Model Validation

"Turtle Trading System"

Submitted as

Coursework in

Risk Management

By

Saurav Kasera

Instructors:

Professor Steven Allen

Professor Ken Abbott

TA: Tom Alberts

TABLE OF CONTENTS

PURPOSE:

This document contains all the information relating to the model validation of the "Turtle Trading System". This would be refer from now on as TTS i.e. Turtle Trading System throughout the document. As this is a trading model, the validation approaches which are adopted here would be different from the conventional model validation techniques most significantly used for pricing and risk management models. Rather than validating for logical answers, we will try to validate it for answers that are right and are seen in the market.

EXECUTIVE SUMMARY:

Introduction:

This summary will enlist the main features of the model and the processes involved in validating along with details.

Introduction to the model:

The system provides answers for each of the decisions a trader must make while trading. The system makes it easier for a trader to trade consistently because there are a set of rules which specifically define what should be done. The mechanics of trading is not left up to the judgment of the trader.

Main features of the model:

- Which markets to trade, with an emphasis on selecting liquid, non-correlated instruments/markets? This point is not touched exactly by the model and is a lot subjective so our validation process will not cover this.
- Time of first entry into the respective markets and then time of adding further units.
- Position Sizing - We agree with the Turtles when they say that "How much to buy or sell is the single most important aspect of trading". The main intention is to keep both the gain/loss in balance. We will have some interesting validation for this part.
- Creating a stop loss strategy to get out of losing positions.
- Creating an exit strategy for getting out of winning positions.
- Tactics for entering orders and dealing with fast markets. This will be out of our scope of validation.

Validation Policy Adopted

- **Independent Review**: This model is reviewed by each member of the team. Although, they have their defined responsibilities in validating the model, the important part goes under review of every individual.
- **Defined Responsibility**: This goes into implementation.
- **Model Documentation**: We try to document each and every part of this process. Graphs are used for easy understanding and interpretation of the results.

Validation of the inputs

- Data: Data was validated to the best of the knowledge taking into consideration the limited resources attainable. As data is a very important part of the model, this model will have to validate from time to time even when under live use. The best policy would be to validate it by taking data from multiple sources.
- Assumptions*:* This process is laid with a lot of assumptions. Let us look at them.
- The calculation of moving averages for the trading signal is simple but not exponential.
- We take a 20 day moving average as laid out in the technical paper [1], but could have tested the performance with other periods.
- Our price closes are based on trading closes and not the strict mark up closes
- We assume no jump in prices in our validation though the model is versatile to do that.
- Our test data contains bond contract prices, where we roll them on the expiry dates. Different people follow different rolling assumptions.

Validation of the Model – Processing Components

- Model Theory: The Model Theory has been totally adopted from [1] and no deviations have been done except for places where choices were given. The whole point of this model is not to leave any leverage of decision to the model user and spit out all the information needed.
- Model Code and Mathematics:
    - The code was checked line by line for errors though no CMM level test were done.
    - The mathematical functions were adopted from Excel and as such were assumed to be error – free though anything like that cannot be fully guaranteed.

- Model Reporting Capability:
    - The reports were validated so that they reflected the results calculated by the processing engine.
    - The completeness of the reports was also validated.
- Testing Process:
    - General Testing: This was done to validate all the components. Tests include testing trading signals, position sizing parameters, exits and loss taking signals.
    - Back Testing: This was done on data running back to 2 years.
    - Stress Testing: These are tests done to test whether the model adopts itself to extreme situation. It is not very relevant in our case because the only inputs are prices and the model is not price pattern dependent. It takes the maximum, minimum and closing prices of every day.

WHITE PAPER/ TECHNICAL SPECIFICATION:

This model is a complete implementation of the following paper:

“The Original Turtle Trading Rules”

It can be obtained for free at:

http://bigpicture.typepad.com/comments/files/turtlerules.pdf

Though you can also donate $29 for the turtles and download it from:

http://www.tradingblox.com/originalturtles/system.htm

For convenience, that paper is also attached as an “Appendix A” to this model validation document.

TESTING AND VALIDATION PROCESS

General Testing

We will go step by step and will present our validation process and results of every component of the model

Inputs to the model

Securities	End Date	Start Date	Ticker	Risk	Roll Over Dates
Bunds	5-Apr-05	11-Aug-05	Bunds	10,000	8-Jun-05
Bobl	5-Apr-05	11-Aug-05	Bobl	10,000	8-Jun-05
Schatz	5-Apr-05	11-Aug-05	Shatz	10,000	8-Jun-05
Aus Future	5-Apr-05	11-Aug-05	HX	10,000	16-Jun-05
USD - JPY	5-Apr-05	11-Aug-05	USDJPY	10,000	
AUD - USD	5-Apr-05	11-Aug-05	AUSUSD	10,000	
EUR - USD	5-Apr-05	11-Aug-05	EURUSD	10,000	
EUR - JPY	5-Apr-05	11-Aug-05	EURJPY	10,000	

Exhibit 1

Exhibit 1 shows the main inputs to the model. The main thing to validate was the "Roll Over" dates. These are the dates when new contracts come and their price differential has to be adjusted. The roll over part was validated and was found to be satisfactory.

We require the high, low and the closing price of an interval from the input time series of data as shown below on Exhibit 2. We validated this part in a couple of ways.

- The first thing we did was to query this information directly from our database and check the values with those entered in the model.
- We then checked it with Bloomberg and CQG.

The above tests validated that our input series was doing the right thing. A notable thing was that the model was robust enough to discard the outlier entries by doing some statistical tests. We also varied the bucket times and the results were found to be satisfactory.

Inputs				
Start Date		5-Apr-05		
End Date		11-Aug-05		
Tick Size		0.00000083		
Risk	10000.00			Refresh Data
CQG Ticker	USDJPY			
Date	Settle Date	High	Low	Close
11-Aug-05	12-Aug-05	0.009124088	0.009030161	0.009119927
10-Aug-05	11-Aug-05	0.009057971	0.008928571	0.009037506
9-Aug-05	10-Aug-05	0.008954957	0.008910274	0.00893655
8-Aug-05	9-Aug-05	0.008965394	0.008879418	0.008914245
5-Aug-05	8-Aug-05	0.00899928	0.008911862	0.008932559
4-Aug-05	5-Aug-05	0.00902853	0.008960573	0.00899038
3-Aug-05	4-Aug-05	0.009009821	0.008932559	0.00900171
2-Aug-05	3-Aug-05	0.00899847	0.008896797	0.008971828
1-Aug-05	2-Aug-05	0.008950148	0.008867607	0.008910274
29-Jul-05	1-Aug-05	0.008931761	0.00888573	0.008888889
28-Jul-05	29-Jul-05	0.008929369	0.00885975	0.00891822
27-Jul-05	28-Jul-05	0.008915835	0.008865248	0.008892051
26-Jul-05	27-Jul-05	0.008979079	0.008879418	0.008886519

Exhibit 2

Model Processing

Let's look at the stages of processing in the model and validate them sequentially.

The Entry signal - There are two types the model supports:

- A 20 day breakout of the highs/lows.
- A 55 day breakout of the highs/lows.

Validating this part was easy. We ran a random simulation of some 100 numbers around 1000 times and tested the breakout signals on the model. The results were found to be satisfactory.

The next part was hard. The model had to discard a signal in case the last signal ended in a profitable trade. We had to generate random trades and had to test this hypothesis.

The Position Sizing: This is the part of the model that required some mathematical validation. The objective here was to produce position sizes that would produce almost equal gains/losses on a given day. This is what we call the "volatility adjusted" position size.

The model measures volatility and calls that volatility no as N

N is simply the 20-day exponential moving average of the True Range, which is now more commonly known as the ATR. Conceptually, N represents the average range in price movement that a particular market makes in a single day, accounting for opening gaps. N was measured in the same points as the underlying contract.

To compute the daily true range:

True Range = Maximum (H – L, H – PDC, PDC - L)

Where:

H = Current High

L = Current Low

PDC = Previous Day's Close

To compute N use the following formula:

N = (19 X PDN + TR) / 20

Where:

PDN = Previous Day's N

TR = Current Day's True Range

Since this formula requires a previous day's N value, we must start with a 20-day simple average of the True Range for the initial calculation.

Dollar Volatility Adjustment:

The first step in determining the position size was to determine the dollar volatility represented by the underlying market's price volatility (defined by its N).

This is:

Dollar Volatility = N X Dollars per Point

Volatility Adjusted Position Units

The Turtles built positions in pieces which we called Units. Units were sized so that 1 N represented 1% of the account equity.

Thus, a unit for a given market or commodity can be calculated using the following formula:

Unit = 1% of Account/ Market Dollar Volatility

For example this is how it is calculated:

Crude Sweet Oil

For some N = let say 0.0141

Account Size = $1,000,000

Dollars per Point = 42,000 (42,000 gallon contracts with price quoted in dollars)

Unit Size = (0.01 X $1,000,000) / (0.0141 X 42,000) = 16.88

16.88 contracts were taken as the unit size in this example.

What we did taking a typical historical time series of data, we generated a random time series of prices imitating the covariance structure.

Then on a day to day basis we calculated the gain/loss everyday of the individual securities. As volatility is not constant, we took an error margin of 5%.

The following were the results:

	Equal Gains/Losses within 5% error	Unequal Gains and Losses
Bunds	*890*	*110*
Bobl	*789*	*211*
Schatz	*901*	*99*
Aus Future	*845*	*155*
USD - JPY	*812*	*188*
AUD - USD	*798*	*202*
EUR - USD	*876*	*124*
EUR - JPY	932	*68*

Exhibit 3

Our results turned out to be pretty robust. Please refer Exhibit 3. Almost 80% (on an average) of the times, the gains/losses were equal on close days and depended on the input risk. In our example, we took equity of $1 million and a risk of 1% of that.

Now the processing parts left were the “stops” and “exits”:

For this we generated the same time series price structure as described above and tested the “stops” and “exits”. There was not much to do except that we sometimes kinked some parts of the data purposely to “stop” or “exit” the trade forcefully.

Back Testing

Back testing was done using last two year’s of price data with 1% of risk on $1 million of equity. Back Testing for a trading model is an integral part of the model validation though it is not of much use for pricing or risk management tools.
The PnL curve for the individual securities is shown on Exhibit 4.

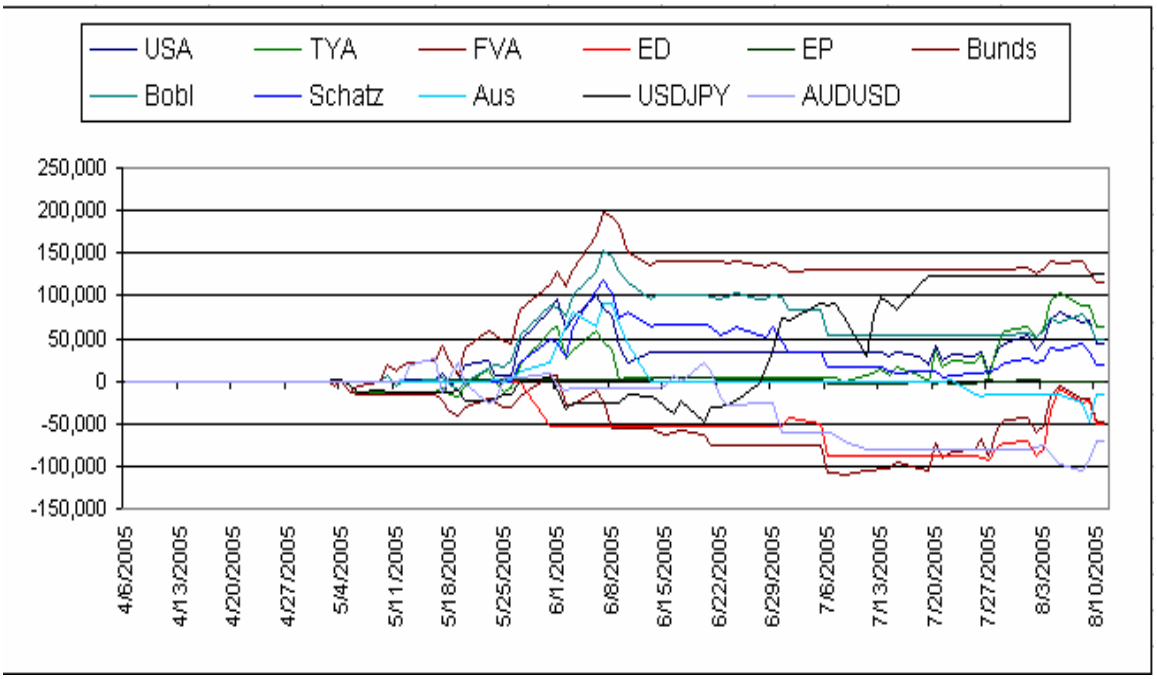

Exhibit 4

The PnL profile for the total portfolio which we call the “Turtle Portfolio Equity Curve” is shown on Exhibit 5.

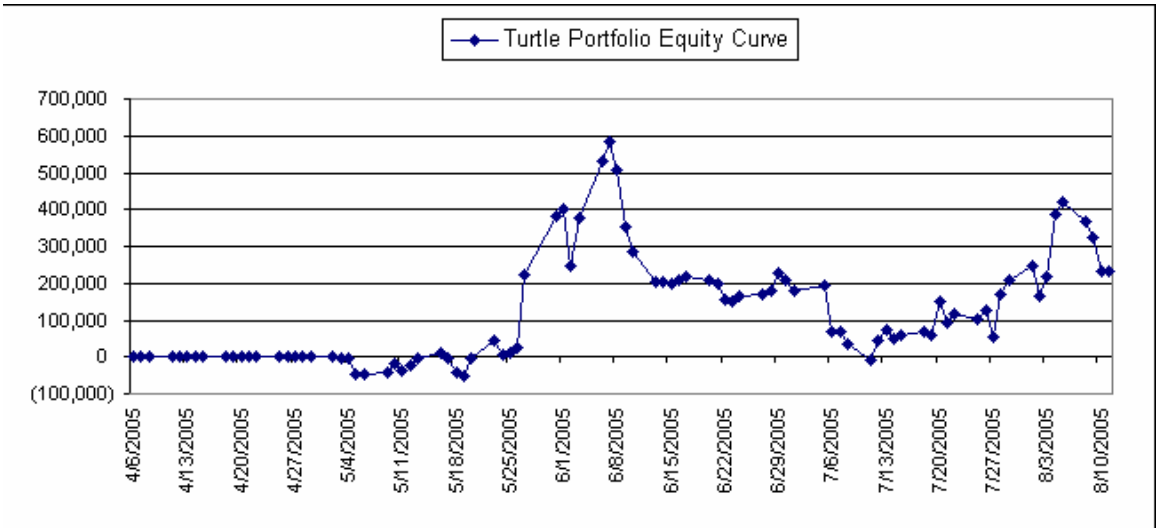

Exhibit 5

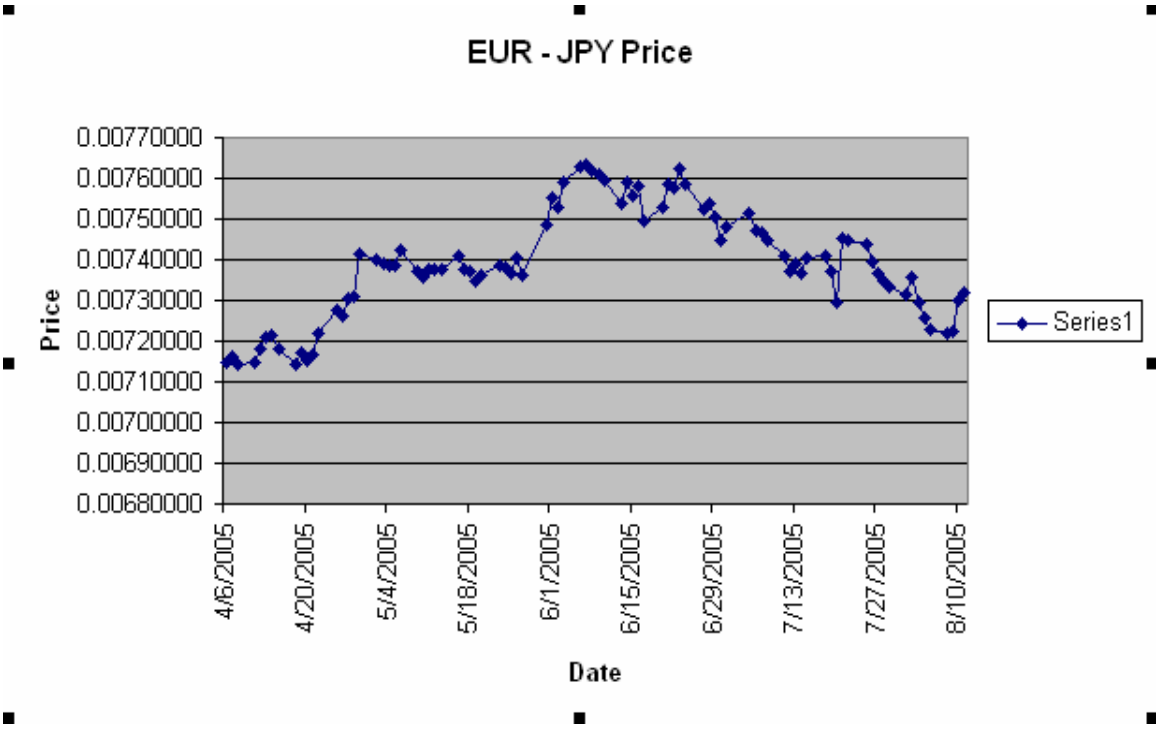

Exhibit 6

Exhibit 6 is the graph of the price history of EUR – JPY. If we closely compare Exhibit 4 with Exhibit 6, we will see that the PnL for EUR – JPY did well whenever the price pattern was directional (upward or downward sloping). Incidentally Exhibit 6 is also closely related with Exhibit 5. Here it shows that the overall portfolio was doing well when EUR – JPY was directional. We indeed confirmed that most of the products in our portfolio were highly correlated with EUR – JPY.

Model Reporting Capability

Here are the snapshots of the reports:

UNIT - PRICE MATRIX SHEET

For Long Positions:

	Position Size	N	Positior	P Close	UNIT 1 Trade	UNIT 1 Stop	UNIT 2 Trade	UNIT 2 Stop	UNIT 3 Trade	UNIT 3 Stop	UNIT 4 Trade	UNIT 4 Stop	Exit
USA	$1,157,323.69	0.8640625		114-300									
TYA	$2,012,578.62	0.496875		110-200									
FYA	$3,248,730.96	0.3078125		107-040									
ED	$19,616,858.24	0.050976563		95.57	95.85	95.75	95.88	95.78	95.91	95.81	95.94	95.84	95.51000
EP	$94,786.73	10.55		1238.25	1248.78	1227.68	1254.06	1232.96	1259.34	1238.24	1264.62	1243.52	1227.25000
Bunds	$2,292,879.53	0.436132813		121.78	122.81	121.94	123.03	122.16	123.25	122.38	123.47	122.6	121.26000
Bobl	$4,060,269.63	0.246289063		114.45	115.13	114.64	115.25	114.76	115.37	114.88	115.49	115	114.12000
Schatz	$12,736,318.41	0.078515625		106.41	106.67	106.51	106.71	106.55	106.75	106.59	106.79	106.63	106.30000
Aus	$15,753,846.15	0.063476563		94.59	94.9	94.77	94.93	94.8	94.96	94.83	94.99	94.86	94.59000
USD - JPY	$1,034,421.70	0.000088	YES										
USD - AUD	$1,078,496.87	0.007185	YES										
USD - EUR	$1,159,441.86	0.01075	YES										
EUR - JPY	$1,177,584.09	0.000062		136.66	133.6	135.86	133.05	135.29	132.5	134.72	131.96	134.16	138.55000

For Short Positions:

	Position Size	N	Positior	P Close	UNIT 1 Trade	UNIT 1 Stop	UNIT 2 Trade	UNIT 2 Stop	UNIT 3 Trade	UNIT 3 Stop	UNIT 4 Trade	UNIT 4 Stop	Exit
USA	$1,157,323.69	0.8640625	YES										
TYA	$2,012,578.62	0.496875	YES										
FYA	$3,248,730.96	0.3078125	YES										
ED	$19,616,858.24	0.050976563	YES										
EP	$94,786.73	10.55		1238.25	1223.97	1245.07	1218.7	1239.8	1213.43	1234.53	1208.16	1229.26	1247.75
Bunds	$2,292,879.53	0.436132813	YES										
Bobl	$4,060,269.63	0.246289063	YES										
Schatz	$12,736,318.41	0.078515625	YES										
Aus	$15,753,846.15	0.063476563	YES										
USD - JPY	$1,034,421.70	0.000088		109.65	113.72	111.48	114.29	112.03	114.87	112.59	115.45	113.15	109.65
USD - AUD	$1,078,496.87	0.007185		0.7749	0.7472	0.7616	0.7436	0.758	0.74	0.7544	0.7364	0.7508	0.7749
USD - EUR	$1,159,441.86	0.01075		1.2464	1.1954	1.2169	1.19	1.2115	1.1846	1.2061	1.1792	1.2007	1.2464
EUR - JPY	$1,177,584.09	0.000062	YES										

Note: For Position Data, Refer to the Position Sheet

Exhibit 7

POSITION SHEET

Risk	10,000.00						UNIT 1 Price	UNIT 1 Stop	UNIT 2 Price	UNIT 2 Stop	UNIT 3 Price	UNIT 3 Stop	UNIT 4 Price	UNIT 4 Stop	Stopped	Exit	Exit
	Close	N(Cal)	Volatility	Position Size	Positior	Units											
USA	114-300	0.86	27.65	12.00	SHORT	4.00	115-290	117-246	115-141	117-097	114-312	116-270	114-163	116-121			
TYA	110-200	0.50	15.90	20.00	SHORT	4.00	112-02+	113-095	111-246	112-317	111-150	112-221	111-052	112-123			
FYA	107-040	0.31	9.85	32.00	SHORT	4.00	108-010	108-256	107-266	108-19+	107-20+	108-132	107-142	108-070			
ED	95.57	0.05	5.10	78.00	SHORT	4.00	95.67	95.79	95.64	95.76	95.61	95.73	95.58	95.70			95.70
EP	1,238.25	10.55	10.55	19.00													
Bunds	121.78	0.44	0.44	22.93	SHORT	3.00	121.74	122.74	121.49	122.49	121.24	122.24	120.99	121.99			122.58
Bobl	114.45	0.25	0.25	40.60	SHORT	3.00	114.55	115.15	114.40	115.00	114.25	114.85	114.10	114.70			114.95
Schatz	106.41	0.08	0.08	127.36	SHORT	3.00	106.48	106.72	106.42	106.66	106.36	106.60	106.30	106.54			106.54
Aus	94.59	0.06	0.06	157.54	SHORT	3.00	94.63	94.76	94.60	94.73	94.57	94.70	94.53	94.66			94.86
USD - JPY	109.65	0.000088	0.000088	1.034	LONG	1.00	109.87	112.04	109.34	111.49	108.82	110.95	108.30	110.41			112.50
USD - AUD	0.7749	0.00719	0.00719	1.078	LONG	2.00	0.7688	0.7533	0.7727	0.7572	0.7766	0.7611	0.7804	0.7649			0.7566
USD - EUR	1.2380	0.01075	0.01075	1.165	LONG	4.00	1.2256	1.2013	1.2317	1.2074	1.2377	1.2134	1.2438	1.2195			1.2121
EUR - JPY	138.55	0.000062	0.000062	1.164	SHORT	4.00	133.53	131.28	134.11	131.84	134.69	132.40	135.27	132.96			110.65

1. The Risk is in dollars, euros and australian dollars for the US, European and Australian futures respectively.
2. The entry signal uses a 20 day breakout system. (the other one would be a combination of 20 and 55 day breakout)
3. The stop placements are based on the simple stop rules.(the alternative would be the whipsaw strategy)
4. The exit signal uses a 10 day breakout system. (the alternative being a 20 day breakout exit signal)
5. EUR - JPY means long and short the JPY. The risk is in euros.

Exhibit 8

CONSOLIDATED PnL SHEET

Daily P&L

	USA	TYA	FVA	ED	EP	Bunds	Bobl	Schatz	Aus	USDJPY	AUDUSD	EURUSD	EURJPY
11-Aug-05	(27916.33)	(25600.14)	(26448.54)	(27428.82)		(10962.28)	(16347.81)	(14368.92)	31226.82	2076.67	24285.38	22892.87	(10987.69)
10-Aug-05	2326.36	0.00	(1497.03)	2742.89		(13654.78)	(12260.66)	(8891.62)	(21468.44)		10692.55	2474.26	(47007.91)
9-Aug-05	(11631.80)	(13730.43)	(14670.33)	(16200.25)		3461.77	6514.46	8092.64	(9758.38)		(7462.29)	4453.67	(4225.33)
8-Aug-05	9306.44	9153.62	13473.27	27428.82		(4423.37)	(3405.79)	(3696.73)	(247.51)		(10692.55)	(1237.13)	7480.99
5-Aug-05	26753.15	32953.03	34431.70	44654.23	828.46	10347.70	14639.09	14280.40			(10692.55)	(6680.50)	18319.03
4-Aug-05	9306.44	9153.62	7485.15	8227.40	(2692.50)	6532.15	6680.20	3696.69			2325.19	6309.31	23441.14
3-Aug-05	(16810.88)	(13730.43)	(16467.33)	(16454.79)	759.42	(7060.20)	(5689.46)	(6393.54)			2240.69	8385.65	39182.81
2-Aug-05	11631.80	5492.17	2994.08	2056.85	2071.16	1279.49	4477.68	5992.62					(27517.72)
1-Aug-05	6124.72	17391.66	8982.18	5312.62	207.12		(907.02)	5189.67					11034.41
29-Jul-05	27659.67	38446.20	32634.67	13965.80	(2830.58)			3295.10					10077.73
28-Jul-05	(25247.82)	(27460.66)	(19481.39)	(3427.01)	3002.12			2696.99	1380.64				11136.95
27-Jul-05	6094.30	8236.26	11976.24	(685.40)	1311.73			0.00	(3451.61)				18882.41
26-Jul-05	(2611.84)	(1630.72)	1497.03		276.15			2996.55	(15187.09)				26377.50
25-Jul-05	7936.53	8236.26	7485.15		(828.46)			696.66	690.32				5178.18
22-Jul-05	(19153.82)	(19222.60)	(17964.38)		1933.08			(5991.10)					2766.43
21-Jul-05	23202.56	36632.44	33210.62		(2232.85)			(596.11)		429.50			(96230.55)
20-Jul-05	(9888.53)	(6656.79)	(3385.29)		674.72			(299.55)		9669.63			47950.39
19-Jul-05	(8950.83)	(10260.69)	(6730.57)		1401.34			2396.44		30079.56			22473.64
18-Jul-05	4927.17	8226.95	6797.42		(986.13)			(1497.77)		(7646.10)			(1710.24)
15-Jul-05	(4624.54)	(5753.79)	0.00		(103.80)			(4792.66)		(8256.63)			(35184.27)
14-Jul-05		4107.84	2988.66		(80.61)					21361.03			16291.40
13-Jul-05		3194.99	594.92		173.83					47280.16			(11890.53)
12-Jul-05		7302.83	3732.49		15.21					(45528.96)	(6637.13)	4239.89	16596.77
11-Jul-05		(5842.66)	(2239.50)							(16150.97)	(7209.16)	(24732.71)	14992.75
8-Jul-05		0.00								3463.07	(3604.58)	(4004.34)	5177.00
7-Jul-05			(32013.42)	(37336.22)	(4234.72)		(30210.56)	(16668.16)		(3047.96)	(277.28)	(4004.34)	1557.63
6-Jul-05				(7255.62)		2392.36				19680.65	(277.28)	(4646.54)	13412.46
5-Jul-05				8086.08		(7697.13)	(13654.09)	(11962.64)		(2192.33)		4929.13	(9769.84)
1-Jul-05				0.00		(2548.37)	(4149.67)	(16369.93)		37963.51	(35016.16)	11288.58	(10893.67)
30-Jun-05						6136.60	5971.77	12692.25		22365.43		(2733.29)	7904.26
29-Jun-05						(2028.30)	(1518.26)	(2518.46)		15714.52		(1327.60)	
28-Jun-05						(5304.78)	(5263.26)	(10703.41)		20647.97	4365.23	8512.25	
27-Jun-05						2132.31	3137.71	7566.36		4678.06	(1742.06)	(5544.68)	(10153.37)
24-Jun-05					496.54	(2664.44)	2327.98	1259.23		2754.91	(10017.02)	(5857.05)	(6159.76)
23-Jun-05					(3786.75)		(2327.98)	(8164.96)		1149.67	(29615.55)		(3623.71)
22-Jun-05			(11688.38)		0.00		(1621.90)	(2155.16)		16440.06	(10017.02)		
21-Jun-05			(4617.43)		221.57					(25151.19)	23082.71		
20-Jun-05			2847.85		(110.79)					15682.74	(6710.46)		
17-Jun-05			1513.06		1052.47					(7641.54)	12832.58	6621.55	10794.72
16-Jun-05			(3026.11)		886.29					(6649.79)	2280.69	2006.34	20024.95
15-Jun-05			(3026.11)		387.75	4826.19	5656.39	1868.33		(6156.51)		(32903.93)	(27509.47)
14-Jun-05	12710.47				553.93	(14800.31)	(21464.29)	(16796.95)	(44079.30)	(2046.42)		30496.33	44174.70
13-Jun-05	(19643.46)	3750.06			775.51	(32818.08)	(11678.42)	5596.96	(22039.65)	10661.56		4012.67	(45111.55)
10-Jun-05	(35520.42)	(35626.58)			(443.15)	(9674.12)	(17534.61)	(27964.91)	(25188.17)			4494.95	(14557.55)
9-Jun-05	(9243.96)	(9075.15)	(32209.63)		1107.87	(4826.19)	(6787.67)	(14930.62)	0.00			1805.07	(5182.11)
8-Jun-05	(13865.97)	(13126.21)	(12481.78)		(884.72)	27991.89	24322.48	11197.97	28336.69			20985.91	(13230.10)
7-Jun-05	25420.94	22600.37	15265.51		221.57	36909.50	26847.60	42905.53	(18891.13)			(10432.95)	5304.28
6-Jun-05	12710.47	11250.18	1386.88		(110.79)	19626.50	23191.20	32693.90	18891.13	5900.78	2576.07	(10432.95)	30575.17
3-Jun-05	(34954.92)	(36436.13)	(34671.61)		(1495.82)	(17052.53)	(10181.50)	(13064.29)	22039.65	(20743.60)	(5352.14)	13843.09	51061.00
2-Jun-05	13865.97	5625.09	0.00		886.29	15443.80	(1131.28)	(5596.96)	18891.13	(16089.29)	(14589.71)	(35311.54)	(18469.50)
1-Jun-05	35520.42	39075.64	24279.76	(51966.83)	1176.38	31209.35	33372.71	26069.67	11417.05	5087.06	5407.60	46757.18	46235.34
31-May-05	40442.41	26250.43	12505.41		(1208.58)	36574.74	31675.79	23289.49	9685.00	14650.61		112354.89	13039.19
27-May-05	1155.50	4667.56	894.74		375.08	(3880.95)	7353.31	(469.14)	1574.91	(460.46)	651.06	(29292.52)	
26-May-05	(1155.50)	(10012.67)	(4653.21)		916.85	(5791.43)	(2628.20)	0.00	(3149.83)	5538.62	27696.47	36515.34	
25-May-05	(19467.96)	(16675.27)	(4653.21)		(208.38)	(6756.68)	4443.12	(466.84)	2362.37	1368.06	2604.32	(7222.81)	
24-May-05	6745.84	21641.16	8336.94		(416.75)	20591.74	14756.96			231.49	(24089.96)	(2407.60)	
23-May-05	19972.17	12496.09	10421.17		606.50	31209.35	11041.58			(11751.62)	(24741.07)	(7222.81)	
20-May-05	868.36	(2346.94)	(4653.21)		(111.48)	(15443.80)	(7361.06)			2595.57	17579.18	33305.20	
19-May-05	(10420.36)	(9096.75)	(13200.15)		331.50	(17374.28)	(6776.64)				16881.34	14846.60	1878.23
18-May-05	6192.96	6133.00	(7368.62)		249.88	15765.55	2831.17				(40367.00)	(29292.52)	(1251.90)
17-May-05	1162.46	1647.12				3217.46	2264.94				7612.97	14445.63	(6396.71)
16-May-05	0.00	236.30				1808.73	1415.59				16496.46	(5216.48)	6396.71
13-May-05	581.23	(1647.12)				9350.61	4529.68				1477.24	15874.09	0.00
12-May-05						(6211.30)	(12457.17)			712.14		9697.84	(308.82)
11-May-05						18838.71	7685.14			(2257.90)			4475.99
10-May-05						6914.03	(1841.23)			594.97			(3224.02)
9-May-05		240.39	(339.32)			6047.72				(6696.03)			(10289.70)
6-May-05		(12500.49)	(14251.55)			(11772.89)				(7132.41)			1320.61
5-May-05		(1442.36)	(339.32)			4515.63				971.62			
4-May-05						(5805.81)				618.25			
3-May-05													
2-May-05													
29-Apr-05													
28-Apr-05													
27-Apr-05													
26-Apr-05													
25-Apr-05													
22-Apr-05													
21-Apr-05													
20-Apr-05													
19-Apr-05													
18-Apr-05													
15-Apr-05													
14-Apr-05													
13-Apr-05													
12-Apr-05													
11-Apr-05													
8-Apr-05													
7-Apr-05													
6-Apr-05													
Total	44,276.80	62,932.71	(48,140.79)	(51,280.26)	(802.32)	115,282.30	48,807.88	19,697.78	(10,965.38)	125,060.40	(89,342.55)	255,571.35	146,399.04
TOTAL													633,138.74

Exhibit 9

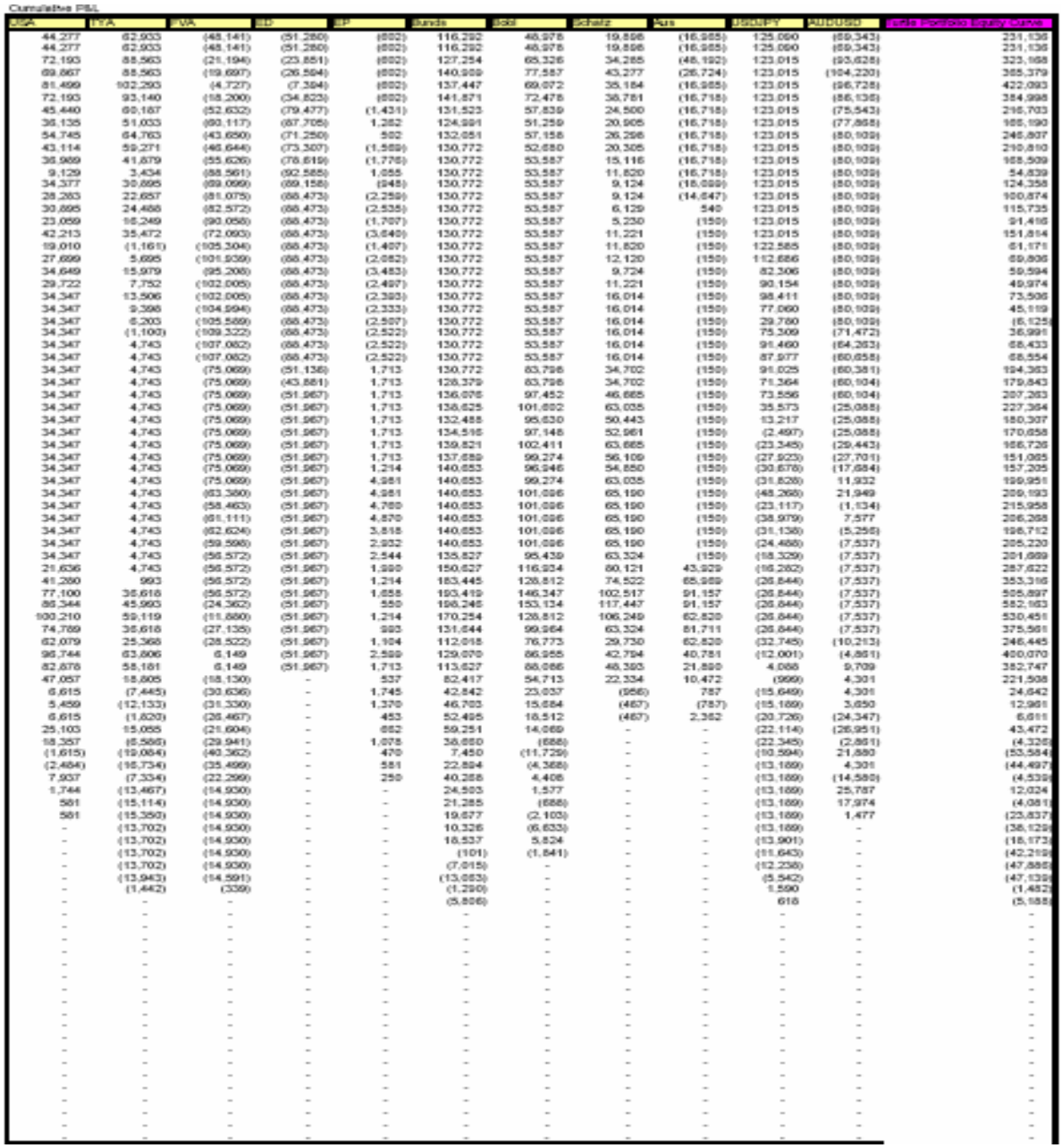
Cumulative P&L
USA
FRA
EUA
EB
EP
Bunds
Gold
Schatz
Aus
EURJPY
AUDUSD
TOTAL WORKING STRATEGIES

Exhibit 10

Exhibit 7 and Exhibit 8 were validated for inconsistencies. We compared the reports with the numbers generated by the processing arm. Our work was made easy by the fact that these reports took some specific data from the actual processing spreadsheets. It was easy to check that.

Exhibit 9 and Exhibit 10 contain the PnL and Cumulative PnL sheet. We also found that the report capability of the model was good and it reported the relevant information though some of the information seems duplicated.

CONDITIONS FOR USE

As shown in our “Back Testing” section, this model does well when the prices move in a directional way. They don’t perform very well in a mean reverting environment. This was also proved by the PnL generation in the 2 year bond and the EUR/JPY. The PnL generation for 2 year bonds was not very impressive because it’s kind of mean reverting whereas for EUR/JPY it was quite impressive. This was also proved by the high correlation between Exhibit 5 and Exhibit 6. This model also seems to work more with long term strategies rather than day trading. This model needs a gestation time for the market to go directional. So this might not be very useful in day trading strategies.

ADVANTAGES/ DISADVANTAGES

This is how we would sum up the advantages:

- This model is pretty versatile in the sense it is not security dependent. It can work with any time series of prices technically.
- It uses a unique position sizing methodology which keeps the gains/losses of the portfolio balanced given some amount of risk.
- Computationally this model is very efficient and uses very simple and fast algorithm.
- The reports generated are pretty effective and can be very useful to a directional trader or otherwise.

Disadvantages:

- As explained previously, this might not be the best model for mean reverting securities.
- The rolling over of contracts creates some noise but that can be classified as security dependent.
- Back testing reveals that the number of successful trades as compared to the unsuccessful trades though the successful trades might produce more money.
- The position sizing formula often lends the answer in decimal format which forces the model to round it off to the nearest contract. This leads to a bit of noise.

REFEERENCES

[1] http://www.tradingblox.com/originalturtles/system.htm

[2] OCC 2000–16

[3] Lepus – Executive Summary

[4] Goldman Sachs – The Basel II Capital Accord