Chartered Bank Corporation Case[1]

"Beeeeeep! Brad, it's Rachel Garner here at CBC. Listen, what can you do for me with GNMA floating rate swaps? Give me a call when you get back and let's talk."

Brad Kaiser works in the Client Strategies Group of Wright Derivatives Co., a AAA rated subsidiary of WrightBank Inc. specializing in swaps and other structured products. Rachel Garner is a VP at Chartered Bank Corporation (CBC), a "Yankee" (US) bank subsidiary of the Chartered Merchants' Bank of the United Kingdom.

The reason for Ms Garner's call is that, with the continuing flatness of the US yield curve, CBC has decided to dramatically shorten the duration of its bond portfolio. In particular, it wants to invest $500 million in short-term US debt for the next 3 years. The question in Ms Garner's mind is how best to do this.

One simple possibility is to invest the $500 million in one-year Eurodollar deposits and roll them over annually. A second possibility is to roll over one-year US Treasury bills. A third somewhat trickier possibility is a position in GNMA adjustable rate mortgage bonds (ARMs).

On the liability side, CBC is funding this position by short-term overseas borrowing at a cost – given a variety of subsidies and tax breaks by CBC's UK parent bank – of LIBOR *minus* a spread of (Brad guesses) roughly 35 basis points.

Term structure data: Table 1 gives the current US zero-coupon Treasury yield curve and also the term structure for the TED spread (difference between the Eurodollar and the Treasury rates).

GNMA Mortgages: GNMA (Ginnie Mae) ARMs are floating rate bonds backed by pools of adjustable rate mortgages that are guaranteed against default by the Government National Mortgage Association. Payments of interest and principal are collected by a mortgage servicer, which then passes them through – net of an annual 20 basis point servicing fee – to the GNMA bond holders.

The interest rate on GNMA ARMs is reset *annually* to reflect a contractually specified spread over a specified reference rate – usually the one-year constant maturity US Treasury (CMT) rate – subject to both *periodic* caps and floors, which limit the maximum rate change in any given year, as well as a *life-time* cap/floor on the change over the entire term of the mortgage.

The standard practice is to originate floating rate mortgages with an initial low promotional "teaser" rate payable over the first year of the mortgage. After the first year, the rate on the now seasoned (i.e., older than one year) floating rate mortgages jumps contractually to a higher spread. The initial teaser and future spreads passed through to bond holders – less the servicing fee – are set so that GNMA ARMs trade at par at issuance.

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Currently, the teaser spread on new 10-year GNMA ARMs is 75 basis points.[2] Thus, given today's one-year CMT rate of 3.12 percent (see Table 1), the current GNMA teaser rate paid by homeowners on new mortgages is 3.87 percent (i.e., 3.12 percent plus 75 basis points). Thereafter, the rate on these mortgages increases to 125 basis points over the reference one-year CMT rate prevailing at the beginning of each subsequent year – subject to periodic caps/floors limiting change in the GNMA rate to +/- 50 basis points per year. The lifetime cap is currently 2.00 percent above the initial rate. Thus, if the one-year CMT rate in one year is, hypothetically, 3.40 percent, then the seasoned 9-year GNMA rate for year 2 will be min{3.87 + 0.50 (old GNMA rate with cap), 3.40 + 1.25 (new CMT with seasoned spread), 3.87 + 2.00 (old CNMA rate plus lifetime cap} = 4.37 percent. [3]

Over time the outstanding balance for a GNMA bond declines due to both scheduled amortization and unscheduled prepayments in the underlying mortgages. On a pure *option-free* floating rate bond, prepayments are irrelevant. However, once caps, floors, promotional teaser rates and interest rate "lock ins" – i.e., annual rate resetting, but monthly prepayment (note that this case ignores the rate "lock in" effect) – are introduced, owners of GNMA ARMs can have interest rate risk. The "frictions" in the GNMA rate setting rules can cause the contractual reset GNMA rates (for seasoned mortgages) to diverge from the future market spot rates (which investors earn) and also from the future teaser rates available to homeowners when they refinance. Consequently, refinancing decisions by homeowners on the underlying mortgages are now non-trivial and may represent (i.e., along with the periodic caps/floors) a source of potential interest rate risk to bond holders.

The mortgage prepayment/interest rate risk is exacerbated by the ongoing presence of teaser rates in the market place. Since the teaser rate in the first year of a *new* mortgage *in the future* is set at a significantly smaller spread (i.e., over the CMT reference rate) than are the reset rates of *seasoned* mortgages, there is a built-in bias towards prepayment. WB Mortgage research forecasts that teaser rates in the future will continue to be in the 75 basis point ballpark.

Offsetting the bias towards refinancing are two additional factors. First, banks charge closing costs totaling 40 basis points when originating new (zero-point) mortgages. Refinancing only makes economic sense if the future interest rate savings from refinancing *at least* cover the refinancing costs. Second, some homeowners may simply not be paying attention – and, thus, don't get around to refinancing even when it makes financial sense – or they may be unable to refinance because if their credit worthiness deteriorates.

WD Mortgage Research forecasts that, due to scheduled amortization of principal and non-interest-rate related prepayments (e.g., because the homeowner moves, etc.), a typical GNMA pool of new 10-year floating rate mortgages pays off at an annual CPR of 10 percent (with a final balloon payment equal to the unpaid balance at the end of year 10). However, *each time* the new teaser rate is less than the GNMA rate on seasoned mortgages by enough to cover the closing costs, there is an *additional* 30 percent CPR jump in prepayments as homeowners refinance and "hop over" to the new teaser rate.

[2] All interest rates and spreads are quoted on an annualized basis.

[3] It is important not to confuse the future *teaser* rate on future *new* mortgages with the future *reset* rate on *seasoned* (i.e., previously issued) mortgages.

In evaluating the possibility of investing in GNMA ARMs, Ms Garner is intrigued by the healthy spread they pay over the one-year CMT rate. However, she is concerned whether CBC has the expertise to effectively manage US prepayment risk. In her mind there are three risks in buying the GNMAs:

- The risk in GNMA cash flows over her three-year investment horizon due to the embedded interest rate optionality arising from the way GNMA rates are reset.
- The basis risk in investing in Treasury rate linked bonds when her funding costs are tied to LIBOR.
- The interest rate dependence in the resale value of the seasoned GNMA ARMs *after* three years.

The competitor's proposal: Before calling Brad at Wright Derivatives, Ms. Garner spoke with Rob Dudley at Wrong Brothers, Co. He proposed a term repurchase agreement under which CBC would buy $500 million of par GNMA ARMs from Wrong Bros, hold them for three years and then sell them back to Wrong Bros. at a contractually set repo price. To hedge the option risk in the interim cash flows, Mr. Dudley recommends the CBC buy a three-year interest rate cap and write a three-year interest rate floor each with fixed notionals. The rationale was that these caps and floors should, Mr. Dudley claims, hedge out much of the impact of the periodic caps and floors on the GNMA interest cash flows and, thus, convert the GNMA ARM into something closer to an "option free" floating rate instrument.

Ms Garner is dissatisfied with Mr. Dudley's proposal. First, it ignores any interaction between the path interest rates follow over the next three years – and, hence, the resulting prepayments – and the number of embedded caps and floors implicit in a GNMA bond position. Second, there is basis risk in Mr. Dudley's proposal relative to LIBOR, the index for CBC's cost of funds. And third, the repo price Mr. Dudley quoted for her seemed too low.

Ms Garner wonders whether her concerns are valid and, if so, whether Brad can set up a GNMA transaction which would do a better job of purging the attendant interest rate dependence and the LIBOR/CMT basis risk from her GNMA cash flows over the next three years. Or should she just roll over Eurodollars or T-bills?

GNMA swaps: In a standard three-year GNMA swap, CBC would buy $500 million of new GNMA floating rate bonds at par today. CBC would reinvest any principal paid on the mortgages, including prepayments, but pay all of the next three annual *interest* payments to Wright Derivatives. The questions Brad faces are: What rate should WD agree to pay CBC in return? What future repo price should he offer? How can he meet CBC's special needs?

Current interest rate volatility conditions: Table 2 gives annualized forward volatilities implied by the market prices of interest rate caps. For example, the one-year estimated relative volatility is 15 percent for the future one-year CMT rate in one year. In addition, Table 2 also gives (relative) forward volatilities for the TED spread. The estimated correlation between innovations to the Treasury rate and the TED spread is 0.1.

Brad intends to model interest rates using a single-factor spot rate evolution model (e.g., Hull & White or Black-Derman-Toy or something similar). WD Research recommends setting the annualized speed of mean reversion parameter for the Treasury rate process to be 0.1. Similarly, the recommended speed of mean reversion for the TED spread is 1.8.

Hints: To keep thing numerically tractable in your analysis for the case, you can:

- Use an annual "time step" in simulating your spot interest rate processes.
- Assume that interest payments and prepayment/refinancing decisions are made at an annual frequency.

Some issues to consider: For your presentation and the subsequent Q&A, you will want to be prepared to discuss specific issues such as:

- Why did you choose the particular structure you did? Why is WD's GNMA ARM + swap + repo structure preferable to CBC's other investment alternatives (e.g., rolling over t-bills, rolling over Eurodollar deposits, and Wrong's GNMA + caps and floors + repo) and, specifically, to Mr. Dudley's proposal?
- How important are the GNMA periodic caps relative to the floors in pricing this structure? If they are different, why?
- What are the different risks (e.g., counterparty risk, prepayment risk, etc.) CDC and, particularly, WD are exposed to? How, for example, would changes to the zero Treasury curve affect the WD's profit/loss on the swap if unhedged?
- What strategy should Wright Derivatives follow in managing its various risks?

Presentation Format:

- In your sales presentation you can assume your client is knowledgeable about derivatives, but that she is primarily interested in how your proposal will solve her business problem.
- In the general Q&A, you may be asked questions about alternative parameter values. Bring your spreadsheet (or whatever numerical package you use) to the presentation so, if needed, you can plug them in your model and discuss them.

Written documents: Before the start of your presentation, you should submit the following written items via the digital drop box in BB.

- Copies of your sales pitch and boss briefing PowerPoint slides.
- A short summary "term sheet" with all key contractual terms for your deal (e.g., payoff rules, strike prices, timing issues, etc.)
- An 8-10 page deal memo to your boss describing the deal structure, your pricing and calibration methodology and results, your quantitative risk assessments, and your risk management strategy, and anything else you think your boss might be interested in even if, given the time constraint, you don't plan on including it in your verbal boss briefing.
- A short calibration questionnaire for grading purposes. In particular, since different teams may work with different deal structures, it is helpful to have a standard benchmark to assess the numerical properties of your calibration and simulation. The questionnaire should answer the following questions:

- What are your calibrated parameter values?
- What are the cross-path means and standard deviations of your simulated CMT interest rates and TED spreads after one year and after two and three years?
- What are the cross-path mean and SD of the remaining principal mortgage balance on the initial pool after three years?

Evaluation criteria: Your sales pitch will be evaluated in terms of the following criteria

- *Appropriateness of the structured product.* You have a fair amount of latitude in designing the structured product for CBC. Why did you choose the structure you did? Intuitively, what are the shortcomings of the Wrong structure?
- *Salesmanship.* While you want to understand the details, it is important to be able to rise above them in your presentation. Focus on the forest rather than the trees. You are selling an idea either to Ms Garner. The technical specifics of your analysis are a *means* to that end, rather than an end in and of themselves. Sell the deal. Sell your team. Sell your firm.
- *Clarity of the presentation and explanations.* When dealing with technically complicated products, clarity and intuition are particularly important.
- *Valuation.* This includes understanding the valuation drivers as well as model calibration and implementation.
- *Risk management.* What are the risks, who will bear them, and what is you (Wright's) strategy for managing your risks?

Good luck!

Table 1: Current Treasury and Imputed TED Term Structures

Maturity	Market YTM	Market TED
0		
1	0.0312	0.0045
2	0.0320	0.0094
3	0.0325	0.0084
4	0.0328	0.0095
5	0.0333	0.0092
6	0.0337	0.0089
7	0.0340	0.0087
8	0.0343	0.0085
9	0.0345	0.0084
10	0.0347	0.0083

Table 2: Implied Forward Volatilities

Maturity	Treasury v(t)	TED v(t)
0		
1	0.15	0.05
2	0.15	0.05
3	0.15	0.05
4	0.125	0.05
5	0.125	0.05
6	0.125	0.05
7	0.125	0.05
8	0.125	0.05
9	0.125	0.05
10		