

**Methodology Article**

# Comovement of Asset Returns Between Single and Dual Listed Firms Within a Single Stock Exchange

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**Abstract:** This study analyzed the comovement of asset returns between single and dual listed firms on the Botswana Stock Exchange (BSE) with ultimate aim being to determine if investors can realize diversification benefits by investing across single and dual listed firms in a single stock exchange. Using correlation coefficient and the  $\beta$  coefficients of two univariate regression models in which returns of single listed firms were regressed against the returns of dual listed firms and vice versa to determine the strength and direction of the comovement of the asset returns respectively, evidence of weak but positive comovement of the returns was found. Since diversification benefits can be only be realized if assets are both weakly and negatively correlated, we concluded that it is not possible to reap diversification benefits by investing across single and dual listed firms on the BSE. Although weak comovement implied that it may possible to reap diversification benefits by investing across single and dual listed firms, evidence of positive comovement negate the realization of such potential diversification benefits.

**Keywords:** Comovement, Asset Returns, Dual Listed Firms, Single Listed Firms, Diversification Benefits

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## 1. Introduction

The comovement of asset returns has become an important topic in the field of finance and investment. This is because the extent and the direction of comovement of asset returns have serious implications on asset allocation and portfolio management. Investors generally desire to allocate their investments in such a way that maximizes the risk-return trade off of their portfolios. Knowledge of the comovement of asset returns allows them to efficiently and effectively optimize their portfolio asset allocation, and as well as devise risk management strategies necessary to eliminate or minimize risks associated with movements in asset prices [1, 2]. In other words, comovement of asset returns allows investors to efficiently and effectively diversify their portfolio. Hence, studies of comovement of asset returns have attracted much attention in financial literature.

Increased research interest in the comovement of asset returns have allowed researchers to discover various patterns of comovement among assets sharing common factors. Such

discoveries have allowed portfolio managers to efficiently and effectively exploit potential diversification benefits by investing across weakly correlated assets. Patterns of comovement have been identified in assets of the same type, industry or country. Thus, investors tend to diversify their portfolios by investing across assets of the same type, industry and country.

Due to the vast amount of empirical literature which suggests that diversifying internationally is much more effective [1, 3, 4, 5, 6, 7], international diversification (or country diversification) has become the most practiced way of diversifying portfolios. However, with increasing international integration of stock market, international diversification is obviously becoming less and less significant. Thus there is need to find more ways of diversifying portfolios using local assets.

A notable consequence of great integration of stock markets has been the rise of dual listing of stocks. Dual listing is on the rise because it increases a firm's access to new capital, makes its shares more marketable and increases their liquidity. Much

interestingly, dual listing might be presenting diversification opportunities for investors willing to diversify their portfolios using local assets. Within a single stock exchange, there is a possibility that dual listed stocks will display distinct price patterns with single listed stocks. This is because returns of dual listed stocks, unlike single listed stocks will be influenced by market conditions of both two stock exchanges in which they are being traded. The possible distinct price patterns between single and dual may be exploited by investors to diversify their portfolios by investing across single and dual listed stocks. Thus dual listing, despite being one way in which financial markets are becoming increasingly integrated, might be presenting an opportunity for investors to diversify their risk using local assets.

However, despite the potential diversification benefits present, most investors are yet to exploit the diversification opportunities being presented by the presence of dual listed stocks within their local stock exchanges. The lack of willingness to exploit possible diversification presented by dual listing can be largely be attributed to the lack of empirical evidence that prove that there is weak and distinct comovement of returns between single and dual listed firms. Few or maybe no studies at all have explored the comovement of asset returns between dual and single listed firms. Most studies on asset return co-movements have rather focused on comovement of international stock markets and also the presence of extreme comovements in asset returns [8, 9, 10]. There are also some studies that have investigated the comovement of asset returns within the dual firms themselves [11, 12, 13, 14, 15]. However, it seems they were much interested in investigating and explaining pricing disparities and arbitrage opportunities normally observed in dually – listed stocks, rather than the potential diversification benefits that dual listing may present within a stock exchange<sup>1</sup>.

Empirical evidence of weak distinct comovement between returns of single and dual listed firms is necessary because it ultimately gives investors the basis and the confidence to exploit possible diversification which dual listing may be presenting. However, with lack of research on the subject of comovement between returns of single and dual listed firms, investors will continue to lack the willingness to exploit possible diversification that dual listing might be presenting. Therefore this research tries to close the gap in literature by analyzing the comovement of asset returns between dual and single listed firms within a single stock exchange, with the ultimate intention of determining if potential diversification benefits can be realized by investing across single and dual listed firms within a single stock exchange.

Using Botswana Stock Exchange (BSE) as a case study, this study analyzes comovement of asset returns between single and dual listed firms on the BSE from 2009 to 2013<sup>2</sup>. To

determine if possible diversification benefits can be realized by investing across single and dual listed firms, we needed to determine the direction of comovement and as well as the degree of the comovement between asset returns of single and dual listed firms. Thus, the objectives of the study can be summarized as follows:

- To determine the direction of comovement between single and dual listed firms
- To determine the degree of comovement between single and dual listed firms
- To determine if investors can realize possible diversification benefits by investing across single and dual listed firms

The study is structured as follows: Section 2 discusses the Literature Review; Section 3 discusses the Methodology; Section 4 discusses the results and Section 5 concludes the study.

## 2. Literature Review

### 2.1. The Theory of Comovement of Asset Returns

Comovement of asset returns refers to a strong correlation among yields of different markets, or that different stock prices share a common long-run equilibrium relationship or possess a long-term trend of synchronized movement [16]. In other words, it is the tendency of asset prices to simultaneously move together, such that their prices are positively correlated [17]. Thus, comovement can simply be defined as that kind of movement which is shared by a group of assets with common factors [18].

What causes common comovement in asset returns? In general comovement in asset returns is due to assets sharing common characteristics. As a result firms with similar characteristics- similar size, price level, value/growth, and firms traded on the same exchange or are members of the same market index are expected to move together [19].

But are what are the specific factors that drive comovement is asset returns? Traditional financial theory asserts that co-movement in asset returns is mainly driven by fundamental factors. Precisely, the traditional theory states that in a frictionless economy with rational investors, co-movement in prices reflects comovement in fundamental values [20, 21]. The fundamental values change due to changes in the fundamental factors macroeconomic news, interest rate and exchange rate shocks and even trade volume [22], thereby causing investors to revise their rational expectations about future cash flows or the discount rates they apply to those cash flows. Thus according to the fundamental view, comovement in asset returns is due to either correlated changes in rationally expected cash flows or correlated changes in rationally

1 Theoretically dual listed firm trade at the same price across the two stock exchanges, occur, dual listed firms should trade at the same price [11]. However, pricing disparities sometimes occur and as such researchers are interested in the arbitrage opportunities that such price disparities bring.

2 'The BSE is a small but thriving stock exchange located in Gaborone, Botswana.

It was established in 1989 as a Botswana Share Market, and only became known as the Botswana Stock Exchange later in 1995. BSE has grown immensely over the years and is now the third largest stock exchange in the Southern African Region in terms of market capitalization' [23].

applied discount rates [10]<sup>3</sup>.

The fundamental view explains why firms in the same industry, sharing common fundamentals will exhibit higher return comovement [24]<sup>4</sup>. However, numerous researchers found out that asset return comovement can not only be explained by fundamentals<sup>5</sup>. In other words, comovement of asset returns may also be caused by non-fundamental factors. Their findings are based on behavioral theories which argue that market frictions and investor sentiment weaken the link between stock returns and fundamentals and induce comovement in returns that is unrelated to fundamentals [19]. Precisely, in the presence of irrational investors, market imperfections and limits to arbitrage, asset prices and fundamental values become disentangled, rendering traditional fundamental theory of comovement non-functional [21]. In financial literature, this type of comovement is regarded as excess co-movement.

Excess comovement is defined as comovement beyond the degree that can be justified by economic fundamentals [24]. The theory which explains excess co-movement in asset returns broadly classified as the friction based and the sentiment based theories of co-movement.

Barberis et al [20] divided the friction based and the sentiment based theories into three specific views which are the category view, the habitat view and the information diffusion view. The category view is based that investors group assets into categories such as small-cap stocks, oil industry stocks, or junk bonds, and then allocate funds at the level of these categories rather than at the individual asset level. Thus, as they move funds from one category to another, their coordinated demand induces common factors in the returns of assets that happen to be classified into the same category, thereby causing common comovement.

The habitat view of comovement predicts that there will be a common factor in the returns of securities that are held and traded by a specific subset of investors, such as individual investors. It is based on the observation that many investors tend to choose to trade only a subset of all available securities<sup>6</sup> such that when their risk aversion, sentiment, or liquidity needs change, they tend alter their exposure to the securities in their habitat, thereby inducing a common factor in the returns of these securities.

The information diffusion view predicts that there will be a

common factor in the returns of stocks that incorporate information at similar rates. Information is incorporated at different rates by stocks due to market frictions. For example, some stocks may be less costly to trade, or may be held by investors with faster access to breaking news and the resources required to exploit it [20]. However, despite the market frictions, there will be a group of some stocks which will incorporate information at similar rates. Thus, stocks that incorporate information at similar rates should display common comovement.

## ***2.2. Diminishing Importance of International Diversification and the Need for Local Diversification***

Comovement of asset returns has always been of great interest to researchers. This is because the study of comovement in asset prices provides significant insights into possible diversification strategies that impact the risk–return relationship or the expected return from investing in a portfolio of stocks [27]. In other words, comovement of asset returns is used to determine possible comovement of assets. In fact, researchers have uncovered numerous patterns of comovement in asset returns of small-cap stocks, value stocks, closed-end funds, stocks in the same industry, and bonds of the same rating and maturity and as well as individual stocks within national markets and also among international markets themselves [20]. Thus, research on asset comovement has led to the development of diversification strategies that exploit differences in comovement among assets of the same type, class, industry, country.

International portfolio diversification across countries has been the common diversification strategy practiced by most portfolio managers. This is due to the early evidence in the literature on portfolio diversification which suggested that diversification across countries is more effective for risk reduction than diversifying across industries [28]. The literature actually created great desire for international diversification of portfolios among many investors and portfolio managers. This desire to diversify risk internationally and to attain higher rates of return has led to greater globalization of investments [29], thereby promoting financial integration of markets. At the same time, many countries have encouraged inflows of capital by dismantling restrictions and controls on capital outflows, deregulating the domestic financial markets, liberalizing restrictions on foreign direct investment, and improving their economic environment and prospects through the introduction of market-oriented reforms, further promoting financial integration [30]. Thus, the widespread belief in financial literature that financial integration is increasing.

Actually there is a vast amount of empirical literature showing that financial integration among many countries is indeed increasing. For example He [31] examined the degree of market integration and market interdependence between China and the world stock markets between 2003 and 2007 in the aftermath of financial liberalization policies which were implemented in 2001. The researcher found evidence of increased integration and interdependence of China stock

3 It is also asserted that common movements in discount rates might also emerge as a result of interest rate changes or perceived risk aversion or because of changes in rationally perceived asset risk [10].

4 Precisely, their earnings and hence their intrinsic values, are related, such that when one industry constituent reports good financial results, it is rather likely that other firms in the same industry will too [21].

5 Researchers managed to find out that comovement can be driven by non-fundamental factors by analyzing whether increases in correlations between asset returns were due to the irrational propagation of shocks or merely to the surge in the variance of a common source of risk driving returns in the affected markets [25]. This was achieved by decomposing returns into a fundamental and non-fundamental [26].

6 Such preferred habitats could arise because of transaction costs, international trading restrictions, or lack of information [20].

markets with world financial markets.

Neaime [32] studied the integration of MENA stock markets with world financial markets. He found that emerging MENA stock markets like those of Turkey, Egypt, Morocco and to a lesser extent Jordan have matured and are now integrated with the world financial markets.

Raj and Dhal [2] investigated the nature of the financial integration of India's stock market with global and major regional markets. Using correlations of daily stock price indices and returns, their study revealed that there is strengthening of the integration of India's stock market with global and regional markets in the more recent period since 2003.

Mobarek [33] study examined the extent of cross-country returns co-movement between the stock markets of five developed benchmark countries [US, UK, Japan, Germany and France] and five emerging benchmark countries [Brazil, Russia, India, China and South Africa] countries, vis-à-vis a total country sample composed by 20 countries. The researcher found evidence of increased stock market integration between the countries.

The increasing financial integration is diminishing international diversification benefits which can be derived by investing across countries. This is because, as the integration of financial markets progresses, arbitrage transactions tend to bring about a convergence of the returns of assets with similar risk characteristics [34]. In other words, as financial markets become increasingly integrated, the financial markets will also become increasingly correlated, thereby diminishing their ability to enhance and diversify international portfolios [32]. Thus, the movement towards greater integration is seen as a concern by investors willing to diversify their portfolios and maximize their risk-return trade off.

Though there is increased integration of stock markets across the world, it is important to note that there are also a number of empirical studies showing that there are some countries which are still less integrated with world financial markets. For example, Neaime [32] study revealed that the GCC equity markets are not well integrated with world stock markets and as such still offer international investors portfolio diversification opportunities<sup>7</sup>.

Though the benefits may not be as high as before, investors may still have room to internationally diversify their portfolio. However, with the world continuing to move towards greater integration, there is no doubt that international diversification benefits will continue to decrease. This means that investors might have to look for other ways of diversifying their portfolios. With the benefits of international diversification decreasing, investors might have to re-examine other ways of diversifying their portfolios locally. Thus the need to uncover new patterns of comovement among locally traded assets.

### ***2.3. Dual Listing as a New Opportunity for Local Diversification of Assets***

What is dual listing? Dual listing is a complex arrangement. Robinson [35] defined a dual listed company structure as a series of contractual arrangements between two listed entities under which they operate as if they were a single economic enterprise while retaining their separate legal identities, tax residencies and stock exchange listings, with the result being that the shareholders of each entity are in substantially the same position in terms of votes, dividends and capital returns as if they held shares in a single economic enterprise controlling the assets of both entities. Spitzer [11] defined it as a unique corporate structure that enables the firm to list on more than one stock exchange while maintaining separate legal entities in each market<sup>8</sup>. In simple terms, dual listing is an arrangement in which a firm lists on two stock exchanges. Sometimes, dual listing is referred to as cross-listing, meaning a stock cross-listed in another stock exchange.

With the globalization and greater integration of the stock markets worldwide, dual or multiple listing of stocks across the globe is emerging as the latest trend [36]. Why is dual listing becoming more popular? More or less similar reasons exist in literature about the reasons that motivate firms to dual list. Li [37] pointed out that dual or multiple listings increases firms' access to new equity capital, existing cross-listed home-country public shares benefit from greater liquidity and pricing efficiency when firms inter-list in foreign stock exchanges, such as the US stock exchanges, consolidation and competition with foreign markets lower the barriers to capital flows and make information release more efficient and domestic investors may take advantage of enhanced liquidity and favourable lower cost of domestic capital market, allowing them to enjoy higher valuations. Chau [38] pointed out the following as some of the benefits that make firms to seek dual listing: (1) it makes a company's shares more marketable, (2) it enhance the firm's corporate image and public recognition, (3) dual – listed companies are more closely followed by the media and are in a better position to have their press releases widely disseminated and (4) dual listing helps firms to overcoming capital and informational barriers as well as foreign market superiority in liquidity, tax treatment, disclosure, familiarity and containment of shareholder expropriation risk. Guo et al [39] pointed out that cross-listed firms benefit from greater shareholder base, more analyst coverage and improved corporate governance.

Though dual listing is a consequence of greater financial integration which is diminishing international diversification benefits, much interestingly, it might be presenting new diversification opportunities for investors willing to diversify their portfolios using local assets. The major question is how dual listing is presenting investors with new diversification benefits? The question can be answered using several

<sup>7</sup> This is the same study in which Neaime [32] examined MENA countries and found some of them to be integrated with world stock markets.

<sup>8</sup> This means that as a result, dual listed stocks have unique trading behaviors and value the same cash flows and earnings [11].

theoretical arguments. Firstly, it is important to note that unlike single listed stocks are traded not only in different stock markets, but also in two very different economic systems. This means that there are not only exposed to volatility fluctuations of more than one market, but also of different economic systems [40, 41]. This causes dual listed firms to display a common, but distinct price pattern or comovement with single listed firms, which investors may exploit to diversify their asset allocation [41]. Thus, depending on the nature of the nature and degree of the comovement of single listed and dual listed stocks, diversification benefits may be realized by diversifying assets across dual and single listed firms.

There can be counterarguments to the view that diversification benefits could be realized by diversify across single and dual listed firms. Firstly, it might be argued that national factors dominate the returns generating process of firms [12, 42, 43], to an extent that the return generating of firms of dual listed would be similar as to that of single listed firms. However it is important to note that, for dual listed firms to co-move with single listed firms within a single stock exchange, the return generating process of dual listed to be similar to single listed firms, both single and dual listed firms should be equally sensitive to the market index. With single and dual listed stocks affected by different fundamental factors, it would be difficult in practice to find single and dual listed firms, being equally sensitive to the market index. Thus, single and dual listed firms would still be expected to display distinct price patterns that investors may exploit to diversify their portfolios.

Secondly, it can also be argued that dual listing is one way in which financial markets are becoming increasingly integrated<sup>9</sup>. As such, dual listing help to mitigate segmentation of markets by improving risk sharing, especially in markets where barriers to investment are more severe [43], thereby causing assets in different countries to share a common stochastic trend [42]<sup>10</sup>. In other words, with greater financial integration, price patterns of single and dual listed firms may display a common stochastic trend. However, it should be noted that this scenario will happen under conditions of full integration, which is rare in practice. Moreover, most countries still far from reaching higher levels of integration. Thus, there are greater potential diversification benefits emanating from dual listed firms, especially in countries that are still at low levels of integration with international markets.

Thirdly, it can be argued using the behavioral view that, greater comovement between single and dual listed firms will occur if investors transmit market sentiment and market frictions between the two categories. Specifically, greater comovement will occur (1) if investors expand their interest from one category to another category, theory transmitting

investor sentiment, (2) if investor sentiment triggers mispricing in one category, thereby inviting pairs trading between the assets in two categories and (3) if market frictions cause weakening of distinctions between the two categories thereby making new information diffuse to both categories at more similar rates [44]. This will cause returns of single and dual listed firms to commove in the same direction. However, it should also be noted that sentiment driven movement results in excess comovement, is a temporary phenomenon rather than a permanent one. Moreover, in the extreme, a market sentiment can lead investors to focus on a single category and at the same time, category-specific market frictions can retard the diffusion of new information so that assets in different categories do not incorporate the new information at the same speed [45]. Thus, weak comovement may still observed, in the presence of sentiment-driven comovement implying that investors could still diversify their portfolios by investing across single and dual listed firms.

#### ***2.4. The Gap in Empirical Literature Regarding Comovement of Asset Returns Between Single and Dual Listed Firms***

Are there specific empirical studies that actually support the theoretical argument that portfolio diversification benefits can be realized by diversifying across countries? There is actually a huge gap in empirical literature regarding the comovement of asset returns between single and dual listed firms. This is because there is no empirical study that has specifically analyzed the comovement of asset returns between single and dual listed firms. Most studies of the comovement of asset returns have mainly focused on the international co-movement of asset returns that is comovement of asset returns across [1, 4, 5, 6, 7]. This is because there is overwhelming empirical evidence in financial literature that investors accrue significant diversification benefits if they invest their assets across countries [46].

In recent times though, studies on international the comovement of asset returns are being driven by the need to analyze and explore the role of integrated financial markets in the transmission of financial shocks across countries [17]<sup>11</sup>. This is because when stock markets are closely linked (or co-move together), there is a danger that shocks in one market may spill to the other markets [18]. In other words, integrated markets can be a channel through which financial crises can be spread. A significant number of studies have also focused on stock return comovement have been focused on investigating the presence of extreme co-movements in asset returns [8, 9, 10]. Thus, comovement of returns between single and dual listed firms remains largely unexplored.

<sup>9</sup> Integration of capital markets is defined as a situation where investors earn the same risk-adjusted expected return on similar financial instruments in different national markets, such that in a fully integrated market only the world-wide risk factors are priced and the price of risk is the same as worldwide [43].

<sup>10</sup> In fact, there is overwhelming evidence in literature of some equity markets in different countries sharing a common stochastic trend [42].

<sup>11</sup> The recent global financial crisis in particular has resulted in the growth of a body of literature that study the magnified inter-linkages between asset return comovement and volatility transmission across various markets. Another occurrence that intensified the need to understand international stock market co-movements and transmission mechanisms of shocks was Asian crisis in 1997 [17].

Despite the lack of past research that have specifically investigated the comovement between the single and dual listed firms, it is interesting to note that there have been some studies that at least have investigated comovement of asset returns among dual listed firms themselves. Much interestingly, several of these studies found evidence of common comovement within dual-listed firms. For example, Chan [47] investigated the causal relationship between the China's dual listed A and H shares<sup>12</sup>. Utilizing the co-integration and error-correction model (ECM), the results indicated that there is causal relationship between A and H shares, thereby implying common comovement within the dual listed stocks.

Pan et al [48] investigated the cointegration of the same Chinese A-shares with that of Hong Kong H-shares, and on how it relates to the functions of finance, including investment strategy and/or arbitrage. Unlike Chan et al [47], the researchers implemented Granger Causality (GE) and the Vector Error Correction Model (VECM) on 44 cross-listed firms. Their study confirmed the comovement of cross-listed companies under the application of VECM<sup>13</sup>.

Liebenberg [41] used the price differences in the Anglo American Plc. dual-listed stock prices on the LSE to measure their volatility spillover impact on the JSE. His study found evidence of both comovement and volatility spillover effects between the two markets. Essentially, the researcher's results confirmed that there is a long-run cointegration relationship between the Anglo American Plc. dual-listed stock prices on the JSE and the LSE.

These general empirical findings indicate that they may be common comovement among dually listed stocks might be significant<sup>14</sup>. This is because common comovement among dually listed stocks might tempt us to infer that dual listed stocks have a price pattern that is distinct from single listed stocks, implying that diversification benefits can be realized by investing across single and dual listed firms. However it is important to note that most of studies which analyzed comovement within dual listed firms were meant to analyze price discoveries and arbitrage opportunities that exist within

dual listed firms, and not comovement between dual listed firms with single listed firms. This means that these empirical findings cannot be used to infer the nature of the comovement between single and dual listed firms. Thus, the comovement between returns of single and dual listed firms can still be regarded as being largely unexplored and this gap in literature forms the basis of this study.

### 3. Methodology

#### 3.1. Model

We estimated a regression model that relates the returns of single listed firms with the returns of dual listed firms. Formulating an econometric regression model that relates the returns of single listed firms with the returns of dual listed firms within a single stock exchange was not easy because it was difficult to determine which variable between the returns of single listed firms and the returns of dual listed firms to take as the dependent variable and the independent variable. To solve this problem, we decided followed the same process undertaken by Chow et al [49] in formulating regression models to study the economic integration of East Asian economies among one another and with the United States using co-movement of stock market prices<sup>15</sup>.

Using the process, we formulated a model in which the returns of dual listed firms are regressed on the returns of single listed firms as follows:

$$R_t^* = \alpha + \beta R_t + \varepsilon_t \quad (1)$$

Where:

$R_t$  are the returns of a dual listed firms at time t

$R_t^*$  are the returns of single listed firms at time t

$\varepsilon_t$  is the error term of an ith firm at time t

We then formulated another model in which returns of single listed firms were regressed against the returns of dual listed firms as follows:

$$R_t = \alpha + \beta R_t^* + \varepsilon_t \quad (2)$$

#### 3.2. Data

We collected monthly stock indices data (DCI and FCI) data for the period January 2009 to December 2013 and used it to compute monthly returns for the single and dual listed firm on the BSE. The monthly stock indices data was collected for free from the Bank of Botswana website. We used the following formula to compute the returns of single listed firms, using stock indices data:

$$R_t = \frac{DCI_t - DCI_{t-1}}{DCI_{t-1}} \times 100 \quad (3)$$

Where:

$R_t$  is the aggregate return of single listed firms at time t

12 The A-class shares are stocks listed locally in Mainland China and only domestic investors are allowed to trade them. They are issued by Chinese firms listed on Shanghai and Shenzhen exchanges. The B-class shares are also stocks listed locally in Mainland China, but designated for both foreign and domestic investors with appropriate foreign currency dealing accounts. They are also traded on both Shanghai and Shenzhen exchanges. The H-class shares are stocks for companies that are incorporated in Mainland China but listed on the Hong Kong stock exchange, although there are now some Chinese stocks traded on the New York, Singapore and London stock exchanges. Many H-share issuing companies are dual-listed, that is they simultaneously listed A-shares on either the Shanghai or the Shenzhen exchanges' [48].

13 Their results also indicate an expected degree of correlation between the two equity markets in the short-term and co integration for the firms sampled in the two equity markets in the long-term [48].

14 It is important to note that there are some empirical studies that did not find common comovement among dually listed stocks. For example, Han et al [50] and Yeung and Zhou [51] found very little comovement between A and H shares dual listed on the Shanghai or Shenzhen stock exchange and the Hong Kong Stock Exchange.

15 Chow et al [49] firstly regressed rate of return in domestic market on the return in a foreign market and then regressed the rate of return in a foreign market on the return in a domestic market.

$DCI_t$  is the domestic sector index at time t  
 $DCI_{t-1}$  is the domestic sector index at previous time (t-1)  
 Similarly, we computed the returns of dual listed firms as follows:

$$R_t^* = \frac{FCI_t - FCI_{t-1}}{FCI_{t-1}} \times 100 \tag{4}$$

Where:

$R_t^*$  is the aggregated return of dual listed firms at time t  
 $FCI_t$  is foreign sector index of dual listed firms at time t  
 $FCI_{t-1}$  is the foreign sector index at previous time (t-1)

### 3.3. Analysis Method

We firstly analysed the strength of the comovement of the returns of single and dual listed firms using the traditional correlation coefficient computed using the estimated regression model (s) coefficient of determination<sup>16</sup>. The ultimate aim was to determine there are potential diversification benefits that could be realized by investing across single and dual listed firms. evidence of weak comovement (correlation coefficient that is close to 0) imply that it is not possible to realize the diversification benefits and conversely, evidence of strong comovement (correlation coefficient close to 1) imply that there are potential diversification benefits that can be realized by investing across single and dual listed firms..

It is important to note that for diversification benefits to be realized, assets need only to be weakly correlated, but should also be negatively correlated. Therefore, to ascertain whether it is actually possible to reap diversification benefits by investing across single and dual listed firms on the BSE, we further analysed the direction of comovement of estimated regression models using the signs of the  $\beta$  coefficients. A positive  $\beta$  was to indicate that returns of single and dual listed firms move in the same direction. Conversely a negative  $\beta$  coefficient was to indicate that the returns of single and dual listed firms generally move in the opposite direction<sup>17</sup>.

## 4. Results and Discussion

We obtained the following results from estimating model (1) in which returns of dual listed firms ( $R_t^*$ ) were regressed on the returns of single listed firms ( $R_t$ ).

Model:

*Table 1. Summary Regression Results for Model (1).*

	Coefficient	Std. Error	t-Statistic	Prob.
$\alpha$	0.419965586	0.429839118	0.977029704	0.332612117
$\beta$	0.174909589	0.147801957	1.183405097	0.241476479

16 The correlation coefficient for a univariate model is basically the square root of the coefficient of determination.

17 The signs of  $\beta$  coefficients for both models should be the same since they measure the nature of the relationship between returns of single and dual listed firms i.e whether the relationship is positive or negative, which is not affected by the specification of the model.

$$R^2 = 0.023576382$$

We then obtained the following results, when model (2) was specified in the opposite direction, that is when returns of single listed firms ( $R_t$ ) were regressed on the returns of dual listed firms ( $R_t^*$ ).

*Table 2. Summary Regression Results for Model 2.*

	Coefficient	Std. Error	t-Statistic	Prob.
$\alpha$	0.516715476	0.374331741	1.380367786	0.172770554
$\beta$	0.134791819	0.113901672	1.183405097	0.241476479

$$R^2 = 0.023576382$$

The strength of the comovement was determined by using the correlation coefficient calculated using the square root of the coefficient of determination of the estimated models. We obtained the following coefficient of determination( $R^2$ ) for both estimated regression<sup>18</sup> on model 1 and 2.

The resultant correlation coefficient obtained by finding the square root of the coefficient of determination ( $R^2$ ) was as follows:

$$\rho = 0.15354603$$

The correlation coefficient value computed above is closer to 0, implying that the degree of comovement between returns of single and dual listed firms is weak. This essentially meant that returns of single and dual listed are weakly correlated such that it may be possible to reap diversification benefits by diversifying across single and dual listed firms within a single stock exchange. The results are consistent with our earlier argument that it may be possible to diversify across single and dual listed firms because they tend to display common but distinct risk and return patterns, emanating from their exposure to economic conditions of different countries. In this case, single listed firms on the BSE are exposed to Botswana economic environment only whilst dual secondary listed firms are exposed to the Botswana economic environment and as well as their country of origin. This makes dual listed firms and single listed firms have common but distinct risk return pattern which investor can exploit to diversify their portfolios.

The weak correlation discovered between single and dual listed firms on the BSE does not conclusively imply it is possible to diversify across single and dual listed firms on the BSE. The results only implied that it may be possible to diversify across single and dual listed firms, taking advantage of weak correlation. There was need to check the direction of the comovement to be able to arrive at such a conclusion. Our further analysis of the direction of comovement using the signs of the  $\beta$  coefficients in the regression mode showed that there is positive comovement between returns of single and dual listed firms (see Table 3 below) thereby implying that the

18 Refer to Section 4.2. Results and Analysis of Estimated Regression Models.

returns of single and dual listed firms move in the same direction. Since diversification benefits can be only be realized if assets are both weakly and negatively correlated, we concluded that it is not possible to reap diversification benefits by investing across single and dual listed firms. Therefore, even if there is evidence of weak comovement which implied there may be potential diversification benefits, the fact that the direction of comovement is positive negate the realization of such benefits.

What may have caused the positive comovement? The positive comovement may well have been due to chance. But considering the period of analysis is relatively long, chance may not be a plausible explanation for such a finding. A more plausible explanation for the positive comovement found between single and dual listed firms may be that the economic factors of Botswana have a dominant influence on the stocks listed on its stock exchange such that they all tend to move in the same direction, irrespective of whether they are dual or single listed. As earlier explained, dual listed firms are exposed to economic condition of two different countries, but in a situation where a particular country factors in which the firm is dually listed have a dominant influence on the stock, it will commove in the same direction with other single listed stocks. Thus despite the weak correlation, the positive comovement caused probably by the dominant influence of a particular country will make it impossible to realize such diversification benefits.

*Table 3. Analysis of the Signs of  $\beta$  Coefficients.*

Regression Model	Sign of $\beta$	Direction of Comovement
Estimated Regression Model (1)	Positive	Positive Comovement
Estimated Regression Model (2)	Positive	Positive Comovement

## 5. Conclusion

We investigated the comovement between single and dual listed firms on the BSE with the intention of finding out if diversification benefits can be realized by diversifying across single and dual listed firms within a single stock exchange. Diversification benefits can be realized where assets are weakly and as well as negatively correlated. We found the returns of single and dual listed firms to be weakly but positively correlated. The finding that comovement between single and dual listed is weak implied that it is possible to reap diversification benefits by investing across single and dual listed firms. However, evidence of positive comovement implied that is not possible to reap diversification benefits by investing across single and dual listed firms. Although weak comovement indicate that it is possible to reap diversification benefits, evidence of positive comovement negate the realization of such potential diversification benefits that dual listing may presenting. Since, this study is specific to the Botswana environment; it may be inaccurate to conclude that it is entirely not possible to reap diversification benefits by investing across single and dual listed firms within a single stock exchange. Such a general conclusion will need further

studies in other stock exchanges. Thus, in order to substantiate these findings we suggest that further studies be undertaken in stock exchanges of other countries.

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