An Analysis Of The Technical Efficiency Of The Russian Stock Market

Carl B. McGowan, Jr., Norfolk State University, USA

ABSTRACT

In this paper, we evaluate the weak form efficiency of the Russian Stock Market using the Russian Trading System Index for the period from when the market opened, September 4, 1995 to June 1, 2007. There does appear to have been a speculative bubble in the run-up to the market peak in late 1997/early 1998 that burst when the government defaulted on debt. However, based on the empirical results of this paper, it appears that the RTSI is generally weak form efficient, particularly in the last eight periods of the study. This weak form efficiency is not surprising given the international interest in the Russian Stock Market and because the RTSI is denominated in US dollars.

Keywords: Stock Market Efficiency; Emerging Stock Market; Russian Trading System

INTRODUCTION

Russia is the remaining portion of the USSR after the collapse of the Soviet system in 1990. In 2009, according to the CIA World Factbook, Russia is the largest country in the world in land mass and is almost twice the size of Canada, the number two largest country. Russia is the ninth largest country in terms of population with 139 million people and has the eighth largest economy in terms of purchasing power parity but only the seventy-fifth largest GDP per capita. Russia is the largest producer of oil and natural gas and the second largest exporter of oil and the largest exporter of natural gas in the world. The total market value of publicly traded shares is seventh largest in the world at $1.322 trillion. Thus, Russia is important in the global economy because of its size, its natural resource base, and its military might. For Russia to attract foreign direct investment and to allow its economy to grow and prosper, an efficient stock market is imperative. The goal of this study is to evaluate the weak form efficiency of the stock market using Russian Trading System Index.

Market efficiency in developed, developing, and emerging markets has been tested extensively. Recent single country studies have been reported for China, Greece, Ireland, Korea, Malaysia, and Turkey and multi-country studies have been reported for stock markets in Africa, twenty-four emerging markets, three Arabian Gulf countries, and five emerging markets. Appendix A contains a list of recent studies of stock market efficiency of emerging stock markets. Certainly, this list is not exhaustive and could include every emerging market and region. Nor is this study of emerging markets weak form efficiency a recent phenomenon.

Early studies by Bachlier (1900), Kendall (1953), and Fama (1965), found that developed markets tended toward weak form market efficiency. Hawawini (1984) summarizes 280 empirical studies of fourteen European stock markets. Hawawini concludes that "despite the peculiarities of European equity markets, the behavior of European stock prices is, with few exceptions, surprisingly similar to that of U.S. common stocks." Weak form market efficiency tests of emerging markets during the 1960's and the 1970's focused on Pacific Rim markets. Generally, results indicate that larger, older, more diversified markets exhibit less auto-correlation, but still exhibit calendar effect anomalies. More recent studies focus on newly industrialized countries and newly liberated countries of the former Soviet bloc. Again, results indicate that newer smaller markets exhibit less weak form efficiency.

Levy and Sarnat (1970) find that even though nine stock markets in developing countries under-perform nineteen stock markets in developed countries, the addition of the developing markets to the investment universe increases the efficient frontier. Levy and Sarnat analyze returns and construct efficient frontiers for stock markets from twenty-eight countries from 1951 to 1967. The efficient frontier increases as the number of stock markets in the investment universe increase, even when those markets are not good stand-alone investments.

Barry and Peavey (1997) using data from the International Financial Corporation Emerging Markets Database find that emerging markets outperformed the US stock market from 1986 to 1995 on a risk-adjusted basis but under-performed from 1990 to 1995 on a risk-adjusted basis, and significantly under-performed during the entire test period from 1975 to 1995. Barry and Peavey use the Sharpe Index to compare performance. Emerging markets provide significant variability in performance. Investable securities, available for investment by foreigners, outperformed the total market, which includes securities that are not available in investable quantities. Reasons posited for performance include government changes in fundamental economic policies. Barry and Peavey do not consider information costs, liquidity costs, tax laws, or repatriation issues.

More recently, Elango and Hussein (2008) test stock markets in seven GCC (Gulf Co-operation Council) countries for market efficiency using tests for normality and randomness for the period October 2001 to October 2006. The authors find that none of the markets exhibit normality or randomness even after liberalization of the markets. Omran and Farrar (2006) test for calendar effects and randomness in five Middle Eastern stock markets and find that only the Israeli Tel100 index shows some randomness. Asiri (2008) examines weak for market efficiency in the Bahrain Stock Exchange using both individual stocks and sectors and find that all of the stocks and sectors follow a random walk. Tests of Middle Eastern stock markets generally find that the markets are not efficient.

Fuss (2005) finds that seven Asian stock markets do not exhibit efficiency in the pre-crisis period (1997) but five stock markets do exhibit efficiency in the post-crisis period. Only Indonesia and Thailand do not exhibit weak-form market efficiency in the post-liberalization period. Islam and Khaled (2005) find that the Dhaka Stock Market is efficient after adjusting returns for heteroscedasticity using the Lo and MacKinlay (1989) technique. Verma and Rao (2007) analyze the Bombay Stock Exchange using the BSE 100 index for three one year period from April 1, 1998 to March 31, 2001 for serial correlation and runs. The authors find that the first two years are not weak form efficient and that the third year is weak form efficient. Rahman, Salat, and Bhuiyam (2004) find that the Dhakat Stock Exchange Index in Bangladesh for the period from 31/01/1990 to 31/09/2003 contains a unit root and does not exhibit weak-from efficiency. Islam and Khaled (2005) find that the Dhakat Stock Market is weak form efficient following the 1996 market crash using heteroscedastic adjusted models. The newer stock markets in Asia exhibit less weak form efficiency than the older stock markets.

Bekaert, Harvey and Lumsdaine (2002) find that emerging equity market liberalization leads to larger and more liquid markets and that stock returns become more volatile but more correlated with world markets. This increase in market integration leads to a lower cost of capital, an improved credit rating, real exchange rate appreciation, and an increase in real economic growth. Similar effects are not found in developed markets. The authors find empirical breaks that do not correspond with official liberalization dates, but do correspond with the actual date of liberalization such as the announcement of the first ADR or the date the first country fund is issued. Empirical liberalization effective dates generally occur after the official dates. “Allowing foreign investment does not appear to be sufficient to bring about market integration; foreigners still have to be willing to invest.” Bekaert, *et. al.* (2002, page 43)

CAPITAL MARKET EFFICIENCY

Capital markets are the primary source of external investment funds for corporations. To fulfill the need for funds for corporations, capital markets must exhibit efficiency. The three types of capital market efficiency are operating efficiency, information efficiency, and allocate efficiency. Stock markets exhibit operating efficiency if transactions costs are minimized reducing the costs of trading. Fama (1970) defines three forms of stock market information efficiency: weak form, semi-strong, and strong.

Allocation efficiency results from the process of moving funds to corporations that provide the highest rates of return in the economy. Allocation efficiency implies that firms that offer higher rates of return can acquire capital at lower costs than less productive firms. Thus, capital markets both supply the investment funds needed by corporations and direct funds to the corporations that use the funds the most efficiently.

How capital markets fulfill these functions is relatively well described in financial economic literature. Markowitz (1952) describes the process that defines a set of portfolios such that each portfolio has the highest possible return for that level of risk or the lowest possible risk for that level of return. This locus of points is called the efficient frontier. When the efficient frontier is combined with the utility preference function for an investor, the optimal portfolio for that investor is determined. Tobin (1958) extends portfolio theory to the inclusion of a risk-free asset. The inclusion of the risk-free asset allows the investor to separate the investment decision from the financing decision. Every investor constructs a portfolio composed of two assets – the risk-free asset and a market portfolio which is composed of a market value weighted portfolio of all assets available for investment in the market. Arrow (1964) develops the state preference model to determine the optimal portfolio for an investor in a world with state contingent outcomes and budget constraints, *i. e.* uncertain outcomes and limited wealth to invest. Sharpe (1963, 1964) develops an asset pricing model for securities based on market risk only. The Capital Asset Pricing Model, CAPM, greatly simplifies the computations necessary to determine the expected return and risk of a portfolio.

Efficient capital markets allow investors to buy properly priced assets in firms which are more productive, offering higher returns, and allow firms to acquire capital at cost commensurate with the riskiness of those firms. Thus, one might assume that economies that are more developed will have capital markets that are more developed as well. Bernstein (2002) finds a strong relationship between population growth and stock market returns. Stock market growth reflects economic growth

In this paper, we specifically address information efficiency, Fama (1970). There are three levels of stock market information efficiency. At the first level, to be tested in this paper, is the weak form efficient market hypothesis which posits that current stock prices impound all past price and volume data. That is, there are no patterns in past price and volume data that can be used to earn excess profits in the future. In effect, technical analysis would not be useful if stock markets are weak form efficient. The second level of the efficient market hypothesis is the semi-strong efficient market hypothesis which posits that stock prices impound all publicly available information. This information set subsumes stock price and volume data and adds any other information available to the investing public. In effect, the semi-strong form of the efficient market hypothesis argues against the use of fundamental analysis. The third level of information efficiency is the strong form of the efficient market hypothesis. This hypothesis argues that stock prices anticipate inside information, material non-public information.

Bachlier (1900) used serial correlation analysis to evaluate the market efficiency of commodity markets in France. Bachlier finds that commodity prices in France follow a random walk, that is, commodity prices do not follow a discernable pattern. Kendall (1953) analyzed stock price in the United Kingdom and reports that the markets exhibit weak form market efficiency. Fama (1965) reports serial correlation test results for the United States stock market and finds weak form market efficiency.

THE RTS STOCK EXCHANGE

The RTS Stock Exchange (RTS) was established in 1995 from a number of regional securities trading floors. The information in this section is taken from the RTS Stock Exchange web site at http://www.rts.ru. The RTS lists more than 400 securities of which more than 50 are bonds and the rest stocks that are of interest to both Russian and foreign investors. RTS provides market indicator information to financial information services. The RTS Index (RTSI) is the official indicator of the market and was first reported on September 1, 1995. The RTSI is computed every thirty minutes with real-time prices of the most liquid stock listed on the RTS and then reported.

There are three levels of stock reported by the RTS. Stocks are assigned to each level by a the Information Committee based on total market capitalization, average weighted daily trade volume, frequency of trades, the existence of demand and offers, the value of the spread, and other factors deemed to be important. The number of securities included in each level varies over time. Level 1 contains seven securities, as shown in Appendix B. Level 2 contains twenty-four securities. The remaining securities are in level 3. The interval for changing the lists of securities is changed at intervals of three months or longer. Changes to the list become effective in one month.

RTSI is calculated every 30 minutes from 12:00 to 17:30 and reported. The closing price is calculated at 18:10. The 12:00 value is considered the opening value and the 18:10 value is the closing value. The RTSI is computed in dollars and then converted to rubles and both numbers are reported. The index at the end of the time period, I_t, is calculated as the ratio of the total market capitalization of the stocks in the index at end of the time period, MC_t, to the total market capitalization of the stock in the index the previous period, MC_{t-1}, multiplied by the index value at the beginning of the time period, I_{t-1}.

$$I_t = I_{t-1} (MC_t / MC_{t-1})$$

The total market capitalization is the number of shares issued by the issuer as of the date of computation, Q_i, times the stock price of each stock in the index in US dollars as of the calculation time, P_{ti}, times the number of stocks in the index at the time of computations.

$$MC_t = \Sigma(P_{ti})(Q_i)$$

The ruble value of the RTSI, I_r, is calculated as the product of the ending value of the ruble to US dollar exchange rate, R_t, divided by the beginning ruble to US dollar exchange rate, R_{t-1}, times the RTSI in dollars.

$$I_r, = I_t (R_t / R_{t-1})$$

The initial value of the RTSI for September 1, 1995 was 100 and the ruble to US dollar exchange rate was 4.447 rubles per US dollar.

The price used for each stock in the index is the sum of the number of shares for each trade, P_{ik}, times the number of shares traded, Q_{ik}, divided by the total number of shares traded during the period.

$$Pi = \Sigma (P_{ik})(Q_{ik})/\Sigma(Q_{ik})$$

Each stock is represented by I and each trade is represented by k. If a stock does not trade during a calculation period, the last trade during the last ten trading periods is used. If there were no trades during the last ten trading sessions, the best bid price during the calculation period is used. If there were no trades during the last ten trading sessions and there were no bid quotes, the last bid price is used.

The currency used is the US dollar which is then converted to rubles. The securities used in calculating the RTSI are the securities in Level 1, Level 2, and shares added by the Information Committee based on expert estimation. Expert estimation is based on the characteristics of the security such as total market capitalization, the average weighted daily trading volume, the frequency of trading, the existence of securities for demand and offer, the size of the spread, and any other factors that affect liquidity. The list of securities in the RTSI may not be considered more often than every three months and changes are implemented with a one month delay. To avoid changes in the RTSI when the security list is amended, the total market capitalization used to compute RTSI is based on the market capitalization of the previous period with the amended list of securities.

The Russian Trading System Technical Index (RTST) is calculated in a fashion similar to the RTSI but on a different time interval. The RTST is computed from 11:00 to 18:00 at least once a minute. RTST is reported for the opening, close, minimum, and maximum for the day.

RESEARCH DESIGN

The data of the RTSI are from the RTS Stock Exchange web site. The daily returns are computed from index values using day-to-day closing values for the RTSI. The returns are calculated as the natural logarithm of the day-to-day wealth relative. The RTSI for the current day is divided by the RTSI for the previous day to create the wealth relative. We take the natural logarithm of the wealth relative.

Rt = ln(Rt/Rt-1)

where

Rt = the rate of return,
Ln() = the natural logarithm operator,
Rt = the RTSI value for day t,
Rt-1 = the RTSI value for day t-1.

The rate of return is a continuous compounded rate of return.

The total sample of 1650 daily observations are divided into six sub-samples of 250 daily observations and one sample of 150 daily observations from the opening of the RTS Stock Exchange in September 1995. Appendix C provides the dates used for each sub-sample. For each sub-sample we compute summary statistics and statistics to determine if the distributions are normal, auto-correlated, and contain unit roots.

The RTSI is tested for serial correlation. For lag "k" for each price series, the serial correlation coefficient, ρ(k), equals

ρ(k) = cov(R(t),R(t-k)) / var(R(t))

where, R(t) is the natural logarithm of the wealth relative, ln(R(t+1)/R(t)). If the price change series is a stationary process, the variance of R(t) is equal to the variance of R(t-k) and does not change with P(t). The serial correlation coefficient is derived from a regression of R(t) and R(t-k) where ρ(k) is the regression coefficient, βk.

E(R(t)) = α(k) + β(k) R(j-k)

We use the RTSI as the price series to calculate the returns which are used to compute the serial correlation coefficients.

We conduct a runs test by comparing the expected number of runs, n(e), to the actual number of runs, n(a). The standardized normalized variable testing the statistical significance of (n(a) – n(e)) is K.

K = (n(a)+1/2-n(e))/sd(n(a)

where,

$$N(e) = N+1-\sum_{i=1}^{n}(m_i^2)/N$$

and

$$Var(n(a) = (\sum_{i=1}^{n}(m_i^2) *(\sum_{i=1}^{n}(m_i^2) *N(N+1)) - 2N(\sum_{i=1}^{n}(m_i^2) +N2))$$

where, N is the number of observations, m(i) is the number of changes of sign, var(n(a)) is the variance of n(a) and sd(n(a)) is the standard deviation of n(a).

EMPIRICAL TEST RESULTS

Table 1 shows the summary statistics and test results for each of the sample periods. The mean daily continuous compounded rate of return ranges from a high of 0.44% for RTSI-96 to a low of –0.72% for the RTSI-97. The standard deviation is lowest for RTSI-04, 1.33% and highest for RTSI-97, 4.62%. The skewness and kurtosis values do not appear to be close to the theoretical values of zero for skewness and three for kurtosis. The

Jacque-Bera statistics to test for normality all reject the null hypothesis of normality at the (ρ = 0.00) level except for RTSI-01 (ρ=0.27).

Table 1: Summary Statistics
Russian Trading System Index

Statistic	RTSI-95	RTSI-96	RTSI-97	RTSI-98	RTSI-99	RTSI-00
Mean	0.2833	0.4357	-0.7173	0.2713	0.3965	-0.0294
Median	0.0800	0.2519	-0.5293	0.1148	0.3497	-0.0349
Standard Deviation	3.4491	2.2684	4.6203	3.7507	3.2539	2.7480
Skewness	0.4567	0.4283	-0.1011	0.1137	0.4417	-0.1777
Kurtosis	6.1552	3.7914	5.6871	4.9588	5.0529	5.1391
Range	27.9663	13.5694	35.8519	29.3660	24.6712	20.4444
Minimum	-12.1228	-6.1603	-19.0250	-16.1834	-7.8379	-10.8908
Maximum	15.8434	7.4090	16.8269	13.1825	16.8333	9.5536
Count	250	250	250	250	250	250
Jarque-Bera	112.4	14.2	75.6	40.5	52.0	49.0
Probability	0.0000	0.0008	0.0000	0.0000	0.0000	0.0000
Autocorrelation	0.2760	0.2800	0.1010	0.2350	0.1750	-0.0760
Box Ljung Q-Statistic	19.26	19.78	2.61	14.01	7.77	1.45
Probability	0.0000	0.0000	0.1060	0.0000	0.0050	0.2290
Augmented Dickey-Fuller	-6.3449	-6.2823	-6.8397	-7.1620	-6.0753	-6.9045
Significance Level	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Adjusted R^2	0.3795	0.3423	0.4374	0.3873	0.4050	0.5382
Durbin Watson	1.9951	1.9851	1.9974	1.9689	1.9962	1.9820
Statistic	**RTSI-01**	**RTSI-02**	**RTSI-03**	**RTSI-04**	**RTSI-05**	**RTSI-06**
Mean	0.2218	0.2056	0.0536	0.1860	0.2612	0.0655
Median	0.1871	0.3350	0.2457	0.2423	0.3204	0.2305
Standard Deviation	2.1702	1.5181	2.1014	1.3348	2.0707	1.4399
Skewness	-0.1656	-0.4321	-0.4974	-0.3074	-0.8623	-0.7233
Kurtosis	3.3767	3.7007	7.3277	7.0081	6.5955	4.7243
Range	13.0032	9.6041	20.1584	12.2175	16.1210	9.6410
Minimum	-7.3898	-5.1939	-10.0620	-5.5074	-9.3717	-6.4149
Maximum	5.6134	4.4102	10.0964	6.7101	6.7493	3.2261
Count	250	250	250	250	250	182
Jarque-Bera	2.6	12.9	205.4	171.3	165.6	38.4
Probability	0.2698	0.0016	0.0000	0.0000	0.0000	0.0000
Autocorrelation	0.0720	0.1060	0.0800	0.1090	0.0830	0.1040
Box Ljung Q-Statistic	1.32	2.86	1.61	2.99	1.73	1.99
Probability	0.2510	0.0910	0.2040	0.0840	0.1890	0.1580
Augmented Dickey-Fuller	-7.1911	-5.9196	-6.9064	-5.5428	-5.9620	-7.3525
Significance Level	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Adjusted R^2	0.4611	0.4474	0.4540	0.4448	0.4529	0.4511
Durbin Watson	2.0053	1.9888	1.9940	2.0152	1.9907	1.9686

The Q-statistic to determine the significance level of the auto-correlation and partial auto-correlation functions are only significant at the (ρ=0.05) level for four time periods: RSTI-95, RTSI-96, RTSI-98, and RTSI-99, indicating that these time periods exhibit auto-correlation while the remaining times period do not exhibit auto-correlation. The Durbin-Watson test statistics for first order auto-correlation are all close to 2.00, the theoretical value indicating a lack of first order auto-correlation. The Augmented Dickey-Fuller statistics all indicate that there is no unit root, that is, each time period follows a random walk. These results are mixed but support the hypothesis that the RTSI, for the sample time periods, are weak form efficient in the later periods but not in the first four test periods.

Table 2 contains the results of the runs tests for both the median and mean tests. The RTSI exhibits the presence of statistically significant runs for the first four test periods, RTSI-95 to RTSI-98 using the median test and the mean test. The Z-values for the median tests range from 0.38 (ρ = 0.70) for the RTSI-00 period to -3.55 (ρ = 0.00) for the RTSI-97 period. The Z-values for the mean tests range from 0.38 (ρ = 0.70) for the RTSI-00 period to -3.88 (ρ = 0.00) for the RTSI-95 period. For the test periods following RTSI-99, the results of the runs test do not appear to be statistically significant, that is the persistence in the return series has diminished.

Table2: Runs Tests
Russian Trading System *I*ndex

Statistics - Median						
Time Period	RTSI-95	RTSI-96	RTSI-97	RTSI-98	RTSI-99	RTSI-00
Test Value(a)	0.0800	0.2519	-0.5293	0.1148	0.3497	-0.0349
Cases < Test Value	125	125	125	125	125	125
Cases >= Test Value	125	125	125	125	125	125
Total Cases	250	250	250	250	250	250
Number of Runs	99	102	98	108	112	129
Z	-3.42	-3.04	-3.55	-2.28	-1.77	0.38
Asymp. Sig. (2-tailed)	0.0006	0.0024	0.0004	0.0225	0.0760	0.7038
Statistics - Mean	RTSI-95	RTSI-96	RTSI-97	RTSI-98	RTSI-99	RTSI-00
Test Value(a)	0.2833	0.4357	-0.7173	0.2713	0.3965	-0.0294
Cases < Test Value	133	137	123	130	126	125
Cases >= Test Value	117	113	127	120	124	125
Total Cases	250	250	250	250	250	250
Number of Runs	95	97	100	106	114	129
Z	-3.88	-3.56	-3.29	-2.51	-1.52	0.38
Asymp. Sig. (2-tailed)	0.0001	0.0004	0.0010	0.0120	0.1285	0.7038
Statistics - Median						
Time Period	RTSI-01	RTSI-02	RTSI-03	RTSI-04	RTSI-05	RTSI-06
Test Value(a)	0.1871	0.3350	0.2457	0.2423	0.3204	0.2305
Cases < Test Value	125	125	125	125	125	91
Cases >= Test Value	125	125	125	125	125	91
Total Cases	250	250	250	250	250	182
Number of Runs	120	124	119	112	122	94
Z	-0.76	-0.25	-0.89	-1.77	-0.51	0.30
Asymp. Sig. (2-tailed)	0.4470	0.7999	0.3750	0.0760	0.6122	0.7662
Statistics - Mean	RTSI-01	RTSI-02	RTSI-03	RTSI-04	RTSI-05	RTSI-06
Test Value(a)	0.2218	0.2056	0.0536	0.1860	0.2612	0.0655
Cases < Test Value	127	119	110	120	117	76
Cases >= Test Value	123	131	140	130	133	106
Total Cases	250	250	250	250	250	182
Number of Runs	120	124	115	112	114	84
Z	-0.76	-0.22	-1.18	-1.75	-1.46	-0.84
Asymp. Sig. (2-tailed)	0.4493	0.8278	0.2367	0.0798	0.1437	0.3982

SUMMARY AND CONCLUSIONS

In this study, we evaluate the characteristics of the RTS Stock Exchange in Moscow over the period from the opening on September 4, 1995 to June 1, 2007. The empirical results indicate that the RTS followed a trend in the first four time periods tested but follows is weak form efficient in the remaining eight time periods. These results would be consistent with a run-up of the RTS in the first four years of the RTS operation. However, after the collapse of the Russian economy and of the RTS following the default of the Russian government on bonds in 1997, the initial exuberance for the RTS declined and the market followed a normal pattern of weak for efficiency.

Although the RTS is an emerging market, only fifteen years old, and even though the Russian government defaulted on debt during this period, the daily returns for the RTSI are follow a random walk during the last eight time periods tested and do not exhibit serial correlation. That is, the RTS appears to be weak form efficient, particularly in the later years.

AUTHOR INFORMATION

Carl B. McGowan, Jr., PhD, CFA is a Faculty Distinguished Professor and Professor of Finance at Norfolk State University, has a BA in International Relations (Syracuse), an MBA in Finance (Eastern Michigan), and a PhD in Business Administration (Finance) from Michigan State. From 2003 to 2004, he held the RHB Bank Distinguished Chair in Finance at the Universiti Kebangsaan Malaysia and has taught in Cost Rica, Malaysia, Moscow, Saudi Arabia, and The UAE. Professor McGowan has published in numerous journals including *American Journal of Business Education, Applied Financial Economics, Decision Science, Financial Practice and Education, The Financial Review, International Business and Economics Research Journal, The International Review of Financial Analysis, The Journal of Applied Business Research, The Journal of Business Case Studies, The Journal of Diversity Management, The Journal of Real Estate Research, Managerial Finance, Managing Global Transitions, The Southwestern Economic Review, and Urban Studies.* E-mail: cbmcgowan@yahoo.com

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APPENDIX A

Recent Market Efficiency Tests of Emerging Markets

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APPENDIX B

RTS Quotation List
November 27, 2002

Level 1
United Energy System (Common)
United Energy System (Preferred)
LUKoil Holdings (Common)
Mosenergo (Common)
Rostelcom (Common)
Sberbank RF (Common)
Tatneft (Common)

Level 2
Aeroflot (common)
Electrosvyaz of Novosibirsk Region (common)
Electrosvyaz of Novosibirsk Region (preferred)
Center Telecom (common)
Center Telecom (preferred)
Trade House GUM (common)
Irkutskenergo (common)
Southern Telecommunications Company (common)
Southern Telecommunications Company (preferred)
Lenenergo (common)
Lenenergo (preferred)
Volga Telecom (common)
Baltika Brewery (common)
Baltika Brewery (preferred)
RBC Information System (common)
Rostelcom (preferred)
Sberbank RF (preferred)
Sibneft (common)
Surgutneftgas (common)
Surgutneftgas (preferred)
North-West Telecom (common)
North-West Telecom (preferred)
Uralsvyazinform (common)
YUKOS (common)

APPENDIX C

Sample Periods
Russian Trading System Index

	Begin Date	**End Date**
RTSI-95	9/4/1995	9/6/1996
RTSI-96	9/9/1996	9/4/1997
RTSI-97	9/5/1997	9/3/1998
RTSI-98	9/4/1998	9/2/1999
RTSI-99	9/3/1999	8/31/2000
RTSI-00	9/1/2000	8/30/2001
RTSI-01	8/31/2001	8/30/2002
RTSI-02	9/2/2002	9/1/2003
RTSI-03	9/2/2003	8/31/2004
RTSI-04	9/1/2004	9/2/2005
RTSI-05	9/5/2005	9/5/2006
RTSI-06	9/6/2006	6/1/2007

NOTES