Supplementary information on “Identifying long-term precursors of financial market crashes using correlation patterns”

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Figure S1. Plots of the mean correlation without noise-suppression (blue filled squares) and with high noise-suppression of $\epsilon = 0.6$ (magenta empty circles). For (a) USA (S&P 500), and (b) JPN (Nikkei 225). USA was relatively calm upto 2002 and became turbulent with high mean correlation from 2002 onward; JPN became turbulent 1990 onward.
Figure S2. Plots of the intracluster distance as a function of number of clusters $k$ of USA, for different value of noise-suppression parameter $0.1 \leq \epsilon \leq 0.7$ using $k$-means clustering. We used an ensemble of 500 random generated seeds for analyzing the robustness of different clusters in the $k$-means clustering. The errorbars are the deviation of the measure of intra-cluster distances arise due to different random seeds. The points lie on the boundary of different clusters are subjected to change the association with the cluster for different initial condition to the centroids in the $k$-mean clustering. It changes the measure of intra-cluster distance among clusters. Inset shows different color lines corresponds to different seed. The value is optimized by keeping the standard deviation ‘lowest’ and number of cluster ‘highest’, simultaneously, for the intra-cluster distance. The results are best for $\epsilon = 0.6$ and show minimum deviation for $k = 4$ (max) and it grows for $k > 4$. 
Figure S3. Plots of the intra-cluster distance as a function of number of clusters $k$ of JPN, for different value of nonlinear suppression parameter $0.1 \leq \epsilon \leq 0.7$ using $k$-means clustering. We used an ensemble of 500 random generated seeds for analyzing the robustness of different clusters in the $k$-means clustering. The errorbars are the deviation of the measure of intra-cluster distances arise due to different random seeds. The points lie on the boundary of different clusters are subjected to change the association with the cluster for different initial condition to the centroids in the $k$-mean clustering. It changes the measure of intra-cluster distance among clusters. Inset shows different color lines corresponds to different seed. The value is optimized by keeping the standard deviation ‘lowest’ and number of cluster ‘highest’, simultaneously, for the intra-cluster distance. The results are best for $\epsilon = 0.6$ and show minimum deviation for $k = 5$ (max) and it grows for $k > 5$. 
Table S1. List of all stocks of USA (S&P 500) considered for the analysis. The first column has the serial number, the second column has the abbreviation, the third column has the full name of the stock, and the fourth column specifies the sector as given in the S&P 500.

| S.No. | Code  | Company Name               | Sector                     |
|-------|-------|----------------------------|----------------------------|
| 1     | CMCSA | Comcast Corp.              | Consumer Discretionary     |
| 2     | DIS   | Walt Disney Co.            | Consumer Discretionary     |
| 3     | F     | Ford Motor                 | Consumer Discretionary     |
| 4     | GPC   | Genuine Parts              | Consumer Discretionary     |
| 5     | GPS   | Gap (The)                  | Consumer Discretionary     |
| 6     | GT    | Goodyear Tire & Rubber     | Consumer Discretionary     |
| 7     | HAS   | Hasbro Inc.                | Consumer Discretionary     |
| 8     | HD    | Home Depot                 | Consumer Discretionary     |
| 9     | HRB   | Block H&R                  | Consumer Discretionary     |
| 10    | IPG   | Interpublic Group          | Consumer Discretionary     |
| 11    | JCP   | Penney (J.C.)              | Consumer Discretionary     |
| 12    | JWN   | Nordstrom                  | Consumer Discretionary     |
| 13    | LEG   | Leggett & Platt            | Consumer Discretionary     |
| 14    | LEN   | Lennar Corp.               | Consumer Discretionary     |
| 15    | LOW   | Lowe’s Cos.                | Consumer Discretionary     |
| 16    | MAT   | Mattel Inc.                | Consumer Discretionary     |
| 17    | MCD   | McDonald’s Corp.           | Consumer Discretionary     |
| 18    | NKE   | NIKE Inc.                  | Consumer Discretionary     |
| 19    | SHW   | Sherwin-Williams           | Consumer Discretionary     |
| 20    | TGT   | Target Corp.               | Consumer Discretionary     |
| 21    | VFC   | V.F. Corp.                 | Consumer Discretionary     |
| 22    | WHR   | Whirlpool Corp.            | Consumer Discretionary     |
| 23    | ADM   | Archer-Daniels-Midland Co. | Consumer Staples           |
| 24    | AVP   | Avon Products              | Consumer Staples           |
| 25    | CAG   | ConAgra Foods Inc.         | Consumer Staples           |
| 26    | CL    | Colgate-Palmolive          | Consumer Staples           |
| 27    | CPB   | Campbell Soup              | Consumer Staples           |
| 28    | CVS   | CVS Caremark Corp.         | Consumer Staples           |
| 29    | GIS   | General Mills              | Consumer Staples           |
| 30    | HRL   | Hormel Foods Corp.         | Consumer Staples           |
| 31    | HSY   | The Hershey Company        | Consumer Staples           |
| 32    | K     | Kellog Co.                 | Consumer Staples           |
| 33    | KMB   | Kimberly-Clark             | Consumer Staples           |
| 34    | KO    | Coca Cola Co.              | Consumer Staples           |
| 35    | KR    | Kroger Co.                 | Consumer Staples           |
| 36    | MKC   | McCormick & Co.            | Consumer Staples           |
|   |   |   |
|---|---|---|
| 37 | MO | Altria Group Inc | Consumer Staples |
| 38 | SYY | Sysco Corp. | Consumer Staples |
| 39 | TAP | Molson Coors Brewing Company | Consumer Staples |
| 40 | TSN | Tyson Foods | Consumer Staples |
| 41 | WMT | Wal-Mart Stores | Consumer Staples |
| 42 | APA | Apache Corporation | Energy |
| 43 | COP | ConocoPhillips | Energy |
| 44 | CVX | Chevron Corp. | Energy |
| 45 | ESV | Ensco plc | Energy |
| 46 | HAL | Halliburton Co. | Energy |
| 47 | HES | Hess Corporation | Energy |
| 48 | HP | Helmerich & Payne | Energy |
| 49 | MRO | Marathon Oil Corp. | Energy |
| 50 | MUR | Murphy Oil | Energy |
| 51 | NBL | Noble Energy Inc | Energy |
| 52 | NBR | Nabors Industries Ltd. | Energy |
| 53 | SLB | Schlumberger Ltd. | Energy |
| 54 | TSO | Tesoro Petroleum Co. | Energy |
| 55 | VLO | Valero Energy | Energy |
| 56 | WMB | Williams Cos. | Energy |
| 57 | XOM | Exxon Mobil Corp. | Energy |
| 58 | AFL | AFLAC Inc | Financials |
| 59 | AIG | American Intl Group Inc | Financials |
| 60 | AON | Aon plc | Financials |
| 61 | AXP | American Express Co | Financials |
| 62 | BAC | Bank of America Corp | Financials |
| 63 | BBT | BB&T Corporation | Financials |
| 64 | BEN | Franklin Resources | Financials |
| 65 | BK | The Bank of New York Mellon Corp. | Financials |
| 66 | C | Citigroup Inc. | Financials |
| 67 | CB | Chubb Corp. | Financials |
| 68 | CINF | Cincinnati Financial | Financials |
| 69 | CMA | Comerica Inc. | Financials |
| 70 | EFX | Equifax Inc. | Financials |
| 71 | FHN | First Horizon National | Financials |
| 72 | HBAN | Huntington Bancshares | Financials |
| 73 | HCN | Health Care REIT | Financials |
| 74 | HST | Host Hotels & Resorts | Financials |
| 75 | JPM | JPMorgan Chase & Co. | Financials |
| 76 | L | Loews Corp. | Financials |
|   |   |   |
|---|---|---|
| 77 | LM | Legg Mason Financials |
| 78 | LNC | Lincoln National Financials |
| 79 | LUK | Leucadia National Corp. Financials |
| 80 | MMC | Marsh & McLennan Financials |
| 81 | MTB | M&T Bank Corp. Financials |
| 82 | PSA | Public Storage Financials |
| 83 | SLM | SLM Corporation Financials |
| 84 | TMK | Torchmark Corp. Financials |
| 85 | TRV | The Travelers Companies Inc. Financials |
| 86 | USB | U.S. Bancorp Financials |
| 87 | VNO | Vornado Realty Trust Financials |
| 88 | WFC | Wells Fargo Financials |
| 89 | WY | Weyerhaeuser Corp. Financials |
| 90 | ZION | Zions Bancorp Financials |
| 91 | ABT | Abbott Laboratories Health Care |
| 92 | AET | Aetna Inc Health Care |
| 93 | AMGN | Amgen Inc Health Care |
| 94 | BAX | Baxter International Inc. Health Care |
| 95 | BCR | Bard (C.R.) Inc. Health Care |
| 96 | BDX | Becton Dickinson Health Care |
| 97 | BMY | Bristol-Myers Squibb Health Care |
| 98 | CAH | Cardinal Health Inc. Health Care |
| 99 | CI | CIGNA Corp. Health Care |
| 100 | HUM | Humana Inc. Health Care |
| 101 | JNJ | Johnson & Johnson Health Care |
| 102 | LLY | Lilly (Eli) & Co. Health Care |
| 103 | MDT | Medtronic Inc. Health Care |
| 104 | MRK | Merck & Co. Health Care |
| 105 | MYL | Mylan Inc. Health Care |
| 106 | SYK | Stryker Corp. Health Care |
| 107 | THC | Tenet Healthcare Corp. Health Care |
| 108 | TMO | Thermo Fisher Scientific Health Care |
| 109 | UNH | United Health Group Inc. Health Care |
| 110 | VAR | Varian Medical Systems Health Care |
| 111 | AVY | Avery Dennison Corp Industrials |
| 112 | BA | Boeing Company Industrials |
| 113 | CAT | Caterpillar Inc. Industrials |
| 114 | CMI | Cummins Inc. Industrials |
| 115 | CSX | CSX Corp. Industrials |
| 116 | CTAS | Cintas Corporation Industrials |
| 117 | DE | Deere & Co. Industrials |
|   | Symbol | Company Name                  | Industry         |
|---|--------|-------------------------------|------------------|
| 118| DHR    | Danaher Corp.                 | Industrials      |
| 119| DNB    | Dun & Bradstreet             | Industrials      |
| 120| DOV    | Dover Corp.                  | Industrials      |
| 121| EMR    | Emerson Electric             | Industrials      |
| 122| ETN    | Eaton Corp.                  | Industrials      |
| 123| EXPD   | Expeditors Int’l             | Industrials      |
| 124| FDX    | FedEx Corporation            | Industrials      |
| 125| FLS    | Flowserve Corporation        | Industrials      |
| 126| GD     | General Dynamics             | Industrials      |
| 127| GE     | General Electric             | Industrials      |
| 128| GLW    | Corning Inc.                 | Industrials      |
| 129| GWW    | Grainger (W.W.) Inc.         | Industrials      |
| 130| HON    | Honeywell Int’l Inc.         | Industrials      |
| 131| IR     | Ingersoll-Rand PLC           | Industrials      |
| 132| ITW    | Illinois Tool Works          | Industrials      |
| 133| JEC    | Jacobs Engineering Group     | Industrials      |
| 134| LMT    | Lockheed Martin Corp.        | Industrials      |
| 135| LUV    | Southwest Airlines           | Industrials      |
| 136| MAS    | Masco Corp.                  | Industrials      |
| 137| MMM    | 3M Co.                       | Industrials      |
| 138| ROK    | Rockwell Automation Inc.     | Industrials      |
| 139| RTN    | Raytheon Co.                 | Industrials      |
| 140| TXT    | Textron Inc.                 | Industrials      |
| 141| UNP    | Union Pacific                | Industrials      |
| 142| UTX    | United Technologies          | Industrials      |
| 143| AAPL   | Apple Inc.                   | Information Technology |
| 144| ADI    | Analog Devices Inc           | Information Technology |
| 145| ADP    | Automatic Data Processing    | Information Technology |
| 146| AMAT   | Applied Materials Inc        | Information Technology |
| 147| AMD    | Advanced Micro Devices       | Information Technology |
| 148| CA     | CA, Inc.                     | Information Technology |
| 149| HPQ    | Hewlett-Packard              | Information Technology |
| 150| HRS    | Harris Corporation           | Information Technology |
| 151| IBM    | International Bus. Machines  | Information Technology |
| 152| INTC   | Intel Corp.                  | Information Technology |
| 153| KLAC   | KLA-Tencor Corp.             | Information Technology |
| 154| LRCX   | Lam Research                 | Information Technology |
| 155| MSI    | Motorola Solutions Inc.      | Information Technology |
| 156| MU     | Micron Technology            | Information Technology |
| 157| TSS    | Total System Services        | Information Technology |
| 158| TXN    | Texas Instruments            | Information Technology |
|   | Symbol | Company Name                  | Industry          |
|---|--------|--------------------------------|-------------------|
| 159 | WDC    | Western Digital               | Information Technology |
| 160 | XRX    | Xerox Corp.                   | Information Technology |
| 161 | AA     | Alcoa Inc                     | Materials         |
| 162 | APD    | Air Products & Chemicals Inc | Materials         |
| 163 | BLL    | Ball Corp                     | Materials         |
| 164 | BMS    | Bemis Company                 | Materials         |
| 165 | CLF    | Cliffs Natural Resources      | Materials         |
| 166 | DD     | Du Pont (E.I.)                | Materials         |
| 167 | ECL    | Ecolab Inc.                   | Materials         |
| 168 | FMC    | FMC Corporation               | Materials         |
| 169 | IFF    | International Flav/Frag       | Materials         |
| 170 | IP     | International Paper           | Materials         |
| 171 | NEM    | Newmont Mining Corp. (Hldg. Co.) | Materials     |
| 172 | PPG    | PPG Industries                | Materials         |
| 173 | VMC    | Vulcan Materials              | Materials         |
| 174 | CTL    | CenturyLink Inc               | Telecommunications Services |
| 175 | FTR    | Frontier Communications       | Telecommunications Services |
| 176 | S      | Sprint Nextel Corp.           | Telecommunications Services |
| 177 | T      | AT&T Inc                     | Telecommunications Services |
| 178 | VZ     | Verizon Communications        | Telecommunications Services |
| 179 | AEP    | American Electric Power       | Utilities         |
| 180 | CMS    | CMS Energy                    | Utilities         |
| 181 | CNP    | CenterPoint Energy            | Utilities         |
| 182 | D      | Dominion Resources            | Utilities         |
| 183 | DTE    | DTE Energy Co.                | Utilities         |
| 184 | ED     | Consolidated Edison           | Utilities         |
| 185 | EIX    | Edison Int’l                  | Utilities         |
| 186 | EQT    | EQT Corporation               | Utilities         |
| 187 | ETR    | Entergy Corp.                 | Utilities         |
| 188 | EXC    | Exelon Corp.                  | Utilities         |
| 189 | NEE    | NextEra Energy Resources      | Utilities         |
| 190 | NI     | NiSource Inc.                 | Utilities         |
| 191 | PNW    | Pinnacle West Capital         | Utilities         |
| 192 | SO     | Southern Co.                  | Utilities         |
| 193 | WEC    | Wisconsin Energy Corporation  | Utilities         |
| 194 | XEL    | Xcel Energy Inc               | Utilities         |
**Table S2.** List of all stocks of JPN (Nikkei 225) considered for the analysis. The first column has the serial number, the second column has the abbreviation, the third column has the full name of the stock, and the fourth column specifies the sector as given in the Nikkei 225.

| S. No. | Code   | Company Name                                | Sector             |
|--------|--------|---------------------------------------------|--------------------|
| 1      | S-8801 | MITSUI FUDOSAN CO., LTD.                    | Capital Goods      |
| 2      | S-8802 | MITSUBISHI ESTATE CO., LTD.                 | Capital Goods      |
| 3      | S-8804 | TOKYO TATEMONO CO., LTD.                    | Capital Goods      |
| 4      | S-8830 | SUMITOMO REALTY & DEVELOPMENT CO., LTD.     | Capital Goods      |
| 5      | S-7003 | MITSUI ENG. & SHIPBUILD. CO., LTD.          | Capital Goods      |
| 6      | S-7012 | KAWASAKI HEAVY IND., LTD.                   | Capital Goods      |
| 7      | S-9202 | ANA HOLDINGS INC.                           | Capital Goods      |
| 8      | S-1801 | TAISEI CORP.                                | Capital Goods      |
| 9      | S-1802 | OBAYASHI CORP.                              | Capital Goods      |
| 10     | S-1803 | SHIMIZU CORP.                               | Capital Goods      |
| 11     | S-1808 | HASEKO CORP.                                | Capital Goods      |
| 12     | S-1812 | KAJIMA CORP.                                | Capital Goods      |
| 13     | S-1925 | DAIWA HOUSE IND. CO., LTD.                 | Capital Goods      |
| 14     | S-1928 | SEKISUI HOUSE, LTD.                         | Capital Goods      |
| 15     | S-1963 | JGC CORP.                                   | Capital Goods      |
| 16     | S-5631 | THE JAPAN STEEL WORKS, LTD.                 | Capital Goods      |
| 17     | S-6103 | OKUMA CORP.                                 | Capital Goods      |
| 18     | S-6113 | AMADA HOLDINGS CO., LTD.                    | Capital Goods      |
| 19     | S-6301 | KOMATSU LTD.                                | Capital Goods      |
| 20     | S-6302 | SUMITOMO HEAVY IND., LTD.                   | Capital Goods      |
| 21     | S-6305 | HITACHI CONST. MACH. CO., LTD.              | Capital Goods      |
| 22     | S-6326 | KUBOTA CORP.                                | Capital Goods      |
| 23     | S-6361 | EBARA CORP.                                 | Capital Goods      |
| 24     | S-6366 | CHIYODA CORP.                               | Capital Goods      |
| 25     | S-6367 | DAIKIN INDUSTRIES, LTD.                     | Capital Goods      |
| 26     | S-6471 | NSK LTD.                                    | Capital Goods      |
| 27     | S-6472 | NTN CORP.                                   | Capital Goods      |
| 28     | S-6473 | JTEKT CORP.                                 | Capital Goods      |
| 29     | S-7004 | HITACHI ZOSEN CORP.                         | Capital Goods      |
| 30     | S-7011 | MITSUBISHI HEAVY IND., LTD.                 | Capital Goods      |
| 31     | S-7013 | IHI CORP.                                   | Capital Goods      |
| 32     | S-7911 | TOPPAN PRINTING CO., LTD.                   | Capital Goods      |
| 33     | S-7912 | DAI NIPPON PRINTING CO., LTD.               | Capital Goods      |
| 34     | S-7951 | YAMAHA CORP.                                | Capital Goods      |
| 35     | S-1332 | NIPPON SUISAN KAISHA, LTD.                  | Consumer Goods     |
| 36     | S-2002 | NISSHIN SEIFUN GROUP INC.                   | Consumer Goods     |
|   |   |                                                                 |                       |
|---|---|-----------------------------------------------------------------|------------------------|
|37 | S-2282 | NH FOODS LTD.                                                  | Consumer Goods         |
|38 | S-2501 | SAPPORO HOLDINGS LTD.                                           | Consumer Goods         |
|39 | S-2502 | ASAHI GROUP HOLDINGS, LTD.                                     | Consumer Goods         |
|40 | S-2503 | KIRIN HOLDINGS CO., LTD.                                       | Consumer Goods         |
|41 | S-2531 | TAKARA HOLDINGS INC.                                           | Consumer Goods         |
|42 | S-2801 | KIKKOMAN CORP.                                                 | Consumer Goods         |
|43 | S-2802 | AJINOMOTO CO., INC.                                            | Consumer Goods         |
|44 | S-2871 | NICHIREI CORP.                                                 | Consumer Goods         |
|45 | S-8233 | TAKASHIMAYA CO., LTD.                                          | Consumer Goods         |
|46 | S-8252 | MARUI GROUP CO., LTD.                                          | Consumer Goods         |
|47 | S-8267 | AEON CO., LTD.                                                 | Consumer Goods         |
|48 | S-9602 | TOHO CO., LTD                                                  | Consumer Goods         |
|49 | S-9681 | TOKYO DOME CORP.                                               | Consumer Goods         |
|50 | S-9735 | SECOM CO., LTD.                                                | Consumer Goods         |
|51 | S-8331 | THE CHIBA BANK, LTD.                                           | Finance                |
|52 | S-8355 | THE SHIZUOKA BANK, LTD.                                         | Finance                |
|53 | S-8253 | CREDIT SAISON CO., LTD.                                        | Finance                |
|54 | S-8601 | DAIWA SECURITIES GROUP INC.                                    | Finance                |
|55 | S-8604 | NOMURA HOLDINGS, INC.                                          | Finance                |
|56 | S-3405 | KURARAY CO., LTD.                                              | Materials              |
|57 | S-3407 | ASAHI KASEI CORP.                                              | Materials              |
|58 | S-4004 | SHOWA DENKO K.K.                                               | Materials              |
|59 | S-4005 | SUMITOMO CHEMICAL CO., LTD.                                    | Materials              |
|60 | S-4021 | NISSAN CHEMICAL IND., LTD.                                     | Materials              |
|61 | S-4042 | TOSOH CORP.                                                    | Materials              |
|62 | S-4043 | TOKUYAMA CORP.                                                 | Materials              |
|63 | S-4061 | DENKA CO., LTD.                                                | Materials              |
|64 | S-4063 | SHIN-ETSU CHEMICAL CO., LTD.                                   | Materials              |
|65 | S-4183 | MITSUI CHEMICALS, INC.                                         | Materials              |
|66 | S-4208 | UBE INDUSTRIES, LTD.                                           | Materials              |
|67 | S-4272 | NIPPON KAYAKU CO., LTD.                                        | Materials              |
|68 | S-4452 | KAO CORP.                                                      | Materials              |
|69 | S-4901 | FUJIFILM HOLDINGS CORP.                                        | Materials              |
|70 | S-4911 | SHISEIDO CO., LTD.                                             | Materials              |
|71 | S-6988 | NITTO DENKO CORP.                                              | Materials              |
|72 | S-5002 | SHOWA SHELL SEKIYU K.K.                                        | Materials              |
|73 | S-5201 | ASAHI GLASS CO., LTD.                                          | Materials              |
|74 | S-5202 | NIPPON SHEET GLASS CO., LTD.                                   | Materials              |
|75 | S-5214 | NIPPON ELECTRIC GLASS CO., LTD.                                | Materials              |
|76 | S-5232 | SUMITOMO OSAKA CEMENT CO., LTD.                                | Materials              |
|    | S-5233   | TAIHEIYO CEMENT CORP. |    |
|----|----------|-----------------------|----|
| 77 | S-5301   | TOKAI CARBON CO., LTD. | Materials |
| 78 | S-5332   | TOTO LTD.             |    |
| 79 | S-5333   | NGK INSULATORS, LTD.  |    |
| 80 | S-5706   | MITSUI MINING & SMELTING CO. | Materials |
| 81 | S-5707   | TOHO ZINC CO., LTD.   |    |
| 82 | S-5711   | MITSUBISHI MATERIALS CORP. | Materials |
| 83 | S-5713   | SUMITOMO METAL MINING CO., LTD. | Materials |
| 84 | S-5714   | DOWA HOLDINGS CO., LTD. | Materials |
| 85 | S-5715   | FURUKAWA CO., LTD.    |    |
| 86 | S-5801   | FURUKAWA ELECTRIC CO., LTD. | Materials |
| 87 | S-5802   | SUMITOMO ELECTRIC IND., LTD. | Materials |
| 88 | S-5803   | FUJIKURA LTD.         |    |
| 89 | S-5901   | TOYO SEIKAN GROUP HOLDINGS, LTD. | Materials |
| 90 | S-3861   | OJI HOLDINGS CORP.    |    |
| 91 | S-3865   | HOKUETSU KISHU PAPER CO., LTD. | Materials |
| 92 | S-5108   | BRIDGESTONE CORP.     |    |
| 93 | S-5101   | THE YOKOHAMA RUBBER CO., LTD. | Materials |
| 94 | S-5401   | NIPPON STEEL & SUMITOMO METAL CORP. | Materials |
| 95 | S-5406   | KOBE STEEL, LTD.      |    |
| 96 | S-5541   | PACIFIC METALS CO., LTD. | Materials |
| 97 | S-3101   | TOYOBO CO., LTD.      |    |
| 98 | S-3103   | UNITIKA, LTD.         |    |
| 99 | S-3401   | TEIJIN LTD.           |    |
|100 | S-3402   | TORAY INDUSTRIES, INC. | Materials |
|101 | S-8001   | ITOCHU CORP.          |    |
|102 | S-8002   | MARUBENI CORP.        |    |
|103 | S-8015   | TOYOTA TSUSHO CORP.   |    |
|104 | S-8031   | MITSUI & CO., LTD.    |    |
|105 | S-8053   | SUMITOMO CORP.        |    |
|106 | S-8058   | MITSUBISHI CORP.      |    |
|107 | S-4151   | KYOWA HAKKO KIRIN CO., LTD. | Pharmaceuticals |
|108 | S-4503   | ASTELLAS PHARMA INC.  |    |
|109 | S-4506   | SUMITOMO DAINIPPON PHARMA CO., LTD. | Pharmaceuticals |
|110 | S-4507   | SHIONOGI & CO., LTD.  |    |
|111 | S-4519   | CHUGAI PHARMACEUTICAL CO., LTD. | Pharmaceuticals |
|112 | S-4523   | EISAI CO., LTD.       |    |
|113 | S-7201   | NISSAN MOTOR CO., LTD. | Technology |
|114 | S-7202   | ISUZU MOTORS LTD.     |    |
|115 | S-7205   | HINO MOTORS, LTD.     |    |
|   |   |   |   |
|---|---|---|---|
| 117 | S-7261 | MAZDA MOTOR CORP. | Technology |
| 118 | S-7267 | HONDA MOTOR CO., LTD. | Technology |
| 119 | S-7270 | SUBARU CORP. | Technology |
| 120 | S-7272 | YAMAHA MOTOR CO., LTD. | Technology |
| 121 | S-3105 | NISSHINBO HOLDINGS INC. | Technology |
| 122 | S-6479 | MINEBEA MITSUMI INC. | Technology |
| 123 | S-6501 | HITACHI, LTD. | Technology |
| 124 | S-6502 | TOSHIBA CORP. | Technology |
| 125 | S-6503 | MITSUBISHI ELECTRIC CORP. | Technology |
| 126 | S-6504 | FUJI ELECTRIC CO., LTD. | Technology |
| 127 | S-6506 | YASKAWA ELECTRIC CORP. | Technology |
| 128 | S-6508 | MEIDENSHA CORP. | Technology |
| 129 | S-6701 | NEC CORP. | Technology |
| 130 | S-6702 | FUJITSU LTD. | Technology |
| 131 | S-6703 | OKI ELECTRIC IND. CO., LTD. | Technology |
| 132 | S-6752 | PANASONIC CORP. | Technology |
| 133 | S-6758 | SONY CORP. | Technology |
| 134 | S-6762 | TDK CORP. | Technology |
| 135 | S-6770 | ALPS ELECTRIC CO., LTD. | Technology |
| 136 | S-6773 | PIONEER CORP. | Technology |
| 137 | S-6841 | YOKOGAWA ELECTRIC CORP. | Technology |
| 138 | S-6902 | DENSO CORP. | Technology |
| 139 | S-6952 | CASIO COMPUTER CO., LTD. | Technology |
| 140 | S-6954 | FANUC CORP. | Technology |
| 141 | S-6971 | KYOCERA CORP. | Technology |
| 142 | S-6976 | TAIYO YUDEN CO., LTD. | Technology |
| 143 | S-7752 | RICOH CO., LTD. | Technology |
| 144 | S-8035 | TOKYO ELECTRON LTD. | Technology |
| 145 | S-4543 | TERUMO CORP. | Technology |
| 146 | S-4902 | KONICA MINOLTA, INC. | Technology |
| 147 | S-7731 | NIKON CORP. | Technology |
| 148 | S-7733 | OLYMPUS CORP. | Technology |
| 149 | S-7762 | CITIZEN WATCH CO., LTD. | Technology |
| 150 | S-9501 | TOKYO ELECTRIC POWER COMPANY | Transportation & Utilities |
| 151 | S-9502 | CHUBU ELECTRIC POWER CO., INC. | Transportation & Utilities |
| 152 | S-9503 | THE KANSAI ELECTRIC POWER CO., INC. | Transportation & Utilities |
| 153 | S-9531 | TOKYO GAS CO., LTD. | Transportation & Utilities |
| 154 | S-9532 | OSAKA GAS CO., LTD. | Transportation & Utilities |
| 155 | S-9062 | NIPPON EXPRESS CO., LTD. | Transportation & Utilities |
| 156 | S-9064 | YAMATO HOLDINGS CO., LTD. | Transportation & Utilities |
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|157 | S-9101 | NIPPON YUSEN K.K. | Transportation & Utilities |
|158 | S-9104 | MITSUI O.S.K.LINES, LTD. | Transportation & Utilities |
|159 | S-9107 | KAWASAKI KISEN KAISHA, LTD. | Transportation & Utilities |
|160 | S-9001 | TOBU RAILWAY CO., LTD. | Transportation & Utilities |
|161 | S-9005 | TOKYU CORP. | Transportation & Utilities |
|162 | S-9007 | ODOKYU ELECTRIC RAILWAY CO., LTD. | Transportation & Utilities |
|163 | S-9008 | KEIO CORP. | Transportation & Utilities |
|164 | S-9009 | KEISEI ELECTRIC RAILWAY CO., LTD. | Transportation & Utilities |
|165 | S-9301 | MITSUBISHI LOGISTICS CORP. | Transportation & Utilities |