Market states: A new understanding

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ABSTRACT

We present the clustering analysis of the financial markets of S&P 500 (USA) and Nikkei 225 (JPN) markets over a period of 2006-2019 as an example of a complex system. We investigate the statistical properties of correlation matrices constructed from the sliding epochs. The correlation matrices can be classified into different clusters, named as “market states” based on the similarity of correlation structures. We cluster the S&P 500 market into four and Nikkei 225 into six market states by optimizing the value of intracluster distances. The market shows transitions between these market states and the statistical properties of the transitions to critical market states can indicate likely precursors to the catastrophic events. We also analyze the same clustering technique on surrogate data constructed from average correlations of market states and the fluctuations arise due to the white noise of short time series. We use the correlated Wishart orthogonal ensemble for the construction of surrogate data whose average correlation equals the average of the real data.

Introduction

Some time ago a proposal to consider correlation matrices to define market states was put forward and found some resonance¹. A noise suppression technique was applied directly to the correlation matrices² and thereafter a clustering tree was established and eight market states were established with a certain degree of arbitrariness. Since then ideas from this paper have resonated inside and outside our group. Alternative techniques to handle non-stationary time series through spectral properties have been developed in³–⁵. Other approaches to behave at critical or catastrophic moments have been put forward by various authors⁶–¹⁰. More recently two of us participated in a proposal¹¹ to improve the choice of cluster by simultaneously optimizing the clustering process and the noise suppression parameter. We expanded the analysis from the original study of S&P 500 market by including the Nikkei 225 market. The results were essentially a dynamics consistent with the master equation and transitions to the highest correlation cluster mainly from the previous one, which thus allowed to determine possible precursors. The study had the disadvantage of counting to a large extent old data of last century. We here propose to refine the methods further and to improve the criteria to reduce the number of precursors in a given time period and also to get a better understanding of the transition dynamics between states. We also address a basic weakness of the previous studies that implied roughly that the average correlation or equivalently the largest eigenvalues of the correlation matrix, largely determine to which cluster a given correlation matrix belongs. In the Japanese market we found an interesting essential non-linear evolution, as well as a smaller basis of precursor states, thus reducing the risk base. Also we develop a technique of surrogate data based on correlated orthogonal Wishart ensembles (CWOE) draping white noise around the average correlation of each state. This gives a strong indication as to the interrelation of correlation and noise that we see.

In the present work we shall make actual connection to this matrix by noise to the correlation matrices pertaining to the market states by forming a correlated Wishart ensemble¹²–¹⁴ from the average correlation matrix representing each market state. We shall find that the clusters obtained for each market state are reasonably related to the original clusters if we chose the same time frame for the added noise. We extend the analysis to the Japanese market to confirm our findings as far as the validity of the clustering is concerned and we finally present the result, that a highly turbulent market-phase started near the Lehman Brother crash and terminated around 2016. The latter result is more clear for the US market than for the Japanese market. This likely results from two facts: The data basis (number of stocks) is smaller for the Japanese market and the Japanese market has six states. Both properties make more noise. On the other hand the fact that two intermediate states of the Japanese market display practically the same average correlation eliminates the disturbing fact mentioned in¹ that the average correlation actually dominates the definition of market states to large extent. We thus give a solid base to the concept of market states, as we show, how the clusters, i.e., the market states are made up from average correlations and noise.
Methodology and results

We begin with the identification of market states as a clusters of similar correlation matrices. We have used the adjusted daily closure prices of the stocks making up the two indices S&P 500 of US market (USA) and Nikkei 225 of Japanese market (JPN). We have considered $N = 350$ stocks of the S&P 500 index and $N = 156$ stocks of the Nikkei 225 index traded in the 14-year period from January 2006 to December 2019 which correspond to $T = 3523$ and $T = 3459$ trading days, respectively. Here we include only those stocks which were present for the entire duration of 14 years. We have also shown in the supplementary material of $N = 368$ stocks of the S&P 500 index and $N = 173$ stocks of the Nikkei 225 index for 13-year period from January 2006 to December 2018 which correspond to $T = 3270$ and $T = 3219$ trading days, respectively. The list of the stock considered for the analysis are also listed in the supplementary material. We construct a Pearson cross-correlation matrix (equal-time) of the returns $r_i(\tau)$ of stock $i$: $C_{ij}(\tau) = \frac{\langle r_i r_j \rangle - \langle r_i \rangle \langle r_j \rangle}{\sigma_i \sigma_j}$, where the epoch average $\langle \ldots \rangle$ and the standard deviations $\sigma$ are computed over that epoch of size 20 days with $i, j = 1, \ldots, N$ and $\tau$ is the end date of the epoch using daily returns. Note that we do not compensate for weekends or holidays! However, the short time series the correlation matrices become highly singular. We use the power map method for noise-suppression. In this method, a nonlinear distortion is given to each cross-correlation coefficient within an epoch by: $C_{ij} = \text{sign}(C_{ij})|C_{ij}|^{1+\varepsilon}$, where $\varepsilon \in (0, 1)$ is the noise-suppression parameter. We then study the evolution of the cross-correlation structures $C(\tau)$ of returns for epochs of 20 days with 10-day overlap.

![Figure 1](image-url)
Figure 2. Classification of market states based on optimal intra cluster distances for S&P 500 and Nikkei 225. The measure of the intra cluster distance $d_{\text{intra}}$ calculated for different number of clusters is shown in (a) and (b) for S&P 500 and Nikkei 225, respectively. The three dimensional (3D) $k$-means clustering is performed on 351 noise-suppressed correlation frames of (c) S&P 500 and 344 noise-suppressed correlation frames of (d) Nikkei 225. Here, we use best 2D projection of 3D plots. The errorbar in the plot shows the deviations of the intra cluster distances calculated for 1000 different initial conditions. The plots show the minima of standard deviations at $k = 4$ for S&P 500 and $k = 6$ for Nikkei 225, respectively. Inset: Plots of $d_{\text{intra}}$ measured for different noise-suppression parameters $\varepsilon$ and shows minima at $\varepsilon = 0.5$ and $\varepsilon = 0.3$ for S&P 500 and Nikkei 225, respectively.

Figs. 1 (a) and (b) show the plots of the index returns $R(\tau)$ and mean market correlation $\mu(\tau)$ for S&P 500 and Nikkei 225, respectively. The rather different behavior of the two markets, which we will elaborate on later, already show in these simple measures.

We now define similarity measure for two correlation matrices $C(\tau_1)$ and $C(\tau_2)$ evaluated at different time $\tau_1$ and $\tau_2$ by the distance: $\zeta(C, C') \equiv \langle \| C_{ij}(\tau_1) - C_{ij}(\tau_2) \|_{ij} \rangle$, where $\langle ... \rangle_{ij}$ denotes the average over all components. The similarity matrices for S&P 500 and Nikkei 225 are shown in supplementary Figs. S2 and S3 for periods 2006 − 2019 and 2006 − 2018, respectively. The (dis-)similarity measure is thus a distance in a $N(N-1)/2$ dimensional space which is quite inconvenient particularly because the data set, i.e., the number of correlation matrices we have is smaller than the dimensionality. Multidimensional Scaling (MDS) is a method to accommodate the distances between a set of vectors in higher dimension to a lower dimensional space. This will not always be possible exactly. Thus a statistical method with random initial conditions and subsequent optimization is used as given in the code\textsuperscript{18} to reproduce the distances as well as possible with a given tolerance. In our case we can do this by projection into a three dimensional (3D) space, which will allow visualization of projections or animated 3D
Figure 3. Plot shows dynamics of the S&P 500 and Nikkei 225 markets. (a) Evolution of S&P 500 market through the transitions between four different characterized states $S_1$, $S_2$, $S_3$, and $S_4$ over the period of 2006 – 2019. (b) Evolution of Nikkei 225 market though the transitions between six different characterized states $S_1$, $S_2$, $S_3$, $S_4$, $S_5$, and $S_6$ for the period of 2006 – 2019. US market, relative to Japanese market, is relative calm after 2016 and stays more in lower states.

arrangements. We use these suppressed data in a $k$-means procedure where we slightly improve the techniques of Ref.\textsuperscript{11} to show the clustering of the recent data set. We use the noise suppressed correlation matrix as a starting point, and explicitly discard cluster numbers smaller than 4! As before we choose a noise-suppression, and a cluster number, which minimizes the variance of the intracluster distances generated by the random selections involved. The results are seen in Figs. 2 (a, c) for the US and Figs. 2 (b, d) for the Japanese market using $\epsilon = 0.5$ and 0.3, respectively. The differences mentioned above concerning indices and average correlations now become much more striking. Compared to earlier data, the Japanese market shows one more cluster and while the clusters 3 and 4 are not entirely clear in the older data set. Now we have six clusters for a shorter time period and we encounter the phenomenon that the clusters by no means are in a quasi-linear arrangement which looks somewhat trivial, though it actually is not. Indeed we find that the alignment is along the average correlation, as already pointed out in the very first paper\textsuperscript{1}.

Figs. 3 (a) and (b) show the evolution of S&P 500 through the transitions among these four states named as market states $S_1$, $S_2$, $S_3$, and $S_4$ and Nikkei 225 through six market states $S_1$, $S_2$, $S_3$, $S_4$, $S_5$, and $S_6$ for the period of 2006 – 2019, respectively. For the US market we find average correlations correspond to each market state $\mu(S_1,S_2,S_3,S_4) = (0.19,0.31,0.46,0.63)$ are lined up according to the cluster index $S_1$, $S_2$, $S_3$, $S_4$, while we get for the Japanese market $\mu(S_1,S_2,S_3,S_4,S_5,S_6) = (0.21,0.33,0.43,0.44,0.57,0.68)$, where states $S_3$ and $S_4$ have practically the same average correlation. Note also that the transition probabilities of the Japanese market between states $S_3$ and $S_4$ are very small, and the absolute numbers ($S_3 \rightarrow S_4 = 3$, $S_4 \rightarrow S_3 = 1$) are not visible in the bar plot Fig. 4 (b). What properties of the two markets can reflect this nature should be open for discussion.

If the differences in variances of the intracluster measure $d_{\text{intra}}$ are small, we suggest adding additional criteria relates to Fig. 4, where bar-plots for absolute transition numbers (see, Fig. 4 (a) and (b)) and probability graphs for the dynamics (see, Fig. 4 (c) and (d)) of both markets are shown. On one hand select a clustering that minimizes transitions between clusters, which is particularly apparent for the split pathways to high correlations seen above for the Japanese market. On the other hand a clustering that looks consistent with surrogate data, obtained as CWOE from the average correlation obtained for each cluster, as we shall discuss now. In the supplementary material we again show that the probabilities are consistent with a master equation as seen already in Ref.\textsuperscript{11}.

We can consider that the average correlation matrix obtained for each cluster to large extent characterizes the states. This
Figure 4. Bar plots show the transition counts (frequencies) of paired market states (MS) for (a) S&P 500 and (b) Nikkei 225 markets, respectively. The market show back and forth transitions between these states. Sometime the market remain in a particular state for a long time and sometime it jumps shortly to another state and jumps back or evolve further. Transitions to the nearby state are high probable. The networks plot of transition probabilities (see, Tables S1 and Tables S2) between different states of S&P 500 and Nikkei 225 are shown in (c) and (d) respectively. The probability of market state transition of S3 to S4 is 11% for S&P 500 market, and similarly, for Nikkei 225, the probability of market state transition of S5 to S6 is 17%.

Figure 5. Plots of average correlation matrices of each market state of S&P 500 market and clustering analysis on surrogate data (CWOE). (a-d) The mean correlation matrices $\bar{S}_i$ evaluated over all the correlation frames correspond to each market state $S_1, S_2, S_3,$ & $S_4$ but for the original correlation matrices ($\varepsilon = 0$). It shows the average behavior of each market states of S&P 500 over a period of 14 years (2006-2019). (e) Black dots (MDS (CWOE)) in plot show the MDS map of CWOE using mean correlations martix as $\bar{S}$ and construction of three times bigger ensemble than $S_1$ market state of S&P 500 market (see, Fig. 3 (a)) with the same noise-suppression $\varepsilon = 0.5$. Red circles (k-means (CWOE)) in plot show the points of the first cluster of $k$-means clustering performed on CWOE (dots). Blue squares ($k$-means (USA)) in the plot show the $k$-means clustering on the empirical data of S&P 500. $k$-means clustering on the CWOE and S&P 500 data shows a qualitative similar behavior. (f), (g), and (h) show the same for mean correlation matrices $\bar{S}_2, \bar{S}_3, \text{and } \bar{S}_4$, respectively.
Figure 6. Plots of average correlation matrices of each market state of Nikkei 225 market and clustering analysis on surrogate data (CWOE). (a-f) The mean correlation $\Sigma_1$ evaluated over all the frames correspond to each market state $S_1, S_2, S_3, & S_4$ but for original correlation frames ($\varepsilon = 0$). It shows the average behavior of all six market states of S&P 500 over a period of 14 years (2006-2019). (e) Black dots (MDS (CWOE)) in plot show the MDS map of CWOE using mean correlations martix as $\Sigma_1$ and construction of three times bigger ensemble than $S_1$ market state of Nikkei 225 market (see, Fig. 3 (b)) with the same noise-suppression $\varepsilon = 0.3$. Red circles (k-means (CWOE)) in plot show the points of the first cluster of $k$-means clustering performed on CWOE (dots). Blue squares ($k$-means (USA)) in the plot show the $k$-means clustering on the empirical data of the Nikkei market. $k$-means clustering on the CWOE and S&P 500 data shows a qualitative similar behavior. (g), (h), (i), (j), (k), and (l) show the same for mean correlation matrices $\Sigma_2, \Sigma_3, \Sigma_4, \Sigma_5, \Sigma_6$, respectively.

Assumption implies that the cluster arises from noise around this average as given by a CWOE constructed from the average correlation matrix. Average correlation matrices of each market state of the S&P 500 market are shown in Fig. 5 (a-d). Fig. 5 (e), (f), (g), and (h) show the comparison of clustering analysis of surrogate data CWOE versus each state $S_1, S_2, S_3, & S_4$ of the S&P 500 market, respectively. $k$-means clustering (red circles) on the surrogate data (black dots) shows quantitatively similar behavior with the market states $S_1, S_2, S_3, S_4$ of S&P 500. Fig. 6 shows the same for six market states $S_1, S_2, S_3, S_4, S_5$ and $S_6$.
and S6 of Japanese market. Clustering has a strong dependence on epoch size.

**Discussions and Summary**

We present improved criteria for the definition of clusters and thus market states and apply these to data sets starting in 2006 and ending in 2019 for both the US and the Japanese stock market as represented by the stocks in the S&P 500 and the Nikkei 225 indices. In general terms, we find that the turbulence that started in 2008 are awaiting to some extent. On the technical side we have improved the selection of precursors of market shocks and found a more detailed structure in the Japanese market that will allow a better understanding of market dynamics beyond the dominating influence of average correlation. This brings the idea of market states and their dynamics one step nearer to real market conditions and practical use. As shares are not the entire market at some point both derivative and bond prices as well as possible connections to intra-day trading will have to be included in such studies.

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SUPPLEMENTARY INFORMATION

Data considered for the analysis over a period of 2006-2019

Transition probabilities of the S&P 500 market between four states ($S_1, S_2, S_3,$ and $S_4$) and Nikkei 225 between six states ($S_1, S_2, S_3, S_4, S_5,$ and $S_6$) over the period of 2006 – 2019 is given in Table S1 and Table S2, respectively. The data considered for the analysis are given in Table S3 and Table S4 for the same period.

**Table S1.** Transition probability of market states for USA: Four market states (MS)

|   | S1  | S2  | S3  | S4  |
|---|-----|-----|-----|-----|
| S1 | 0.703 | 0.243 | 0.036 | 0.018 |
| S2 | 0.232 | 0.455 | 0.313 | 0   |
| S3 | 0.077 | 0.33  | 0.484 | 0.11 |
| S4 | 0   | 0.111 | 0.222 | 0.667 |

**Table S2.** Transition probability of market states for JPN: Six market states (MS)

|   | S1  | S2  | S3  | S4  | S5  | S6  |
|---|-----|-----|-----|-----|-----|-----|
| S1 | 0.531 | 0.327 | 0.082 | 0.041 | 0.0 | 0.02 |
| S2 | 0.193 | 0.42  | 0.159 | 0.114 | 0.102 | 0.011 |
| S3 | 0.026 | 0.299 | 0.494 | 0.013 | 0.156 | 0.013 |
| S4 | 0.02 | 0.204 | 0.061 | 0.612 | 0.082 | 0.02 |
| S5 | 0.038 | 0.057 | 0.264 | 0.075 | 0.396 | 0.17 |
| S6 | 0.037 | 0.0  | 0.111 | 0.074 | 0.259 | 0.519 |
Figure S1. Similarity measure $\zeta(C, C')$ among 351 correlation matrices of S&P 500 (top row) and 344 correlation matrices of Nikkei 225 (bottom row). (a) and (c) are without noise-suppression $\epsilon = 0$ and (b) and (d) are with noise-suppression $\epsilon = 0.5$ and $\epsilon = 0.3$, respectively. The evolution of the stock market over 14 years (2006–2019) can be understood from the similarity matrices. Critical events of the markets in red-yellow strips are shown in the similarity matrices. S&P 500 market is less volatile than Nikkei 225 and shows less fluctuations after 2012.

Data considered for the analysis over a period of 2006-2018

We show here similar results with data running up to 2018. The results for Japanese market differ substantially indicating a change in the general market situation. The data considered for the analysis are given in Table S5 and Table S6 for the period 2006-2018.
Figure S2. Plots of similarity measure $\zeta(C,C')$ of S&P 500 (top row) and Nikkei 225 (bottom row). Similarity measure among 325 correlation matrices of S&P 500 (top row) and 320 of Nikkei 225 (bottom row): (a) and (c) without noise-reduction $\varepsilon = 0$, and (b) and (d) with noise-reduction $\varepsilon = 0.7$ and $\varepsilon = 0.5$ over a period of 2006-2018, respectively.
**Figure S3.** Classification of market states using optimal intra cluster distances $d_{\text{intra}}$ for the S&P 500 and Nikkei 225. The measure of the $d_{\text{intra}}$ calculated for different number of clusters is shown in (a) and (b) for the S&P 500 and Nikkei 225 over a period of 2006-2018, respectively. The plots show the minima of standard deviations of intracluster distance $\sigma(d_{\text{intra}})$ at $k = 4$ for S&P 500 and $k = 5$ for Nikkei 225, respectively, which correspond to the “optimal” number of clusters. $k$-means clustering is used to cluster the S&P 500 and Nikkei 225 in four and five number of cluster, respectively. The alignment of the clusters is different in two markets: clusters in (c) S&P 500 market are aligned along the average correlation and trivial but for (d) Nikkei 225 market one more cluster forms between second and fourth cluster with nearly same average correlation.
Figure S4. Market state dynamics of stock markets: (a) Evolution of S&P 500 market through the transitions among four different characterized states (S1, S2, S3, and S4) for the period of 2006 – 2018 and (b) Evolution of Nikkei 225 market though the transitions among five different characterized states (S1, S2, S3, S4, and S5) for the period of 2006 – 2018. The probability to remaining in the same state or transition to nearby states are relatively high.
Figure S5. Bar plots of transition counts (frequencies) of paired market states (MS) for S&P 500 and Nikkei 225 are shown in (a) and (b), respectively. The networks plots of transition probabilities between different states of (c) S&P 500 and (d) Nikkei 225, respectively. The transition probability of market state transition of $S_3$ to $S_4$ is 6% for S&P 500 market, and similarly, for Nikkei 225, the probability of market state transition of $S_4$ to $S_5$ is 13%.
Figure S6. Average correlation of each market state of S&P 500 market and clustering of correlated Wishart orthogonal ensembles (CWOE). (a-d) show mean correlation matrices $S_i$ evaluated over all the frames correspond to each market state $S_1, S_2, S_3, \& S_4$ but for the original correlation matrices ($\epsilon = 0$). It shows the average behavior of each market states of S&P 500 over a period of 13 years (2006-2018). (e) Dots (MDS (CWOE)) in the plot show the multidimensional scaling map of CWOE using mean correlations matrix as $S_1$ and constructing three times bigger ensemble than $S_1$ market state of the S&P 500 market with same noise-suppression $\epsilon = 0.7$. Red circles (k-means (CWOE)) in plot show the points of the $S_1$ cluster of $k$-means clustering performed on CWOE (dots). Blue squares (k-means (USA)) in the plot show the $k$-means clustering on the empirical data of S&P 500. $k$-means clustering on the CWOE and S&P 500 data shows qualitatively similar behavior. (f), (g), and (h) show the same using mean correlation matrices $S_2, S_3,$ and $S_4$ states, respectively.
Figure S7. Average correlation of each market state of Nikkei 225 market and clustering of correlated Wishart orthogonal ensembles (CWOE). (a-e) show mean correlation matrices $S_i$ evaluated over all the frames correspond to each market state $S_1, S_2, S_3, S_4, & S_5$ but for the original correlation matrices ($\epsilon = 0$). It shows the average behavior of each market states of S&P 500 over a period of 13 years (2006-2018). (f) Dots (MDS (CWOE)) in the plot show the multidimensional scaling map of CWOE using mean correlations matrix as $S_1$ and constructing three times bigger ensemble than $S_1$ market state of the S&P 500 market with same noise-suppression $\epsilon = 0.7$. Red circles ($k$-means (CWOE)) in plot show the points of the $S_1$ cluster of $k$-means clustering performed on CWOE (dots). Blue squares ($k$-means (USA)) in the plot show the $k$-means clustering on the empirical data of S&P 500. $k$-means clustering on the CWOE and S&P 500 data shows qualitatively similar behavior. (g), (h), (i), and (j) show the same using mean correlation matrices $S_2, S_3, S_4$, and $S_5$ states, respectively.
Table S3. List of 350 stocks of USA S&P 500 considered for the analysis present over the period of 2006-2019.

| S.No. | Code | Company Name                  | Sector                      | Abbv |
|-------|------|--------------------------------|-----------------------------|------|
| 1     | AAP  | Advance Auto Parts            | Consumer Discretionary      | CD   |
| 2     | AMZN | Amazon.com Inc.               | Consumer Discretionary      | CD   |
| 3     | AZO  | AutoZone Inc                  | Consumer Discretionary      | CD   |
| 4     | BBY  | Best Buy Co. Inc.             | Consumer Discretionary      | CD   |
| 5     | BKN  | Booking Holdings Inc          | Consumer Discretionary      | CD   |
| 6     | CCL  | Carnival Corp.                | Consumer Discretionary      | CD   |
| 7     | CMCSA| Comcast Corp.                 | Consumer Discretionary      | CD   |
| 8     | DHI  | D. R. Horton                   | Consumer Discretionary      | CD   |
| 9     | DISCA| Discovery Inc. Class A        | Consumer Discretionary      | CD   |
| 10    | DISH | Dish Network                  | Consumer Discretionary      | CD   |
| 11    | DLTR | Dollar Tree                   | Consumer Discretionary      | CD   |
| 12    | EXPE | Expedia Inc.                  | Consumer Discretionary      | CD   |
| 13    | F    | Ford Motor                    | Consumer Discretionary      | CD   |
| 14    | GPC  | Genuine Parts                 | Consumer Discretionary      | CD   |
| 15    | GPS  | Gap Inc.                      | Consumer Discretionary      | CD   |
| 16    | GRMN | Garmin Ltd.                   | Consumer Discretionary      | CD   |
| 17    | HAS  | Hasbro Inc.                   | Consumer Discretionary      | CD   |
| 18    | HD   | Home Depot                    | Consumer Discretionary      | CD   |
| 19    | HOG  | Harley-Davidson               | Consumer Discretionary      | CD   |
| 20    | IPG  | Interpublic Group             | Consumer Discretionary      | CD   |
| 21    | JWN  | Nordstrom                     | Consumer Discretionary      | CD   |
| 22    | KMX  | Carmax Inc                    | Consumer Discretionary      | CD   |
| 23    | KSS  | Kohl’s Corp.                  | Consumer Discretionary      | CD   |
| 24    | LB   | L Brands Inc.                 | Consumer Discretionary      | CD   |
| 25    | LEG  | Leggett & Platt               | Consumer Discretionary      | CD   |
| 26    | LEN  | Lennar Corp.                  | Consumer Discretionary      | CD   |
| 27    | LKQ  | LKQ Corporation               | Consumer Discretionary      | CD   |
| 28    | LOW  | Lowe’s Cos.                   | Consumer Discretionary      | CD   |
| 29    | M    | Macy’s Inc.                   | Consumer Discretionary      | CD   |
| 30    | MAR  | Marriott Int.’l.              | Consumer Discretionary      | CD   |
| 31    | MCD  | McDonald’s Corp.              | Consumer Discretionary      | CD   |
| 32    | MGM  | MGM Resorts International     | Consumer Discretionary      | CD   |
| 33    | MHK  | Mohawk Industries             | Consumer Discretionary      | CD   |
| 34    | NKE  | Nike                          | Consumer Discretionary      | CD   |
| 35    | NWL  | Newell Brands                 | Consumer Discretionary      | CD   |
| 36    | OMC  | Omnicom Group                 | Consumer Discretionary      | CD   |
| 37    | ORLY | O’Reilly Automotive           | Consumer Discretionary      | CD   |
| 38    | PHM  | Pulte Homes Inc.              | Consumer Discretionary      | CD   |
| 39    | PVH  | PVH Corp.                     | Consumer Discretionary      | CD   |
| 40    | RL   | Polo Ralph Lauren Corp.       | Consumer Discretionary      | CD   |
| 41    | ROST | Ross Stores                   | Consumer Discretionary      | CD   |
| 42    | SBUX | Starbucks Corp.               | Consumer Discretionary      | CD   |
| 43    | SWK  | Stanley Black & Decker        | Consumer Discretionary      | CD   |
| 44    | TGT  | Target Corp.                  | Consumer Discretionary      | CD   |
| 45    | TIF  | Tiffany & Co.                 | Consumer Discretionary      | CD   |
| 46    | TJX  | TJX Companies Inc.            | Consumer Discretionary      | CD   |
| 47    | TPR  | Tapestry, Inc.                | Consumer Discretionary      | CD   |
| 48    | UAA  | Under Armour Class A          | Consumer Discretionary      | CD   |
| 49    | VFC  | V.F. Corp.                    | Consumer Discretionary      | CD   |
| 50    | WHR  | Whirlpool Corp.               | Consumer Discretionary      | CD   |
| S.No. | Code | Company Name                  | Sector               | Abbrev |
|-------|------|-------------------------------|----------------------|--------|
| 51    | WYNN | Wynn Resorts Ltd.             | Consumer Discretionary | CD     |
| 52    | YUM  | Yum! Brands Inc.              | Consumer Discretionary | CD     |
| 53    | ADM  | Archer-Daniels-Midland Co.    | Consumer Staples     | CS     |
| 54    | CAG  | Conagra Brands                | Consumer Staples     | CS     |
| 55    | CHD  | Church & Dwight               | Consumer Staples     | CS     |
| 56    | CL   | Colgate-Palmolive             | Consumer Staples     | CS     |
| 57    | CLX  | The Clorox Company            | Consumer Staples     | CS     |
| 58    | COST | Costco Wholesale Corp.        | Consumer Staples     | CS     |
| 59    | CPB  | Campbell Soup                 | Consumer Staples     | CS     |
| 60    | CVS  | CVS Health                    | Consumer Staples     | CS     |
| 61    | EL   | Estee Lauder Cos.             | Consumer Staples     | CS     |
| 62    | GIS  | General Mills                 | Consumer Staples     | CS     |
| 63    | HRL  | Hormel Foods Corp.            | Consumer Staples     | CS     |
| 64    | HSY  | The Hershey Company           | Consumer Staples     | CS     |
| 65    | K    | Kellog Co.                    | Consumer Staples     | CS     |
| 66    | KMB  | Kimberly-Clark                | Consumer Staples     | CS     |
| 67    | KO   | Coca-Cola Company (The)       | Consumer Staples     | CS     |
| 68    | KR   | Kroger Co.                    | Consumer Staples     | CS     |
| 69    | MDLZ | Mondelez International        | Consumer Staples     | CS     |
| 70    | MKC  | McCormick & Co.               | Consumer Staples     | CS     |
| 71    | MNST | Monster Beverage              | Consumer Staples     | CS     |
| 72    | MO   | Altria Group Inc              | Consumer Staples     | CS     |
| 73    | PEP  | PepsiCo Inc.                  | Consumer Staples     | CS     |
| 74    | PG   | Procter & Gamble              | Consumer Staples     | CS     |
| 75    | SJM  | JM Smucker                    | Consumer Staples     | CS     |
| 76    | STZ  | Constellation Brands          | Consumer Staples     | CS     |
| 77    | SYY  | Sysco Corp.                   | Consumer Staples     | CS     |
| 78    | TAP  | Molson Coors Brewing Company  | Consumer Staples     | CS     |
| 79    | TSN  | Tyson Foods                   | Consumer Staples     | CS     |
| 80    | WBA  | Walgreens Boots Alliance      | Consumer Staples     | CS     |
| 81    | WMT  | Wal-Mart Stores               | Consumer Staples     | CS     |
| 82    | APA  | Apache Corporation            | Energy               | EG     |
| 83    | COG  | Cabot Oil & Gas               | Energy               | EG     |
| 84    | COP  | ConocoPhillips                | Energy               | EG     |
| 85    | CVX  | Chevron Corp.                 | Energy               | EG     |
| 86    | DVN  | Devon Energy Corp.            | Energy               | EG     |
| 87    | EOG  | EOG Resources                 | Energy               | EG     |
| 88    | FTI  | TechnipFMC                     | Energy               | EG     |
| 89    | HAL  | Halliburton Co.               | Energy               | EG     |
| 90    | HES  | Hess Corporation              | Energy               | EG     |
| 91    | HP   | Helmerich & Payne             | Energy               | EG     |
| 92    | MRO  | Marathon Oil Corp.            | Energy               | EG     |
| 93    | NBL  | Noble Energy Inc              | Energy               | EG     |
| 94    | NOV  | National Oilwell Varco Inc.   | Energy               | EG     |
| 95    | OKE  | ONEOK                          | Energy               | EG     |
| 96    | PXD  | Pioneer Natural Resources     | Energy               | EG     |
| 97    | SLB  | Schlumberger Ltd.             | Energy               | EG     |
| 98    | VLO  | Valero Energy                 | Energy               | EG     |
| 99    | WMB  | Williams Cos.                 | Energy               | EG     |
| 100   | XEC  | Cimarex Energy                | Energy               | EG     |
| 101   | XOM  | Exxon Mobil Corp.             | Energy               | EG     |
| 102   | AFL  | AFLAC Inc                      | Financials           | FN     |
| S.No. | Code | Company Name                           | Sector     | Abbrev |
|-------|------|----------------------------------------|------------|--------|
| 103   | AIG  | American International Group, Inc.     | Financials | FN     |
| 104   | AIZ  | Assurant Inc.                          | Financials | FN     |
| 105   | AJG  | Arthur J. Gallagher & Co.              | Financials | FN     |
| 106   | AMG  | Affiliated Managers Group Inc          | Financials | FN     |
| 107   | AMP  | Ameriprise Financial                   | Financials | FN     |
| 108   | AON  | Aon plc                                | Financials | FN     |
| 109   | AXP  | American Express Co                    | Financials | FN     |
| 110   | BAC  | Bank of America Corp                   | Financials | FN     |
| 111   | BEN  | Franklin Resources                     | Financials | FN     |
| 112   | BK   | The Bank of New York Mellon Corp.      | Financials | FN     |
| 113   | BLK  | BlackRock                              | Financials | FN     |
| 114   | C    | Citigroup Inc.                         | Financials | FN     |
| 115   | CINF | Cincinnati Financial                   | Financials | FN     |
| 116   | CMA  | Comerica Inc.                          | Financials | FN     |
| 117   | CME  | CME Group Inc.                         | Financials | FN     |
| 118   | ETFC | E*Trade                                | Financials | FN     |
| 119   | FITB | Fifth Third Bancorp                    | Financials | FN     |
| 120   | GS   | Goldman Sachs Group                    | Financials | FN     |
| 121   | HBAN | Huntington Bancshares                   | Financials | FN     |
| 122   | HIG  | Hartford Financial Sv.Gp.              | Financials | FN     |
| 123   | HRB  | Block H&R                              | Financials | FN     |
| 124   | ICE  | Intercontinental Exchange              | Financials | FN     |
| 125   | IVZ  | Invesco Ltd.                           | Financials | FN     |
| 126   | JPM  | JPMorgan Chase & Co.                   | Financials | FN     |
| 127   | KEY  | KeyCorp                                | Financials | FN     |
| 128   | L    | Loews Corp.                            | Financials | FN     |
| 129   | LNC  | Lincoln National                       | Financials | FN     |
| 130   | MCO  | Moody’s Corp                           | Financials | FN     |
| 131   | MET  | MetLife Inc.                           | Financials | FN     |
| 132   | MMC  | Marsh & McLennan                       | Financials | FN     |
| 133   | MS   | Morgan Stanley                         | Financials | FN     |
| 134   | MTB  | M&T Bank Corp.                         | Financials | FN     |
| 135   | NDAQ | Nasdaq, Inc.                           | Financials | FN     |
| 136   | NTRS | Northern Trust Corp.                   | Financials | FN     |
| 137   | PBCT | People’s United Financial              | Financials | FN     |
| 138   | PFG  | Principal Financial Group              | Financials | FN     |
| 139   | PGR  | Progressive Corp.                      | Financials | FN     |
| 140   | PNC  | PNC Financial Services                 | Financials | FN     |
| 141   | PRU  | Prudential Financial                   | Financials | FN     |
| 142   | RE   | Everest Re Group Ltd.                  | Financials | FN     |
| 143   | RF   | Regions Financial Corp.                | Financials | FN     |
| 144   | RJF  | Raymond James Financial Inc.           | Financials | FN     |
| 145   | SCHW | Charles Schwab Corporation             | Financials | FN     |
| 146   | SIVB | SVB Financial                           | Financials | FN     |
| 147   | SPGI | S&P Global, Inc.                       | Financials | FN     |
| 148   | STT  | State Street Corp.                     | Financials | FN     |
| 149   | TROW | T. Rowe Price Group                    | Financials | FN     |
| 150   | TRV  | The Travelers Companies Inc.           | Financials | FN     |
| 151   | UNM  | Unum Group                             | Financials | FN     |
| 152   | USB  | U.S. Bancorp                           | Financials | FN     |
| 153   | WFC  | Wells Fargo                            | Financials | FN     |
| 154   | WLTW | Willis Towers Watson                   | Financials | FN     |
| 155   | ZION | Zions Bancorp                          | Financials | FN     |
| S.No. | Code | Company Name                  | Sector     | Abbrev |
|-------|------|-------------------------------|------------|--------|
| 156   | A    | Agilent Technologies Inc      | Health Care| HC     |
| 157   | ABC  | AmerisourceBergen Corp        | Health Care| HC     |
| 158   | ABT  | Abbott Laboratories           | Health Care| HC     |
| 159   | AGN  | Allergan, Plc                 | Health Care| HC     |
| 160   | ALGN | Align Technology              | Health Care| HC     |
| 161   | ALXN | Alexion Pharmaceuticals        | Health Care| HC     |
| 162   | AMGN | Amgen Inc.                    | Health Care| HC     |
| 163   | ANTM | Anthem Inc.                   | Health Care| HC     |
| 164   | BAX  | Baxter International Inc.     | Health Care| HC     |
| 165   | BDX  | Becton Dickinson              | Health Care| HC     |
| 166   | BIIB | Biogen Inc.                   | Health Care| HC     |
| 167   | BMY  | Bristol-Myers Squibb          | Health Care| HC     |
| 168   | BSX  | Boston Scientific             | Health Care| HC     |
| 169   | CERN | Cerner                        | Health Care| HC     |
| 170   | CI   | CIIGNA Corp.                  | Health Care| HC     |
| 171   | CNC  | Centene Corporation           | Health Care| HC     |
| 172   | COO  | The Cooper Companies          | Health Care| HC     |
| 173   | DGX  | Quest Diagnostics             | Health Care| HC     |
| 174   | DVA  | DaVita Inc.                   | Health Care| HC     |
| 175   | EW   | Edwards Lifesciences          | Health Care| HC     |
| 176   | GILD | Gilead Sciences               | Health Care| HC     |
| 177   | HOLX | Hologic                      | Health Care| HC     |
| 178   | HSIC | Henry Schein                 | Health Care| HC     |
| 179   | HUM  | Humana Inc.                  | Health Care| HC     |
| 180   | IDXX | IDEXX Laboratories            | Health Care| HC     |
| 181   | ILMN | Illumina Inc                 | Health Care| HC     |
| 182   | INCY | Incyte                      | Health Care| HC     |
| 183   | ISRG | Intuitive Surgical Inc.      | Health Care| HC     |
| 184   | JNJ  | Johnson & Johnson            | Health Care| HC     |
| 185   | LH   | Laboratory Corp. of America Holding| Health Care| HC |
| 186   | LLY  | Lilly (Eli) & Co.            | Health Care| HC     |
| 187   | MDT  | Medtronic plc                | Health Care| HC     |
| 188   | MRK  | Merck & Co.                  | Health Care| HC     |
| 189   | MTD  | Mettler Toledo               | Health Care| HC     |
| 190   | MYL  | Mylan N.V.                   | Health Care| HC     |
| 191   | PFE  | Pfizer Inc.                  | Health Care| HC     |
| 192   | PKI  | PerkinElmer                  | Health Care| HC     |
| 193   | PRGO | Perrigo                      | Health Care| HC     |
| 194   | REGN | Regeneron                    | Health Care| HC     |
| 195   | RMD  | ResMed                      | Health Care| HC     |
| 196   | SYK  | Stryker Corp.                | Health Care| HC     |
| 197   | TMO  | Thermo Fisher Scientific     | Health Care| HC     |
| 198   | UHS  | Universal Health Services, Inc.| Health Care| HC |
| 199   | UNH  | United Health Group Inc.     | Health Care| HC     |
| 200   | VRTX | Vertex Pharmaceuticals Inc   | Health Care| HC     |
| 201   | WAT  | Waters Corporation           | Health Care| HC     |
| 202   | XRAY | Dentsply Sirona              | Health Care| HC     |
| 203   | ZBH  | Zimmer Biomet Holdings       | Health Care| HC     |
| 204   | AAL  | American Airlines Holdings   | Industrials| ID |
| 205   | ALK  | Alaska Air Group Inc         | Industrials| ID     |
| 206   | AME  | AMETEK Inc.                  | Industrials| ID     |
| S.No. | Code | Company Name               | Sector      | Abbrev |
|------|------|----------------------------|-------------|--------|
| 207  | AOS  | A.O. Smith Corp            | Industrials | ID     |
| 208  | ARNC | Arconic Inc.               | Industrials | ID     |
| 209  | BA   | Boeing Company             | Industrials | ID     |
| 210  | CAT  | Caterpillar Inc.           | Industrials | ID     |
| 211  | CHRW | C. H. Robinson Worldwide   | Industrials | ID     |
| 212  | CMI  | Cummins Inc.               | Industrials | ID     |
| 213  | CSX  | CSX Corp.                  | Industrials | ID     |
| 214  | CTAS | Cintas Corporation         | Industrials | ID     |
| 215  | DE   | Deere & Co.                | Industrials | ID     |
| 216  | DOV  | Dover Corp.                | Industrials | ID     |
| 217  | EFX  | Equifax Inc.               | Industrials | ID     |
| 218  | EMR  | Emerson Electric Company   | Industrials | ID     |
| 219  | ETN  | Eaton Corporation          | Industrials | ID     |
| 220  | EXPD | Expeditors International   | Industrials | ID     |
| 221  | FAST | Fastenal Co               | Industrials | ID     |
| 222  | FDX  | FedEx Corporation          | Industrials | ID     |
| 223  | FLS  | Flowserve Corporation      | Industrials | ID     |
| 224  | GD   | General Dynamics           | Industrials | ID     |
| 225  | GE   | General Electric           | Industrials | ID     |
| 226  | GWW  | Grainger (W.W.) Inc.       | Industrials | ID     |
| 227  | IR   | Ingersoll-Rand PLC         | Industrials | ID     |
| 228  | ITW  | Illinois Tool Works        | Industrials | ID     |
| 229  | JBHT | J. B. Hunt Transport Services | Industrials | ID     |
| 230  | JCI  | Johnson Controls International | Industrials | ID     |
| 231  | KSU  | Kansas City Southern       | Industrials | ID     |
| 232  | LMT  | Lockheed Martin Corp.      | Industrials | ID     |
| 233  | LUV  | Southwest Airlines         | Industrials | ID     |
| 234  | MAS  | Masco Corp.                | Industrials | ID     |
| 235  | NOC  | Northrop Grumman Corp.     | Industrials | ID     |
| 236  | NSC  | Norfolk Southern Corp.     | Industrials | ID     |
| 237  | PCAR | PACCAR Inc.                | Industrials | ID     |
| 238  | PH   | Parker-Hannifin            | Industrials | ID     |
| 239  | PNR  | Pentair Ltd.               | Industrials | ID     |
| 240  | PWR  | Quanta Services Inc.       | Industrials | ID     |
| 241  | RHI  | Robert Half International  | Industrials | ID     |
| 242  | ROK  | Rockwell Automation Inc.   | Industrials | ID     |
| 243  | ROP  | Roper Technologies         | Industrials | ID     |
| 244  | RSG  | Republic Services Inc      | Industrials | ID     |
| 245  | RTN  | Raytheon Co.               | Industrials | ID     |
| 246  | TXT  | Textron Inc.               | Industrials | ID     |
| 247  | UNP  | Union Pacific              | Industrials | ID     |
| 248  | UPS  | United Parcel Service      | Industrials | ID     |
| 249  | URI  | United Rentals, Inc.       | Industrials | ID     |
| 250  | UTX  | United Technologies        | Industrials | ID     |
| 251  | WM   | Waste Management Inc.      | Industrials | ID     |
| 252  | AAPL | Apple Inc.                 | Information Technology | IT |
| 253  | ACN  | Accenture plc             | Information Technology | IT |
| 254  | ADBE | Adobe Systems Inc          | Information Technology | IT |
| 255  | ADI  | Analog Devices, Inc.       | Information Technology | IT |
| 256  | ADP  | Automatic Data Processing  | Information Technology | IT |
| 257  | ADS  | Alliance Data Systems      | Information Technology | IT |
| 258  | ADSK | Autodesk Inc.              | Information Technology | IT |
| S.No. | Code | Company Name                          | Sector              | Abbv |
|-------|------|---------------------------------------|---------------------|------|
| 259   | AKAM | Akamai Technologies Inc               | Information Technology | IT   |
| 260   | AMAT | Applied Materials Inc.                | Information Technology | IT   |
| 261   | AMD  | Advanced Micro Devices Inc            | Information Technology | IT   |
| 262   | ANSS | ANSYS                                 | Information Technology | IT   |
| 263   | APH  | Amphenol Corp                         | Information Technology | IT   |
| 264   | ATVI | Activision Blizzard                  | Information Technology | IT   |
| 265   | CDNS | Cadence Design Systems                | Information Technology | IT   |
| 266   | CRM  | Salesforce.com                        | Information Technology | IT   |
| 267   | CSCO | Cisco Systems                         | Information Technology | IT   |
| 268   | CTSH | Cognizant Technology Solutions        | Information Technology | IT   |
| 269   | CTXS | Citrix Systems                        | Information Technology | IT   |
| 270   | DXC  | DXC Technology                        | Information Technology | IT   |
| 271   | EA   | Electronic Arts                       | Information Technology | IT   |
| 272   | EBAY | eBay Inc.                             | Information Technology | IT   |
| 273   | FFIV | F5 Networks                           | Information Technology | IT   |
| 274   | FIS  | Fidelity National Information Services| Information Technology | IT   |
| 275   | FISV | Fiserv Inc.                           | Information Technology | IT   |
| 276   | FLIR | FLIR Systems                          | Information Technology | IT   |
| 277   | GLW  | Corning Inc.                          | Information Technology | IT   |
| 278   | GOOG | Alphabet Inc Class C                  | Information Technology | IT   |
| 279   | GOOGL| Alphabet Inc Class A                  | Information Technology | IT   |
| 280   | GPN  | Global Payments Inc.                  | Information Technology | IT   |
| 281   | HPQ  | HP Inc.                               | Information Technology | IT   |
| 282   | IBM  | International Business Machines       | Information Technology | IT   |
| 283   | INTC | Intel Corp.                           | Information Technology | IT   |
| 284   | INTU | Intuit Inc.                           | Information Technology | IT   |
| 285   | IT   | Gartner Inc.                          | Information Technology | IT   |
| 286   | JNPR | Juniper Networks                      | Information Technology | IT   |
| 287   | KLA  | KLA-Tencor Corp.                      | Information Technology | IT   |
| 288   | LRCX | Lam Research                          | Information Technology | IT   |
| 289   | MCHP | Microchip Technology                  | Information Technology | IT   |
| 290   | MSFT | Microsoft Corp.                       | Information Technology | IT   |
| 291   | MSI  | Motorola Solutions Inc.               | Information Technology | IT   |
| 292   | MU   | Micron Technology                     | Information Technology | IT   |
| 293   | NFLX | Netflix Inc.                          | Information Technology | IT   |
| 294   | NTAP | NetApp                                | Information Technology | IT   |
| 295   | NVDA | Nvidia Corporation                    | Information Technology | IT   |
| 296   | ORCL | Oracle Corp.                          | Information Technology | IT   |
| 297   | PAYX | Paychex Inc.                          | Information Technology | IT   |
| 298   | QCOM | QUALCOMM Inc.                         | Information Technology | IT   |
| 299   | SNPS | Synopsys Inc.                         | Information Technology | IT   |
| 300   | STX  | Seagate Technology                    | Information Technology | IT   |
| 301   | SWKS | Skyworks Solutions                    | Information Technology | IT   |
| 302   | TTWO | Take-Two Interactive                  | Information Technology | IT   |
| 303   | TXN  | Texas Instruments                     | Information Technology | IT   |
| 304   | VRSN | Verisign Inc.                         | Information Technology | IT   |
| 305   | WDC  | Western Digital                       | Information Technology | IT   |
| 306   | XILNX| Xilinx Inc.                            | Information Technology | IT   |
| 307   | APD  | Air Products & Chemicals Inc          | Materials            | MT   |
| 308   | AVY  | Avery Dennison Corp                   | Materials            | MT   |
| 309   | BLL  | Ball Corp                             | Materials            | MT   |
| S.No. | Code | Company Name                          | Sector       | Abbrev |
|-------|------|---------------------------------------|--------------|--------|
| 310   | CF   | CF Industries Holdings Inc            | Materials    | MT     |
| 311   | ECL  | Ecolab Inc.                           | Materials    | MT     |
| 312   | FCX  | Freeport-McMoRan Inc.                 | Materials    | MT     |
| 313   | FMC  | FMC Corporation                       | Materials    | MT     |
| 314   | IFF  | Intl Flavors & Fragrances              | Materials    | MT     |
| 315   | IP   | International Paper                   | Materials    | MT     |
| 316   | MOS  | The Mosaic Company                    | Materials    | MT     |
| 317   | NEM  | Newmont Mining Corporation            | Materials    | MT     |
| 318   | NUE  | Nucor Corp.                           | Materials    | MT     |
| 319   | PKG  | Packaging Corporation of America       | Materials    | MT     |
| 320   | PPG  | PPG Industries                        | Materials    | MT     |
| 321   | SEE  | Sealed Air                            | Materials    | MT     |
| 322   | SHW  | Sherwin-Williams                      | Materials    | MT     |
| 323   | VMC  | Vulcan Materials                      | Materials    | MT     |
| 324   | CTL  | CenturyLink Inc                       | Telecommunication Services | TC |
| 325   | T    | AT&T Inc.                             | Telecommunication Services | TC |
| 326   | VZ   | Verizon Communications                 | Telecommunication Services | TC |
| 327   | AEE  | Ameren Corp                           | Utilities    | UT     |
| 328   | AEP  | American Electric Power                | Utilities    | UT     |
| 329   | AES  | AES Corp                               | Utilities    | UT     |
| 330   | CMS  | CMS Energy                            | Utilities    | UT     |
| 331   | CNP  | CenterPoint Energy                    | Utilities    | UT     |
| 332   | D    | Dominion Energy                       | Utilities    | UT     |
| 333   | DTE  | DTE Energy Co.                        | Utilities    | UT     |
| 334   | DUK  | Duke Energy                           | Utilities    | UT     |
| 335   | ED   | Consolidated Edison                   | Utilities    | UT     |
| 336   | EIX  | Edison Int’l                          | Utilities    | UT     |
| 337   | ES   | Eversource Energy                     | Utilities    | UT     |
| 338   | ETR  | Entergy Corp.                         | Utilities    | UT     |
| 339   | EXC  | Exelon Corp.                          | Utilities    | UT     |
| 340   | FE   | FirstEnergy Corp                      | Utilities    | UT     |
| 341   | LNT  | Alliant Energy Corp                   | Utilities    | UT     |
| 342   | NEE  | NextEra Energy                        | Utilities    | UT     |
| 343   | NI   | NiSource Inc.                         | Utilities    | UT     |
| 344   | NRG  | NRG Energy                            | Utilities    | UT     |
| 345   | PEG  | Public Serv. Enterprise Inc.          | Utilities    | UT     |
| 346   | PNW  | Pinnacle West Capital                 | Utilities    | UT     |
| 347   | SO   | Southern Co.                          | Utilities    | UT     |
| 348   | SRE  | Sempra Energy                         | Utilities    | UT     |
| 349   | WEC  | Wec Energy Group Inc                  | Utilities    | UT     |
| 350   | XEL  | Xcel Energy Inc                       | Utilities    | UT     |
Table S4. List of 156 stocks of JPN Nikkei 225 considered for the analysis present over the period of 2006-2019.

| S.No. | Code   | Company Name                          | Sector            | Abbrv |
|-------|--------|---------------------------------------|-------------------|-------|
| 1     | 1332.T | NIPPON SUISAN KAISHA, LTD.            | Consumer Goods    | CG    |
| 2     | 2002.T | NISSHIN SEIFUN GROUP INC.             | Consumer Goods    | CG    |
| 3     | 2282.T | NH FOODS LTD.                         | Consumer Goods    | CG    |
| 4     | 2502.T | ASAHI GROUP HOLDINGS, LTD.            | Consumer Goods    | CG    |
| 5     | 2503.T | KIRIN HOLDINGS CO., LTD.              | Consumer Goods    | CG    |
| 6     | 2531.T | TAKARA HOLDINGS INC.                  | Consumer Goods    | CG    |
| 7     | 2801.T | KIKKOMAN CORP.                        | Consumer Goods    | CG    |
| 8     | 2802.T | AJINOMOTO CO., INC.                   | Consumer Goods    | CG    |
| 9     | 2871.T | NICHIREI CORP.                        | Consumer Goods    | CG    |
| 10    | 3086.T | J.FRONT RETAILING CO., LTD.           | Consumer Goods    | CG    |
| 11    | 3099.T | ISETAN MITSUKOSHI HOLDINGS LTD.       | Consumer Goods    | CG    |
| 12    | 4704.T | TREND MICRO INC.                      | Consumer Goods    | CG    |
| 13    | 8028.T | FAMILYMART UNY HOLDINGS CO., LTD.     | Consumer Goods    | CG    |
| 14    | 8233.T | TAKASHIMAYA CO., LTD.                 | Consumer Goods    | CG    |
| 15    | 8267.T | AEON CO., LTD.                        | Consumer Goods    | CG    |
| 16    | 9602.T | TOHO CO., LTD.                        | Consumer Goods    | CG    |
| 17    | 9681.T | TOKYO DOME CORP.                      | Consumer Goods    | CG    |
| 18    | 9766.T | KONAMI HOLDINGS CORP.                 | Consumer Goods    | CG    |
| 19    | 9983.T | FAST RETAILING CO., LTD.              | Consumer Goods    | CG    |
| 20    | 1721.T | COMSYS HOLDINGS CORP.                 | Capital Goods/Others | CP   |
| 21    | 1801.T | Taisei CORP.                          | Capital Goods/Others | CP   |
| 22    | 1803.T | SHIMIZU CORP.                         | Capital Goods/Others | CP   |
| 23    | 1808.T | HASEKO CORP.                          | Capital Goods/Others | CP   |
| 24    | 1812.T | KAJIMA CORP.                          | Capital Goods/Others | CP   |
| 25    | 1928.T | SEKISUI HOUSE, LTD.                   | Capital Goods/Others | CP   |
| 26    | 1963.T | JGC CORP.                             | Capital Goods/Others | CP   |
| 27    | 5631.T | THE JAPAN STEEL WORKS, LTD.           | Capital Goods/Others | CP   |
| 28    | 6113.T | AMADA HOLDINGS CO., LTD.              | Capital Goods/Others | CP   |
| 29    | 6301.T | KOMATSU LTD.                          | Capital Goods/Others | CP   |
| 30    | 6302.T | SUMITOMO HEAVY IND., LTD.             | Capital Goods/Others | CP   |
| 31    | 6305.T | HITACHI CONST. MACH. CO., LTD.        | Capital Goods/Others | CP   |
| 32    | 6326.T | KUBOTA CORP.                          | Capital Goods/Others | CP   |
| 33    | 6361.T | EBARA CORP.                           | Capital Goods/Others | CP   |
| 34    | 6366.T | CHIYODA CORP.                         | Capital Goods/Others | CP   |
| 35    | 6367.T | DAIKIN INDUSTRIES, LTD.               | Capital Goods/Others | CP   |
| 36    | 6471.T | NSK LTD.                              | Capital Goods/Others | CP   |
| 37    | 6472.T | NTN CORP.                             | Capital Goods/Others | CP   |
| 38    | 7003.T | MITSUI E&S HOLDINGS CO., LTD.         | Capital Goods/Others | CP   |
| 39    | 7004.T | HITACHI ZOSEN CORP.                   | Capital Goods/Others | CP   |
| 40    | 7011.T | MITSUBISHI HEAVY IND., LTD.           | Capital Goods/Others | CP   |
| 41    | 7012.T | KAWASAKI HEAVY IND., LTD.             | Capital Goods/Others | CP   |
| 42    | 7013.T | IHI CORP.                             | Capital Goods/Others | CP   |
| 43    | 7912.T | DAI NIPPON PRINTING CO., LTD.         | Capital Goods/Others | CP   |
| 44    | 7951.T | YAMAHA CORP.                          | Capital Goods/Others | CP   |
| 45    | 8801.T | MITSUI FUDOSAN CO., LTD.              | Capital Goods/Others | CP   |
| 46    | 8802.T | MITSUBISHI ESTATE CO., LTD.           | Capital Goods/Others | CP   |
| 47    | 8804.T | TOKYO TATEMONO CO., LTD.              | Capital Goods/Others | CP   |
| 48    | 8830.T | SUMITOMO REALTY & DEVELOPMENT CO., LTD.| Capital Goods/Others | CP   |
| 49    | 8253.T | CREDIT SAISON CO., LTD.               | Financials        | FN    |
| 50    | 8331.T | THE CHIBA BANK, LTD.                  | Financials        | FN    |
| 51    | 8355.T | THE SHIZUOKA BANK, LTD.               | Financials        | FN    |
| S.No. | Code  | Company Name                        | Sector   | Abbrev |
|-------|-------|------------------------------------|----------|--------|
| 52    | 8601.T| DAIWAN SECURITIES GROUP INC.       | Finanical| FN     |
| 53    | 8604.T| NOMURA HOLDINGS, INC.              | Finanical| FN     |
| 54    | 2768.T| SOJITZ CORP.                       | Materials| MT     |
| 55    | 3101.T| TOYOBO CO., LTD.                   | Materials| MT     |
| 56    | 3103.T| UNITIKA, LTD.                      | Materials| MT     |
| 57    | 3401.T| TEEJIN LTD.                        | Materials| MT     |
| 58    | 3402.T| TORAY INDUSTRIES, INC.             | Materials| MT     |
| 59    | 3405.T| KURARAY CO., LTD.                  | Materials| MT     |
| 60    | 3407.T| ASAHI KASEI CORP.                  | Materials| MT     |
| 61    | 3861.T| OJI HOLDINGS CORP.                 | Materials| MT     |
| 62    | 4004.T| SHOWA DENKO K.K.                   | Materials| MT     |
| 63    | 4005.T| SUMITOMO CHEMICAL CO., LTD.        | Materials| MT     |
| 64    | 4021.T| NISSAN CHEMICAL CORP.              | Materials| MT     |
| 65    | 4042.T| TOSOH CORP.                        | Materials| MT     |
| 66    | 4061.T| DENKA CO., LTD.                    | Materials| MT     |
| 67    | 4063.T| SHIN-ETSU CHEMICAL CO., LTD.       | Materials| MT     |
| 68    | 4183.T| MITSUI CHEMICALS, INC.             | Materials| MT     |
| 69    | 4208.T| UBE INDUSTRIES, LTD.               | Materials| MT     |
| 70    | 4272.T| NIPPON KAYAKU CO., LTD.            | Materials| MT     |
| 71    | 4452.T| KAO CORP.                          | Materials| MT     |
| 72    | 4631.T| DIC CORP.                          | Materials| MT     |
| 73    | 4901.T| FUJIFILM HOLDINGS CORP.            | Materials| MT     |
| 74    | 4911.T| SHISEIDO CO., LTD.                | Materials| MT     |
| 75    | 5101.T| THE YOKOHAMA RUBBER CO., LTD.      | Materials| MT     |
| 76    | 5108.T| BRIDGESTONE CORP.                  | Materials| MT     |
| 77    | 5202.T| NIPPON SHEET GLASS CO., LTD.       | Materials| MT     |
| 78    | 5232.T| SUMITOMO OSAKA CEMENT CO., LTD.    | Materials| MT     |
| 79    | 5233.T| TAIHEIYO CEMENT CORP.              | Materials| MT     |
| 80    | 5301.T| TOKAI CARBON CO., LTD.             | Materials| MT     |
| 81    | 5333.T| NGK INSULATORS, LTD.              | Materials| MT     |
| 82    | 5401.T| NIPPOEN STEEL CORP.               | Materials| MT     |
| 83    | 5406.T| KOBE STEEL, LTD.                   | Materials| MT     |
| 84    | 5541.T| PACIFIC METALS CO., LTD.           | Materials| MT     |
| 85    | 5703.T| NIPPON LIGHT METAL HOLDINGS CO., LTD.| Materials| MT     |
| 86    | 5706.T| MITSUI MINING & SMELTING CO.       | Materials| MT     |
| 87    | 5707.T| TOHO ZINC CO., LTD.                | Materials| MT     |
| 88    | 5711.T| MITSUBISHI MATERIALS CORP.         | Materials| MT     |
| 89    | 5713.T| SUMITOMO METAL MINING CO., LTD.    | Materials| MT     |
| 90    | 5714.T| DOWA HOLDINGS CO., LTD.            | Materials| MT     |
| 91    | 5801.T| FURUKAWA ELECTRIC CO., LTD.        | Materials| MT     |
| 92    | 5802.T| SUMITOMO ELECTRIC IND., LTD.       | Materials| MT     |
| 93    | 5803.T| FUJIKURA LTD.                      | Materials| MT     |
| 94    | 5901.T| TOYO SEIKAN GROUP HOLDINGS, LTD.   | Materials| MT     |
| 95    | 6988.T| NITTO DENKO CORP.                  | Materials| MT     |
| 96    | 8001.T| ITOCHU CORP.                       | Materials| MT     |
| 97    | 8002.T| MARUBENI CORP.                     | Materials| MT     |
| 98    | 8015.T| TOYOTA TSUSHO CORP.                | Materials| MT     |
| 99    | 8031.T| MITSUI & CO., LTD.                 | Materials| MT     |
| 100   | 8053.T| SUMITOMO CORP.                     | Materials| MT     |
| 101   | 8058.T| MITSUBISHI CORP.                   | Materials| MT     |
| 102   | 3105.T| NISSHINBO HOLDINGS INC.            | Technology| TC     |
| 103   | 4151.T| KYOWA KIRIN CO., LTD.              | Technology| TC     |
| 104   | 4502.T| TAKEDA PHARMACEUTICAL CO., LTD.    | Technology| TC     |
| S.No. | Code    | Company Name                          | Sector                     | Abbrev |
|-------|---------|---------------------------------------|----------------------------|--------|
| 105   | 4503.T  | ASTELLAS PHARMA INC.                  | Technology                 | TC     |
| 106   | 4506.T  | SUMITOMO DAINIPPON PHARMA CO., LTD.   | Technology                 | TC     |
| 107   | 4507.T  | SHIONOGI & CO., LTD.                  | Technology                 | TC     |
| 108   | 4519.T  | CHUGAI PHARMACEUTICAL CO., LTD.       | Technology                 | TC     |
| 109   | 4543.T  | TERUMO CORP.                          | Technology                 | TC     |
| 110   | 4902.T  | KONICA MINOLTA, INC.                  | Technology                 | TC     |
| 111   | 6479.T  | MINEBEA MITSUMI INC.                  | Technology                 | TC     |
| 112   | 6503.T  | MITSUBISHI ELECTRIC CORP.             | Technology                 | TC     |
| 113   | 6504.T  | FUJI ELECTRIC CO., LTD.               | Technology                 | TC     |
| 114   | 6506.T  | YASKAWA ELECTRIC CORP.                | Technology                 | TC     |
| 115   | 6701.T  | NEC CORP.                             | Technology                 | TC     |
| 116   | 6702.T  | FUJITSU LTD.                          | Technology                 | TC     |
| 117   | 6703.T  | OKI ELECTRIC IND. CO., LTD.           | Technology                 | TC     |
| 118   | 6724.T  | SEIKO EPSON CORP.                     | Technology                 | TC     |
| 119   | 6758.T  | SONY CORP.                            | Technology                 | TC     |
| 120   | 6762.T  | TDK CORP.                             | Technology                 | TC     |
| 121   | 6770.T  | ALPS ALPINE CO., LTD.                 | Technology                 | TC     |
| 122   | 6841.T  | YOKOGAWA ELECTRIC CORP.               | Technology                 | TC     |
| 123   | 6902.T  | DENSO CORP.                           | Technology                 | TC     |
| 124   | 6952.T  | CASIO COMPUTER CO., LTD.              | Technology                 | TC     |
| 125   | 6954.T  | FANUC CORP.                           | Technology                 | TC     |
| 126   | 6976.T  | TAIYO YUDEN CO., LTD.                 | Technology                 | TC     |
| 127   | 7201.T  | NISSAN MOTOR CO., LTD.                | Technology                 | TC     |
| 128   | 7202.T  | ISUZU MOTORS LTD.                     | Technology                 | TC     |
| 129   | 7203.T  | TOYOTA MOTOR CORP.                    | Technology                 | TC     |
| 130   | 7205.T  | HINO MOTORS, LTD.                     | Technology                 | TC     |
| 131   | 7211.T  | MITSUBISHI MOTORS CORP.               | Technology                 | TC     |
| 132   | 7261.T  | MAZDA MOTOR CORP.                     | Technology                 | TC     |
| 133   | 7269.T  | SUZUKI MOTOR CORP.                    | Technology                 | TC     |
| 134   | 7270.T  | SUBARU CORP.                          | Technology                 | TC     |
| 135   | 7272.T  | YAMAHA MOTOR CO., LTD.                | Technology                 | TC     |
| 136   | 7731.T  | NIKON CORP.                           | Technology                 | TC     |
| 137   | 7733.T  | OLYMPUS CORP.                         | Technology                 | TC     |
| 138   | 7735.T  | SCREEN HOLDINGS CO., LTD.             | Technology                 | TC     |
| 139   | 7752.T  | RICOH CO., LTD.                       | Technology                 | TC     |
| 140   | 8035.T  | TOKYO ELECTRON LTD.                   | Technology                 | TC     |
| 141   | 9001.T  | TOBU RAILWAY CO., LTD.                | Transportation and Utilities | UT    |
| 142   | 9005.T  | TOKYU CORP.                           | Transportation and Utilities | UT    |
| 143   | 9007.T  | ODAKYU ELECTRIC RAILWAY CO., LTD.     | Transportation and Utilities | UT    |
| 144   | 9008.T  | KEIO CORP.                            | Transportation and Utilities | UT    |
| 145   | 9009.T  | KEISEI ELECTRIC RAILWAY CO., LTD.     | Transportation and Utilities | UT    |
| 146   | 9062.T  | NIPPON EXPRESS CO., LTD.              | Transportation and Utilities | UT    |
| 147   | 9064.T  | YAMATO HOLDINGS CO., LTD.             | Transportation and Utilities | UT    |
| 148   | 9101.T  | NIPPON YUSEN K.K.                     | Transportation and Utilities | UT    |
| 149   | 9104.T  | MITSUI O.S.K.LINES, LTD.              | Transportation and Utilities | UT    |
| 150   | 9107.T  | KAWASAKI KISEN KAISHA, LTD.           | Transportation and Utilities | UT    |
| 151   | 9301.T  | MITSUBISHI LOGISTICS CORP.            | Transportation and Utilities | UT    |
| 152   | 9501.T  | TOKYO ELECTRIC POWER COMPANY HOLDINGS, I | Transportation and Utilities | UT    |
| 153   | 9502.T  | CHUBU ELECTRIC POWER CO., INC.        | Transportation and Utilities | UT    |
| 154   | 9503.T  | THE KANSAI ELECTRIC POWER CO., INC.   | Transportation and Utilities | UT    |
| 155   | 9531.T  | TOKYO GAS CO., LTD.                   | Transportation and Utilities | UT    |
| 156   | 9532.T  | OSAKA GAS CO., LTD.                   | Transportation and Utilities | UT    |
Table S5. List of 368 stocks of USA S&P 500 considered for the analysis present over the period of 2006-2018.

| S.No. | Code | Company Name                  | Sector                  | Abbrv |
|-------|------|--------------------------------|-------------------------|-------|
| 1     | AAP  | Advance Auto Parts             | Consumer Discretionary  | CD    |
| 2     | AMZN | Amazon.com Inc.                | Consumer Discretionary  | CD    |
| 3     | AZO  | AutoZone Inc.                  | Consumer Discretionary  | CD    |
| 4     | BBY  | Best Buy Co. Inc.              | Consumer Discretionary  | CD    |
| 5     | BKNG | Booking Holdings Inc           | Consumer Discretionary  | CD    |
| 6     | CBS  | CBS Corp.                      | Consumer Discretionary  | CD    |
| 7     | CCL  | Carnival Corp.                 | Consumer Discretionary  | CD    |
| 8     | CMCSA| Comcast Corp.                  | Consumer Discretionary  | CD    |
| 9     | DHI  | D. R. Horton                   | Consumer Discretionary  | CD    |
| 10    | DISCA| Discovery Inc. Class A         | Consumer Discretionary  | CD    |
| 11    | DISH | Dish Network                   | Consumer Discretionary  | CD    |
| 12    | DLTR | Dollar Tree                    | Consumer Discretionary  | CD    |
| 13    | EXPE | Expedia Inc.                   | Consumer Discretionary  | CD    |
| 14    | F    | Ford Motor                     | Consumer Discretionary  | CD    |
| 15    | FL   | Foot Locker Inc                | Consumer Discretionary  | CD    |
| 16    | FOX  | Twenty-First Century Fox Class B| Consumer Discretionary| CD    |
| 17    | FOXA | Twenty-First Century Fox Class A| Consumer Discretionary| CD    |
| 18    | GPC  | Genuine Parts                  | Consumer Discretionary  | CD    |
| 19    | GPS  | Gap Inc.                       | Consumer Discretionary  | CD    |
| 20    | GRMN | Garmin Ltd.                    | Consumer Discretionary  | CD    |
| 21    | GT   | Goodyear Tire & Rubber         | Consumer Discretionary  | CD    |
| 22    | HAS  | Hasbro Inc.                    | Consumer Discretionary  | CD    |
| 23    | HD   | Home Depot                     | Consumer Discretionary  | CD    |
| 24    | HOG  | Harley-Davidson                | Consumer Discretionary  | CD    |
| 25    | IPG  | Interpublic Group              | Consumer Discretionary  | CD    |
| 26    | JWN  | Nordstrom                      | Consumer Discretionary  | CD    |
| 27    | KSS  | Kohl’s Corp.                   | Consumer Discretionary  | CD    |
| 28    | LB   | L Brands Inc.                  | Consumer Discretionary  | CD    |
| 29    | LEG  | Leggett & Platt                | Consumer Discretionary  | CD    |
| 30    | LEN  | Lennar Corp.                   | Consumer Discretionary  | CD    |
| 31    | LKQ  | LKQ Corporation                | Consumer Discretionary  | CD    |
| 32    | LOW  | Lowe’s Cos.                    | Consumer Discretionary  | CD    |
| 33    | M    | Macy’s Inc.                    | Consumer Discretionary  | CD    |
| 34    | MAR  | Marriott Int’l.                | Consumer Discretionary  | CD    |
| 35    | MAT  | Mattel Inc.                    | Consumer Discretionary  | CD    |
| 36    | MCD  | McDonald’s Corp.               | Consumer Discretionary  | CD    |
| 37    | MGM  | MGM Resorts International      | Consumer Discretionary  | CD    |
| 38    | MHK  | Mohawk Industries              | Consumer Discretionary  | CD    |
| 39    | NKE  | Nike                           | Consumer Discretionary  | CD    |
| 40    | NWL  | Newell Brands                  | Consumer Discretionary  | CD    |
| 41    | OMC  | Omnicom Group                  | Consumer Discretionary  | CD    |
| 42    | ORLY | O’Reilly Automotive            | Consumer Discretionary  | CD    |
| 43    | PHM  | Pulte Homes Inc.               | Consumer Discretionary  | CD    |
| 44    | PVH  | PVH Corp.                      | Consumer Discretionary  | CD    |
| 45    | RL   | Polo Ralph Lauren Corp.        | Consumer Discretionary  | CD    |
| 46    | ROST | Ross Stores                    | Consumer Discretionary  | CD    |
| 47    | SBUX | Starbucks Corp.                | Consumer Discretionary  | CD    |
| 48    | SNA  | Snap-On Inc.                   | Consumer Discretionary  | CD    |
| 49    | SWK  | Stanley Black & Decker         | Consumer Discretionary  | CD    |
| 50    | TGT  | Target Corp.                   | Consumer Discretionary  | CD    |
| 51    | TIF  | Tiffany & Co.                  | Consumer Discretionary  | CD    |
| S.No. | Code | Company Name                  | Sector                  | Abbrev |
|-------|------|-------------------------------|-------------------------|--------|
| 52    | TJX  | TJX Companies Inc.            | Consumer Discretionary  | CD     |
| 53    | TPR  | Tapestry, Inc.                | Consumer Discretionary  | CD     |
| 54    | UAA  | Under Armour Class A          | Consumer Discretionary  | CD     |
| 55    | VFC  | V.F. Corp.                    | Consumer Discretionary  | CD     |
| 56    | VIAB | Viacom Inc.                   | Consumer Discretionary  | CD     |
| 57    | WHR  | Whirlpool Corp.               | Consumer Discretionary  | CD     |
| 58    | WYNN | Wynn Resorts Ltd              | Consumer Discretionary  | CD     |
| 59    | YUM  | Yum! Brands Inc               | Consumer Discretionary  | CD     |
| 60    | ADM  | Archer-Daniels-Midland Co.    | Consumer Staples        | CS     |
| 61    | CAG  | Conagra Brands                | Consumer Staples        | CS     |
| 62    | CHD  | Church & Dwight               | Consumer Staples        | CS     |
| 63    | CL   | Colgate-Palmolive             | Consumer Staples        | CS     |
| 64    | CLX  | The Clorox Company            | Consumer Staples        | CS     |
| 65    | CPB  | Campbell Soup                 | Consumer Staples        | CS     |
| 66    | CVS  | CVS Health                    | Consumer Staples        | CS     |
| 67    | EL   | Estee Lauder Cos.             | Consumer Staples        | CS     |
| 68    | GIS  | General Mills                 | Consumer Staples        | CS     |
| 69    | HRL  | Hormel Foods Corp.            | Consumer Staples        | CS     |
| 70    | HSY  | The Hershey Company           | Consumer Staples        | CS     |
| 71    | K    | Kellogg Co.                   | Consumer Staples        | CS     |
| 72    | KMB  | Kimberly-Clark                | Consumer Staples        | CS     |
| 73    | KO   | Coca-Cola Company (The)       | Consumer Staples        | CS     |
| 74    | KR   | Kroger Co.                    | Consumer Staples        | CS     |
| 75    | MDLZ | Mondelez International        | Consumer Staples        | CS     |
| 76    | MKC  | McCormick & Co.               | Consumer Staples        | CS     |
| 77    | MNST | Monster Beverage              | Consumer Staples        | CS     |
| 78    | MO   | Altria Group Inc              | Consumer Staples        | CS     |
| 79    | PEP  | PepsiCo Inc.                  | Consumer Staples        | CS     |
| 80    | PG   | Procter & Gamble              | Consumer Staples        | CS     |
| 81    | SJM  | JM Smucker                    | Consumer Staples        | CS     |
| 82    | STZ  | Constellation Brands          | Consumer Staples        | CS     |
| 83    | SYY  | Sysco Corp.                   | Consumer Staples        | CS     |
| 84    | TAP  | Molson Coors Brewing Company  | Consumer Staples        | CS     |
| 85    | TSN  | Tyson Foods                   | Consumer Staples        | CS     |
| 86    | WBA  | Walgreens Boots Alliance      | Consumer Staples        | CS     |
| 87    | WMT  | Wal-Mart Stores               | Consumer Staples        | CS     |
| 88    | APA  | Apache Corporation            | Energy                  | EG     |
| 89    | APC  | Anadarko Petroleum Corp       | Energy                  | EG     |
| 90    | BHGE | Baker Hughes, a GE Company    | Energy                  | EG     |
| 91    | COG  | Cabot Oil & Gas               | Energy                  | EG     |
| 92    | COP  | ConocoPhillips                | Energy                  | EG     |
| 93    | CVX  | Chevron Corp.                 | Energy                  | EG     |
| 94    | DVN  | Devon Energy Corp.            | Energy                  | EG     |
| 95    | EOG  | EOG Resources                 | Energy                  | EG     |
| 96    | EQT  | EQT Corporation               | Energy                  | EG     |
| 97    | FTI  | TechnipFMC                     | Energy                  | EG     |
| 98    | HAL  | Halliburton Co.               | Energy                  | EG     |
| 99    | HES  | Hess Corporation              | Energy                  | EG     |
| 100   | HP   | Helmerich & Payne             | Energy                  | EG     |
| 101   | MRO  | Marathon Oil Corp.            | Energy                  | EG     |
| 102   | NBL  | Noble Energy Inc              | Energy                  | EG     |
| 103   | NOV  | National Oilwell Varco Inc.   | Energy                  | EG     |
| 104   | PXD  | Pioneer Natural Resources     | Energy                  | EG     |
| S.No. | Code | Company Name                      | Sector | Abbrv |
|-------|------|-----------------------------------|--------|-------|
| 105   | RRC  | Range Resources Corp.             | Energy | EG    |
| 106   | SLB  | Schlumberger Ltd.                 | Energy | EG    |
| 107   | VLO  | Valero Energy                     | Energy | EG    |
| 108   | WMB  | Williams Cos.                      | Energy | EG    |
| 109   | XEC  | Cimarex Energy                    | Energy | EG    |
| 110   | XOM  | Exxon Mobil Corp.                 | Energy | EG    |
| 111   | AFL  | AFLAC Inc                         | Financials | FN |
| 112   | AIG  | American International Group, Inc. | Financials | FN |
| 113   | AIZ  | Assurant Inc.                     | Financials | FN |
| 114   | AJG  | Arthur J. Gallagher & Co.         | Financials | FN |
| 115   | AMG  | Affiliated Managers Group Inc     | Financials | FN |
| 116   | AMP  | Ameriprise Financial              | Financials | FN |
| 117   | AON  | Aon plc                           | Financials | FN |
| 118   | AXP  | American Express Co               | Financials | FN |
| 119   | BAC  | Bank of America Corp              | Financials | FN |
| 120   | BBT  | BB&T Corporation                  | Financials | FN |
| 121   | BEN  | Franklin Resources                | Financials | FN |
| 122   | BK   | The Bank of New York Mellon Corp. | Financials | FN |
| 123   | BLK  | BlackRock                         | Financials | FN |
| 124   | C    | Citigroup Inc.                    | Financials | FN |
| 125   | CINF | Cincinnati Financial              | Financials | FN |
| 126   | CMA  | Comerica Inc.                     | Financials | FN |
| 127   | CME  | CME Group Inc.                    | Financials | FN |
| 128   | ETFC | E*Trade                           | Financials | FN |
| 129   | FITB | Fifth Third Bancorp               | Financials | FN |
| 130   | GS   | Goldman Sachs Group               | Financials | FN |
| 131   | HBAN | Huntington Bancshares              | Financials | FN |
| 132   | HRB  | Block H&R                         | Financials | FN |
| 133   | ICE  | Intercontinental Exchange         | Financials | FN |
| 134   | IVZ  | Invesco Ltd.                      | Financials | FN |
| 135   | JPM  | JPMorgan Chase & Co.              | Financials | FN |
| 136   | KEY  | KeyCorp                           | Financials | FN |
| 137   | L    | Loews Corp.                       | Financials | FN |
| 138   | LNC  | Lincoln National                  | Financials | FN |
| 139   | MCO  | Moody’s Corp                      | Financials | FN |
| 140   | MET  | MetLife Inc.                      | Financials | FN |
| 141   | MMC  | Marsh & McLennan                  | Financials | FN |
| 142   | MS   | Morgan Stanley                    | Financials | FN |
| 143   | MTB  | M&T Bank Corp.                    | Financials | FN |
| 144   | NDAQ | Nadsaq, Inc.                      | Financials | FN |
| 145   | NTRS | Northern Trust Corp.              | Financials | FN |
| 146   | PBCT | People’s United Financial         | Financials | FN |
| 147   | PFG  | Principal Financial Group         | Financials | FN |
| 148   | PGR  | Progressive Corp.                 | Financials | FN |
| 149   | PNC  | PNC Financial Services            | Financials | FN |
| 150   | PRU  | Prudential Financial              | Financials | FN |
| 151   | RE   | Everest Re Group Ltd.             | Financials | FN |
| 152   | RF   | Regions Financial Corp.           | Financials | FN |
| 153   | RJF  | Raymond James Financial Inc.      | Financials | FN |
| 154   | SCHW | Charles Schwab Corporation        | Financials | FN |
| 155   | SIVB | SVB Financial                      | Financials | FN |
| 156   | SPGI | S&P Global, Inc.                  | Financials | FN |
| S.No. | Code | Company Name                  | Sector    | Abbrev |
|-------|------|-------------------------------|-----------|--------|
| 157   | STI  | SunTrust Banks                | Financials| FN     |
| 158   | STT  | State Street Corp.            | Financials| FN     |
| 159   | TMK  | Torchmark Corp.               | Financials| FN     |
| 160   | TROW | T. Rowe Price Group           | Financials| FN     |
| 161   | TRV  | The Travelers Companies Inc.  | Financials| FN     |
| 162   | UNM  | Unum Group                    | Financials| FN     |
| 163   | USB  | U.S. Bancorp                  | Financials| FN     |
| 164   | WFC  | Wells Fargo                   | Financials| FN     |
| 165   | WLTW | Willis Towers Watson          | Financials| FN     |
| 166   | ZION | Zions Bancorp                 | Financials| FN     |
| 167   | A    | Agilent Technologies Inc      | Health Care| HC    |
| 168   | ABC  | AmerisourceBergen Corp        | Health Care| HC    |
| 169   | ABT  | Abbott Laboratories           | Health Care| HC    |
| 170   | AGN  | Allergan, Plc                 | Health Care| HC    |
| 171   | ALGN | Align Technology              | Health Care| HC    |
| 172   | ALXN | Alexion Pharmaceuticals        | Health Care| HC    |
| 173   | AMGN | Amgen Inc.                    | Health Care| HC    |
| 174   | ANTM | Anthem Inc.                   | Health Care| HC    |
| 175   | BAX  | Baxter International Inc.     | Health Care| HC    |
| 176   | BDX  | Becton Dickinson              | Health Care| HC    |
| 177   | BIIB | Biogen Inc.                   | Health Care| HC    |
| 178   | BMY  | Bristol-Myers Squibb          | Health Care| HC    |
| 179   | BSX  | Boston Scientific             | Health Care| HC    |
| 180   | CELG | Celgene Corp.                 | Health Care| HC    |
| 181   | CERN | Cerner                        | Health Care| HC    |
| 182   | CI   | CIGNA Corp.                   | Health Care| HC    |
| 183   | CNC  | Centene Corporation           | Health Care| HC    |
| 184   | COO  | The Cooper Companies          | Health Care| HC    |
| 185   | DVA  | DaVita Inc.                   | Health Care| HC    |
| 186   | EW   | Edwards Lifesciences          | Health Care| HC    |
| 187   | GILD | Gilead Sciences               | Health Care| HC    |
| 188   | HOLX | Hologic                       | Health Care| HC    |
| 189   | HSIC | Henry Schein                  | Health Care| HC    |
| 190   | HUM  | Humana Inc.                   | Health Care| HC    |
| 191   | IDXX | IDEXX Laboratories            | Health Care| HC    |
| 192   | ILMN | Illumina Inc                  | Health Care| HC    |
| 193   | INCY | Incyte                        | Health Care| HC    |
| 194   | ISRG | Intuitive Surgical Inc.       | Health Care| HC    |
| 195   | LH   | Laboratory Corp. of America Holding| Health Care| HC    |
| 196   | LLY  | Lilly (Eli) & Co.             | Health Care| HC    |
| 197   | MDT  | Medtronic plc                 | Health Care| HC    |
| 198   | MRK  | Merck & Co.                   | Health Care| HC    |
| 199   | MTD  | Mettler Toledo                | Health Care| HC    |
| 200   | MYL  | Mylan N.V.                    | Health Care| HC    |
| 201   | PFE  | Pfizer Inc.                   | Health Care| HC    |
| 202   | PKI  | PerkinElmer                   | Health Care| HC    |
| 203   | PRGO | Perrigo                       | Health Care| HC    |
| 204   | REGN | Regeneron                     | Health Care| HC    |
| 205   | RMD  | ResMed                        | Health Care| HC    |
| 206   | SYK  | Stryker Corp.                 | Health Care| HC    |
| 207   | TMO  | Thermo Fisher Scientific      | Health Care| HC    |
| 208   | UHS  | Universal Health Services, Inc.| Health Care| HC    |
| S.No. | Code | Company Name                  | Sector   | Abbrev |
|-------|------|------------------------------|----------|--------|
| 209   | UNH  | United Health Group Inc.     | Health Care | HC     |
| 210   | VRTX | Vertex Pharmaceuticals Inc   | Health Care | HC     |
| 211   | WAT  | Waters Corporation           | Health Care | HC     |
| 212   | XRAY | Dentsply Sirona              | Health Care | HC     |
| 213   | ZBH  | Zimmer Biomet Holdings       | Health Care | HC     |
| 214   | AAL  | American Airlines Group      | Industrials | ID     |
| 215   | ALK  | Alaska Air Group Inc         | Industrials | ID     |
| 216   | AME  | AMETEK Inc.                  | Industrials | ID     |
| 217   | AOS  | A.O. Smith Corp.             | Industrials | ID     |
| 218   | ARNC | Arconic Inc.                 | Industrials | ID     |
| 219   | AYI  | Acuity Brands Inc            | Industrials | ID     |
| 220   | BA   | Boeing Company               | Industrials | ID     |
| 221   | CAT  | Caterpillar Inc.             | Industrials | ID     |
| 222   | CHRW | C. H. Robinson Worldwide      | Industrials | ID     |
| 223   | CMI  | Cummins Inc.                 | Industrials | ID     |
| 224   | CSX  | CSX Corp.                    | Industrials | ID     |
| 225   | CTAS | Cintas Corporation           | Industrials | ID     |
| 226   | DE   | Deere & Co.                  | Industrials | ID     |
| 227   | DOV  | Dover Corp.                  | Industrials | ID     |
| 228   | EFX  | Equifax Inc.                 | Industrials | ID     |
| 229   | EMR  | Emerson Electric Company     | Industrials | ID     |
| 230   | ETN  | Eaton Corporation            | Industrials | ID     |
| 231   | EXPD | Expeditors International      | Industrials | ID     |
| 232   | FAST | Fastenal Co                  | Industrials | ID     |
| 233   | FDX  | FedEx Corporation            | Industrials | ID     |
| 234   | FLR  | Fluor Corp.                  | Industrials | ID     |
| 235   | FLS  | Flowserve Corporation        | Industrials | ID     |
| 236   | GD   | General Dynamics             | Industrials | ID     |
| 237   | GE   | General Electric             | Industrials | ID     |
| 238   | GWW  | Grainger (W.W.) Inc.         | Industrials | ID     |
| 239   | IR   | Ingersoll-Rand PLC           | Industrials | ID     |
| 240   | ITW  | Illinois Tool Works          | Industrials | ID     |
| 241   | JBHT | J. B. Hunt Transport Services| Industrials | ID     |
| 242   | JCI  | Johnson Controls International| Industrials | ID     |
| 243   | JEC  | Jacobs Engineering Group     | Industrials | ID     |
| 244   | KSU  | Kansas City Southern         | Industrials | ID     |
| 245   | LLL  | L-3 Communications Holdings  | Industrials | ID     |
| 246   | LMT  | Lockheed Martin Corp.        | Industrials | ID     |
| 247   | LUV  | Southwest Airlines           | Industrials | ID     |
| 248   | MAS  | Masco Corp.                  | Industrials | ID     |
| 249   | NOC  | Northrop Grumman Corp.       | Industrials | ID     |
| 250   | NSC  | Norfolk Southern Corp.       | Industrials | ID     |
| 251   | PCAR | PACCAR Inc.                  | Industrials | ID     |
| 252   | PH   | Parker-Hannifin              | Industrials | ID     |
| 253   | PNR  | Pentair Ltd.                 | Industrials | ID     |
| 254   | PWR  | Quanta Services Inc.         | Industrials | ID     |
| 255   | RHI  | Robert Half International    | Industrials | ID     |
| 256   | ROK  | Rockwell Automation Inc.     | Industrials | ID     |
| 257   | ROP  | Roper Technologies           | Industrials | ID     |
| 258   | RSG  | Republic Services Inc        | Industrials | ID     |
| 259   | RTN  | Raytheon Co.                 | Industrials | ID     |
| 260   | SRCL | Stericycle Inc               | Industrials | ID     |
| 261   | TXT  | Textron Inc.                 | Industrials | ID     |

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| S.No. | Code | Company Name               | Sector         | Abbrev |
|-------|------|----------------------------|----------------|--------|
| 262   | UNP  | Union Pacific              | Industrials    | ID     |
| 263   | UPS  | United Parcel Service      | Industrials    | ID     |
| 264   | URI  | United Rentals, Inc.       | Industrials    | ID     |
| 265   | UTX  | United Technologies       | Industrials    | ID     |
| 266   | WM   | Waste Management Inc.      | Industrials    | ID     |
| 267   | AAPL | Apple Inc.                 | Information Technology | IT |
| 268   | ACN  | Accenture plc             | Information Technology | IT |
| 269   | ADBE | Adobe Systems Inc         | Information Technology | IT |
| 270   | ADI  | Analog Devices, Inc.      | Information Technology | IT |
| 271   | ADP  | Automatic Data Processing | Information Technology | IT |
| 272   | ADS  | Alliance Data Systems     | Information Technology | IT |
| 273   | ADSK | Autodesk Inc.              | Information Technology | IT |
| 274   | AKAM | Akamai Technologies Inc   | Information Technology | IT |
| 275   | AMAT | Applied Materials Inc.    | Information Technology | IT |
| 276   | AMD  | Advanced Micro Devices Inc| Information Technology | IT |
| 277   | ANSS | ANSYS                      | Information Technology | IT |
| 278   | APH  | Amphenol Corp              | Information Technology | IT |
| 279   | ATV1 | Activision Blizzard       | Information Technology | IT |
| 280   | CDNS | Cadence Design Systems    | Information Technology | IT |
| 281   | CRM  | Salesforce.com             | Information Technology | IT |
| 282   | CSCO | Cisco Systems             | Information Technology | IT |
| 283   | CTSH | Cognizant Technology Solutions | Information Technology | IT |
| 284   | CTXS | Citrix Systems             | Information Technology | IT |
| 285   | DXC  | DXC Technology             | Information Technology | IT |
| 286   | EA   | Electronic Arts            | Information Technology | IT |
| 287   | EBAY | eBay Inc.                  | Information Technology | IT |
| 288   | FFIV | F5 Networks                | Information Technology | IT |
| 289   | FIS  | Fidelity National Information Services | Information Technology | IT |
| 290   | FISV | Fiserv Inc                 | Information Technology | IT |
| 291   | FLIR | FLIR Systems               | Information Technology | IT |
| 292   | GLW  | Corning Inc.               | Information Technology | IT |
| 293   | GOOG | Alphabet Inc Class C      | Information Technology | IT |
| 294   | GOOGL| Alphabet Inc Class A       | Information Technology | IT |
| 295   | GPN  | Global Payments Inc.      | Information Technology | IT |
| 296   | HPQ  | HP Inc.                    | Information Technology | IT |
| 297   | HRS  | Harris Corporation         | Information Technology | IT |
| 298   | IBM  | International Business Machines | Information Technology | IT |
| 299   | INTC | Intel Corp.                | Information Technology | IT |
| 300   | INTU | Intuit Inc.                | Information Technology | IT |
| 301   | IT   | Gartner Inc                | Information Technology | IT |
| 302   | JNPR | Juniper Networks           | Information Technology | IT |
| 303   | KLAC | KLA-Tencor Corp.           | Information Technology | IT |
| 304   | LRCX | Lam Research               | Information Technology | IT |
| 305   | MCHP | Microchip Technology       | Information Technology | IT |
| 306   | MSFT | Microsoft Corp.            | Information Technology | IT |
| 307   | MSI  | Motorola Solutions Inc.   | Information Technology | IT |
| 308   | MU   | Micron Technology          | Information Technology | IT |
| 309   | NFLX | Netflix Inc.               | Information Technology | IT |
| 310   | NTAP | NetApp                     | Information Technology | IT |
| 311   | NVDA | Nvidia Corporation         | Information Technology | IT |
| 312   | ORCL | Oracle Corp.               | Information Technology | IT |
| 313   | PAYX | Paychex Inc.               | Information Technology | IT |
| 314   | QCOM | QUALCOMM Inc.              | Information Technology | IT |
| S.No. | Code | Company Name                      | Sector                     | Abbrev |
|-------|------|-----------------------------------|---------------------------|--------|
| 315   | RHT  | Red Hat Inc.                      | Information Technology    | IT     |
| 316   | SNPS | Synopsys Inc.                     | Information Technology    | IT     |
| 317   | STX  | Seagate Technology                | Information Technology    | IT     |
| 318   | SWKS | Skyworks Solutions                | Information Technology    | IT     |
| 319   | SYMC | Symantec Corp.                    | Information Technology    | IT     |
| 320   | TSS  | Total System Services             | Information Technology    | IT     |
| 321   | TTWO | Take-Two Interactive              | Information Technology    | IT     |
| 322   | TXN  | Texas Instruments                 | Information Technology    | IT     |
| 323   | VRSN | Verisign Inc.                     | Information Technology    | IT     |
| 324   | WDC  | Western Digital                   | Information Technology    | IT     |
| 325   | XLNX | Xilinx Inc.                       | Information Technology    | IT     |
| 326   | APD  | Air Products & Chemicals Inc      | Materials                 | MT     |
| 327   | AVY  | Avery Dennison Corp               | Materials                 | MT     |
| 328   | BLL  | Ball Corp                         | Materials                 | MT     |
| 329   | CF   | CF Industries Holdings Inc        | Materials                 | MT     |
| 330   | DWDP | DowDuPont                         | Materials                 | MT     |
| 331   | ECL  | Ecolab Inc.                       | Materials                 | MT     |
| 332   | FCX  | Freeport-McMoRan Inc.             | Materials                 | MT     |
| 333   | FMC  | FMC Corporation                   | Materials                 | MT     |
| 334   | IFF  | Intl Flavors & Fragrances         | Materials                 | MT     |
| 335   | IP   | International Paper               | Materials                 | MT     |
| 336   | MOS  | The Mosaic Company                | Materials                 | MT     |
| 337   | NEM  | Newmont Mining Corporation        | Materials                 | MT     |
| 338   | NUE  | Nucor Corp.                       | Materials                 | MT     |
| 339   | PKG  | Packaging Corporation of America  | Materials                 | MT     |
| 340   | SEE  | Sealed Air                        | Materials                 | MT     |
| 341   | SHW  | Sherwin-Williams                  | Materials                 | MT     |
| 342   | CTL  | CenturyLink Inc                   | Telecommunication Services | TC     |
| 343   | T    | AT&T Inc.                         | Telecommunication Services | TC     |
| 344   | VZ   | Verizon Communications            | Telecommunication Services | TC     |
| 345   | AEE  | Ameren Corp                       | Utilities                 | UT     |
| 346   | AEP  | American Electric Power           | Utilities                 | UT     |
| 347   | AES  | AES Corp                          | Utilities                 | UT     |
| 348   | CMS  | CMS Energy                        | Utilities                 | UT     |
| 349   | CNP  | CenterPoint Energy                | Utilities                 | UT     |
| 350   | D    | Dominion Energy                   | Utilities                 | UT     |
| 351   | DTE  | DTE Energy Co.                    | Utilities                 | UT     |
| 352   | DUK  | Duke Energy                       | Utilities                 | UT     |
| 353   | ED   | Consolidated Edison               | Utilities                 | UT     |
| 354   | EIX  | Edison Int’I                      | Utilities                 | UT     |
| 355   | ES   | Eversource Energy                 | Utilities                 | UT     |
| 356   | ETR  | Entergy Corp.                     | Utilities                 | UT     |
| 357   | EXC  | Exelon Corp.                      | Utilities                 | UT     |
| 358   | FE   | FirstEnergy Corp                  | Utilities                 | UT     |
| 359   | LNT  | Alliant Energy Corp               | Utilities                 | UT     |
| 360   | NEE  | NextEra Energy                    | Utilities                 | UT     |
| 361   | NI   | NiSource Inc.                     | Utilities                 | UT     |
| 362   | NRG  | NRG Energy                        | Utilities                 | UT     |
| 363   | PCG  | PG&E Corp.                        | Utilities                 | UT     |
| 364   | PEG  | Public Serv. Enterprise Inc.      | Utilities                 | UT     |
| S.No. | Code   | Company Name                     | Sector    | Abbrv |
|-------|--------|----------------------------------|-----------|-------|
| 365   | SO     | Southern Co.                     | Utilities | UT    |
| 366   | SRE    | Sempra Energy                    | Utilities | UT    |
| 367   | WEC    | Wec Energy Group Inc             | Utilities | UT    |
| 368   | XEL    | Xcel Energy Inc                  | Utilities | UT    |

**Table S6.** List of 173 stocks of JPN Nikkei 225 considered for the analysis present over the period of 2006-2018.

| S.No. | Code   | Company Name                     | Sector     | Abbrv |
|-------|--------|----------------------------------|------------|-------|
| 1     | 1332.T | NIPPON SUISAN KAISHA, LTD.       | Consumer   | CG    |
| 2     | 2002.T | NISSHIN SEIFUN GROUP INC.        | Consumer   | CG    |
| 3     | 2282.T | NH FOODS LTD.                    | Consumer   | CG    |
| 4     | 2501.T | SAPPORO HOLDINGS LTD.            | Consumer   | CG    |
| 5     | 2502.T | ASAHI GROUP HOLDINGS, LTD.       | Consumer   | CG    |
| 6     | 2503.T | KIRIN HOLDINGS CO., LTD.         | Consumer   | CG    |
| 7     | 2531.T | TAKARA HOLDINGS INC.             | Consumer   | CG    |
| 8     | 2801.T | KIKKOMAN CORP.                   | Consumer   | CG    |
| 9     | 2802.T | AJINOMOTO CO., INC.              | Consumer   | CG    |
| 10    | 2871.T | NICHIIREI CORP.                  | Consumer   | CG    |
| 11    | 3086.T | J.FRONT RETAILING CO., LTD.      | Consumer   | CG    |
| 12    | 3099.T | ISETAN MITSUKOSHI HOLDINGS LTD.  | Consumer   | CG    |
| 13    | 3382.T | SEVEN & I HOLDINGS CO., LTD.     | Consumer   | CG    |
| 14    | 4324.T | DENTSU INC.                      | Consumer   | CG    |
| 15    | 4704.T | TREND MICRO INC.                 | Consumer   | CG    |
| 16    | 8028.T | FAMILYMART UNY HOLDINGS CO., LTD.| Consumer   | CG    |
| 17    | 8233.T | TAKASHIMAYA CO., LTD.            | Consumer   | CG    |
| 18    | 8252.T | MARUI GROUP CO., LTD.            | Consumer   | CG    |
| 19    | 8267.T | AEON CO., LTD.                   | Consumer   | CG    |
| 20    | 9602.T | TOHO CO., LTD                    | Consumer   | CG    |
| 21    | 9681.T | TOKYO DOME CORP.                 | Consumer   | CG    |
| 22    | 9735.T | SECOM CO., LTD.                  | Consumer   | CG    |
| 23    | 9766.T | KONAMI HOLDINGS CORP.            | Consumer   | CG    |
| 24    | 9983.T | FAST RETAILING CO., LTD.         | Consumer   | CG    |
| 25    | 1721.T | COMSYS HOLDINGS CORP.            | Capital     | CP    |
| 26    | 1801.T | TAISEI CORP.                     | Capital     | CP    |
| 27    | 1802.T | Oabayashi CORP.                  | Capital     | CP    |
| 28    | 1803.T | SHIMIZU CORP.                    | Capital     | CP    |
| 29    | 1808.T | HASEKO CORP.                     | Capital     | CP    |
| 30    | 1812.T | KAJIMA CORP.                     | Capital     | CP    |
| 31    | 1928.T | SEKISUI HOUSE, LTD.              | Capital     | CP    |
| 32    | 1963.T | JGC CORP.                        | Capital     | CP    |
| 33    | 5631.T | THE JAPAN STEEL WORKS, LTD.      | Capital     | CP    |
| 34    | 6113.T | AMADA HOLDINGS CO., LTD.         | Capital     | CP    |
| 35    | 6301.T | KOMATSU LTD.                     | Capital     | CP    |
| 36    | 6302.T | SUMITOMO HEAVY IND., LTD.        | Capital     | CP    |
| 37    | 6305.T | HITACHI CONST. MACH. CO., LTD.   | Capital     | CP    |
| 38    | 6326.T | KUBOTA CORP.                     | Capital     | CP    |
| 39    | 6361.T | EBARA CORP.                      | Capital     | CP    |
| 40    | 6366.T | CHIYODA CORP.                    | Capital     | CP    |
| 41    | 6367.T | DAIKIN INDUSTRIES, LTD.          | Capital     | CP    |
| 42    | 6471.T | NSK LTD.                         | Capital     | CP    |
| 43    | 6472.T | NTN CORP.                        | Capital     | CP    |
| 44    | 6473.T | JTEKT CORP.                      | Capital     | CP    |
| 45    | 7003.T | MITSUI E&S HOLDINGS CO., LTD.    | Capital     | CP    |
| S.No. | Code   | Company Name                                      | Sector                     | Abbrv |
|-------|--------|--------------------------------------------------|----------------------------|-------|
| 46    | 7004.T | HITACHI ZOSEN CORP.                              | Capital Goods/Others       | CP    |
| 47    | 7011.T | MITUBISHI HEAVY IND., LTD.                       | Capital Goods/Others       | CP    |
| 48    | 7012.T | KAWASAKI HEAVY IND., LTD.                        | Capital Goods/Others       | CP    |
| 49    | 7013.T | IHI CORP.                                        | Capital Goods/Others       | CP    |
| 50    | 7911.T | TOPPAN PRINTING CO., LTD.                        | Capital Goods/Others       | CP    |
| 51    | 7912.T | DAI NIPPON PRINTING CO., LTD.                    | Capital Goods/Others       | CP    |
| 52    | 7951.T | YAMAHA CORP.                                     | Capital Goods/Others       | CP    |
| 53    | 8801.T | MITUSI FUDOSAN CO., LTD.                         | Capital Goods/Others       | CP    |
| 54    | 8802.T | MITUSIBISHI ESTATE CO., LTD.                     | Capital Goods/Others       | CP    |
| 55    | 8804.T | TOKYO TATEMONO CO., LTD.                         | Capital Goods/Others       | CP    |
| 56    | 8830.T | SUMITOMO REALTY & DEVELOPMENT CO., LTD.          | Capital Goods/Others       | CP    |
| 57    | 8253.T | CREDIT SAISON CO., LTD.                          | Financials                 | FN    |
| 58    | 8303.T | SHINSEI BANK, LTD.                               | Financials                 | FN    |
| 59    | 8331.T | THE CHIBA BANK, LTD.                             | Financials                 | FN    |
| 60    | 8355.T | THE SHIZUOKA BANK, LTD.                          | Financials                 | FN    |
| 61    | 8601.T | DAIWA SECURITIES GROUP INC.                      | Financials                 | FN    |
| 62    | 8604.T | NOMURA HOLDINGS, INC.                            | Financials                 | FN    |
| 63    | 8628.T | MATSUI SECURITIES CO., LTD.                      | Financials                 | FN    |
| 64    | 2768.T | SOJITZ CORP.                                     | Materials                  | MT    |
| 65    | 3101.T | TOYOBO CO., LTD.                                 | Materials                  | MT    |
| 66    | 3103.T | UNITIKA, LTD.                                    | Materials                  | MT    |
| 67    | 3401.T | TEIJIN LTD.                                      | Materials                  | MT    |
| 68    | 3402.T | TORAY INDUSTRIES, INC.                           | Materials                  | MT    |
| 69    | 3405.T | KURARAY CO., LTD.                                | Materials                  | MT    |
| 70    | 3407.T | ASAHI KASEI CORP.                                | Materials                  | MT    |
| 71    | 3436.T | SUMCO CORP.                                      | Materials                  | MT    |
| 72    | 3861.T | OJI HOLDINGS CORP.                               | Materials                  | MT    |
| 73    | 4004.T | SHOWA DENKO K.K.                                 | Materials                  | MT    |
| 74    | 4005.T | SUMITOMO CHEMICAL CO., LTD.                      | Materials                  | MT    |
| 75    | 4042.T | TOSOH CORP.                                      | Materials                  | MT    |
| 76    | 4043.T | TOKUYAMA CORP.                                   | Materials                  | MT    |
| 77    | 4061.T | DENKA CO., LTD.                                  | Materials                  | MT    |
| 78    | 4063.T | SHIN-ETSU CHEMICAL CO., LTD.                     | Materials                  | MT    |
| 79    | 4183.T | MITSUI CHEMICALS, INC.                           | Materials                  | MT    |
| 80    | 4188.T | MITSUBISHI CHEMICAL HOLDINGS CORP.                | Materials                  | MT    |
| 81    | 4208.T | UBE INDUSTRIES, LTD.                             | Materials                  | MT    |
| 82    | 4272.T | NIPPON KAYAKU CO., LTD.                          | Materials                  | MT    |
| 83    | 4452.T | KAO CORP.                                        | Materials                  | MT    |
| 84    | 4631.T | DIC CORP.                                        | Materials                  | MT    |
| 85    | 4901.T | FUJIFILM HOLDINGS CORP.                           | Materials                  | MT    |
| 86    | 4911.T | SHISEIDO CO., LTD.                               | Materials                  | MT    |
| 87    | 5020.T | JXTG HOLDINGS, INC.                              | Materials                  | MT    |
| 88    | 5101.T | THE YOKOHAMA RUBBER CO., LTD.                    | Materials                  | MT    |
| 89    | 5108.T | BRIDGESTONE CORP.                                | Materials                  | MT    |
| 90    | 5201.T | AGC INC.                                         | Materials                  | MT    |
| 91    | 5202.T | NIPPON SHEET GLASS CO., LTD.                     | Materials                  | MT    |
| 92    | 5232.T | SUMITOMO OSAKA CEMENT CO., LTD.                  | Materials                  | MT    |
| 93    | 5233.T | TAIHEIYO CEMENT CORP.                            | Materials                  | MT    |
| 94    | 5301.T | TOKAI CARBON CO., LTD.                           | Materials                  | MT    |
| 95    | 5333.T | NGK INSULATORS, LTD.                             | Materials                  | MT    |
| S.No | Code  | Company Name                               | Sector   | Abbrev |
|------|-------|--------------------------------------------|----------|--------|
| 96   | 5401.T | NIPPON STEEL CORP.                         | Materials| MT     |
| 97   | 5406.T | KOBE STEEL, LTD.                           | Materials| MT     |
| 98   | 5411.T | JFE HOLDINGS, INC.                         | Materials| MT     |
| 99   | 5541.T | PACIFIC METALS CO., LTD.                   | Materials| MT     |
| 100  | 5703.T | NIPPON LIGHT METAL HOLDINGS CO., LTD.      | Materials| MT     |
| 101  | 5706.T | MITSUI MINING & SMELTING CO.               | Materials| MT     |
| 102  | 5707.T | TOHO ZINC CO., LTD.                        | Materials| MT     |
| 103  | 5711.T | MITSUBISHI MATERIALS CORP.                 | Materials| MT     |
| 104  | 5713.T | SUMITOMO METAL MINING CO., LTD.            | Materials| MT     |
| 105  | 5714.T | DOWA HOLDINGS CO., LTD.                    | Materials| MT     |
| 106  | 5801.T | FURUKAWA ELECTRIC CO., LTD.                | Materials| MT     |
| 107  | 5802.T | SUMITOMO ELECTRIC IND., LTD.               | Materials| MT     |
| 108  | 5803.T | FUJIKURA LTD.                              | Materials| MT     |
| 109  | 5901.T | TOYO SEIKAN GROUP HOLDINGS, LTD.           | Materials| MT     |
| 110  | 6988.T | NITTO DENKO CORP.                          | Materials| MT     |
| 111  | 8001.T | ITOCHU CORP.                               | Materials| MT     |
| 112  | 8002.T | MARUBENI CORP.                             | Materials| MT     |
| 113  | 8015.T | TOYOTA TSUSHO CORP.                        | Materials| MT     |
| 114  | 8031.T | MITSUI & CO., LTD.                         | Materials| MT     |
| 115  | 8053.T | SUMITOMO CORP.                             | Materials| MT     |
| 116  | 8058.T | MITSUBISHI CORP.                           | Materials| MT     |
| 117  | 3105.T | NISSHINBO HOLDINGS INC.                    | Technology| TC    |
| 118  | 4151.T | KYOWA KIRIN CO., LTD.                      | Technology| TC    |
| 119  | 4502.T | TAKEDA PHARMACEUTICAL CO., LTD.            | Technology| TC    |
| 120  | 4503.T | ASTELLAS PHARMA INC.                       | Technology| TC    |
| 121  | 4506.T | SUMITOMO DAINIPPON PHARMA CO., LTD.        | Technology| TC    |
| 122  | 4507.T | SHIONOGI & CO., LTD.                       | Technology| TC    |
| 123  | 4519.T | CHUGAI PHARMACEUTICAL CO., LTD.            | Technology| TC    |
| 124  | 4523.T | EISAI CO., LTD.                            | Technology| TC    |
| 125  | 4543.T | TERUMO CORP.                               | Technology| TC    |
| 126  | 4902.T | KONICA MINOLTA, INC.                       | Technology| TC    |
| 127  | 6479.T | MINEBEA MITSUMI INC.                       | Technology| TC    |
| 128  | 6501.T | HITACHI, LTD.                              | Technology| TC    |
| 129  | 6503.T | MITSUBISHI ELECTRIC CORP.                  | Technology| TC    |
| 130  | 6504.T | FUJI ELECTRIC CO., LTD.                    | Technology| TC    |
| 131  | 6506.T | YASKAWA ELECTRIC CORP.                     | Technology| TC    |
| 132  | 6645.T | OMRON CORP.                                | Technology| TC    |
| 133  | 6674.T | GS YUASA CORP.                             | Technology| TC    |
| 134  | 6701.T | NEC CORP.                                  | Technology| TC    |
| 135  | 6703.T | OKI ELECTRIC IND. CO., LTD.                | Technology| TC    |
| 136  | 6724.T | SEIKO EPSON CORP.                          | Technology| TC    |
| 137  | 6758.T | SONY CORP.                                 | Technology| TC    |
| 138  | 6762.T | TDK CORP.                                  | Technology| TC    |
| 139  | 6770.T | ALPS ALPINE CO., LTD.                      | Technology| TC    |
| 140  | 6841.T | YOKOGAWA ELECTRIC CORP.                    | Technology| TC    |
| 141  | 6902.T | DENSO CORP.                                | Technology| TC    |
| 142  | 6952.T | CASIO COMPUTER CO., LTD.                   | Technology| TC    |
| 143  | 6954.T | FANUC CORP.                                | Technology| TC    |
| 144  | 7201.T | NISSAN MOTOR CO., LTD.                     | Technology| TC    |
| 145  | 7202.T | ISUZU MOTORS LTD.                          | Technology| TC    |
| 146  | 7203.T | TOYOTA MOTOR CORP.                         | Technology| TC    |
| 147  | 7205.T | HINO MOTORS, LTD.                          | Technology| TC    |
| 148  | 7211.T | MITSUBISHI MOTORS CORP.                    | Technology| TC    |
| S.No. | Code  | Company Name                               | Sector                    | Abbrev |
|-------|-------|--------------------------------------------|---------------------------|--------|
| 149   | 7261.T| MAZDA MOTOR CORP.                          | Technology                | TC     |
| 150   | 7269.T| SUZUKI MOTOR CORP.                         | Technology                | TC     |
| 151   | 7270.T| SUBARU CORP.                               | Technology                | TC     |
| 152   | 7272.T| YAMAHA MOTOR CO., LTD.                     | Technology                | TC     |
| 153   | 7731.T| NIKON CORP.                                | Technology                | TC     |
| 154   | 7735.T| SCREEN HOLDINGS CO., LTD.                  | Technology                | TC     |
| 155   | 7752.T| RICOH CO., LTD.                            | Technology                | TC     |
| 156   | 8035.T| TOKYO ELECTRON LTD.                        | Technology                | TC     |
| 157   | 9412.T| SKY PERFECT JSAT HOLDINGS INC.             | Technology                | TC     |
| 158   | 9984.T| SOFTBANK GROUP CORP.                       | Technology                | TC     |
| 159   | 9001.T| TOBU RAILWAY CO., LTD.                     | Transportation and Utilities | UT     |
| 160   | 9005.T| TOKYU CORP.                                | Transportation and Utilities | UT     |
| 161   | 9007.T| ODAKYU ELECTRIC RAILWAY CO., LTD.          | Transportation and Utilities | UT     |
| 162   | 9008.T| KEIO CORP.                                 | Transportation and Utilities | UT     |
| 163   | 9009.T| KEISEI ELECTRIC RAILWAY CO., LTD.          | Transportation and Utilities | UT     |
| 164   | 9062.T| NIPPON EXPRESS CO., LTD.                   | Transportation and Utilities | UT     |
| 165   | 9064.T| YAMATO HOLDINGS CO., LTD.                  | Transportation and Utilities | UT     |
| 166   | 9101.T| NIPPON YUSEN K.K.                          | Transportation and Utilities | UT     |
| 167   | 9104.T| MITSUI O.S.K.LINES, LTD.                   | Transportation and Utilities | UT     |
| 168   | 9107.T| KAWASAKI KISEN KAISHA, LTD.                | Transportation and Utilities | UT     |
| 169   | 9301.T| MITSUBISHI LOGISTICS CORP.                 | Transportation and Utilities | UT     |
| 170   | 9501.T| TOKYO ELECTRIC POWER COMPANY HOLDINGS, I   | Transportation and Utilities | UT     |
| 171   | 9502.T| CHUBU ELECTRIC POWER CO., INC.             | Transportation and Utilities | UT     |
| 172   | 9503.T| THE KANSAI ELECTRIC POWER CO., INC.        | Transportation and Utilities | UT     |
| 173   | 9532.T| OSAKA GAS CO., LTD.                       | Transportation and Utilities | UT     |