The Evaluation of the Canadian BAX Contract In Managing Short-term Interest Rate Exposure

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This paper documents stylized features and market behaviour of the Canadian Bankers' Acceptance Futures (BAX) contract. We investigate the historical context of the inception of the Canadian short-term interest rate futures market in the early 1980s and investigate the subsequent rapid development of the BAX market and outlook for the BAX contract as the dominant instrument to manage Canadian short-term interest rate exposure. Our key finding is the growth of the BAX Market hinges on the further development of the Canadian money market and its appeal to the international investor. Furthermore, the paper presents a time varying estimation of the hedge ratios between the BAX contract and a number of Canadian money market instruments, demonstrating the suitability of the BAX contract as a tool in managing Canadian short-term interest rate exposure.

Field of Research: Finance, Risk Management, Interest Rates

Keywords: Futures, Interest rate, BAX.

JEL classification codes: G14, G15, G18

1. Introduction

Canadian Money Market flourished in the early 1990's with the rapid increase in use of short-term interest rate derivatives, such as Interest Rates Swaps[1] (IRS) and Forward Rate Agreements (FRA). Canadian Money Market futures trading began in 1983 with the introduction of the Canadian T-bill futures contract by the Toronto Stock Exchange. This first attempt failed[2] and traders attributed this failure to several reasons. *First*, the Canadian T-bills futures required physical delivery similar to its U.S. counterpart, an undesirable trading characteristic for a small, thinly traded market (where the possibility of a short squeeze is always present). *Second*, financial derivatives were fairly new and traditional money market traders did not understand the complexity of derivatives which were viewed as competition to their products rather than as complementary instruments. *Third*, there was little institutional support to educate investors in these new products. *Finally*, the introduction of T-bills futures occurred before the takeover of major brokers by Canadian banks when the two groups of financial institutions were in direct competition with each other[3].

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Futures trading on the Montreal Exchange (Mx) began in April 1988 in an economic period that was characterized by increased volatility of short-term interest rates, with the introduction of the 3-month Canadian Bankers' Acceptance futures (BAX) contract in response to the need for market participants to manage interest-rate risk. One year later the ten-year Government of Canada Futures (CGB) was introduced to manage Canadian long-term interest rates, and in 1992 and 1995 two other contracts were introduced the one-month Canadian Bankers Acceptance (BAR) and the five-year Government of Canada Bond Futures (CGF) respectively. However, these contracts failed to generate market interest and were subsequently delisted (the BAR in 1996 and the CGF in 2000). In 2002 one other short-term interest rates futures contract was introduced the 30-day Overnight Repo Rate Futures (ONX), and that too has failed to generate any significant market interest. The only contracts that maintained market interest were the CGB and the BAX. By 1995, the BAX replaced the FRA (forward rate agreement) as the benchmark for the Canadian short-term interest forward rates, and became the main instrument to hedge and price Canadian Money Market derivatives.

In this paper we study the BAX contract; the contract has the following market characteristics at present: the daily average volume is at 26,209 contracts and its yearly volume has risen to over 6.5 million contracts for 2003, a 45% increase over 2002 volume (please see Table 1). In 1997 outstanding market value (stock) of the BAX contract surpassed the cash T-bill (the most popular and liquid Canadian Money Market instrument). Currently, the BAX market value (stock outstanding) is over two and half times the size of the Canadian T-bill market. Consequently, it appears that money market participants use the BAX contract as a benchmark to price not only derivatives but also their cash instruments.

Table 1

Growth of Montreal Exchange Interest Rates Futures Contracts

	BAX Volume Open Interest	**BAR** Volume Open Interest	**CGB** Volume Open Interest	**CGF** Volume Open Interest	**ONX** Volume Open Interest	**Total**
1990	88,262 5,514	N/A	454,058 5,100	N/A	N/A	542,320 10,614
1991	194,071 21,874	N/A	421,493 3,713	N/A	N/A	615,564 25,587
1992	419,765 12,749	23,502 596	515,732 3,673	N/A	N/A	958,999 17,018
1993	724,158 49,882	24,552 1,312	895,047 15,789	N/A	N/A	1,643,757 66,983
1994	1,918,976 83,837	12,172 1,718	1,496,543 20,740	N/A	N/A	3,427,691 106,295
1995	2,326,709 67,255	24,552 1,312	1,026,854 15,368	63,842 2,171	N/A	3,441,957 86,106
1996	2,415,563 99,564	23,502 596	1,072,111 19,784	35,649 2,799	N/A	3,546,825 122,743
1997	4,129,777 186,535	N/A	1,272,970 36,285	50,944 3,576	N/A	5,453,691 226,396
1998	6,803,028 171,354	N/A	1,836,979 42,626	45,113 1,479	N/A	8,685,120 215,459
1999	6,047,542 211,852	N/A	1,598,463 29,594	21,506 157	N/A	7,667,511 241,603
2000	4,992,957 148,927	N/A	1,501,264 55,649	222 0	N/A	6,494,443 204,576
2001	4,234,236 156,352	N/A	1,835,229 59,642	N/A	N/A	6,069,465 215,994
2002	4,789,319 147,870	N/A	1,803,420 63,542	N/A	6,817 400	6,599,556 211,812
2003	6,578,451 187,905	N/A	2,397,119 77,177	N/A	6.055 0	8,975,576 265,082

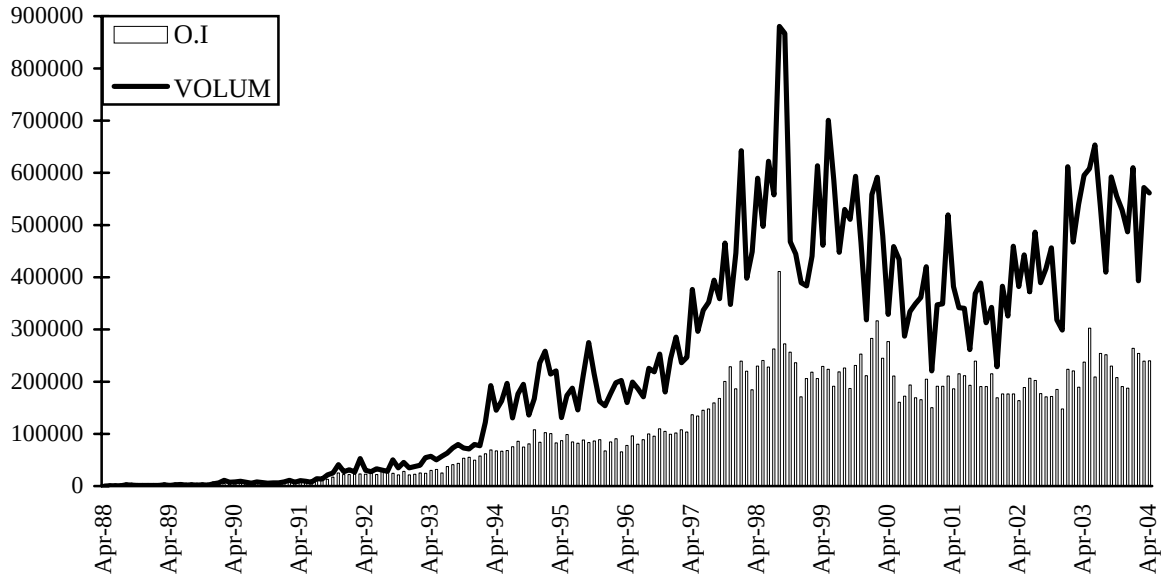
(Source: Montreal Exchange)

Notes: The Table exhibits the Annual trading volume (first line) and End of year open interest (second line) of the contracts that are listed on the Montreal Exchange. ONX – 30-day Overnight Repo Rate Futures; BAX – Three-month Canadian Bankers' Acceptance Futures; CGB – Ten-year Government of Canada Bond Futures.

In sharp contrast to the previous experience with T-bill futures, the popularity of the BAX contracts with Canadian financial institutions (amounting to about 40% of all BAX trading) was not accidental, but stimulated by the Montreal Exchange. The Exchange desired a contract that would be used by the financial community, particularly the banks. The original plan was to model a contract based on the Canadian Interbank Offer Rate[4]. However, at the recommendation of the financial institutions, Canadian Bankers' Acceptance (BAs) was used as the underlying asset of the proposed future contract[5]. As Table 1 demonstrates its success, as none of the instruments listed on the Montreal Exchange come close to the BAX contract in terms of volume, liquidity, depth and width of their markets. In fact the BAX contract volume represents one third of all products traded (at the Mx) and over 70% of all interest derivatives. Both total trading volume and open interest grew by 2.8 times since 1995, in 2003 the BAX volume is close to the high set in 1998. Clearly the contract has the lion's share of this market and in spite of the drop in early 2000s it continues to represent over 70% (78% in 2003) of the total trading volume of all futures contracts that trade on the Montreal Exchange (over 3.6 times the volume of the nearest rival the CGB). This phenomenal growth of Bankers' Acceptance futures is also reflected in the open interest numbers.

Figure 1

BAX Monthly Volume and Open Interest



The remainder of the paper is organized as follows. *Section two* introduces the BAX contract, its development and institutional features. *Section three* demonstrates the suitability of the BAX contract as a hedging vehicle for Canadian short-term interest rates. *Section four* concludes with suggestions for further research.

2.0 The BAX Contract

Figure 1 depicted the BAX tremendous growth (both, monthly volume and open interest), in a decade and half of the BAX existence. From a modest start of 210 contracts in April 1988 to 572,012 in March 2004, highest volume occurred in August 1998 at 880,544 contracts. March 2004 volume represents an underlying value of over 572 billion dollars, an impressive amount for any instrument trading on the Canadian market. Closer examination of Figure 1 reveals several milestones, 1994 volume reflects an increase of 2.7 times over 1993 average monthly volume (161,000 vs. 60,000). Three years later (1997) the average monthly more than doubles to 345,000 contracts; a year later another milestone is set with average monthly volume exceeding 500,000 contracts (1998, monthly average 567,000). Although this level was maintained in 1999, the monthly average started dropping to a low of 349,000 in 2001. Since then the average has climbed to 400,000 and 550,000 in 2002 and 2003 respectively. This observation raises the following question: What were the factors in the building of and sustaining this huge increase in trading volume?

As Table 1 clearly demonstrates that the yearly BAX volume doubled every year from 1990 to 1994, and in 1994 replaced the CGB as the main contract traded at the Mx. 1994 was the defining period for the BAX, the period known as the dollar crisis period. Interest rates increased violently due to pre-election jitters, the Canadian dollar lost 1.37 cents in less than one week. The dollar slide continued until it reached a 5-year low, despite the Bank of Canada intervention. As a result, T-bill rates rose sharply and the increased volatility pointed to further expected rate jumps in the Bank rate. Influx of money market traders and f/x traders increased participation in the BAX market[6]. In 1997, increase in trading volume was driven by speculation on the widening Canada – US interest rate spread and the increase "spread play" by large hedge funds (mainly from the US). Foreign exchange traders who were long the Canadian dollar hedged their position by selling BAX contracts. New market participants (portfolio, hedge funds and foreign traders) were introduced to the BAX market, and were impressed by its depth and liquidity. The trading volume increased to the highs in 1998 due to the increased market volatility from the Long-Term Capital Management fiasco and the unprecedented one-day increase of 100 Basis point (August) of the Bank of Canada to shore the dollar. Market participants desperately attempted find ways to hedge their exposed positions; they found their answer in the BAX contract. In short, during its comparatively short career the BAX contract established itself as an effective hedging tool in volatile times.

The driving factors behind the stylised finding in Table 1, namely the 2000 – 2001 decline (in volume and open interest) were: shrinking financial needs of the Canadian government, explosion of the equity market, historical low levels of interest rates and decline in interest rate volatility[7] resulted in lack of market interest in interest rates futures. In 1990's Canadian financial markets experienced phenomenal growth. The stock of all outstanding marketable securities[8] increased by 115% and reached over $2.4 trillion in 2000. However, the composition of the increment changed: in year 2000

bond and money market instruments totalled about 55% of the outstanding marketable securities down from 65% (1990). In addition the composition within fixed income changed, with the greatest decline experienced by the Money Market, down to about 11% from 20% (in contrast, the bond market experienced only a 2% drop, from about 44% to 42%). As well, with a steady rise in corporate issuance, Government of Canada bonds share declined to 38% down from 46%.

Table 2

	T-BILLS	Asset Backed CP	CP	BA	GOC BONDS
1990	135.4	N/A	29.3	44.1	138.3
1991	147.6	N/A	28.8	36.1	157.3
1992	139.5	N/A	26.3	22.0	172.1
1993	165.9	3.7	28.0	26.2	198.3
1994	159.6	3.6	31.9	26.61	226.2
1995	160.1	4.9	35.6	30.7	249.8
1996	135.2	8.5	31.2	34.0	277.8
1997	108.8	22.4	35.9	40.2	298.9
1998	87.1	41.2	40.1	45.9	299.4
1999	93.5	53.8	51.5	47.1	301.9
2000	78.7	60.0	55.8	51.5	301.0
2001	95.0	61.5	49.1	44.3	288.0
2002	104.4	63.4	47.0	37.4	283.0
2003	116.8	62.6	39.5	32.3	273.2

Outstanding Cash Securities (in Billions)

(Source: Bank of Canada)
Notes: The Table provides end of year outstanding stock of the most popular Canadian short-term interest rates instruments (Canadian T-Bills, Commercial Paper CP, and Bankers' Acceptance) and the Government of Canada Bonds (GOC). Usually bonds under 18 months are considered money market instruments. The Benchmark is roll out from the Scotia Bond Index which is considered the Canadian index for bond portfolios.

The above changes occurred in the Canadian financial market as a result of market participants shifting from low yielding debt instruments to the relatively high-income generating equity market: a global move to equities, in midst of a bull market. In addition, low debt market volatility and the consequent low borrowing cost reduced the need to hedge. Furthermore, anecdotal evidence suggests that the reduction in Government of Canada issuance contributed to the decline in liquidity not only in the fixed income market but also in the futures market (Bank of Canada Review, (2002)). Market participants increasingly adopted a buy and hold strategy that further curtailed

the secondary supply of GOC (Government of Canada) securities. Table 3, shows that the weekly turnover[9] for GOC instruments dropped from their peak in the late 1990s to early 2000s dragging with them the turnover of the futures contracts. In addition, the introduction of electronic trading eliminated the Montreal Exchange trading crowd impacted the liquidity and depth of the futures market. Electronic trading was introduced by the Mx in early 2000, and despite its' efficiency gains, the evidence is mixed when it comes to liquidity and immediacy of order execution. The futures market lost the majority of the "locals" (professional traders) who started trading the BAX and CGB contracts in 1989, and at their peak totalled over 200. Losing them contributed (at least initially) to loss of liquidity and trading volume.

Table 3

Weekly Turnover, Annual Average

	T-BILLS	GOC BONDS	BAX	CGB
1995	0.55	0.24	0.50	0.19
1996	0.60	0.30	0.51	0.20
1997	0.48	0.32	0.54	0.16
1998	0.36	0.27	0.55	0.16
1999	0.25	0.20	0.54	0.14
2000	0.27	0.19	0.45	0.12
2001	0.21	0.24	0.42	0.11
2002	0.20	0.19	0.51	0.11
2003	.21	.31	0.60	0.13

(Source: Bank of Canada, Montreal Exchange). Turnover = Trading Volume / Open Interest.

The other point Table 1 makes is that the CGB rebounded in 2001 while the BAX continued to fall. Historically low interest rates in real and nominal terms in the early 2000s supported longer-term borrowing, which attracted private and government issuers, and which fuelled the growth of longer term debt and hence the CGB contract. With the simultaneous bubble bursting in the equity market, investors' flight to quality and an increase in interest rates (from historical lows), anecdotal evidence shows both the BAX and the CGB rebounded to historical highs in 2003. In fact, the total volume money market futures contracts in the Mx reached a new high (8.9 million compared to 8.6 million for 1998). A similar rebound was experienced in the T-bill stock outstanding and a slight reversal in the weekly turnover (see Tables 2&3).

2.1 Institutional Market Features

The primary use of BAX contracts as mentioned above is to manage short-term interest rate exposure. However, the contract is also used for speculation and arbitrage. The

BAX contract major participants can be divided into two main groups: financial and non-financial. Some trade for themselves and some on behalf of clients (70% of all trades). Professional traders, brokers, market makers, and dealers account for the balance. Financial institutions act as intermediaries in the derivatives market, extracting revenues from fees, dealers' bid/ask spreads and trading profits. Market risk associated with cash securities inventories is managed through rebalancing inventory levels with offsetting customers' orders. However, since customers' orders rarely coincide with dealer's rebalancing needs, dealers are forced to take natural long positions and therefore build up their institution's inventory with the expectation of a profit later on. The existence of a liquid BAX market allows them to hedge these positions thereby improving their ability to carry out market risk management in the cash market which promotes greater overall liquidity.

The BAX contract is also used to hedge risks associated with banking operations; for example, banks can hedge their demand deposits with offsetting positions in the BAX contacts. According to data published by the Montreal Exchange over half of the transactions in the BAX market are undertaken for hedging purposes[10]. Bank traders who manage the "funding book", hedge their short-term exposures with the BAXs. Most Money Market traders have used BA futures to hedge their positions in one way or another. In addition, financial institutions – banks in particular – are concerned with the impact of fluctuations on their interest rate gap between assets and liabilities. Canadian banks have set up risk-management departments to measure and manage interest rate exposure resulting from their intermediation role. They also try to cover any undesirable FRA position offsetting it in the BAX market. Financial institutions thus carry out a significant portion of their interest rate management through the BAX market. It is estimated (by the Mx) that about 40 percent of all BAX volume is a direct result of trading by financial institutions, such as investment dealers and pension funds.

Another major user of the BAX are non-financial entities who manage short-term debt commitments. Non-financial institutions that issue short-term debt and use credit lines to finance day-to-day operations are exposed to short-term interest fluctuations. Therefore, the most common use of the BAX contract is to minimize the impact of short-term interest rate fluctuations on the firm's financing strategy. Treasurers use BAXs to achieve a more desirable matching of current assets and liabilities. They can also protect themselves against the risk of unfavourable interest rate movements by trading the BAX contracts, and lock in their short-term financing rate.

It should be mentioned that non-residents also trade BAXs to hedge or take advantage of the foreign – domestic interest rates spread, i.e. interest rate differential between Canada and other countries. This is facilitated by the existence of international contracts (Eurodollar, US T-Bills futures, Short-term Sterling, and others) with similar specification. Traders can speculate not only on the direction of short-term interest rates, but also on volatility spillovers, movements, and spread differentials between short-term domestic and international rates. One of the popular spreads to emerge is

the “BED” spread. The BED spread is the difference between the Canadian BAX contract price and the U.S. Eurodollar futures price. Depending on whether the BED spread narrows or widens with respect to some benchmark selected by the trader, the trader will take offsetting positions in the hope that the spread will “normalize” in the future. For individual investors the main rationale for using BAX contracts is to hedge the returns of their Canadian investments.

Finally, the BAX market has contributed significantly to the efficiency of the Canadian Money Market. Money Market participants have come to regard the BAX as the benchmark for pricing and hedging. The existence, efficiency and liquidity of the BAX market has also provided the possibility of arbitrage among Money Market instruments. We also examined the relationship between the T-bills and the BAX for the period 1995-2003, the BAX market responded to new information faster than the T-bill market 67%[11]. Demonstrating the BAX contract money market leading role and its volubility as the source of information on market interest rate expectations. Market expectation of the future behaviour of short-term interest rate yield curve can be inferred from the BAX rates of the different maturities (for more details see Section 3).

2.2 The BAX Advantage

To evaluate the advantages of the BAX contract, alternatives in managing interest-rate risk are examined. The best alternative to the BAX contract is found in over-the-counter (OTC) Money Market derivatives[12]. These are off-exchange derivatives which had an earlier start than the BAX contract and for a time were the only Canadian products available to manage interest-rate exposure. The OTC products include FRAs, IRS and OTC options. Interest-rate FRAs are contracts that set the rate of interest to be paid (or received) over a predetermined period of time and are based on the BA rate. IRS are agreements whereby two parties agree to exchange short-term floating interest rate payments for a longer-term fixed interest rate payments or vice versa. Interest-rate options are provisions to pay or receive a specific interest rate on a predetermined principal for a pre-set period of time.

The Bank of Canada conducted a survey of the Canadian foreign-exchange market in April 1995. The survey included for the first time questions concerning over-the-counter interest rate derivatives. The survey was repeated in April 1998 and in April 2001 (see Tables 4 and 5). During the month of April 2001, OTC interest rates derivatives totalled over US$198 billion, up 47.5% from US$134 billion in 1998 (1995 figure was US$82 billion dollars). The daily turnover of OTC interest rate derivatives amounted to US$9.9 billion dollars an increase of 55 percent over 1998 $US 6.4 billion dollars (1995 figure was US$4.3 billion dollars). Table 4 and Table 5 document the phenomenal growth of the Canadian money market as a whole with an incredible growth for the IRS market[13] (over 600%). Two other contracts were reported in the Bank of Canada survey, interest-rate forward rate agreements and OTC interest-rate options.

Table 4
Total Single-currency Turnover reported by Banks and other Financial Institutions
Millions of U.S. Dollars

	1995	1998	2001	GROWTH*
FRA				
Total	56,683	50,983	57,656	1.7
Canadian Dollar	31,414	31,801	18,235	- 42.0
U.S. Dollar	21,962	18,767	24,724	12.6
IRS				
Total	20,165	61,449	121,464	602.4
Canadian Dollar	8,247	41,575	59,157	717.3
U.S. Dollar	10,285	13,744	43,121	419.3
OTC Options	5,640	22,034	19,203	340.5
Total	82,488	134,466	198,323	240.4

(Source: Bank of Canada. As of April 1995, 1998 and 2001)

- (*) Growth is calculated from 1995 to 2001.
- Turnover = Trading Volume / Open Interest

Table 5
Principal amount Outstanding
For Canadian Single Currency Derivatives
(in Billions of U.S. Dollars)

	1995	1998	2001	GROWTH*
FRA				
Total	137.4	313.8	278.3	102.5
Canadian Dollar	81.8	81.3	29.8	-63.6
U.S. Dollar	53.4	126.2	89.2	67.04
IRS				
Total	507.2	1360.5	1927.9	380.1
Canadian Dollar	216.6	415.1	551.4	254.6
U.S. Dollar	259.4	449.8	635.1	244.8

	1995	1998	2001	GROWTH*
OTC Options	110.9	317.4	345.0	311.1
Total	755.5	1991.7	2551.2	337.9

(Source: Bank of Canada, as of June 30 for 1998 and 2001 and as of March 31 for 1995)
(*) Growth is calculated from 1995 to 2001.

The best comparison of the BAX contract is with the OTC interest-rate FRAs. BAX and FRAs allow the hedger to fix the rate of interest for a specified term in a future period and are used primarily to manage interest-rate risk. Tables 4 and 5 are not so favourable to the FRAs as they show a modest increase of 1.7 % from 1995 and amounted to 10.9% (down from 23% in 1998) of the total outstanding of interest-rate derivatives market. The picture gets bleaker when we take into consideration the Canadian denominated FRAs, the true competitor to the BAX. The majority of FRA contracts are denominated in other currencies, while the BAX is denominated only in Canadian dollars. Since 1995 the Canadian dollar denominated FRAs actually declined by 63% (outstanding stock) while the BAX increased by 232% (using open interest).

An additional point is the difference between the amount of the FRA outstanding and BAX open interest with respect to the relative liquidity of the two markets. Open interest is measured by the total net position[14] on the Mx, while outstanding FRAs represent the gross of the notional amounts held by the banks. Any offsetting position on a contract thus reduces the net amount of open interest in the BAX, while for FRAs, it is added to outstanding. Therefore, the growth of the BAX compared to the FRA is underestimated. The higher growth of the BAX contract is due to a number of advantages over OTC contracts, such as:

1) OTC products such as FRAs are customized and involve considerable negotiation, where as price is the only item open for negotiation with the BAX.
2) Customised FRAs are not interchangeable and therefore restrict trading, where as entry and exit in the BAX market occurs daily (BAXs are more suitable for trading).
3) The BAX daily volume of over 26,000 contracts, and the tight bid/ask spreads ensure superior liquidity[15]. A wide bid and ask spread for FRA adds additional costs to entry and exit from the positions established.
4) For creditworthiness, the BAX is guaranteed by the Canadian Derivatives Clearing Corporation. Given the bilateral nature of the FRA, each party is exposed to default by the other[16].
5) The BAX contract is a publicly traded contract and price quotes are provided over the Internet. FRA clientele generally must “shop around”, so price competitiveness may be reduced.

6) Margin requirements and transaction costs are lower for exchange-traded products[17] than for off-exchange products. To trade OTC products a credit line is generally required which bars entry for some market participants.

2.3 Outlook for the BAX Contract

The outlook and success of the Canadian futures market and the BAX market depends to a great degree on the outlook and success of the Canadian money market in particular and the fixed income market in general. In 2000, the total Canadian fixed income products outstanding totalled just above $US1 trillion[18] (US$19 trillion in the US). Historically, Canadian money market compromises of about 20% of the Canadian fixed income market (over 35% in the US). Traditionally, Governments are the largest borrowers. Canada is no exception, Government bonds (Federal, Provincial and Municipal) account for about 65% of all outstanding Canadian bonds. In recent years these numbers are declining, the growth of the outstanding Canadian bonds has lagged the growth of other debt instruments. In contrast, corporate borrowers account for the bulk of money market borrowing as T-bill market (see below) has shrank significantly. In contrast, US Treasuries account for 16% of the US fixed income market and have long dominated the fixed income market in term of trade volume (58%). Trading in the Canadian fixed income market is relatively active for Governments securities (about 7% of the volume of the US market and ranks fifth behind, US, France[19], Japan and Italy), but lags other countries in term of its corporate market. Recently, trading in Government bonds has dropped due to two reasons. *First*, the Bank of Canada's policy of actively retiring debt and *second*, historical low rates have promoted investors to hold relatively high yielding corporate rates and as a result corporate bond trading is on the rise.

In recent years, a number of trends have affected the composition of the Canadian fixed income money market. The elimination of government budget deficits in the mid-nineties, shrinking federal government financial requirements, and the related decline in the T-bill market. As a result the T-bills made up only 29% (45% in the US) of the outstanding Money Market instruments in 2000 (all time low) compared to 69% in 1993. Consequently, other Money Market instruments such as the Canadian Bankers' Acceptance (BA), Canadian Prime Commercial Paper (CP) and the Asset Backed Commercial Paper (ABCP) attempted to fill the void as demonstrated by Table 2. However, the growth trend of the Money Market instruments and GOC bonds (1998-00) came to a halt in favour of the T-bills stock (2001 and on). The apparent increase in the stock of Canadian T-bills is due to the commitments of the Bank of Canada and the Department of Finance to increase the supply of T-bills by 20%, the only exception was the ABCP. This demonstrate *first*, that the Canadian money market has a primary dependence on government debt, and *second*, the Canadian demand for short-term paper is geared toward well-known issuers with limited appetite for securities with lower rating. The rapid growth in "AAA rated" Asset Backed Commercial Paper enforces the second point. However, Money Market practitioners believe that the ABCP has peaked around $63 billion mark. The 2003 T-bill volume show a 22% increase over 2001

volume, which means that the supply of the T-bills will hold steady at this level as long as, the Government maintains a surplus spending position. The futures/cash ratio provides a rough estimation of the relative importance of the futures market relative to the cash market. In Canada this ratio stands at 3% well behind Sweden and the Switzerland. The US futures/cash ratio is 37% and in the UK and Japan the ratio stands at 102% and 143% respectively[20].

These current trends are raising the anxiety of Canadian Money Market practitioners. A number of Canadian financial institutions declared their intention to reduce their corporate exposure (by one-third), which implies a reduction in BA market. This fact along with the "buy and hold" traditional attitude of the Canadian Investor, prompted the Investment Dealers Associations to infer that the decline is a potential indicator that liquidity in corporate money market is fading. Reduced market profitability is another worry, which will force many Canadian corporate borrowers into the US and offshore money markets. Low capital expenditures by the Canadian corporation[21] and a growing trend to use multi-term financing[22], translates into reduced money market issuance and liquidity. The continued growth of these trends have market practitioners question whether the Canadian money market will keep expanding.

On the positive side, the growth of corporate sector will offset the downward trend in government debt outstanding. Has promoted a key Canadian fixed income index (Scotia McLeod Index) to shift relative weighting of government to corporate securities. To follow the index, investors will weight their portfolio more heavily toward corporate securities, fuelling further increase in this market. Another positive point is the establishment of Canadian fixed income electronic trading and its impact on futures trading. Technology plays two important functions in this context. *First*, it provides quick access to information (market microstructure and news). *Second*, trades execution (orders routing and matching) is more efficient. In 2001 Canadian firms (CANDEAL and CBID) launched two electronic trading platforms for institutional fixed income trading, and two for retail (CollectiveBid Systems and BondDesk Canada). The systems were introduced to increase transparency and market visibility an important aspect to penetrate the international fixed income market. Currently over 2,500 Canadian debt instruments trade on the electronic platform these include: Government of Canada T-bills, money market instruments, all domestic Government of Canada Bond issues, federal agency bonds, Provincial and Municipal bonds.

Obviously, the continued long-term success and role of the BAX in the money market hinges greatly on the outcome of the above trends and changing dynamics in the marketplace. Various initiatives that can have long-term impact on the BAX market and the entire Canadian Financial markets that be explored, developed and encouraged include:

1) Continued improvement in the investment-grade of the Canadian money market instruments.

2) Increase in the sophistication of the Canadian institutional investor, striving to match risk-reward payoffs with greater participation in the Canadian corporate market.
3) The extent the BAX hedging role is further exploited in the risk-reward match up.
4) Needed changes in Canadian investors' attitude toward risk, mainly toward lower grade short-tem paper, replacing their strict diet of mainly high credit paper.
5) Continued commitment of the federal Government to preserve the integrity of the market for Government securities and adopting initiative to enhance market liquidity and to alleviate some of the pressure on the effective supply of these securities.
6) The extent of the multi-dealer online fixed income-trading network will enhance transparency and efficiency, and attract both domestic and international investors.
7) The continued popularity of the shift from the money market to multi-term financing. The phenomenon may be the result of what is perceived as current "historical low yields", the question is; whether this shift will continue if yields expectation change?

In summary, there is little doubt that the futures and fate of the BAX contract is greatly influenced by the continued growth of the Canadian money market. Barring any major crisis, practitioners believe that the volume of the BAX contract will hover around the 6.5 million mark. However, the likely outcome for the Canadian market over the next few years will be relatively flat demand with a downward bias. Dealers will look to ways innovate while simultaneously reducing cost and improving efficiency, such as the development of electronic trading. The current outlook for the BAX enhanced by recent growth and the lack of any serious competition[23] remains optimistic. The contract will continue to serve as "the benchmark" for pricing and hedging Canadian short-term interest rate exposure for the foreseeable future.

3.0 Hedging Canadian Short-term Interest Rates Exposure

In this section, we estimate a time-varying hedge ratio between the major Canadian Money Market instruments[24]. The purpose of this section is not to calibrate an "optimal" model for the market hedge ratio[25], but rather to demonstrate the effectiveness and suitability of the BAX contract as a hedging vehicle for Canadian short-term interest rates. In this context, the optimal hedge ratio is associated with the covariance between the spot yield and the futures yield. In previous studies, researchers adopted a (G)ARCH methodology to model the time-varying nature of the volatility of stock and bond prices in the context of hedging (Bollerslev (1987), Ceccetti, Cumby, and Figlewski (1988), Baillie and Myers (1991).

The motivations and theory of hedging is well grounded in economics and finance literature. Basically hedging adds value, as reinsurers (hedgers) attempt to deal with market risk. Hedging enables market participants to alter the risk they face from unexpected changes. Therefore, the proper estimation of the hedge ratio is of crucial importance, as underestimation of the hedge ratio leaves the hedger underinsured, and over estimation of the hedge ratio results in higher costs (over insurance). An effective application of hedging requires a way to manage the difference between cash and futures price movements (basis – risk minimization). The closer the price sensitivity of the futures position to the price sensitivity of the cash position, the more effective the hedge. Therefore, the optimal hedge ratio (HR) indicates the proper number of futures contracts required to compensate for the yield movements of the cash and is measured by:

$$HR_t = \left[\frac{Cov(\Delta S, \Delta F) \mid \Omega_{t-1})}{Var(\Delta F \mid \Omega_{t-1})} \right] \text{.....(1)}$$

Ω_{t-1} is the information set at time t-1, ΔS and ΔF spot and futures yields differences.

3.1 The Model

The hedge ratio is estimated using Bollerslev (1990) Multivariate GARCH specification, where an error correction term in the mean equation is added to correct for the misspecification arising from the cointegration between spot and futures series[26]. In this form of multivariate GARCH, the assumption is that the conditional correlation between the elements of $_{.t}$ is constant over time. This specification reduces the complexity of estimation and is quite tractable.

$$\mu_t = \begin{bmatrix} B_C + \delta_C (C_{t-1} - F_{t-1}) + \varepsilon_{C,t} \\ B_F + \delta_F (C_{t-1} - F_{t-1}) + \varepsilon_{F,t} \end{bmatrix}, \text{.....(2)}$$

$$\Sigma_t = \begin{bmatrix} \sigma^2_{C,t} \\ \sigma^2_{F,t} \\ \sigma_{CF,t} \end{bmatrix} = \begin{bmatrix} V_C + \alpha_C \varepsilon^2_{C,t-1} + \beta_C \sigma^2_{C,t-1} \\ V_F + \alpha_F \varepsilon^2_{F,t-1} + \beta_F \sigma^2_{F,t-1} \\ \rho_{CF} (\sigma_{C,t-1} \sigma_{F,t-1}) \end{bmatrix} \text{.....(3)}$$

A number of researchers have estimated the hedge ratio in the context of interest rate futures, Cecchetti, Cumby and Figlewski (1988), Kroner and Sultan. (1993), and Koutmos and Spericli (1998). The three models were estimated with error-correction terms using multivariate-t distributions with five degrees of freedom[27].

3.2 The Data

The data on the Money Market instruments are daily closing yields for the Canadian three-month T-bills (TB), Canadian three-month Bankers' Acceptance (BA), and Canadian Prime Commercial Paper (CP) and the settlement yields[28] on the 3-month Bankers' Acceptance Futures contract (BAX) were obtained from the Bank of Canada and the Montreal Exchange (see Figure 2). The time period under consideration is January 3rd 1995 to March 31st 2004, representing a total of 2,320 daily observations for all the series. The first 2,257 observations ending December 31, 2004 are used to model the series. The remaining 63 observations were used to reflect a 3-month forecasting horizon ending March 31st, 2004. To avoid expiration effect and thin trading near expiration, the BAX contract is rolled into the next contract on the last day of the month before expiration[29]. Several diagnostic checks[30] on the distributional properties of the data were conducted (see Table 6).

Figure 2
BAX, T-bill, BA and CP Daily Yields

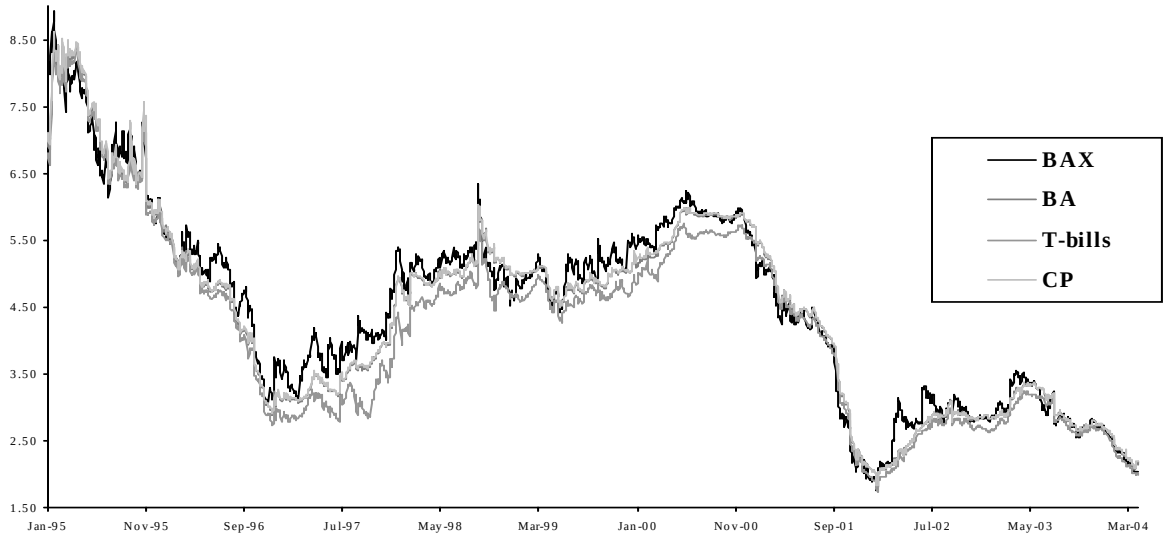


Table 6
Descriptive Statistics

	T-bills	T-bills Diff.	CP	CP Diff.	BA	BA Diff.	BAX	BAX Diff.
Mean	4.23	-0.0021	4.43	-0.0021	4.42	-0.0021	4.52	-0.0027
Maximum	8.33	0.85	8.62	0.81	8.54	0.76	8.93	0.68
Minimum	1.73	-1.00	1.82	-1.27	1.80	-1.15	1.76	-0.65
Skewness	0.536 (0.00)	0.032 (0.522)	0.430 (0.00)	-2.032 (0.00)	0.422 (0.00)	-1.493 (0.00)	0.303 (0.00)	0.639 (0.00)
Kurtosis	-0.091 (0.374)	70.37 (0.00)	-0.211 (0.037)	112.63 (0.00)	-0.231 (0.023)	98.70 (0.00)	-0.29 (0.004)	12.89 (0.00)
BJ test for Normality	111.95 (0.00)	478727 (0.00)	75.85 (0.00)	1228001 (0.00)	73.94 (0.00)	942664 (0.00)	43.95 (0.00)	16231 (0.00)
Test for ARCH effects		59.44 (0.00)		70.98 (0.00)		65.46 (0.00)		42.98 (0.00)
Dickey-Fuller rho-test (5 Lags)	-4.46	-2746*	-4.44	-3438*	-4.24	-3050*	-7.67	-4652*
Dickey-Fuller t-test (5 Lags)	-1.46	-20.23*	-1.51	-20.85*	-1.56	-20.52*	-2.25	-21.49*
Phillips-Perron rho-test (5 Lags)	-4.05	-2145*	-4.29	-2127*	-4.03	-2136*	-8.71	-2017*
Phillips-Perron t-test (5 Lags)	-1.57	-43.12*	-1.58	-43.82*	-1.46	-43.33*	-2.34	-44.03*

Notes: The BJ [Berra-Jarque] test for normality is distributed $\chi^2(2)$. The test for ARCH effects is described in the text, and it is distributed $\chi^2(2)$. P-values are given in parentheses. The variables are defined in the text. The 5% critical value for the rho test is -21.8; the 5% critical value for the t-test is -3.41. Starred entries are significant at the 5% level.

3.3 Results and Discussion

The discussion in this section provides evidence of the flexibility of the BAX contract and its suitability as a hedging vehicle for the Money Markets. The BAX is an effective tool in managing Canadian short-term interest rate exposure. Investment dealers and pension funds find it necessary to hedge their T-bill exposure because of their large size trades (even in time of low volatility). Some of the problems outlined in section 2 are reinforced by this section analysis. Namely the choppiness and illiquidity of the Canadian money market instruments. This evidently has a negative impacted on the performance of the BAX contract. It is evidently clear that the BAX contract for better or worse is linked to the Canadian money market. The results in Table 6 confirm that the data under consideration are mean non-stationary. A formal test for skewness rejects the null of symmetry with low p-values. As well, the data are fat-tailed as confirmed by the kurtosis test. Both the skewness and kurtosis tests are highly significant, indicating

that normality can be rejected. The test for ARCH effects is to regress a series containing the squared difference of the elements of the T-bills, BA, CP and BAX series on a constant and 5 lags of the series. The statistic is quite large, indicating that past values of the square of the series are useful in predicting current volatility; in short, there is clustering overtime. The statistical analysis readily confirms that all of the series are non-stationary and the null of a unit root cannot be rejected. If a long-run relationship does exist between these two variables, then its omission in model estimation leads to inconsistent estimates. Our results indicate that the T-bills-BAX, the BA-BAX, the CP-BAX prices are cointergrated with cointegrating vector (1, -1). Based on the results, a multivariate student–t distribution with error correction term is used to model the error terms.

The estimates of the T-bills/BAX model, the BA/BAX model and the CP/BAX model, are presented in Tables 7. Several features of the estimates merit comment. *First*, all of the models meet both the positivity and stationarity conditions[31] as indicated in the estimated coefficients of the variance series. *Second*, the α's and β's are significant and changing over time implying that the risk-minimizing hedge is changing over time. (β_{ii}) the key persistence parameters are high for all the models and a high β implies a high carryover effect of past to future shocks i.e. volatility. And *third*, the highest likelihood function belongs to the BA/BAX model. Naturally, the BA and BAX are of the some credit quality and the hedge estimated between the is considered a pure hedge, with the other two instruments the hedge is considered a cross hedge. *Fourth,* ρ_{CF} the constant correlation matrix measures the correlation between the cash and the futures. In this environment the estimate varies from 0.45 to 0.66. Interestingly the strongest correlation is between shocks to T-bills prices and BAX prices and not the BA prices and the BAX prices. *Fifth*, the error-correction coefficients are strongly significant. When cash and futures market function efficiently and are very liquid, new information should be disseminated simultaneously in both markets. However, certain market impediments may delay the dissemination of new information. These include high transaction and investments costs and more restrictive nature of short position in the spot markets (as evident by the BA and CP markets). Although these affect the T-bills, they affect the BAs and CPs to a higher degree.

Table 7

Maximum Likelihood Estimation

MODEL [LIKELIHOOD]	**TB/BAX** [374.19]	**BA/BAX** [643.87]	**CP/BAX** [278.93]
B_C	-0.042438929	-0.019793838	-0.021677745
(s.e.)	(0.007680651)	(0.004383254)	(0.004534684)
B_F	-0.010209292	-0.015107667	-0.016392719
(s.e.)	(0.013386288)	(0.008668184)	(0.008724185)
δ_C	0.011244002	0.014197683	0.018288715
(s.e.)	(0.002344054)	(0.002082832)	(0.001814937)

MODEL [LIKELIHOOD]		TB/BAX [374.19]		BA/BAX [643.87]		CP/BAX [278.93]	
δ_F (s.e.)		0.005593573 (0.003981675)		0.015097906 (0.004598485)		0.014037176 (0.004149527)	
V_C (s.e.)		0.00106000 (0.000036428)		0.001860000 (0.000074110)		0.004940000 (0.000142469)	
V_F (s.e.)		0.00341000 (0.000121975)		0.003970000 (0.004285084)		0.003780000 (0.000155751)	
ρ_{CF} (s.e.)		0.659609159 (0.010855882)		0.621599003 (0.012050505)		0.455752954 (0.018654976)	
β_C (s.e.)		0.941287877 (0.000078671)		0.893777017 (0.000168194)		0.728884658 (0.000296045)	
β_F (s.e.)		0.934597256 (0.000281824)		0.928085439 (0.009202557)		0.926097578 (0.000360210)	
α_C (s.e.)		0.008997637 (0.000319249)		0.014850323 (0.001151190)		0.049203808 (0.002334988)	
α_F (s.e.)		0.009906784 (0.000383569)		0.010417614 (0.001566142)		0.011766136 (0.000524331)	
Within-Sample Hedge Ratio							
MIN. MAX.	Mean Variance	0.16368 0.81661	0.4167 0.0096	0.13233 1.05353	0.3478 0.0108	0.0911 21.39870	0.26386 0.01249
Out-of-Sample Hedge Ratio							
MIN. MAX.	Mean Variance	0.35998 0.42849	0.39290 0.00041	0.3247 10.56444	0.36339 0.00201	0.23687 0.72954	0.34001 0.01150

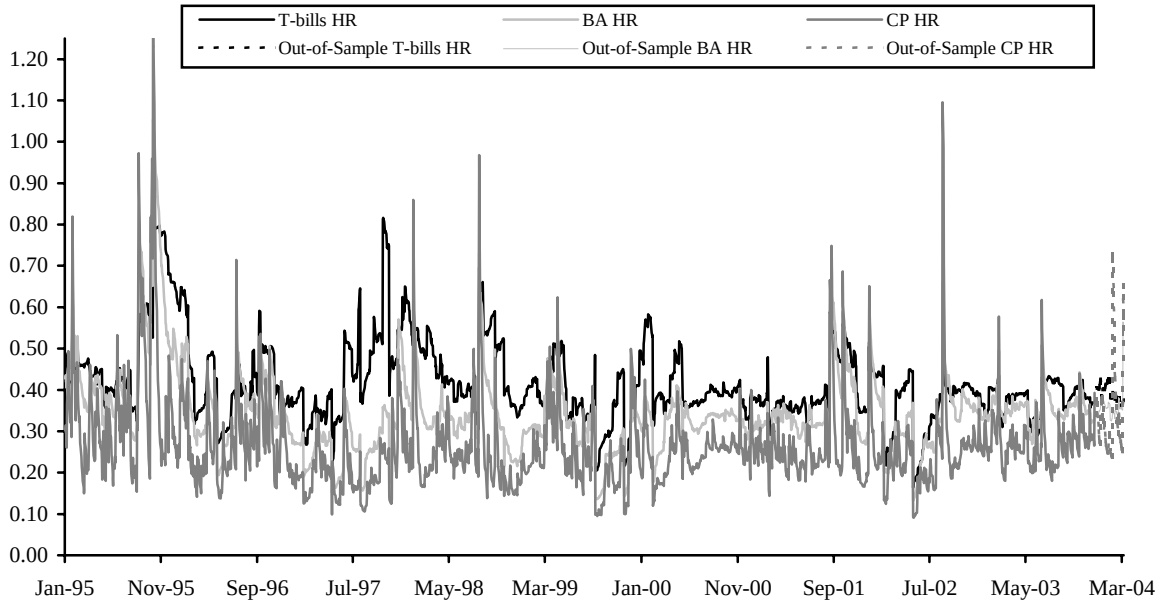
Notes: The numbers in [ ] are the value of likelihood function; the numbers in parentheses ( ) are asymptotic standard errors. Regarding positivity and stationarity conditions, the positivity conditions are c_{ii} , a_{ii} and $b_{ii} > 0$, the stationarity conditions are and $(\alpha_{ii} + \beta_{ii}) < 1$ (i = C,F).

Even with declining stock, the T-bills market was larger than the two combined (the only exception is 2000). The degree of flexibility[32] in the futures market encourages participants to deal with the BAX market before dealing with the spot market when new information hits the market. The leading indicator role can be measured by the error correction coefficients (δ_C and δ_F). The leading-indicator role is illustrated by the ratio:

$$\left[\delta_C / (\delta_C + \delta_F)\right] \qquad (4)$$

The coefficients depend on the market arbitrage operations, and if no such operation exist both market are deemed independent (with $\delta_C = \delta_F = 0$) and as long as δ_C and $\delta_F \neq 0$ the markets are said to be linked. In addition, if $\delta_F = 0$, the ratio is equal to one and new information is always disseminated first on the futures market, i.e. the futures market always responds earlier than the spot market. All of the coefficients (Table 7) are different from zero with the δ_F for the TB/BAX model is the closet to zero (0.0055), the leading-indicator ratio for the BAX and T-bills is 67% confirming that the BAX market responds to new information faster than the T-bills 67% of the time. The ratio is 48% and 56% for the BA/BAX and CP/BAX respectively (borrowing BAs and CPs[33] for short selling is near impossible, only the banks can take advantage of such arbitrage opportunities). Finally, the Table also reports on the within and out-of sample estimates hedge ratio given by equation 1.

Figure 3
T-bill, BA and CP Hedge Ratio



The hedge ratio (HR) estimates from the three models are plotted in Figure 3 for the purpose of comparison. All three HR estimates are positively correlated with the BAX contract and show considerable variation over time. They are clearly changing as new information arrives in the market, implying that if the hedge ratio is large (relative to its long-run mean), then in absence of new shocks (information) to the system, we would expect it to remain large the next day, but it would converge to its long-run mean. An inspection of the graphs (Figure 3) of the hedge ratio estimates displays a similar pattern for the BA and CP hedge ratios, while the TB hedge ratio is relatively smooth and less jagged. Also the difference is evident by the larger range of the BA and CP

hedge ratios and larger variances (see Table 7). These markets seem to be exposed to larger shocks that produce greater impact on the HR estimation.

An effective application of hedging requires an effective management of the difference between cash and futures interest rate movements (basis-risk minimization). The basis risk here is the short-term interest rate exposure throughout the duration of the hedging period. In an examination of the relationship between the TB and the BAX; the highest correlation (sensitivity) is found between the BAX and T-bills. The worst performer of the three in terms of range and variance is with the CP both within and out-of sample estimates. It is interesting that the price of the underlying BA is less correlated with the BAX price changes than the T-bills. Although the BA is the underlying asset, the importance of the BAX market does not come from the BA. Unlike the US market the BA rate has nothing to do with foreign trade. We often find divergence in the BA market due to credits limits of different end users (which does not happen in the BAX market); also BA investors are often not allowed to trade futures and therefore cannot arbitrage. Therefore, selling short the BA to take advantage of basis differences is next to impossible. Its value to the Canadian market is diminishing evident by the continued deterioration in its outstanding stocks (see Table 2), although the BA has value as the benchmark for interbank lending rate, the Canadian LIBOR. The closer sensitivity of the BAX to the T-bills implies a more effective hedge between them (compared to the BA and CP), largely due to the instruments liquidity and volume.

4.0 Conclusion

The paper describes the growth of the BAX contract from its inception in 1988. The BAX contract has met many domestic and international benchmarks and become main hedging tool for hedging Canadian short-term interest rates. It also provides both domestic and international investors an arbitrage opportunity that responds more quickly to the arrival of new information. The BAX contract today is seen not only as the Canadian benchmark to price interest rates derivatives, but the benchmark to price Canadian Money Market instruments. This paper demonstrated that the BAX contract is still a valuable source of information. However, the Canadian futures market is well behind other international markets, a position that suggests that in order for the BAX market to continue its growth there is a need for the Canadian money market itself to grow. Current outlook suggests that the BAX market will continue to grow and figure prominently among Canadian Money Market instruments.

In addition, this paper evaluated three bivariate GARCH models to measure the sensitivity (hedge ratios) between the BAX and major money market instruments. The results provide evidence on the high sensitivity between the BAX and the money market instruments. This sensitivity analysis highlights the relationship between the T-bills and the BAX contract confirming its effective role in managing Canadian short-term interest rate exposure. Further research into the appropriate model to calibrate the “optimal hedge ratio”, and the efficacy of the BAX in prediction of the yield curve for Canadian

markets and other related issues would be fruitful; given the pre-eminent standing of the BAX contract demonstrated by the results of the paper.

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End Notes

[1] Although not a money market instrument (a liability management instruments not a funding instrument) Swaps play a major role in managing Canadian short-term interest rates exposure.
[2] T-bills futures were delisted only 6-months later.
[3] The Banks preferred to sell their own FRAs and interest rate swap contracts, the traditional OTC (over the counter) money market derivatives, T-bill futures were perceived as an Exchange or brokers' product.
[4] The Canadian version of the British LIBOR (similar to the Eurodollar, the Sterling, and the PIB, which are based on Interbank Offered Rates).
[5] It was all in all a straightforward decision, as the banks themselves use the BA rate as their Interbank Offer Rate (the Canadian LIBOR is only used by London-based market makers).
[6] The price correlation of the BAX contract and the Canadian dollar is quite high.
[7] The volatility use to price OBX (options on the BAX contract) declined from about 22% to 11%.
[8] Equities, money market Instruments, and bonds.
[9] Trading volume/open interest.
[10] The remainder includes 25% for speculation and 25% for arbitrage and yield-investment strategies.
[11] See section 3.
[12] Although the CME introduced the "Euro Canada" contract in 1997 to compete with the BAX. The contract was a flop with little liquidity and eventually collapsed in favour of the BAX.
[13] Interest-rate swaps are closely linked to borrowing/lending operations; a direct comparison between the swaps and the BAX contract is inappropriate.
[14] Remaining open contracts.
[15] Usual BAX bid/ask spread is about one basis point apart ($25), while the OTC contracts range from about four to ten basis points ($100-$250).
[16] The collapse of Enron and other firms has focused the spotlight on hedging partners.
[17] Margin requirements for the BAX contract, represent about 0.001 % of the underlying value. The transaction costs are declining; a round-trip fee can be as low as $7.5 per BAX contract (a 50% reduction from 1988).
[18] Including debt issued by Canadian Governments and corporations both domestically and abroad.
[19] France is a distant second.
[20] The futures market in England and Japan in larger than the domestic fixed income market, data supplied by the Bank of Canada.
[21] Canadian corporations are either cash rich or/and see reduced investment opportunities.
[22] A growing market of securitized borrowing (credit cards, auto loans…) of terms of two years and over is contributing to reduced Money Market issuance and liquidity.
[23] From rivals, in term of volume, liquidity, market depth and width.
[24] T-bills, Bankers' Acceptance, and Prime Commercial Paper.
[25] We leave this task for future work.
[26] See Engle and Granger (1987).
[27] The models assume that the error terms are drawn from the student t-distribution with five degrees of freedom, when the degrees of freedom were estimated freely, the estimates of the degrees of freedom were about 2.4, which is not consistent with the existence of a finite fourth moment. Five degrees of freedom were imposed on the estimation of the various models. The theoretical kurtosis of the student-t distribution is given by the expression $3(v - 2)/ (v - 4)$, where v=s are degrees of freedom. The kurtosis estimated by the various models imply 5 degrees of freedom, so on this measure the models with t-distribution appears to provide a better fit for the two series.
[28] Converted into yields form closing prices, (Yield = 1 – Price).
[29] For example, December BAX contract is rolled into March contract on the last day of November.
[30] The Bera-Jarque test for normality, a skewness and kurtosis test, the Langrange multiplier test for ARCH effects, the Dickey-Fuller tests and Phillips-Perron tests.
[31] Positivity conditions are c_{ii} , a_{ii} and $b_{ii} > 0$, the stationarity conditions are and $(\alpha_{ii} + \beta_{ii}) < 1$ (i = C,F).
[32] Low transaction, tight bid/ask spread, lower investments cost (margins) and the ability to short the market with ease.
[33] Although borrowing CPs are still easier than borrowing BAs.