Some Neglected Empirical Regularities in Long Run Stock Price Behaviour

Surender Kaur

Research Scholar, Gokhale Institute of Politics and Economics, Pune, India–411004

Email: su91.kaur@gmail.com

Abstract

The study attempt to examine previously unexplored long run stock price behaviours, focusing on the convergence of stock returns over extended periods and the relationship between earnings fluctuations and stock prices. Using Data from 2007 to 2019 across major indices in India, Japan, the UK, the USA, and the Eurozone, the paper analyzes "running returns" and "holding period returns." It finds that long-term holding returns provide a more stable measure of performance compared to short-term running returns, with significant convergence of returns and a very clear link between earnings growth and price appreciation over longer durations. The paper challenges traditional financial theories like CAPM and the Efficient Market Hypothesis, advocating for the inclusion of these long-term trends in investment strategies and theoretical finance. Documenting these long-term trends, the study enriches our understanding of stock market behavior over longer periods and offers insights that could impact both theoretical finance and practical investment strategies. The research give insights for the integration of these long-term empirical regularities into decision-making frameworks for investors.

Keywords: Equity premium puzzle, relationship between returns and earnings, long-term stock price behavior.

JEL Codes: G30, G40, O16

1 Introduction

The study of stock price dynamics has traditionally focused on short-term i.e. day-on-day, week-on-week, month-on-month returns, and so on. This feature has obscured some interesting phenomena that are revealed in the behaviour of stock returns when they are measured over longer intervals of time like year-on-year, five-year on five-year returns and so on. The purpose of this paper is to call the attention of the readers to two empirical phenomena that are revealed in data on long-term cumulative returns. a) the relatively rapid convergence between the returns on stocks towards one another, a phenomenon that is not emphasized in the literature because majority of studies of stock market behavior used short-term running returns and b) the significantly greater strength of the relationship between long-run earnings growth/decline and long-run stock price appreciation/depreciation as compared to the relationship between the short-run earnings growth/decline and short-run stock price appreciation/depreciation.

2 Short Term and Long term Stock Return Measurement

Before proceeding to elaborate on the individual exercises it is necessary to point out a difference in the formula for the stock return usually employed in the stock market literature and long-term returns employed here and the relation between the two. The usual formula is:

$$r_t = \left(\frac{S_t}{S_{t-1}}\right) - 1 \tag{1}$$

$$r_t = \left(\frac{S_t}{S_{t-1}}\right) - 1 \tag{2}$$

Wherever relevant, D_t , the dividend paid by the stock in period t is added to S_t. This return may be called the "running return" in which the size of the investment

is revised period by period. In contrast the "holding return" is defined as,

$$R_t = \left(\frac{S_t}{S_0}\right)^{\frac{1}{t}} - 1 \tag{3}$$

in which the base period investment is kept fixed. This may be called the "holding return over period t" or in short holding return. There is of course an obvious connection between the running returns and holding return, over the period $(0, N)$. The running returns $r_1, r_2, \ldots r_n$ and the holding returns $R_1, R_2, \ldots R_n$ are connected by the formulae.

$$\begin{aligned} R_1 &= r_1 \\ R_2 &= [(1+r_1)(1+r_2)]^{\frac{1}{2}} - 1 \\ &\ldots \\ R_n &= \Pi_{t-1}^{N}(1+r_t)^{\frac{1}{t}} - 1 \end{aligned} \tag{4}$$

so that R_t the holding return upto period N are the geometric means of the running returns over the same period. Obviously the arithmetic mean of the running returns $\bar{r_n} = \sum r_t/N$ always exceeds the geometric mean R_N which is invariably imply in Modern Portfolio theory, whose behavior being explained in this paper.Even though the respective rates of returns namely running returns and holding period returns are intimately related to one another.It is the purpose of empirical regularities of this paper to show that the are concrete which are captured by holding period returns but not revealed by running returns. Moreover these empirical regularities regularities hold across several stock markets.

3 Convergence of Stock returns

In this section, we shall explore the behavior exhibited by stock returns over long periods of time. We shall consider both types of returns: running returns and holding returns, as defined by formulae equation 1 and equation 3 respectively. For this study,

we have analyzed data from five countries: India (BSE500), Japan (Nikkei 250), the UK (FTSE All-Share), the USA (S&P 500), and the Eurozone (STOXX).The timeframe considered for this study spans from 2007 to 2019, with quarterly data sourced from Thomson Reuters (Eikon) and CMIE. Wherever these is missing data in the sample, resorted to interpolating the data anyways.The sample for the study consist of companies drawn from some leading stock indices across five countries. Therefor the final sample consists of 163 companies from India, 142 from Japan, 233 from the UK, 221 from the USA, and 227 from the Eurozone.

Figure 3.1: India running returns

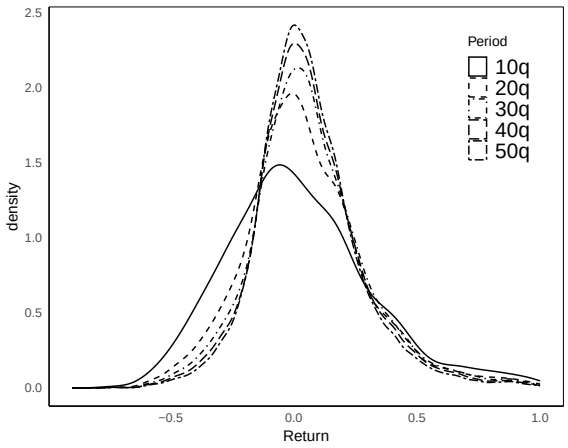


Figure 3.2: India holding period returns

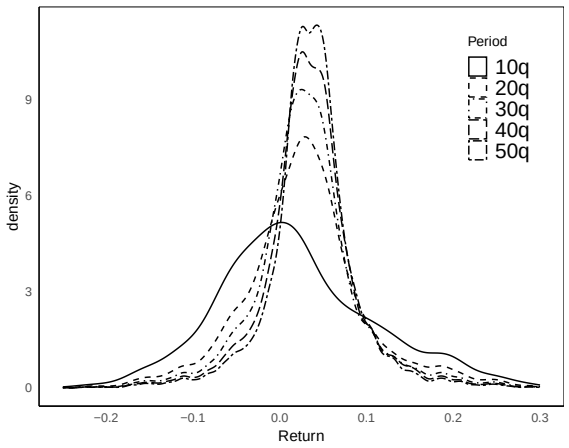


Table 3.1: Descriptive Statistics

Time frame	Mean	Median	SD	Kurtosis	skewness
10q	0.05414	0	0.35852	3.50912	1.40966
20q	0.06121	0.02467	0.28701	5.16793	1.46375
30q	0.07634	0.04342	0.26855	5.73141	1.49106
40q	0.07143	0.04055	0.24990	7.30680	1.62392
50q	0.06556	0.03803	0.23413	8.03110	1.65785

Table 3.2: Descriptive Statistics

Time frame	Mean	Median	SD	Kurtosis	skewness
10q	0.025609	0.010373	0.10453	2.638423	1.04417
20q	0.031662	0.027853	0.079086	5.16671	1.064013
30q	0.032605	0.029316	0.06725	7.265365	1.128655
40q	0.03622	0.034278	0.060462	8.53496	1.05472
50q	0.038079	0.036759	0.05536	9.969163	1.0311

[1]The data sources for all the tables and graphs presented are Thomson Reuters Eikon. For data specific to India, the source is Prowess CMIE

Figure 3.3: Japan running returns

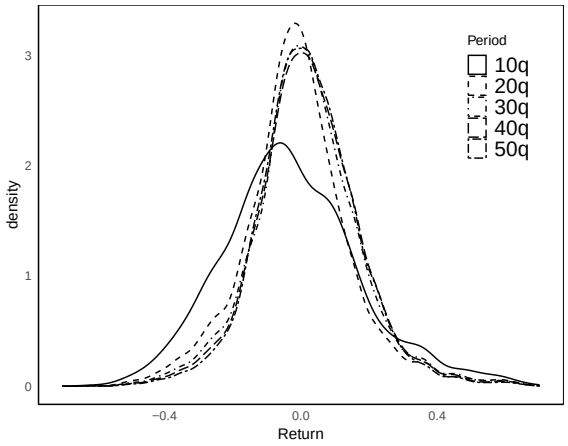


Figure 3.4: Japan holding period returns

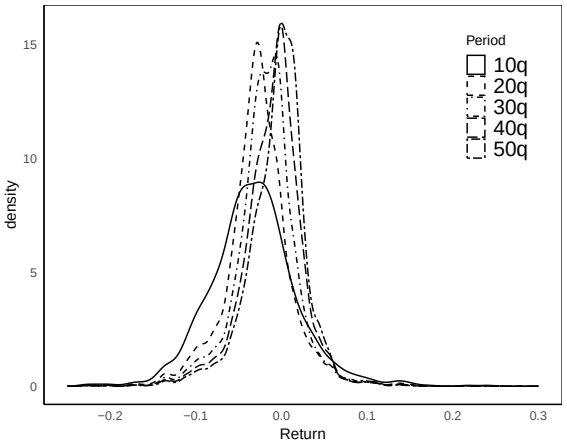


Table 3.3: Descriptive Statistics

Time frame	Mean	Median	SD	Kurtosis	skewness
10q	-0.01509	-0.03943	0.22892	3.68763	1.18233
20q	-0.00415	-0.01262	0.17743	6.03894	1.20140
30q	0.02092	0.01247	0.17007	4.85672	0.95212
40q	0.02554	0.01716	0.16239	4.50307	0.84598
50q	0.02463	0.01658	0.15501	4.56749	0.83794

Table 3.4: Descriptive Statistics

Time frame	Mean	Median	SD	Kurtosis	skewness
10q	-0.03295	-0.03364	0.05229	2.44176	0.26362
20q	-0.02708	-0.02710	0.04058	4.49776	0.05065
30q	-0.01857	-0.01698	0.03718	4.72391	-0.24913
40q	-0.01056	-0.00701	0.03615	4.31161	-0.47895
50q	-0.00535	-0.00150	0.03472	4.48192	-0.66420

Figure 3.5: UK running returns

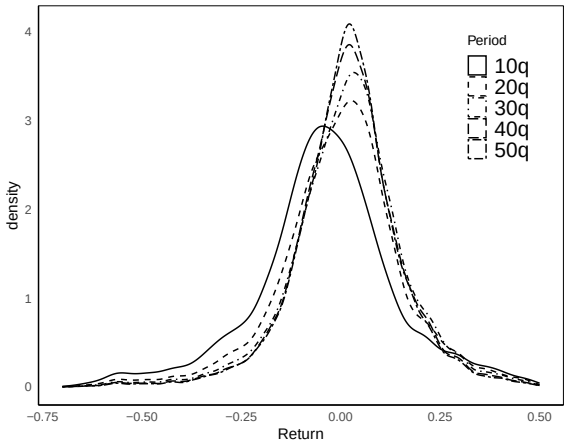


Figure 3.6: UK holding period returns

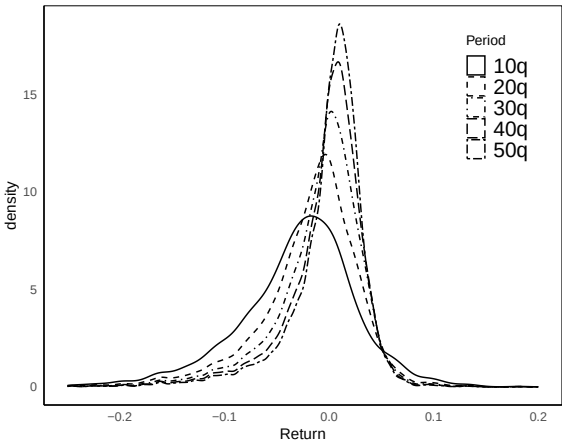


Table 3.5: Descriptive Statistics

Time frame	Mean	Median	SD	Kurtosis	skewness
10q	-0.02132	-0.03450	0.23025	16.53537	2.14088
20q	0.01187	0.01067	0.19231	16.69586	1.75271
30q	0.02658	0.02496	0.17275	17.76515	1.64782
40q	0.02333	0.02017	0.15881	19.31033	1.65105
50q	0.02235	0.02032	0.15116	19.21984	1.54020

Table 3.6: Descriptive Statistics

Time frame	Mean	Median	SD	Kurtosis	skewness
10q	-0.03197	-0.02441	0.06085	2.95379	-0.96396
20q	-0.01961	-0.01125	0.05062	4.70324	-1.38239
30q	-0.01051	-0.00194	0.04534	6.28961	-1.69299
40q	-0.00499	0.00294	0.04133	8.09528	-1.96889
50q	-0.00144	0.00622	0.03838	9.72801	-2.17251

Figure 3.7: USA running returns

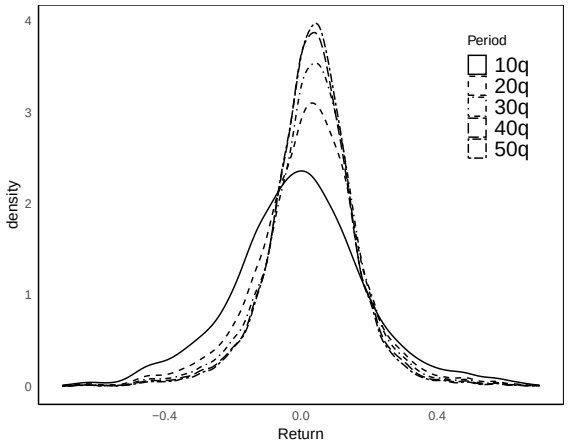


Figure 3.8: USA holding period returns

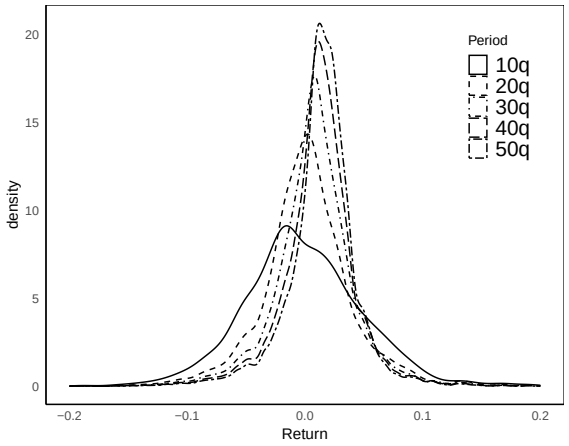


Table 3.7: Descriptive Statistics

Time frame	Mean	Median	SD	Kurtosis	skewness
10q	-0.00088	-0.00339	0.20904	4.31212	0.71210
20q	0.02488	0.02850	0.16911	5.64929	0.48867
30q	0.03497	0.03849	0.15061	6.62376	0.41866
40q	0.03354	0.03451	0.13825	7.38501	0.44759
50q	0.03386	0.03602	0.13147	7.40385	0.40215

Table 3.8: Descriptive Statistics

Time frame	Mean	Median	SD	Kurtosis	skewness
10q	-0.00059	-0.00450	0.05354	2.61767	0.53713
20q	0.00243	0.00142	0.04140	4.93397	0.53848
30q	0.00804	0.00838	0.03638	5.84179	0.29000
40q	0.01182	0.01268	0.03311	6.71937	0.09029
50q	0.01444	0.01562	0.03073	7.57888	-0.06618

Figure 3.9: Eurozone running returns

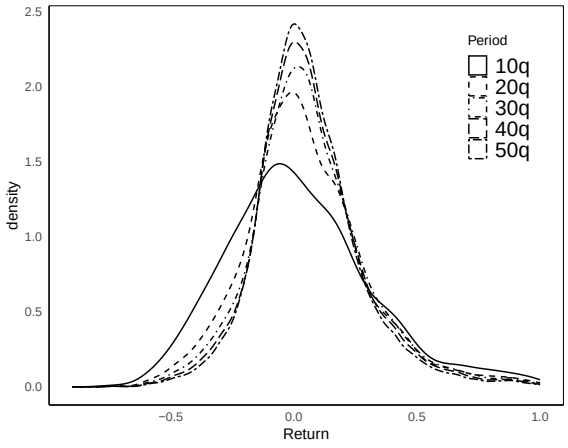


Figure 3.10: Eurozone holding period returns

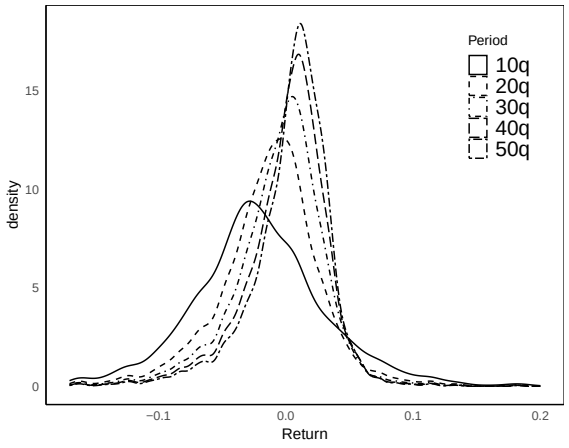


Table 3.9: Descriptive Statistics

Time frame	Mean	Median	SD	Kurtosis	skewness
10q	-0.01945	-0.02953	0.20235	7.54250	1.36778
20q	0.01157	0.00918	0.17115	6.99958	0.89273
30q	0.02668	0.02553	0.15674	6.75408	0.70847
40q	0.02740	0.02393	0.14761	7.05781	0.73380
50q	0.02773	0.02510	0.14136	6.90250	0.68261

Table 3.10: Descriptive Statistics

Time frame	Mean	Median	SD	Kurtosis	skewness
10q	-0.02164	-0.02366	0.05443	1.52169	0.11254
20q	-0.01270	-0.00973	0.04250	3.10586	-0.31101
30q	-0.00532	-0.00083	0.03790	3.91002	-0.66097
40q	0.00006	0.00504	0.03499	4.70995	-0.92755
50q	0.00373	0.00858	0.03286	5.46617	-1.10928

Table 3.1 to 3.10 describes the manner in which the parameters of the probability distribution of the running returns and holding period returns change as the holding period increases from 10Q(2.5 year) to 50Q(12.5 year) but the standard deviation of holding period returns measure the cross sectional standard deviation of individual stocks from the sample mean decline at much faster rate than those of running retu rns.

This is true across all the markets that have been selected for the study. Similar patterns are observed for the other moments of the distribution i.e. skewness and kurtosis . Skewness declines means extremely high rates of return becomes less and less probable but extremely low rate of return become more probable as the time period of holding increases. The skewness declines much faster for the holding period returns than the running returns. The kurtosis consistently increases when holding returns are considered but may rise or decline (see table 3.9 for Eurozone) for the running returns.

The convergence of stock returns towards uniformity (declines in the cross-sectional standard deviation of individual stock in the samples across countries) over long periods of time scarcely find a mention in the literature on stock market behaviour which is dominated instead by the idea of random walks. Obviously no mention is made of the systematic behaviour of the higher moments of the statistical distributions like skewness and kurtosis. The modal probability of earning mean rate of return increases as the holding period increases, simply because higher order moments they disappears for normal or lognormal distribution which are customarily assumed in the literature.

4 Relationship between earnings and stock returns

In this section therefore we shall consider the elementary relationship between the rate of growth of earning per share and the rate of stock appreciation known to us from fundamental analysis.

Table 4.1: India (ri ∼ gi)

TimeFrame	RSquared	Intercept (T-Stat)	Slope (T-Stat)
10q	0.00880	0.05157 (5.64977)	0.02434 (3.69337)
20q	0.00914	0.05914 (11.76487)	0.02609 (5.47288)
30q	0.00771	0.07445 (19.53424)	0.02678 (6.20763)
40q	0.00634	0.06993 (22.85856)	0.02298 (6.52232)
50q	0.00466	0.06439 (25.16416)	0.01822 (6.26085)

Table 4.2: India (Ri ∼ Gi)

TimeFrame	RSquared	Intercept (T-Stat)	Slope (T-Stat)
10q	0.04720	0.02024 (7.57039)	0.13503 (8.72592)
20q	0.04989	0.02779 (20.06394)	0.14124 (13.05779)
30q	0.05516	0.02928 (30.86096)	0.15118 (17.01069)
40q	0.05551	0.03326 (45.26337)	0.15512 (19.79529)
50q	0.05628	0.03536 (58.94276)	0.15840 (22.35089)

Table 4.3: Japan running (ri ∼ gi)

TimeFrame	RSquared	Intercept (T-Stat)	Slope (T-Stat)
10q	0.00115	-0.01511 (-2.28409)	0.03081 (1.17524)
20q	0.00134	-0.00485 (-1.36593)	0.01278 (1.84010)
30q	0.00691	0.01934 (7.04003)	0.02506 (5.17838)
40q	0.00703	0.02398 (10.59978)	0.02732 (6.05864)
50q	0.00697	0.02312 (11.99834)	0.02868 (6.76376)

Table 4.4: japan Hpr (Ri ∼ Gi)

TimeFrame	RSquared	Intercept (T-Stat)	Slope (T-Stat)
10q	0.06003	-0.03420 (-23.22206)	0.17980 (8.73587)
20q	0.07641	-0.02714 (-34.97842)	0.18778 (14.45316)
30q	0.10614	-0.01952 (-34.37305)	0.23887 (21.39511)
40q	0.13675	-0.01274 (-26.96653)	0.29674 (28.65968)
50q	0.15830	-0.00863 (-21.26885)	0.33685 (35.00416)

Table 4.5: UK running (ri ∼ gi)

TimeFrame	RSquared	Intercept (T-Stat)	Slope (T-Stat)
10q	0.00019	-0.02096 (-4.19571)	-0.00721 (-0.64629)
20q	0.00000	0.01186 (4.14707)	0.00014 (0.04149)
30q	0.00005	0.02650 (12.74048)	0.00169 (0.56746)
40q	0.00007	0.02324 (14.09382)	0.00225 (0.83553)
50q	0.00012	0.02223 (15.87780)	0.00268 (1.19056)

Table 4.6: UK Hpr (Ri ∼ Gi)

TimeFrame	RSquared	Intercept (T-Stat)	Slope (T-Stat)
10q	0.02372	-0.03552 (-25.61347)	0.14985 (7.22508)
20q	0.06723	-0.02378 (-31.23840)	0.23661 (18.08685)
30q	0.08748	-0.01549 (-27.90709)	0.28197 (25.77351)
40q	0.09635	-0.01022 (-23.25904)	0.30285 (31.52103)
50q	0.10411	-0.00690 (-18.79789)	0.31958 (36.88653)

Table 4.7: USA running (ri ∼ gi)

TimeFrame	RSquared	Intercept (T-Stat)	Slope (T-Stat)
10q	0.00003	-0.00097 (-0.20662)	0.00284 (0.23273)
20q	0.00006	0.02468 (9.35988)	0.00397 (0.50482)
30q	0.00000	0.03498 (18.45811)	-0.00005 (-0.01106)
40q	0.00004	0.03344 (22.32090)	0.00205 (0.59257)
50q	0.00007	0.03373 (26.50217)	0.00272 (0.87333)

Table 4.8: USA Hpr (Ri ∼ Gi)

TimeFrame	RSquared	Intercept (T-Stat)	Slope (T-Stat)
10q	0.06665	-0.00619 (-4.94261)	0.19463 (11.90148)
20q	0.091264	-0.00211 (-3.25878)	0.21226 (20.53053)
30q	0.108837	-0.002782 (5.938926)	0.238616 (27.97287)
40q	0.118167	0.006161 (16.47066)	0.254939 (33.98114)
50q	0.126098	0.008438 (26.77829)	0.268477 (39.52551)

Table 4.9: Eurozone running (ri ∼ gi)

TimeFrame	RSquared	Intercept (T-Stat)	Slope (T-Stat)
10q	0.00005	-0.01960 (-4.21640)	0.00372 (0.29900)
20q	0.00067	0.01145 (4.25552)	0.00084 (1.64317)
30q	0.00054	0.02659 (13.33224)	0.00085 (1.83115)
40q	0.00055	0.02731 (16.86366)	0.00093 (2.13541)
50q	0.00051	0.02765 (19.97712)	0.00096 (2.30094)

Table 4.10: Eurozone Hpr (Ri ∼ Gi)

TimeFrame	RSquared	Intercept (T-Stat)	Slope (T-Stat)
10q	0.02246	-0.02437 (-18.79738)	0.11272 (6.63288)
20q	0.04218	-0.01495 (-22.13795)	0.14338 (13.34740)
30q	0.05537	-0.00797 (-16.30384)	0.17315 (19.02563)
40q	0.06261	-0.00283 (-7.23435)	0.19191 (23.55241)
50q	0.07111	0.00047 (1.43480)	0.21181 (28.26317)

It can be said with some inbuilt justification that the empirical regularity explored in the earlier section has as much statistical content as economic context to the extent at the geometric means are always always numerically smaller than the corresponding arithmetic means and standard deviation from the geometric means are always lower than those from the arithmetic mean.

A more powerful test is required to demonstrates the superiority of holding returns when the purpose is to understand empirical regularities in long run stock price behaviour.

Table 4.1 to 4.10 are arranged as follows. Each pair of tabled shows the results of regressing stock price returns on growth rate of earning per share e.g 4.1 shows the regression between running return and running earning per share growth rate.[1] 4.2 shows the regression between the holding period return and growth rate of earning per share over the corresponding holding period.[2] And this has been done for several holding periods and for all the markets that are included in the sample. The regression of running return on running earning per share shown in equation (5) and for holding period shown in equation (6)

$$r_i = a + bg_i + u_i \tag{5}$$

$$R_i = a + bG_i + u_i \tag{6}$$

As table 4.1 to 4.10 shows that the estimated slope parameters of the regression

[1] r_i = running returns and g_i = running earnings per share

[2] R_i = holding period return and G_i = growth rate of earnings per share

are all positive. But observe that in all cases without exception the t-values of slope parameters for equation 6 exceed those of equation 5 and are greater than 2 so that p-values are nearly zero.Moreover excepting for the case of India the sizes of R^2s for equation 6 exceeds those of equation 5 showing a greater explanatory power of earnings growth as an explanatory variable of long term holding return. In addition theR^2 invariably increases as longer time periods are considered. In other words even though the running returns and holding returns are related to one another in a straight forward manner as shown in equation 4 above, their information contents that they convey differ from one another depending on the length of time period considered.

5 Concluding Remarks

Modern theories of stock prices behaviour such as the Capital Asset Pricing Model, Arbitrage Pricing Theory, Efficient Market Hypothesis, the Fama-French models attempt to provide explanations for the observed behaviour of running rates of return on stocks. They are not necessarily concerned with long-term phenomena such as the equity premium puzzle (Prescott and Mehra 1985) which are visible only in the long term returns. The purpose of our paper is to explore other kinds of empirical regularities that are exhibited by long run stock price behaviour.We have pointed out two such regularities a) convergence towards uniformity of long term stock returns and b) increasing power of earnings growth in explaining stock returns as the holding period is increased.

References

Agwuegbo, S. O. N., Adewole, A. P., and Maduegbuna, A. N. (2010). A random walk model for stock market prices.

Bernstein, P. L. (2009). Capital ideas evolving. John Wiley & Sons.

Campbell, J. Y. and Kyle, A. S. (1993). Smart money, noise trading and stock price behaviour. The Review of Economic Studies, 60(1):1–34.

Emm, E. E. and Trevino, R. C. (2019). Risk and investment horizon: Is time really money? The Journal of Investing, 28(1):86–96.

Fama, E. F. (1965). The behavior of stock-market prices. The Journal of Business, 38(1):34–105.

Fama, E. F. (1995). Random walks in stock market prices. Financial Analysts Journal, 51(1):75–80.

Fama, E. F. (1998). Market efficiency, long-term returns, and behavioral finance. Journal of Financial Economics, 49(3):283–306.

Godfrey, M. D., Granger, C. W. J., and Morgenstern, O. (1964). The random-walk hypothesis of stock market behavior. Kyklos, 17(1):1–30.

Graham, B., Dodd, D. L. F., Cottle, S., and Tatham, C. (1951). Security Analysis: Principles and Technique. McGraw-Hill, New York.

Kurz, M., Jin, H., and Motolese, M. (2005). Determinants of stock market volatility and risk premia. Annals of Finance, 1:109–147.

Levy, R. A. (1967). Random walks: Reality or myth. Financial Analysts Journal, 23(6):69–77.

Li, B., Liu, B., Bianchi, R., and Su, J. J. (2012). Stock returns and holding periods. JASSA, (2):43–48.

Malkiel, B. G. (1996). A Random Walk Down Wall Street. Norton, New York.

Mehra, R. and Prescott, E. C. (1985). The equity premium: A puzzle. Journal of Monetary Economics, 15(2):145–161.

Mehra, R. and Prescott, E. C. (1988). The equity risk premium: A solution? Journal of Monetary Economics, 22(1):133–136.

Mehra, R. and Prescott, E. C. (2003). The equity premium in retrospect, volume 1, pages 889–938. Elsevier.

Prescott, E. C. and Mehra, R. (2005). Recursive competitive equilibrium: The case of homogeneous households, pages 357–371.