

Recent Advances in the Kanban Cell Neuron Stock Trading System

Abstract—The Kanban cell neuron stock trading system (KCNSTS) is extended to include evaluation of logical trading signals for periods within historical time series. Signals are automatically generated on a daily basis to predict the next day trading strategy of buy, hold, or sell. The range of the period selected in this study is from 2007 to 2009. This extends over the exemplary 2008 market extrema. Seven arbitrary historical periods are analyzed from 64- to 1008-trading days or up to four trading years. Six of the most difficult stock issues to predict are chosen from the 96 issues as randomly selected with replacement from SP500. Tabulation shows that KCNSTS is 100% profitable and hence successfully predicts market trend over the periods of the series.

I. INTRODUCTION

THE background development of the Kanban cell neuron model (KCNM) is described in [4]. It is based on a four valued logical system of the 2-tuple of <01, 10, 11, 00> proved to be bivalent and not a probabilistic vector space [3]. The abstraction of the logical system matches the abstraction of an accounting arithmetic system developed much earlier [1]. That abstraction was shown to be the same model as a Kanban cell [2], originally developed by Toyota for just in time (JIT) flexible manufacturing systems (FMS) to minimize inventory of parts in the assembly of automobiles. (Kanban in Japanese "かんばん" means card or board and is pronounced "kon bon".) The KCNM as applied here is a linear, multivariate, clustering formula for exact logical results and with non provisional patent pending.

Because clustering evaluates virtually any time series, trading trend in marketplaces is an area of universal interest. Consequently the KCNM was applied to the prediction of trading signals for financial markets such as 10-year treasuries, five disparate commodities [4], and 96 random issues of the SP500 [5] and Russell 2000 index [6]. That lead to invalidating the efficient market hypothesis (EMH) [7].

II. IMPROVEMENTS TO KCNSTS

For the Kanban cell neuron stock trading system (KCNSTS), previous studies [5, 6] used a selective subset of 25 of 64 signals based on an arbitrary assignment of logical values. The 2-tuple is respectively <"true", "false", "false or true", "true and false">, where the last two in the list also mean "tautology" and "contradiction". This study retains the meaning of the 2-tuple but extends those considered to include all logical values for evaluation.

Meanings of the four logical values of the 2-tuple are defined here for profitable trading actions at market closing prices as respectively <"sell on close up", "buy on close down", "trade on close no change", "trade on close

does not exit">. The last two states listed are effectively ignored in KCNSTS because of no profitability.

In addition, profitability was improved by about 5% from a new method named

III. TEST APPARATUS

The automated trading system of KCNSTS as written in TrueBASIC® uses published market statistics to produce runs of trading days within a range of dates. The beginning date of the range is defined as the oldest date in the series, and the ending date as the most recent date. Periods of trading days may be limited to whole multiples of years from one to four years or from 252 trading days per year to 1008 trading days. The name of a time series run contains the ending date for the trading period and the duration of the period both from which the beginning date is derivable.

IV. TEST METHOD

The testing approach in this study was comprehensive for range, period, stock issue, and signal analysis. The range of the period was selected for the 512 trading days from October 8, 2007 to October 10, 2009. This extended over the exemplary extrema of 2008 market phenomena.

Historical periods may be recurring or non recurring. Recurring historical periods are arbitrarily selected for 64-, 128-, 192-, 252-, 504-, 756-, and 1008-trading days (0.25, 0.5, 0.75, 1, 2, 3, and 4 years). The maximum number of trading days remaining in a series is a non recurring period because some issues have more historical data than others. In other words, not all issues have time series of trading days for as long as up to ten years.

Six stock issues evaluated here are from the 96 issues as randomly selected with replacement from the SP500. The most difficult issues to predict are chosen as: Autodesk (ADSK), Huntington Bancshares (HBAN), M&T Bank Corporation (MTB), People's United Financial (PBCT), Time Warner (TWX), and Washington Post (WPO).

V. TEST ANALYSIS

Profitability is calculated from the closing values for pairs of consecutive sell and buy signals. A requirement is that

For overall prediction of profitability of an issue, another requirement is

The profitabilities of signals for shorter periods are extended to longer periods. The shorter periods are less than one year such as 64-, 128-, and 192-trading days. The

longer periods are extended to one, two, three, and four years or 252-, 504-, 756-, and 1008-trading days. It is this process that determines profitable signals for an issue over periods. Table I below shows the distribution of profitable signals for issues and days (dy), years (yr), and periods (t). No period outside of one to five years was favored.

TABLE I
KCNSTS DISTRIBUTION OF PROFITABLE SIGNALS OF STOCK ISSUES BY PERIOD

Issue	t < 1 year 64 128 192 days	1 year <= t <= 5 years 252 504 756 1008 days	t > 5 years	Totals
ADSK	66	50	10	126
HBAN	79	50	22	151
MTB	71	54	17	142
PDBT	86	51	10	147
TWX	77	51	11	139
WPO	89	32	8	129
Totals	468	288	78	834

VI. TEST RESULTS

The detail of profitable signals is in Table II below. The unmasked sell/buy trading signals are tabulated in examples of data set runs only, hence rendering graphics unnecessary. Presented are sell and buy dates and closing price values on those respective dates. Amounts are rounded up. An end date designated with the letter "a" avoided trades during the 2008 extrema.

No issues here were found to have periods without profitable signals and consequently not traded. Because TWX was selected with replacement two times in the 96 issues, TWX is counted two times here. Therefore the number of issues found tradeable here is 7 out of 7 or 100% of the most difficult issues to predict.

TABLE II
KCNSTS DETAIL OF TRADES OF STOCK ISSUES BY PROFITABLE SIGNALS

Issue	Trade signal	End date and period(t)	Sell date	Sell close	Buy date	Buy close
ADSK	60	2009.10.19.756	2009.08.12	24.73	2009.07.30	21.79
			2009.07.28	22.51	2008.10.31	21.31
			2006.11.13	35.34		
ADSK	61	2009.10.12.756	2009.07.28	22.51	2008.10.27	20.68
			2006.10.13	34.89		
ADSK	71	2009.06.12.504	2009.05.29	21.46	2009.01.16	16.14
			2009.01.02	20.68	2008.11.12	19.03
			2008.07.28	33.11		
HBAN	72	2009.09.21.504	2009.09.29	4.40	2009.09.28	4.20
			2009.09.23	4.37	2009.09.02	3.93
			2009.08.10	4.77	2009.07.06	3.91
			2009.06.24	4.37	2009.05.28	4.03
			2009.05.11	5.71	2009.02.03	1.81
			2008.06.13	6.53		
MTB	62	2009.10.19.756	2009.08.26	61.46	2009.08.14	60.02
			2009.08.10	61.62	2008.12.24	55.93

Issue	Trade signal	End date and period(t)	Sell date	Sell close	Buy date	Buy close
			2008.12.05	67.88	2008.12.02	59.84
			2008.11.25	64.38	2008.11.19	56.14
			2008.10.28	80.55		
MTB	62	2009.09.23.504 a	2009.07.27	59.53	2009.01.12	45.46
			2008.12.26	55.39		
PBCT	80	2009.09.16.504			2009.09.02	15.68
			2009.08.11	16.85	2009.04.28	15.85
			2009.03.25	17.15	2009.02.23	15.86
			2008.11.07	16.65	2008.10.16	16.52
			2008.07.21	16.36	2008.07.01	15.57
			2008.02.22	16.93	2008.01.16	16.03
PBCT	142	2009.09.29.1008			2007.11.05	16.67
					2009.01.15	16.65
			2008.11.12	17.94	2008.11.07	16.65
			2008.09.11	18.27	2008.05.22	16.69
			2008.04.07	18.05	2007.08.07	15.67
PBCT	203	2009.09.15.504			2007.07.13	18.29
					2009.05.14	15.68
			2008.08.29	17.92	2008.06.27	15.83
			2008.03.25	18.13	2008.01.15	15.97
			2008.01.02	17.37	2007.11.27	16.39
PBCT	203	2008.06.27.252			2007.10.04	17.57
					2008.06.27	15.83
			2008.04.03	17.98	2008.01.15	15.97
			2008.01.02	17.37	2007.11.08	16.31
			2007.08.27	17.44	2007.08.09	15.97
TWX	62	2009.09.29.504	2009.05.05	22.67	2009.04.30	20.33
			2009.04.17	21.63	2009.01.13	20.25
			2009.01.05	21.68	2008.12.22	19.59
			2008.12.17	21.43	2008.10.16	19.82
			2008.10.06	23.18		
TWX	72	2009.09.02.504	2009.05.04	22.76	2009.01.13	20.25
			2009.01.02	21.94	2008.11.14	18.89
			2008.11.05	20.95	2008.10.22	19.84
			2008.10.21	21.41	2008.10.16	19.82
			2008.03.28	28.63		
TWX	92	2009.07.01.504	2009.05.28	21.93	2009.04.30	20.33
			2009.04.16	22.10	2008.12.22	19.59
			2008.12.18	21.04	2008.11.14	18.89
			2008.11.04	22.36	2008.10.16	19.82
			2008.03.20	29.27		
WPO	82	2009.09.25.504	2009.07.24	407.88	2009.05.11	369.73
			2009.04.16	416.14	2009.02.25	382.25
			2009.01.02	413.20	2009.12.16	392.00
			2008.12.08	409.00	2008.11.19	370.50
			2008.11.03	417.00	2008.10.17	349.00
			2008.10.02	522.00		
WPO	93	2009.09.30.756	2009.07.31	451.50	2009.01.23	407.71
			2009.01.21	422.32	2008.11.11	404.70
			2008.11.04	450.25	2008.10.16	353.91
			2008.03.13	665.15		

Issue	Trade signal	End date and period(t)	Sell date	Sell close	Buy date	Buy close
WPO	93	2009.09.29.504	2009.07.23	402.58	2009.05.04	352.36
			2009.04.17	427.79	2009.02.27	360.49
			2009.01.12	413.40	2008.12.19	394.00
			2008.12.04	400.75	2008.11.17	389.00
			2008.11.04	450.25	2008.10.16	353.91
			2008.10.09	406.70		

Further details of issue HBAN are presented in Table III. For trading signals, the number of dates within a range of end dates of period (t) is shown. HBAN is known to be one of the most difficult issues to predict within the range tested of 2007 to 2009.

TABLE III
KCNSTS DETAIL OF TRADES OF STOCK ISSUE HBAN BY PROFITABLE SIGNALS

Trade signal	Trade days	From end date	To end date	Period (t)
62	15	2009.05.14	2009.07.30	252
72	9	2009.05.12	2009.06.01	252
72	15	2009.09.29	2009.10.19	504
73	19	2009.09.23	2009.10.19	504
81	13	2009.01.02	2009.09.09	252
92	35	2009.05.13	2009.07.29	252
132	13	2009.07.15	2009.09.09	252
133	15	2009.07.31	2009.10.14	252

CONCLUSIONS

The result of this study is that KCNSTS produces signals that are 100% profitable and hence predicts market trends. Practical applications of KCNSTS are implied to emerging markets and manipulated marketplaces. While the historical series for SP500 are extensive and verifiably correct, such series for other markets are not necessarily available, complete, or authenticated for evaluation. What follows is the need for standardized historical data series against which to test. The literature has none such apparently because there is nothing similar to KCNSTS. This study also replicates and verifies results of a previous study [7] invalidating the EMH.

ACKNOWLEDGMENTS

Thanks are due to Mark Horn and Derek Stone for helpful discussions.

REFERENCES

- [1] C. James. A Reusable Database Engine for Accounting Arithmetic. *Proceedings of The Third Biennial World Conference on Integrated Design & Process Technology*, 2:25-30. 1998.
- [2] C. James. Recent Advances in Logic Tables for Reusable Database Engines. *Proceedings of the American Society of Mechanical Engineers International, Petroleum Division*. 1999.
- [3] C. James. Proof of Four Valued Bit Code (4vbc) as a Group, Ring, and Module. *World Congress and School on Universal Logic III*, 2010.

- [4] C. James. Recent Advances in Algorithmic Learning Theory of the Kanban Cell Neuron Network. *IEEE Proceedings of International Joint Conference on Neural Networks*. pp. 2158-63, August, 2013.
- [5] C. James. "KCNSTS predicting market trend with 96 random SP500 and dates (Unpublished periodical style)," unpublished.
- [6] C. James. "KCNSTS at 2008 extrema: predicting market trend and beating the Russell 2000 index (Unpublished periodical style)," unpublished.