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REINVESTIGATING THE INFLUENCE OF DOT COM BUBBLE ON FINANCIAL MARKET AND INVESTMENTS

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ABSTRACT

Development of financial markets and investment sector have ensured mutual reinforcement which was started in 1995 and deepened until the collapse of the bubble in 2000, which refined the characteristics of the web. This study thoroughly investigates speculative dot com bubble in research related to corporate finance by exploring the issues of dividend policy. In addition, we examined the dividend policy and speculative bubbles on the dataset and S&P 500. This study designs the contours of this capacity with emphasis on the generation of demand.

Considering the "dividend smoothing" phenomenon, this article raises question on the efficiency of dividends observed as an important factor that affects investment bubbles. This study builds hypothetical payouts of dividends as per the corporate earnings reported. It is inferred that firms' dividend policy affects speculative bubbles. The "dotcom bubble" is widely known as a common example for a "stock price bubble" in various equity indices like NASDAQ. It is observed with the dividend series observed as a common factor. It is not basically the case with the adjusted time series of dividends.

Keywords: dotcom bubble, investment bubbles, hypothetical payouts, dividends, financial markets, S&P 500, dividend policy, NASDAQ

1. Introduction

The "Dividend Discount Model or Present Value Model of stock prices is still known as one of the foundations of financial markets (Shiller, 2014; Blanchard & Watson, 1982). First of all, this approach is the backbone of corporate finance to perform equity valuation. Furthermore, it is also used as a theoretical basis in the studies for bubble testing (West, 1988; Evans, 1991; Diba & Grossman, 1988). According to these seminal roles in detecting bubbles and theory of events,

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recent studies have widely used “recursive right-tailed unit root tests” to detect bubbles in asset prices (Phillips & Yu, 2011; Pavlidis et al., 2017; Phillips et al, 2011; 2015).

Phillips et al. (2011) have made the most important contributions with their influential approach for several empirical studies by taking the critique by Evans (1991) that “cointegration tests” and “conventional unit root test” are not powerful enough for collapsing bubbles regularly. With this approach, different financial markets across the world have used “right-tailed unit root tests” from equity to housing markets and “commodity futures” like crude oil markets (Pavlidis et al., 2017; 2018; Figuerola-Ferretti et al., 2020; Engsted et al., 2016; Kivedal, 2013; Homm & Breitung, 2012). The price should decouple from the foundation explosively for rational bubble.

> “*A rational bubble reflects a self-confirming belief that an asset’s price depends on a variable (or a combination of variables) that is intrinsically irrelevant—that is, not part of market fundamentals*” (Diba & Grossman, 1988, p.520).

The fundamental of asset refers to the sum of existing discounted values of payoffs in future from the ownership of asset. Hence, the results of these bubble tests are affected by the ex-ante characteristics of the fundamental (Pavlidis et al., 2017). Dividend payments which have been observed are considered as a proxy for basic factors in recent studies, which affected stock market valuation. As per the “dividend smoothing” concept, firm managers attempt to get rid of any situation where they have to steeply omit or cut dividend payments.

Due to this reason, it is observed that companies are likely to go with this policy which makes dividend payments smoother with some consistency. Managers merely increase dividends due to increased corporate revenue when they feel that rise in level of payments of dividends can be maintained with reasonable odds in future. Hence, it could be problematic for dividend payments as proxy varies for the stock value (Chen et al., 2012; Marsh & Merton, 1986). As choice of management for dividend policy is known to affect changes in time series, developing relation among “rational stock prices” and “volatility of dividends needs analysing the relationship between highly controllable process of dividend and highly uncontrollable intrinsic value process” (Marsh & Merton, 1986).

2. Literature Reviews

Fairchild et al. (2022) developed a seminal theoretical model in “emotional finance framework” which has initial peek at the unconscious and conscious emotions of relating investors to crypto and stock market bubbles and crashes. Since this model is first of its kind, they speculated on whether it can be “ex ante predictive” along with being “ex post descriptive.” They also conducted mapping of investor sentiments and emotions with “Elliott Wave Theory” to compare Dotcom crash in the beginning of 2000s and Bitcoin bearish market in 2021.

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Fan (2022) revisited the seminal paper of Phillips et al. (2011) to test the dotcom bubble. The researcher had applied recent advances of their approaches to NASDAQ stocks and used novel specification for the basics. To deal with literature divide, the researcher generated an in-depth sectoral breakdown of the bubble. It consists of different overlapping exuberance episodes and there were two dates to start the exuberance of the internet.

The use of Infocom and internet has been redefined over the years over the past two decades. Human lives have switched from objects that can only get information to subjects that can make decisions individually. In addition, use of "info communication technologies" has changed the conditions of both individuals and whole national and global economies. A lot of businesses and established firms have made millions with these technologies and a lot of them are hoping to do it. This study explores the role of "info communication technologies" in Dotcom crisis and implementing the traditional financial policy. Alekseievska et al. (2021) revealed the impact of dotcom bubble and unusual monetary policy on socio-economic growth of nations.

Burks et al. (2021) identified and measured the properties of volatility clustering, asset bubbles, and financial contagion over the three anomalies in financial market which originated the Chinese and American markets. This study is mainly aimed to measure and identify the properties of volatility clustering, asset bubbles, and financial contagion over the past three anomalies in financial market in Chinese and the US markets. They especially focused on the "2008 Housing Crisis," "2000 Dotcom bubble," and the "2015 Chinese Bubble." They used the "DCC-GARCH model to determine volatility clustering, LPPL model for detecting asset bubbles, and the Diebold-Yilmaz volatility spillover index" to determine the financial contagion level. They gave strong evidence of limited spillover between the "Shenzhen and Shanghai Composite Indexes and S&P 500." Over the past two crises, i.e., the "2015 Chinese Bubble and the Housing crisis," the spillover effects were significantly higher. Hence, financial markets have been more globalized and there is higher transmission of volatility and limited potential benefits from global diversification."

Xu (2023) introduced the development of "behavioral finance" considering psychological factors on behaviors of investors to determine anomalies in finance. They used "Tulip Mania in 17th Century" as the first market bubble to find out how illogical behaviour impacts stock market. They studied the herd impact which caused collapse of the market in behavioural finance. There were three reasons behind it – speculation, reputation, and half information which caused herd mentality. It shows how herd mentality affects decision-making of investors in stock market. They also used "dotcom bubble in 2000" as a prime example to find out true effect of herd mentality on buying craze of investors which caused market bubbles. They also discussed the recent crypto bubble which means market bubble may also be developed in the near future.

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2.1 Research Gap

The market structure of the internet affects its communications. Social media is renowned for promoting cultural and political involvement. But a lot of social media platforms are still made by companies which monetize political activities of the users. Social media is the fresh repetition of more common marketing function which has been designed since the beginning of online commercial services and World Wide Wen. Topics like "dataveillance, digital labour, and networked publics have been discussed over the years but there is a lack of attention given to commercialization of the web by scholars (Scholz, 2013; Zimmer, 2008;Papacharissi, 2010; Turow, 2011). This article fills the gap between financial market and investments and impact of dotcom bubble on them by discussing the connections among them.

2.2 Research Question

- What is the "Present Value Model" of stock prices?
- What are the data and methodological issues to determine annual data of stock market?
- How to test bubbles with "hypothetical dividend"?

2.3 Research Objectives

- To discuss the "Present Value Model" of stock prices
- To discuss data and methodological issues to determine annual data of stock market
- To test bubbles with "hypothetical dividend"

3. Research Methodology

When the dotcom bubble (the prime example of speculative bubble in equity markets in the US) affected the "NASDAQ, it must have also had consequences for all the equity indices across the North America. With the dividend payments observed as a primary factor, the existence of stock market bubbles is confirmed in the S&P 500 by Shi & Phillips (2020) and Phillips et al. (2015).

Hence, this study examines the "Present Value Model" of stock prices as well as extensions. In addition, we review previous studies on issues related to dividend policy and examine the datasets. This study also develops hypothetical payouts of dividend and focuses on various approaches for bubble testing and identification procedure.

4. Analysis of Study

4.1. "Present Value Model" of stock prices

This section starts while defining the "Present Value Model" to evaluate share price for corporate finance in Eq. (1).

$$P_t = \frac{1}{1+r_t} \mathrm{E}_t \left[P_{t+1} + D_{t+1} \right], \tag{1}$$

Here, $P_t$refers to the stock price being investigated, r_t refers to the "positive discount rate, D_t indicates the dividend process of the given stock, and $\mathrm{E}_t[\cdot] := \mathrm{E}\,[\cdot|\Omega_t]$ refers to the conditional expectations regarding the set of data Ω_t available at time t, with $t = 1,\ldots.., T$." The focus here is on the impact of dividends as well as corporate earnings on testing bubble. Since dividend policy issues are being tested, the Eq.(1) is adjusted here.

$$P_t = \frac{1}{1+r_t} \mathrm{E}_t \left(P_{t+1} + \underbrace{q_{t+1} CE_{t+1}}_{D_{t+1}} \right) \tag{2}$$

Here CE_t refers to "corporate earnings" and q_t refers to the "dividend payout ratio." Hence, companies consider dividend policy when setting the payout as corporate earnings share. The law of "iterated expectations" is applied to Eq. (1) till period l. After doing this, Eq. (3) illustrates decomposition of bubble and fundamental part.

$$P_t = \underbrace{\sum_{i=1}^{l} \frac{1}{(1+r_t)^i} \mathrm{E}_t \left[q_{t+i} CE_{t+i} \right]}_{F_t} + \underbrace{\frac{1}{(1+r_t)^l} \mathrm{E}_t \left[P_{t+l} \right]}_{B_t}, \tag{3}$$

Here, B_t is the bubble part and F_t is the fundamental component. While holding the "transversality condition," the price would be equivalent to the basic component which refers to "$B_t = 0$" and "stochastic trading behaviour" of price is equivalent to "stochastic trending behaviour" of the fundamental. The stock price must be similar to the total of "discounted future expected dividend payouts." This way, empirical evidence infers that the price acts as a random walk. If there is no hold in Eq. (4), the prices process would show explosive behaviour and exceeds the "fundamental for $B_t > 0$" as the bubble fulfils the submartingale process (Diba & Grossman, 1988).

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$$\lim_{l \to \infty} \mathrm{E}_t \left[(1 + r_t)^{-l} P_{t+l} \right] = 0 \quad (4)$$

Here, the price process detaches itself from the fundamental explosively. Hence, it is important to apply the "recursive right-tailed unit root tests" to stock prices for testing bubbles against the explosiveness of (log) price dividend ratio." The specification of dividend or fundamental process is vital for the results of bubble test.

4.2. Data and Methodological Issues to Determine Annual Data of Stock Market

Basse et al. (2021) tested the annual data of the US stock market. They especially paid attention to "earnings per index share, dividends per index share, and stock prices of S&P 500 equity market index from 1871 to 2014." They obtained the data from the official "Robert Shiller's portal." However, there is no adjustment of time series for inflation. They used annual data to avoid issues related to substantial seasonal patterns in "dividend time series" (Phillips & Shi, 2020). They relied on nominal data without estimating real prices to evaluate nominal equity prices and fundamental approaches are widely used as per nominal data. With the perspective of flows of information among the participants, it is important to go for nominal data, especially when it comes to examine the dividend smoothing. There is smoothening of dividend in nominal terms when it comes to analyse inflation's role (Baker & Jabbouri, 2017; Basse & Reddemann, 2011).

This way, Basse et al. (2021) outlined 6 hypothetical dividend series for various dividend policies. These are used for bubble testing as fundamental.

According to the "first *hypothetical* dividend time series (*HDREIT*)", all companies must act as "real estate investment trusts (REITs)" and pay up to 90% of their income in the form of dividends. So, it is assumed that this time series seems more like paying out most of the earnings than any specific dividend policy.

The "second *hypothetical* dividend time series (*HDWW1*)" is built by evaluating "average payout ratio" by gathering data from the period before and after the beginning of World War I. Hence, this time series must control instabilities between corporate earnings and dividends due to this war. This hypothetical time series must help dealing with potential data issues due to switching behaviour to fiat money post the period of World War I.

The third "*hypothetical* dividend time series (*HDWW2*)" is estimated as per average payout for the period before and after the beginning of World War II. Chen et al. (2012) have empirically proved that the dividend policy of the US firms was affected by World War II.

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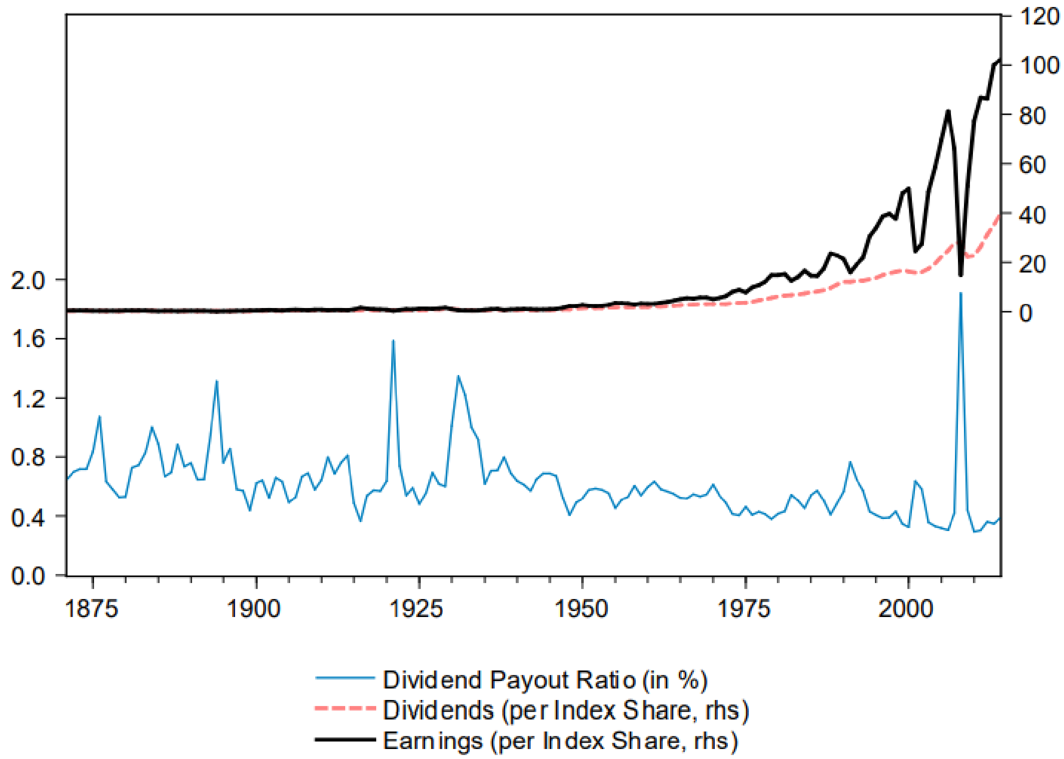
The "fourth *hypothetical* dividend time series (*HDBW*)" follows the concept that leading economic busts and booms on crashes of stock market overall can impact the dividend policy of companies in a way to cause "atypical behaviour of payout ratio." This concept is based on the study conducted by Baker & Wurgler (2004).

The "fifth *hypothetical* dividend time series (*HDNIX03*)" manages changes in policy and is designed by excruciating the data in two subsets like the third hypothetical time series. The median payout before the World War II and after this period was considered.

The "sixth *hypothetical* dividend time series (*HDMID*)" is evaluated with "5-year non-overlapping averages" of dividend payout along with the existing corporate earnings. This way, dividend time series is built, i.e., strong against smoothing activities of companies but it is a lot similar to the observed payouts of dividend.

Figure 1 – "Dividends per index share and Earnings per index share of S&P 500 along with Dividend Payout Ratio"



Source - Basse et al. (2021)

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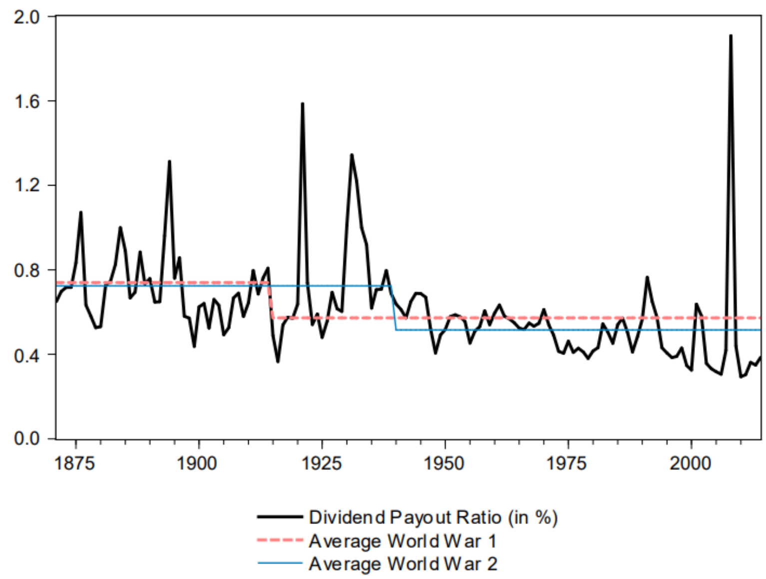
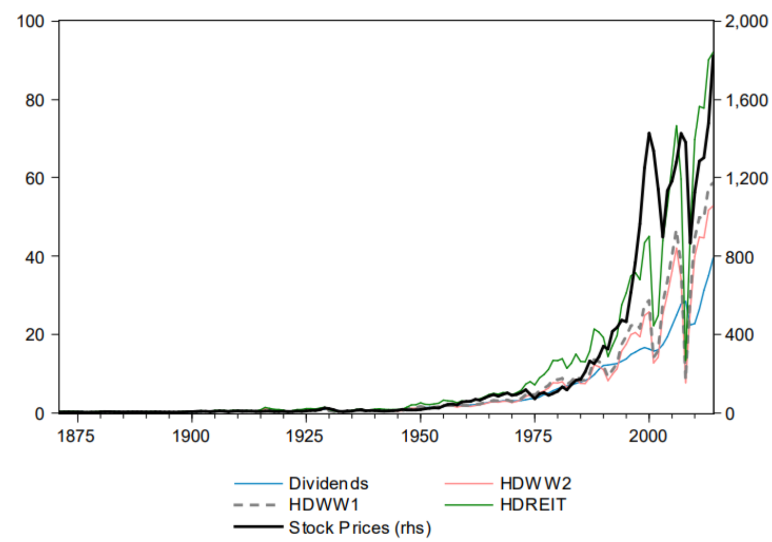
Figure 2 – Historical data of "Dividend Payout Ratio" to calculate "S&P 500 equity index and its predecessors along with average dividend payout ratio before, during, and after WWI and WW2



Source -Basse et al. (2021)

Figure 3 – "Dividends (per index share) and stock prices of S&P 500 equity index and its predecessors along with 3 *hypothetical* dividend time series from corporate earnings"



Source -Basse et al. (2021)

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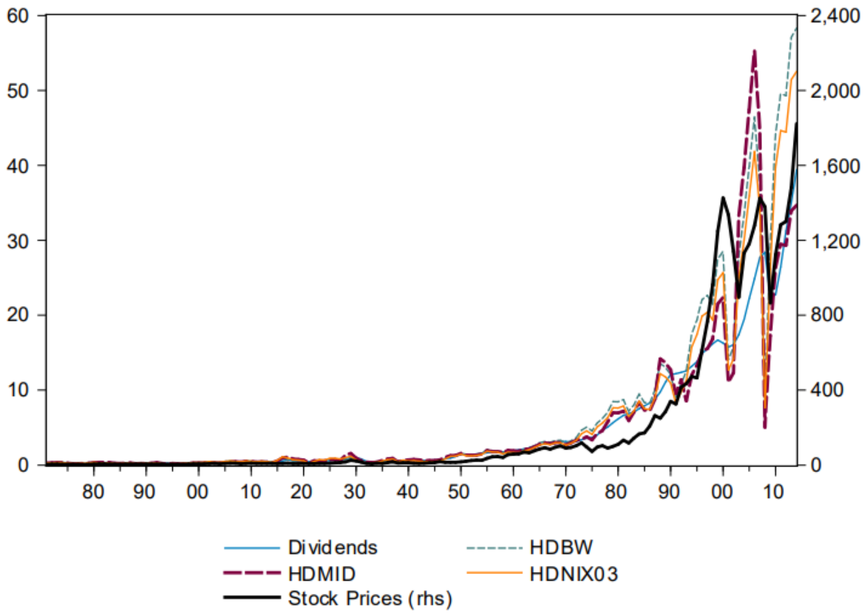
Figure 4 – "Stock Prices (S&P 500 Equity index and predecessors) and three *hypothetical* dividend time series developed from corporate earnings"



Source -Basse et al. (2021)

First of all, it is worth noting that there has been a decline in "dividend payout ratio" in America. According to Goetzmann et al. (2001), in comparison to 20th century, US firms' dividend policy was not similar to that in 19th century where a huge profit share was used to paid out. The trend of holding earnings was not much prevalent and companies were used to pay high dividends back then to let capital gains go. Figure 1 illustrates this phenomenon. During the 2008 Recession, the impact of smoothing dividends was very common with the spike in dividend payout ratio. In addition, Figure 2 illustrates attention increased on average payout ratio of dividends when estimating the "hypothetical dividend payout time series." The dividend payouts are observed in stock prices "S&P 500 and its predecessors" in Figure 3 and Figure 4.

4.3. Testing bubbles with "Hypothetical Dividend"

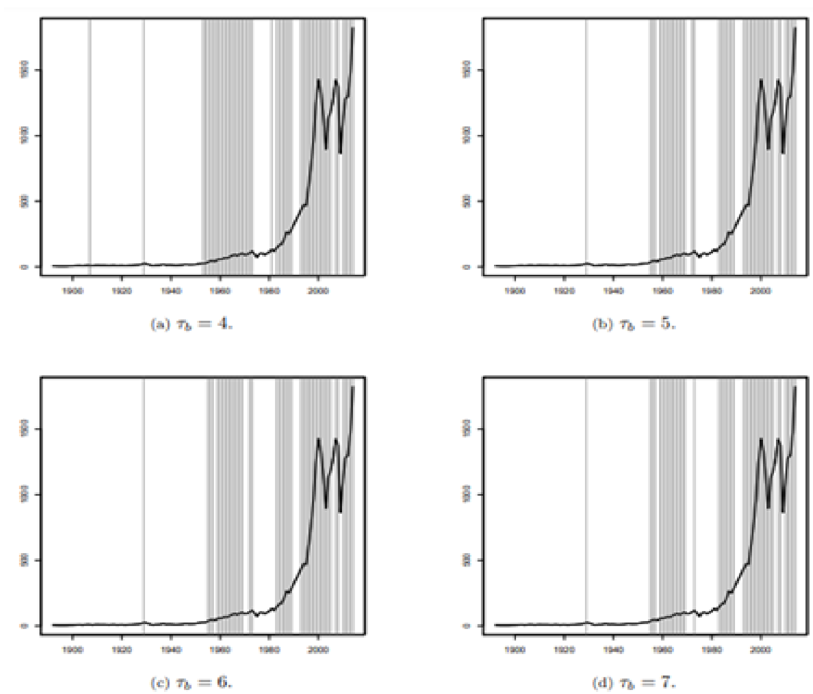
This section uses "time-series monitoring" proposed by Phillips & Shi (2020). Unlike other testing methods, this novel approach enables controlling the empirical size *ex ante* for the specified time period. Basse et al. (2021) adopted the "Data Generating Process (DGP)" proposed by Phillips & Shi (2018). The "DGP for (log-) prices p_t" in this model is defined in Eq. (5).

$$p_t = \begin{cases} c_0 T^{-\eta} + p_{t-1} + \varepsilon_t, & t < a = \lfloor A \times T \rfloor, \quad \textit{normal times}, \\ \rho p_{t-1} + \varepsilon_t, & t \geq a = \lfloor A \times T \rfloor, \quad \textit{bubble}, \\ \gamma p_{t-1} + \varepsilon_t, & t \geq b = \lfloor B \times T \rfloor, \quad \textit{burst}, \\ c_0 T^{-\eta} + p_{t-1} + \varepsilon_t, & t \geq c = \lfloor C \times T \rfloor, \quad \textit{normal times}. \end{cases} \tag{5}$$

Here, the "innovation process ε_t" is identically dispersed and individual random variable including "$E(\varepsilon_t) = 0$ and variance σ^2 for $t = 1,\ldots,T$. The parameters of $A < B < C \in (0, 1)$ means first observation in the consistent regimes. The process p_t is started with p_0 as martingale process with negligible trend of $c_0 T^{-\eta}$, where c_0 is a constant and $\eta > 1/2$, for $t = 1, \ldots, a-1$. Hence, it is possible to apply the asymptomatic theory defined by Phillips & Magdalinos (2007) for autoregressive time series."

Basse et al. (2021) applied the "real-time monitoring" proposed by Phillips & Shi (2020) to test S&P 500 bubble behaviour to the price series. They found explosive phases in Figure 5.

Figure 5 – Trajectories of annual price series with real-time monitoring for level of significance (α = 0.05). From upper left to right at the bottom from 4 to 9, the "size control parameter τ_b rises"



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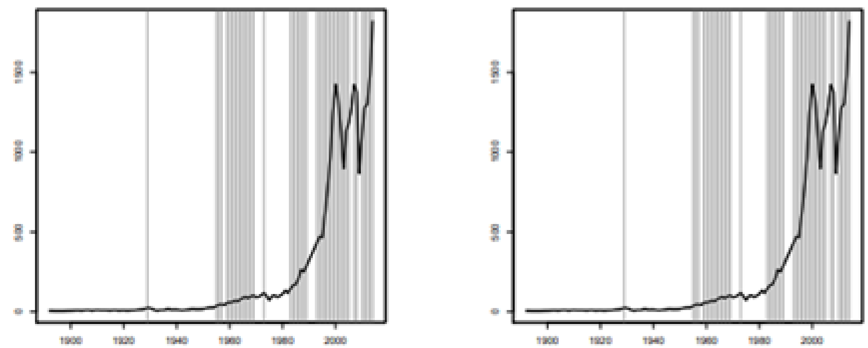
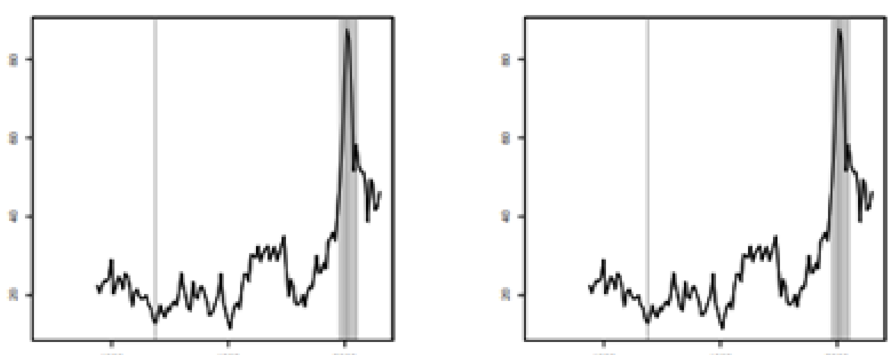


(e) $\tau_b = 8$. (f) $\tau_b = 9$.

Source -Basse et al. (2021)

Basse et al. (2021) presented the monitoring outcome proposed by Phillips & Shi (2020) on monthly and annual price-dividend ratio and annual ratios among hypothetical dividends and prices for the level of significance (α = 0.05). Figure 6 illustrates the results of bubble test for annual price-dividend ratio. The parameter for size control ranges from 4 to 9 years. The trade-off among power and longer periods of control causes fewer years in the period of bubble for larger τ_b values. The process of bubble testing shows substantial evidence for early 2000's financial bubble or dotcom bubble and accords with the findings of Phillips & Shi (2020) and Phillips et al. (2015). Figure 7 also highlights the findings of Phillips & Shi (2020) to indicate the sturdiness of such findings around dotcom bubble period.

Figure 6 – "Trajectories of annual price-dividend ratio for level of significance (α = 0.05) as discussed by Phillips & Shi (2020). There is a rise in size control τ_b parameter from upper left to right at the bottom from 4 to 9 by steps of 1."



(a) $\tau_b = 4$. (b) $\tau_b = 5$.

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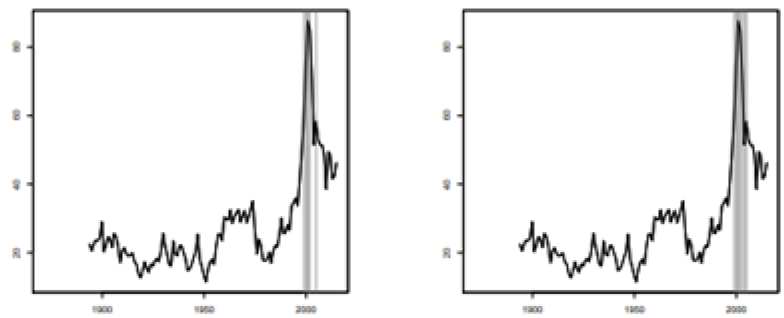
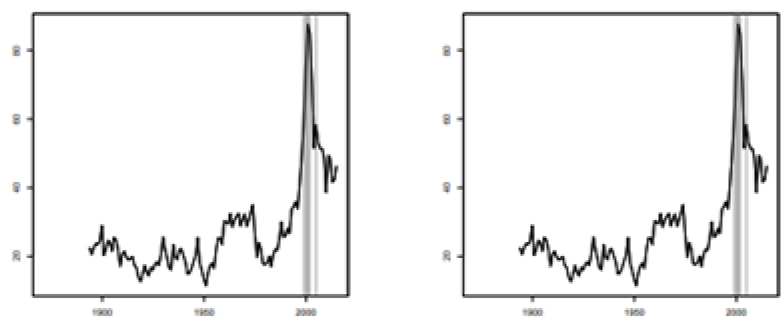


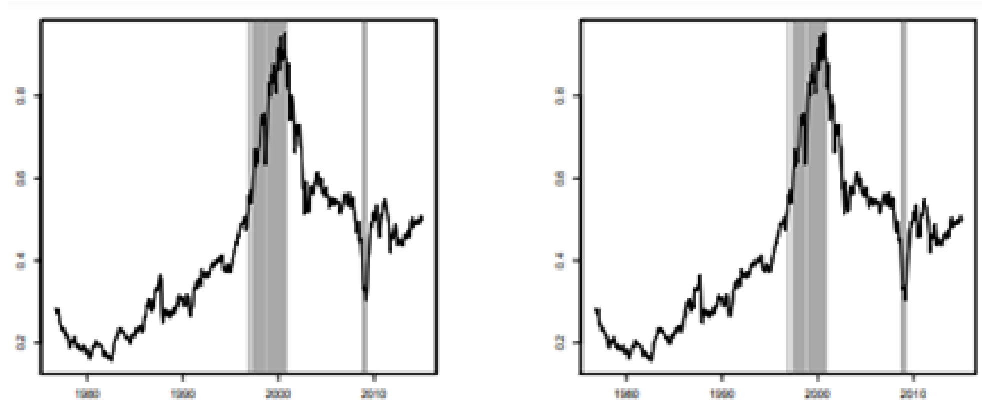
(c) $\tau_b = 6$. (d) $\tau_b = 7$.



(e) $\tau_b = 8$. (f) $\tau_b = 9$.

Source - Phillips & Shi (2020)

Figure 7 – Monthly Price-Dividend Ratio with pseudo real-time monitoring by Phillips & Shi (2020) for level of significance (α = 0.05).



(a) $\tau_b = 4$. (b) $\tau_b = 5$.

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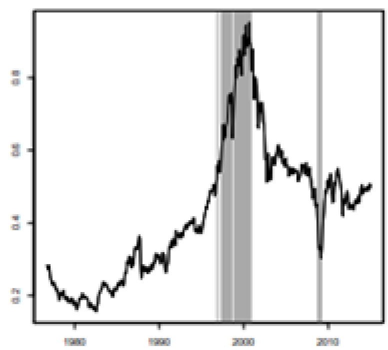
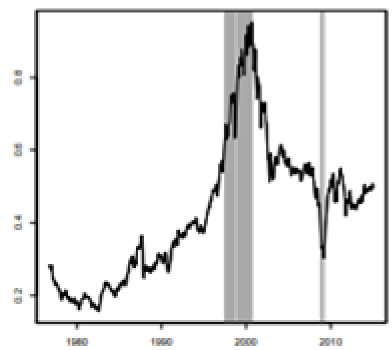
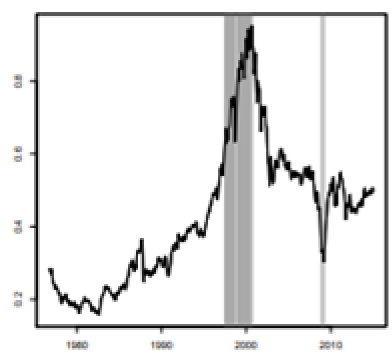


(c) $\tau_b = 6$.



(d) $\tau_b = 7$.

(e) $\tau_b = 8$.



(f) $\tau_b = 9$.

Source – Phillips & Shi (2020)

When it comes to annual data, there are consistent start and end periods. So, it is wise to go with annual data when it comes to test hypothetical dividends. It can help get rid of seasonal patterns and problems of data availability.

5. Results

This study was conducted to associate empirical evidence with testing bubbles in corporate finance. This study was focused on “dividend policy issues.” In the US, there is dividend smoothing in empirical evidences and there might be conflicts on the usefulness of dividend payments with “recursive right-tailed unit root tests” for identifying bubbles. Hence, “hypothetical dividend payouts” are designed as per the corporate earnings which have been reported. The empirical evidence shows that dividend policy is important when it comes to do bubble testing.

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Dotcom bubble is considered as a key example for speculative bubbles in stock market prices in NASDAQ and other equity indices. It can be tested with the "dividend time series to determine the S&P 500." When adjusting with the dividend policy, it is not majorly the case with the hypothetical time series. The efficient hypothesis predicts no bubbles in prices and the irrelevancy theorem depends on assuming the ideal markets. Hence, empirical evidence is not much attractive to financial bubbles.

When it comes to asset price bubble, it is important to determine whether focus is on dividend smoothing that can justify the market theory. One can answer this core question with "yes" while considering other factors. Considering that companies making dividend payments smoother to a specific level clearly results in less substantial evidence for speculative bubbles. It is assumed that there should not be existence of asset price bubbles. The "hypothetical dividend payouts" are mainly built out of corporate earnings and "earning smoothing" can be used by the firms (Gao & Zhang, 2015; Baker & Weigand, 2015).

6. Conclusion

This study has proposed various techniques to manage the distorting impact of dividend policy of companies in terms of valuation. This paper has constructed the "alternative dividend payout time series" for better insights on the dividend payouts that investors expect. This study found less appealing evidence for speculative dotcom bubble in S&P 500 and used hypothetical payments as basic factors. If the findings of this study give a strong association between dividend policy and financial bubble literature, it could be a very promising study in this research path.

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