

A Bank's Focal Point for Market Risk: The Transfer Pricing Mismatch Unit

By John Chittenden*

SUMMARY

First we explore the mechanics of the transfer pricing Mismatch Unit and discuss the degree to which its P&L holds the Bank's profits from interest rate risk management. Then we discuss how the performance of this unit should be measured.

*Vice President, Union Bank of California

Interest rate risk (market risk) has not been a primary concern of U.S. financial institutions for the last several years. The money markets have been relatively calm and rate movements have been modest and gradual. In this environment many Banks have not focused much attention on this source of risk. Yet ALM and profitability reporting software have made considerable advances in providing more precise and timely information on the Banks' performance in controlling and profiting from market risk. This paper explores the primary mechanism for tracking the effectiveness of a Bank's market risk control: the performance of its transfer pricing mismatch unit.

DEFINITION OF THE MISMATCH UNIT

A Bank's Treasury department is usually a relatively small unit in terms of personnel and space occupied. In the cost allocation schema, it is more nearly comparable to the Summer Picnic Committee than to the Mortgage origination unit. On the other hand, the proportion of the balance sheet managed by Treasury can be very large, greater perhaps than any other single business unit's. Yet the true measure of Treasury performance must ultimately focus on its P&L . . . its "bottom line" effect. Measuring Treasury performance through its P&L is not a simple matter.

As one begins to look into the mechanics of establishing management objectives and performance measurements for a Treasury department, he soon finds that what might sound straightforward at the outset soon becomes confusing and, like the pot of gold at the end of the rainbow, is easily seen from a certain distance but vanishes with proximity. In part, this is due to the many different, sometimes conflicting, objectives of a Treasury unit: liquidity management, investment for profit, funding, interest rate risk management, collateral management, and, perhaps, trading for profit. Of all these functions, probably the most unsettled in definition is the interest rate risk management as reflected in the transfer pricing Mismatch Unit and its relation to ALM hedging actions.

Matched term transfer pricing creates a "shadow" asset or liability for each expected cash flow on the balance sheet and attaches to each a market rate based on its term. Hence, we say "matched term" transfer pricing. Real assets are accordingly funded by "shadow" liabilities to produce a match-funded spread; conversely, real liabilities receive income

from “shadow” assets for the same purpose. The offsets from these cost/credits for funds are posted to a single Treasury unit which holds all of them in one place and is thus “mismatched” except in the very improbable case that the Bank’s balance sheet fortuitously has asset and liability cash flows which are exactly matched. This concept is illustrated in the simple “T” account diagram below:

Business Units				Mismatch Unit	
Assets \$100 10.0%	Shadow Liabilities \$100 -7.0%	Shadow Assets \$100 5.0%	Liab/Eq \$100 -4.0%	OFFSET Shadow Liabilities \$100 7.0%	OFFSET Shadow Assets \$100 -5.0%
Asset spread: <u>3.0%</u>		Liab/Eq spread: <u>1.0%</u>		Mismatch Unit spread: <u>2.0%</u>	

This very simple Bank’s mismatch position is illustrated again on page 6, where some term information has been added. The credit and funding spreads are provided by matched term funding and the Mismatch Unit holds the resulting position.

To see the effects of market rate movements on the mismatch position, consider the same simple balance sheet if rates move up 2% in the next month (shown in the table on page 7).



Today's Balance Sheet

5 Yr Fixed Rate Loan		1 Month CD		Total Bank Spread
Loan yield	10%	Deposit rate	-4%	6%
Cost of funds	-7%	Credit for funds	5%	Mismatch Offset
Lending spread	3%	Deposit spread	1%	

Components of Bank Spread:

Lending Spread	3%
Deposit Gathering Spread	1%
Mismatch Unit Spread	2%
	6%

Next Month's Balance Sheet... Rates up 2%

5 Yr Fixed Rate Loan	1 Month CD	Total Bank Spread
Loan yield	Deposit rate	4%
10%	-6%	
Cost of funds	Credit for funds	
-7%	7%	
Lending spread	Deposit spread	Mismatch Offset
3%	1%	0%

Components of Bank Spread:

Lending Spread	3%
Deposit Gathering Spread	1%
<<<< Mismatch Unit Reflects ALL Market Risk	0%
	4%

The Bank's total spread has declined from 6% to 4%, the full amount of which is reflected in the Mismatch Unit because it was caused by changing market rates.

In short, then, matched term transfer pricing pulls interest rate risk from the business units into the Mismatch Unit making the Mismatch Unit the true holder of the Bank's interest rate risk position. The Mismatch Unit's P&L is based solely on market rates absent the credit and funding spreads required by external customers. This concept is important. An example should clarify it:

Bank's all-in cost of 3 month "wholesale" money: 4.50%

[Funding source: wholesale CD.]

This is the 3 month point on the Bank's transfer pricing yield curve.

3 month Libor 4.40%

Loan A: reprices every 3 months; index = 3 month Libor
Price to customer: 3 month Libor + 200 bp

Deposit B: retails 3 month CD. 4.25%

	Loan A	Deposit B	Mismatch Unit	Total
Index	4.40%			
Customer pricing spread	2.00%			
Yield	6.40%	-4.25%		2.15%
TP cost/credit for funds	-4.50%	4.50%	0.00%	0.00%
Credit spread	1.90%			
Funding spread		0.25%		
Market risk spread			0.00%	
				<u>2.15%</u>

The point here is that the Mismatch Unit holds only market risk profits or losses. It does not hedge credit spreads for the lenders nor does it hedge against retail deposit price erosion due to competitive pressures. These are line unit risks. The Mismatch Unit's profits are based solely on market rates.

The ALM department hedges the Bank's interest rate risk and therefore:

- changes the risk profile of the Bank's asset/liability mix,
- changes the volatility of its margin, and
- changes the Bank's profitability.

In doing so, it has these same three effects on the Mismatch Unit.

When the hedging results are posted to the Mismatch Unit and combined with the transfer pricing offsets, the Mismatch Unit becomes the sole measure of the Bank's market risk hedging programs. In this context one may legitimately say that ALCO policies which state ALM risk limits in terms of the Bank's net interest income are logically misapplied. The limits should be based on the Mismatch Unit's net interest income, which, as shown above, is based on market rates and is, therefore, the only amount that market hedging can address. Indeed, the emerging market for credit swaps may focus direct attention on credit spreads and ultimately compel many Banks to make a clear distinction between market risk profits and credit risk profits. We'll explore this topic in more detail below.

OBJECTIVES OF THE MISMATCH UNIT

If the Mismatch Unit bears all of the Bank's market risk, an understanding of the components of its margin should reveal all of the *market factors* that drive changes in the Bank's margin.

Given this understanding, the Mismatch Unit Manager should have the following functions:

Mismatch Unit Management

- keep Bank's [more properly, Mismatch Unit's] margin within ALCO policy limits,
- keep Mismatch Unit's earnings at acceptable levels.

Consolidated Bank Net Interest Margin Analysis (as opposed to Management)

- explain the Bank's margin dynamics through analysis of Mismatch Unit performance, and
- monitor and analyze the Bank's net interest margin.

This all sounds relatively straightforward, but most Banks have difficulty deciding how closely the Mismatch Unit's P&L should be interpreted. At least three major types of policy decisions need to be fully understood before this issue can be resolved.

1. What does the ALM unit hedge: market value or GAAP accounting net interest income?

GAAP accounting net interest income is based on many non-market-based reporting conventions such as:

- accrued interest income/expense,
- summarization of events by calendar month only . . . an arbitrary and varying space of time with seasonal effects,
- reporting income with a mixture of mark-to-market and cost-basis, contractual payment reporting.

Hedging instruments are traded in the money markets whose economics are universally based on “present value” valuations. The market value of a swap is determined by its current expected present value, not its predicted monthly accounting income through its expected term. If such an instrument is used primarily to hedge near-term accounting income, a non-economical decision on which instrument to purchase can be made.

To illustrate the difference in accrual and market value measurements, consider a 5-year interest rate swap with a notional value of \$1 million paying a floating rate of 4.00% and receiving fixed at 4.85%. These rates have been determined based on a stipulated current yield curve. If we forecast rates as the implied forward rates in this same yield curve and assume that these rates are a perfect predictor of actual spot rates, then this swap would report the following accrual-based income for the five years:

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Accrual income	3,279	(221)	(621)	(1,021)	(1,421)	0

If we mark the swap to market each year using the same rates, the mark-to-market P&L would look like this:

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Market value chg	(2,962)	688	722	757	796	0

The total net income is zero in both cases because this is an economically priced swap and, in our analysis, rates in the future behave exactly as expected in the initial pricing.

The combination of accrual income (interest payments received) and the market value change is probably the best indicator of the swap's periodic performance. It would be:

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Net	317	467	101	(263)	(625)	0

The point here is that accrual income alone is not a good reflector of underlying economics in this case. Yet accrual income is posted to the Mismatch Unit to indicate the performance of the hedging programs. The mitigating consideration is that the balance sheet instruments being hedged *might* reflect a similar relationship between market value change and accrual income, and that hedging based on market value economics would “translate” relatively well into reported accrual income.

2. To what extent *can* the Mismatch Unit's net earnings be controlled by the ALM department?

The honest answer to this question is the unsatisfying “it depends . . .” Of course, generally speaking, the more precise the transfer pricing methods, the more meaningful the Mismatch Unit results. It is often helpful to analyze the quality of Mismatch Unit results by making broad distinctions as follows.

There are areas where Treasury has **substantive control** over the Mismatch Unit's earnings:

- Treasury (ALM) performs the net interest forecasts. When based on good data, these forecasts will reveal *major* anticipated balance sheet and market rate movements which affect the Bank's rate risk position. This is a solid basis for net interest margin hedging within the timing and materiality constraints imposed by the availability of this data.
- All market risk hedges are proposed and executed by Treasury (ALM). Their results are reported in the Mismatch Unit earnings.

There are areas where Treasury has **approximate control** over the Mismatch Unit's earnings. A few among many examples:

- Non-contractual maturity deposits have both balance and rate characteristics that are not directly related to money market rates, are not precisely predictable, and are therefore not fully hedgeable.
- Prime basis risk can only be partially hedged. The Bank's credit standing is probably not sufficient for it to hedge all of the Bank's Prime loans on a cost efficient basis in the Prime/Libor swap market.
- Prepayment behavior of fixed rate mortgage loans is, at best, "covered" by an option charge, but these charges cannot be expected to correspond exactly with the real gains/losses on the prepayment options in the loan products.

There are areas where Treasury has **little control** over the Mismatch Unit's earnings:

- Most earnings-based profitability analyses focus on month-to-month changes. Monthly trends in the Mismatch Unit P&L are not meaningful indicators of the effectiveness of interest rate risk management. They are subject to days-in-month accrual choppiness and the happenstance timing of accounting entries. Longer term P&L measurements must be used. Perhaps even quarter to quarter results are not long enough to be meaningful.
- Exact measurements of risk gradations in the Mismatch Unit's position are probably not possible. Therefore, when the P&L is used together with equity allocation to produce an ROE, this risk/return ratio must be interpreted with a wide latitude. For example, a movement from a 13% ROE to a 15% ROE from quarter to quarter may not have significance. This is discussed in greater detail below.
- Specific exceptions must be given for ALCO-directed trades which have an immediate effect on the interest rate risk position, but whose effect cannot be immediately hedged.

3. What are the legitimate sources of profit for the Mismatch Unit? Should all profits from interest rate risk be in a Trading book rather than the Mismatch Unit?

Although there are only a few U.S. Banks which have significant trading-for-profit strategies, those that do clearly segregate trading from Treasury operations. Profits belonging to the Trading book(s) are clearly defined and broadly understood. They are basically short-term market

rate bets in a defined, balanced book of business. This operation perhaps entails trading long term assets/liabilities but with gains/losses based on short-term realization and mark-to-market accounting. Currency trading might, of course, be another trading book. Such trading books are usually found only in large, money center banks. From this perspective, "trading for profit" does not include opportunistic Fed Funds or Repo trading as part of the Bank funding operations.

Profits belonging to a Mismatch Unit are distinct from this "trading for profit." Here the Bank's entire balance sheet *excluding any trading book(s)* "belongs" to the Mismatch Unit in the sense that its transfer pricing "shadow" asset and liability offsets are posted there. Logically speaking then, profits from managing this risk should be there also. But *should* there be *profits* from this operation? Is making *profits* a violation of the ALM charge for interest rate risk *control*?

For the Mismatch Unit and for any trading book, there should be no contradiction between *profits from risk* and *risk control* if the profits are made within the defined risk limits. The Mismatch Unit should be able to make profits from intermediate and long term rate "bets" and from the management of basis risk.

In highly over-simplified terms, most Banks make profits from basis risk and from short-funding a portion of their long-term fixed rate assets. These are legitimate sources of profits for a Bank. Fully hedging them away may be a very costly over-"protection" of earnings.

MISMATCH UNIT PERFORMANCE MEASUREMENTS

Let us return now to the question of how the Mismatch Unit's results should be measured. The logical place to start is with the Mismatch Unit's two principal functions.

1. As an *image of total market risk* in the Bank's consolidated net interest margin, does the Mismatch Unit's net interest *stay within ALCO risk limits*?
2. As a *source of profits* to the Bank, are the Mismatch Unit's *risk-adjusted returns* adequate?

We'll take these one at a time.

Principal Function #1: Staying Within ALCO Limits

Does the Mismatch Unit's net interest stay within ALCO risk limits? As we mentioned above, usually ALCO risk limits are expressed in terms of the consolidated Bank net interest income sensitivity.

Suppose the limit is defined as follows:

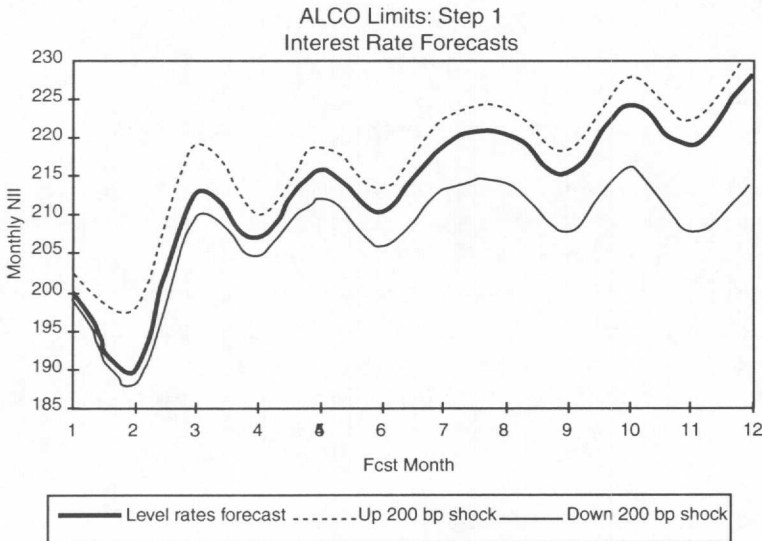
The Bank's net interest income is forecasted over 12 months under three rate scenarios:

1. no change from current rate levels,
2. a 200 basis point upward shock, and
3. a 200 basis point downward shock.

Net interest income in scenarios #2 and #3 cannot decrease more than 2% of the amount forecasted in #1.

Our goal is to find a logical way to look at the historical trends in the consolidated Bank net interest income to see whether net interest income has remained within the ALCO policy guidelines. We'll step through one logical approach.

STEP 1: Determine the ALCO limits based on net interest income forecasts at total bank level. The ALCO risk limit is the *change* in 12-month net interest from the Base scenario to the rate shock scenarios. Let's assume the three forecasts shown below.



These forecasts produce the following risk limit and profile:

Scenario	12 Months Net Interest Forecast	<u>Risk Limit</u>	
Level Rates	\$ 2,560	\$ 51	2.0%
		Change in Net Interest	
+200 bp	\$ 2,607	\$ 47	1.8%
-200 bp	\$ 2,492	\$ (68)	-2.7%

In this case the Bank has exceeded its risk limit for a 200bp downward shock in market rates.

STEP 2: Relate the risk limit based on forecasted net interest sensitivities to the actual results at the total bank level.

The issue here is *how* a risk limit based on a *comparison* of net interest forecasts relates to *actual reported net interest*? The most straightforward answer is to compare the base (level) rate forecast from twelve months earlier to the last twelve months' actual interest income:

	From 12 months ago: 12 Months Forecasted Net Interest (Level Rates)	Last 12 Months Actual Net Interest
Total Amount	\$ 2,545	\$ 2,570
Difference:		\$ 25
Risk Limit (2%)	\$ 51	

Our conclusion is that the Bank's net interest income has remained within the risk limits.

STEP #3: Apply this limit to the mismatch unit.

Here we confront the issue raised above: Most ALCO policies are stated in terms of total Bank net interest income, only a (small) portion of which results from market risks and therefore can be hedged by the ALM department. If the policies were stated in terms of Mismatch Unit net interest income, what would the table above look like? Consider the one below:

	<i>From 12 months ago:</i> 12 Months Forecasted Net Interest (Level Rates)	Last 12 Months Actual Net Interest
	Total Bank	Mismatch Unit
Total Amount	\$ 2,545	\$ 170
<i>Difference:</i>		\$???
Risk Limit (2%)	\$ 51	

Not much sense can be made of the ALCO limits when compared directly to the Mismatch Unit net interest income. Obviously this is because the total Bank net interest contains credit and funding spreads which ALCO does not attempt to hedge. Logically speaking, therefore, ALCO limits should be stated in terms of Mismatch Unit net interest, not total Bank net interest. This can make a BIG difference. Consider the Bank P&L on the next page:

Bank P&L: Net Interest

	Corporate Banking	Consumer Lending	Treasury	Branch System	Subtotal	Mismatch Unit	Total Bank
Interest income on assets	1,000	800	200		2,000		2,000
Cost of funds	(775)	(500)	(195)		(1,470)	1,470	
Credit spread	225	300	5		530		
Interest expense on liabilities	(200)		(140)	(700)	(1,040)		(1,040)
Credit for funds	210		143	1,000	1,353	(1,353)	
Funding spread	10		3	300	313		
Off Balance Sheet Hedging						50	50
Net Interest Income	235	300	8	300	843	117	960
						Market Risk Spread	Total Spread

In the example above, the Mismatch Unit net interest is only about 10% of the total Bank net interest (\$117 of the \$960 total). In such a situation it's rather like asking the tail to wag the dog to ask ALM to hedge the total Bank's net interest income. The Mismatch Unit net interest income is probably not above 30% in most Banks, and 10% would not be unreasonable. Presumably the greatest risk most Banks take is credit risk, not market risk. We would accordingly expect more net interest income from credit spreads than from market risks.

To return to our objective, we want to state ALCO risk limits in terms of Mismatch Unit net interest. But what do we compare to what? There are at least two logical solutions.

1. Forecast Mismatch Unit net interest as part of the ALM process and compare the base forecast from 12 months prior to last 12 months actuals of the Mismatch Unit.

or

2. Compare Mismatch Units *actuals*:
 - 24 to 13 months prior [*this is assumed equivalent to a "base" forecast*]
compared to
 - the last 12 months.

The first alternative is simply translating current practice from a total Bank to the Mismatch Unit focus, but it does assume that Bank's ALM software as the capability of forecasting with transfer rates to simulate Mismatch Unit net interest income. It would also require the software to calculate market values of these forecasted cash flows if the ALCO risk limits were stipulated in terms of market value rather than net interest sensitivities.

The second alternative is a compromise, assuming the Bank's software is not capable of simulating Mismatch Unit net interest. Instead of comparing 12 months' actual income to a base forecast from 12 months earlier covering the same period, it assumes that the "base" scenario is the preceding 12 months' actual income. Obviously this is not precise since rates will not have been stable during that period and there will have been some balance sheet growth or decrease. But it is a reasonable proxy for determining *sensitivity* of net interest income.

Principal Function #2: Adequate Profits in the Mismatch Unit

The Mismatch Unit can legitimately be seen as a source of profits to Bank. The difficult task is deciding how to determine the level of profits that is adequate, always assuming that the risk position has been kept within the ALCO policy as per Function #1 above. Focus on *adequacy* of returns usually is based on a risk-adjusted equity measurement. For a Mismatch Unit, equity attribution should logically be based on some measure of the Bank's total market risk so that allocated equity increases with increased risk and *vice versa*. There is, unfortunately, no precise and widely accepted way to make this measurement and it tends to be more approximate than other allocations within the Bank. As a result, the ROE produced for the Mismatch Unit cannot be interpreted too closely. Long-range trends within a broad scope should be the focus.

The results shown on the next page can (and should) be produced for the Mismatch Unit. My own experience, however, tells me that they are not "actionable" results. The range of ROEs shown on the next page, in other words, have no significant difference.

MISMATCH UNIT RISK-ADJUSTED RETURN: SHORT TERM FOCUS

	Jan	Feb	Mar	1st Qtr	Apr	May	Jun	2nd Qtr	Last 12 Months
NII Adjusted to 30/360	1,245	1,220	1,300	3,765	1,210	1,345	1,135	3,690	14,875
Accrual Adjustment	52	(166)	54	(60)	(33)	47	(8)	6	1
NII	1,297	1,054	1,354	3,705	1,177	1,392	1,127	3,696	14,876
Allocated Equity	99,500	99,670	99,800	99,657	100,000	99,900	100,000	99,967	99,657
Annualized ROE:									
- NII Adjusted	15.0%	14.7%	15.6%	15.1%	14.5%	16.2%	13.6%	14.8%	
- NII	15.3%	13.8%	16.0%	15.1%	13.9%	17.0%	13.3%	14.7%	
Annual ROE:									14.9%

A more proper scale for reviewed risk-adjusted returns from a Mismatch Unit would be the following:

MISMATCH UNIT RISK-ADJUSTED RETURN: LONG TERM FOCUS

	Prior Months 36-25	Prior Months 24-13	Last 12 Months	Last 36 Months
NII	16,489	15,432	14,876	46,797
<i>Allocated Equity</i>	94,330	98,988	99,657	97,658
ROE	17%	16%	15%	16%
Corporate Hurdle Rate	16%	16%	16%	16%

These results require the interpreter to answer three basic questions:

- Over what timeframe are we able to see a meaningful change in results ?
- What amounts of change in the results is significant?
- What level of results is adequate?

In the example above, I would think that the consistent decline in the Mismatch Unit's ROE should be analyzed, but its falling 1% below the corporate hurdle rate is not meaningful.

SUMMARY

This paper's thoughts on the Mismatch Unit are intended to show that the ALM department, assuming that it's properly differentiated from trading for profit, should be able to demonstrate through its Mismatch Unit's P&L that it has effectively controlled the Bank's interest rate risk and, in so doing, has generated acceptable profits. Banks which do not understand the performance of their Mismatch Unit will always be taking on pure faith that the prospective ALM risk measurements, like net interest sensitivity forecasts, are properly identifying the Bank's market risk and that the ALM group has probably hedged them.

OTHER RELATED ISSUES

If the Mismatch Unit picture isn't confusing enough at this point, there are other related issues that should be considered if a full understanding of the Bank's market risk position is the goal. The first is the calculation of the Mismatch Unit results where the "matched term" is not the original term but the remaining term for each instrument. This produces the current risk position of the Mismatch Unit; the difference between this and the full position represents the embedded or historical risk position.

A second area receiving some current attention in the industry is the Mismatch Unit treatment of embedded option costs (caps/floors, prepayments, rate commitments) as well as the P&L effect of hedging instruments other than swaps (futures, caps, floors). Few Banks have carried this analysis very far because the vast majority of hedges are in the form of interest rate swaps and the embedded option costs have been largely ignored. This topic brings us unavoidably into the issue of GAAP vs. mark-to-market accounting. In addition, it puts considerable stress on the management reporting systems to identify embedded option costs when they occur. It might require, for example, the identification of ARM loans which have hit their periodic caps and the monthly quantification of interest lost due to those caps.

Finally, the emerging market for credit swaps will lead some Banks into internal discussion on who "owns" these swaps and how they will affect management reporting and incentive compensation.

The Mismatch Unit is very much the focal point of Bank market risk management. As a result, we should expect to see it in the center of many risk policy debates in the year to come. Through the transfer pricing process, which is essentially a risk transfer process, it touches nearly every Banking activity in a material way. And it holds a great deal of information, if Bank executives will only ask to see it.