanese yen, Swiss franc, Mexican peso, Dutch guilder and the French franc commenced (Edwards and Ma, 1992). The trading in the above contracts showed great success and sparked off further innovations in the field of financial futures and the first interest bearing security (8% Government National Mortgage Association Certificate) was introduced by the Chicago Board of Trade. Other securities like Treasury bills, long term Treasury bonds also came on the market followed by Eurodollars and Treasury notes. The New York Futures Exchange introduced the 20 year Treasury bonds in 1980 and a week later trading commenced in 90-day Treasury bill futures3 which led to a stiff competition and conflict with the Chicago exchanges (Whaley, 2006; Andersen, 2006). The bond markets are the places where large volumes of interest rate futures are traded and factors such as the growth of the fixed income securities market and the increased volatility of interest rates have enhanced the growth of the interest rate futures (Edwards and Ma, 1992). For some time now financial futures trading has emerged on a number of financial futures trading markets, where trading is done in terms of contracts for future delivery of debt securities. These contracts possess a feature that their prices go up and down with changes in interest rates on underlying securities and were introduced partly to

mitigate interest rate risk (Whaley, 2006; Venkataramani, Johnson, O’Neil, Poindexter & Rodney, 2006; Edwards and Ma 1992). The trading volumes of interest rate futures contracts are much higher compared to those of stocks and indexes due to the enormous growth of the fixed income securities market and increased volatility of interest rate risk (Whaley, 2006; Edwards and Ma, 1992). Trading in interest rate derivatives today shows that the derivatives on the interest derivatives have the largest volume of all the over the counter trades with fixed income securities as the underlying assets (Hintz; Montgomery; & Curotto, 2011). The largest volume of interest rate futures is traded on the Chicago Mercantile Exchange (CME) and this exchange has the largest share of trading volume of all the major futures of interest rate futures foreign exchange futures and equity indexes. The global futures and options volume by category based on the number of contracts traded and/or cleared at 84 exchanges worldwide for the period January 2012 to June 2012 is given in Table 1.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>PERCENTAGE VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity Shares</td>
<td>32.1</td>
</tr>
<tr>
<td>Individual Equities</td>
<td>30.7</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>14.2</td>
</tr>
<tr>
<td>Currency</td>
<td>10.3</td>
</tr>
<tr>
<td>Agriculture</td>
<td>4.6</td>
</tr>
<tr>
<td>Energy</td>
<td>3.8</td>
</tr>
<tr>
<td>Metals</td>
<td>3.6</td>
</tr>
<tr>
<td>Others</td>
<td>0.7</td>
</tr>
</tbody>
</table>

Source: www.futuresindustry.org

For the period January-June 2011 the percentage volume for interest rate futures was 14.9% (www.futuresindustry.org) and this volume was 4.7% higher than the January-June 2012 figure. In 2011 the effects of the 2008 global crisis were still strong in the market and the bond markets were still volatile. In such environments investors tend to strongly use derivatives to mitigate risks and therefore the bigger volume in 2011. Furthermore the Motladiile and Smit (2003) study found that open interest in futures contracts is positively related to the volatility of the underlying asset and when volatility reduces the volumes of interest rate futures also reduce because hedging does not create any benefits (Hintz; Montgomery; & Curotto, 2011).

**4. THE MARKET FUNCTIONS OF INTEREST RATE FUTURES**

It has long been recognized that interest rate futures have a number of market functions (Andersen, 2006; Anderson and Danthine, 1981; Hilliard, 1984). In particular interest rate futures have the risk reduction function, speculative function and the arbitrage function. These market functions are useful to individual and

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4 More than 50% of all the total market value of the US securities in 2003 was composed of bonds.
institutional investors. Hedgers, arbitrageurs and speculators are the major participants in the futures markets and hedgers are interested in making contracts to buy or sell as a temporary substitute for a cash market transaction of equivalent or equal size. Hedging serves the purpose of offsetting the price risk incidental to cash or spot market operations and can take two different forms namely a hedge of an existing cash market position and an anticipated cash market position in the future. The futures contracts allow investors to hedge the risk of adverse price movements in the cash market and the more volatile the underlying asset prices the more hedging demand will develop. In response to this increased risk, financial futures markets have been developed which allow holders of cash positions to hedge their interest rates. The risk avoidance potential of futures markets is the main theme advanced by the traditional theories of hedging (Working, 1953; Ederington 1979). According to Ederington (1979) the expression

$$H = X[(P_{s1} - P_{s2}) - (P_{f2} - P_{f1})]$$

is for gain or loss of the hedged position and

$$U = X[P_{s2} - P_{s1}]$$

is for the unhedged position.

Where:

- $P_{s1}$ = the spot price in period 1.
- $P_{s2}$ = the spot price in period 2.
- $P_{f1}$ = the futures price in period 1.
- $P_{f2}$ = the futures price in period 2.
- $X$ = the number of futures contracts.

The application of portfolio theory of hedging argues that $|H| < U$ or $Var(H) < Var(U)$ for spot and futures market prices to move together. Futures markets also allow speculators to back their forecasts with a high degree of leverage where they deal with a single market purchase or sale of an asset and their intention is to resell or repurchase the asset. Speculators will only enter the market only if they expect positive profits (Keynes, 1930; Hicks, 1939). The uncertainty about the future transaction price results into both risk and reward but speculators usually try as much as possible to avoid risk. For instance Krehbiel and Collier (1996, p.902) found that such speculators can only “be long (short) interest rate futures contracts at contract prices below (above) the expectation of the spot price on the contract delivery date”. The Koppenhaver (1984) study emphasized the need for speculators in the futures market. Therefore both hedgers and speculators are necessary for effective operation of the futures market where speculators provide liquidity for the market and this allows the hedgers to easily buy or sell securities in large volumes. Research has also shown that liquidity is a necessary condition for the success the futures markets (Melamed, 1981).

4.1 THE RISK REDUCTION MARKET FUNCTION

The risk reduction market function of the interest rate futures is achieved through hedging and this involves the purchase or sale of a futures contract as a temporary substitute for the cash market transactions. In order to
accomplish the hedging function one has to take a futures position equal and opposite to the existing or anticipated cash market position. However given today’s dynamic business environment it is not a necessary condition that investors and financial managers should expect close correlation between spot and futures prices. As suggested by Working (1953) the focus should be on the expected changes in spot premium and the spreads between spot/futures prices. The demand for financial instrument trade has grown and there is heavy use of these instruments by banks and financial institutions dealing in the mortgage market where forward commitment of funds in an era of increasingly volatile interest rates (Becon and Williams, 1976). Worldwide interest rates have been fluctuating as a result of unprecedented inflation which has in turn amplified the market risks related to activities of banks and financial institutions. Initially the conventional interest rate futures hedging strategies have been used to alleviate the risks these institutions face and these financial institutions now have an efficient and low cost risk tool to employ in reducing interest rate risks. The managers of these organizations can carry out risk management objectives of locking in returns on investments in fixed income securities to be made in the future, locking in current yields on short term securities, protecting the value of present holdings in fixed income to be liquidated in future and protecting the value of fixed income securities to be held indefinitely (Daane and Fredman, 1979). Other scholars have considered maturity of the hedged and hedging instrument, the coupon structure of the hedged or hedging instrument, the varying risk structure of interest rates and the changes in term structure as the key factors on which the effectiveness of hedging of interest rate risk depends (Kolb and Chiang, 1981). Working (1953) examined the multiple motives of hedgers in the futures market and found that risk minimization and profit maximization were the main motives. A significant amount of research on interest rate futures has focused on financial futures hedging (Alexander and Barbosa, 2007; Ederington, 1979) and the conventional hedge ratio approaches namely the naïve hedging approach, conversion factor ratio, minimum variance ratio and the duration or price ratio have been applied. The Kolb and Gay (1985) price sensitivity model proved to be a superior model since it is based on the notion of a perfect hedge where the overall wealth of the hedger is left unchanged regardless of the changes in interest rates. In the later half of the 1980s research was carried out on the hedging interest rate futures using more quantitative approaches. For example Sharda and Musser (1986) applied a more sophisticated and advanced approach to interest rate futures hedging based on multiple objective goal programming. They found that the multiple objective goal programming approach yielded better results than the conventional hedging approaches. Financial institutions and banks are the main users of interest rate futures in reducing risk and today the financial futures trade has enormously grown especially for those institutions dealing in the mortgage market. One characteristic of these mortgage market institutions is that they are normally faced with a commitment of funds upfront in an era of increasing and volatile interest

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5 Conventional hedging strategies assume that spot and futures prices move in a lockstep so as to achieve a perfect hedge.
rates (Bacon and Williams, 1976) Therefore interest rate futures can be used to hedge against interest rate risk.

4.2 THE SPECULATIVE MARKET FUNCTION OF INTEREST RATE FUTURES
Speculation is the second market function of interest rate futures and while some financial futures market participants use these markets to hedge risk others use them to speculate on price movements. Speculators prefer the high leverage obtainable and the low capital required for trades in the futures markets as compared to trades in the cash market. Early research on the speculation function of interest rate futures showed what this function can accomplish for the market participants. In this respect Arak and MacCurdy (1979) concluded that speculation on interest rates could be accomplished in the cash market but would involve greater costs than the futures market. A number of speculative spreading strategies exist that can be used by speculators in the financial futures markets. When interest rates are expected to fall, with short term rates leading the fall, speculators will frequently purchase futures in the short-term instruments and short sell futures in long-term securities. The explanation is that short-term interest rates experience the largest decline and since an inverse relationship exists between interest rates and prices, greater price increases will be produced in short maturity futures than in futures for long maturity instruments. If however the rates continue to rise, the profits from the short positions would cover most of the losses incurred in the long position (Edwards and Ma, 1992). The second spread is used during periods of rising interest rates when the long term rates are believed to have just reached a plateau and at this point speculators holding such a belief expect the short term rates to continue rising. By short selling futures in short maturities and purchasing the more volatile contracts in long maturities, they expect to take advantage of short term instrument prices as they continue to fall. These types of trades create arbitrages where the market a participant buys a security from one market and at the same time sells it in another market and this action results into riskless returns for that market participant. It should be noted that most arbitraging activities generally reflect speculation on the relationship between cash and futures rates.

The importance of speculation in financial futures trading should not be underrated because the high leverage available in the futures markets coupled with opportunities to apply a range of strategies to a term structure of volatile rates and prices, provides the market participants with incentives and challenges. The gains as well as the losses for risk taking in such a market should be evaluated very carefully.

4.3 THE ARBITRAGE FUNCTION OF INTEREST RATE FUTURES
The third market function of the interest rate futures is the arbitrage function (Whaley, 2006; Edwards and Ma, 1992; Hull, 2010). To arbitrage is to profit from mispricing between futures contracts and the underlying assets. The market efficiency hypothesis assumes that all the market participants have the necessary information regarding the asset prices such that no particular investor earning advantage over the other market
participants (Figlewski, 1984). However some researchers have suggested that capital markets are unpredictable and uncertain (Birau, 2011) and some investors gain more than others through arbitraging. For instance Halm and Won (2011) found that arbitrage opportunities are ever present in the futures markets. With such opportunities riskless profits can be made in the futures markets.

5. CONCLUSION

The interest rate futures have evolved as a result of interest rates exhibiting a high degree volatility leading to increased interest rate risk exposure to institutional and individual investors. The early trading of interest rate futures took place on the Chicago Mercantile Exchange. In the recent years the trading volumes of the interest rate futures contracts have been reducing as a result of the 2008 global financial effects and the subsequent regulation of the futures markets thus becoming lighter in a number of markets. The implication of this statement is that as long as the bond markets are volatile the demand for interest rate futures contracts must be high to mitigate the interest rate risks. This paper has identified risk reduction through hedging strategies, speculation and arbitrage as the major functions of interest futures. The smooth running of the futures markets requires the presence of hedgers, speculators and arbitrageurs. If derivatives are used well they can lead to a number of benefits.

6. REFERENCES


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