2.1 INTRODUCTION

In a seminal work, Miller & Modigliani (1961) demonstrate that, in an ideal economy characterized by the assumptions of perfect capital markets, rational behaviour and perfect certainty, given the investment policy, the dividend policy of a firm is irrelevant in firm valuation. Instead, it is the earning power of the assets and the investment policy of the firm that determines the firm value. One of the important assumptions on which Miller & Modigliani (1961) proposed the irrelevance concept is that, investment decisions of a firm are separable from its dividend decisions i.e. investment decisions of a firm should not be influenced by its dividend decisions, although dividend decisions may or may not be influenced by its investment decisions. Fama & Miller (1971) expressed views similar to that of Miller & Modigliani (1961) and termed the independence proposition between investment and dividend decisions as separation principle.

A differing view, put forth by Dhrymes & Kurz (1967), is that the investment and dividend decisions of firms are interdependent i.e. they are not separable. Dhrymes

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3 Perfect capital market is characterized by an equal and costless access to information about price and other details of shares, with no brokerage fees, no transfer taxes or other transaction costs and no tax differentials between dividends and capital gains. Rational behaviour implies that investors prefer more wealth and are indifferent to whether they receive income in the form of dividends or capital gains. By perfect certainty it means that, investors are assured of the future investment program of the firm and its future profits.

* A paper based on this chapter is published in Applied Financial Economics (Sanju et al., 2011)
& Kurz (1967) assert that, due to capital market imperfections, internal funds are a cheaper source of financing for firms compared to external finance. Firms therefore try to use the internal funds to meet their financial requirements; this results in a situation in which investment and dividend decisions compete for the funds available with the firm i.e. increased investments would reduce the funds available with the firm for dividend payments and vice-versa. This way, dividend and investment decisions become competitive and are thus interdependent; the investment decision of a firm would be influenced by its dividend decision and vice versa. This notion of Dhrymes & Kurz (1967) is in sharp contrast to what Miller & Modigliani (1961) assumed.

The above discussed arguments in favour of separation principle and in sharp contrast to it sparked off a debate in the finance literature, with the empirical investigation of the validity of separation principle yielding mixed evidence.

Few empirical studies have exhibited evidence in support of separation principle. Fama (1974) examined the extent to which investment and dividend decisions of American firms are interrelated and found that there is no association between investment and dividend decisions. Similar evidence of investment and dividend decisions being independent of each other is provided by McDonald et al (1975) for French firms.

Morgan & Saint-Pierre (1978) for Canadian firms found that dividend payments do not restrict the use of funds for investment. In a later study, Smirlock & Marshall (1983) for American firms also found evidence supporting separation principle. For a
sample of Australian firms, Partington (1985) found that investment and dividend decisions were made independent of each other. It is further reported that firms set desired levels of investment and dividend, and only if internal funds are not sufficient to meet these needs, external finance in the form of debt is sought. With the above discussed studies supporting separation principle, there are also studies in the literature that exhibit evidence in support of the notion that investment and dividend decisions are inseparable. Dhrymes & Kurz (1967) for American firms were the first to provide empirical evidence of interdependence between investment and dividend decisions. Similar evidence for American firms is provided by McCabe (1979).

Similarly, for Australian firms, Chiarella et al (1992) document that investment and dividend decisions are interrelated, a finding that violates separation principle. Abeyratna (1994) found that investment and dividend decisions of UK firms are not separable; instead, they compete for the funds available with the firm. Similar evidence of the interdependency between investment and dividend decisions is provided by Mougoué & Mukherjee (1994) and DeFusco et al (2007), who find evidence of bi-directional causality between investment and dividend decisions of American firms. Louton & Domian (1995) reported that there is unidirectional causality from dividend to investment for American firms.

A recent study by Bhaduri & Durai (2006) has tested the validity of separation principle for the Indian market. The study found that investment and dividend decisions are jointly determined, a finding that refutes separation principle. Unidirectional causality from dividend to investment is evident for high-growth
firms, whereas for low-growth firms, bi-directional causality between investment and dividend is found.

In the Indian context, Bhaduri & Durai (2006) is the only study that has examined separation principle by testing for causality between investment and dividend using panel data. The study has, however, ignored the test of cointegration between the variables and proceeded to the test of causality. Further, the study has focused on firms belonging to manufacturing sector alone.

In this chapter, an attempt is made to test whether separation principle holds good in the Indian market. To accomplish this, an error correction model is constructed, prior to which the unit root properties of the data and cointegration between the variables is tested. Further, the empirical investigation of separation principle is carried out for different sectors.

2.2 METHODOLOGY

The empirical investigation of separation principle is carried out in three steps. The first step is to assess the stationarity of data. To this end, the panel unit root tests are employed. This step is followed by the test of cointegration that examines whether a long-run equilibrium relationship exists between the variables under consideration. The third and final step involves testing for causality between the variables via an error correction model, if the variables under consideration are cointegrated.
2.2.1 PANEL UNIT ROOT TEST

To test for unit root in panel data, the Fisher type tests viz., Fisher-ADF and Fisher-PP test, proposed by Maddala & Wu (1999) are employed. These tests assume individual unit root process i.e. the autoregressive coefficient ($\rho_i$) is allowed to vary across the cross sections. In Fisher-ADF test, the augmented Dickey-Fuller (ADF) test is applied to each individual cross section $i$, and the $p$-values from the individual unit root test of each cross section are then combined to test for unit root in the panel.

Similar to Fisher-ADF test, the Fisher-PP test is also based on combination of the $p$-values from individual unit root test of each cross sectional unit. It employs Phillips-Perron individual unit root test to each cross section, instead of ADF test. The combination of $p$-values under both the tests is of the form given in equation (2.1).

$$p_\lambda = -2 \sum_{i=1}^N \log(\pi_i) \quad (2.1)$$

where $\pi_i$ is the $p$-value from the individual unit root test of cross-section $i$. The test statistic $p_\lambda$ follows $\chi^2$ distribution with $2N$ degrees of freedom.

The null hypothesis ($H_0$) being tested is that there is unit root for all the cross sections i.e. $H_0: \rho_i = \rho = 0$ for all $i$, and the alternative hypothesis ($H_1$) is that some cross sections do not have unit root i.e. $H_1: \rho_i = 0$ for some $i$ and $\rho_i < 0$ for the other $i$. 
2.2.2 PANEL COINTEGRATION TEST

To test for the existence of cointegration between the variables, the panel cointegration test developed by Pedroni (1999, 2004) is used. This test is a residual based test that allows for considerable heterogeneity among individual members of the panel. This test is an extension of the Engle & Granger (1987) two step residual based method for testing for cointegration in heterogeneous panels, that allows for individual member specific fixed effects, deterministic trends and slope coefficients.

To test whether there is a long-run relationship between investment \((I)\) and dividend \((D)\), the following relation is estimated.

\[
I_{i,t} = \alpha_i + \beta_i D_{i,t} + e_{i,t}
\]  

(2.2)

where \(\alpha_i\) is the member specific intercept; \(\beta_i\) is slope coefficient of \(i^{th}\) member; \(e_{i,t}\) is error term; \(i = 1, \ldots, N\); \(N\) is number of cross-sectional units; \(t = 1, \ldots, T\); \(T\) is the number of observations over time.

Investment and dividend in equation (2.2) are integrated of the same order and said to be cointegrated, if \(e_{i,t}\) is a stationary process; hence, testing for cointegration between investment and dividend involves testing for stationarity of \(e_{i,t}\). The stationarity of the residuals \(e_{i,t}\), is tested by estimating the following auxiliary regression:

\[
e_{i,t} = \rho_i e_{i,t-1} + u_{i,t}
\]  

(2.3)

In order to test for cointegration between a set of variables, Pedroni (1999) proposes two different sets of statistics, viz., panel cointegration statistics or within-dimension
statistics and group mean panel cointegration statistics or between-dimension statistics. There are a total of seven statistics of which four statistics viz., Panel Variance, Panel Rho, Panel PP and Panel ADF statistic are panel cointegration statistics, while the other three statistics viz., Group Rho, Group PP and Group ADF statistic are group mean panel cointegration statistics.

The null hypothesis in both the sets of statistics is that there is no cointegration i.e. \( H_0: \rho_i = 1 \) for all \( i \). The alternative hypothesis is, however, different for the two sets of statistics. In case of panel cointegration statistics, the alternative hypothesis is that there is cointegration between the variables for all members in the panel, i.e. \( H_1: \rho_i = \rho < 1 \) for all \( i \). Here, a common value is assumed for all \( \rho_i \)'s such that \( \rho_i = \rho \). In group mean panel cointegration statistics, the alternative hypothesis is \( H_1: \rho_i < 1 \) for all \( i \). Here, unlike panel cointegration statistics, a common value for \( \rho_i \) is not assumed. The group mean panel cointegration statistics, therefore, allows to model an additional source of potential heterogeneity across individual members of the panel.

### 2.2.3 FULLY MODIFIED ORDINARY LEAST SQUARES METHOD

If the variables of interest are cointegrated, the next step is to obtain the estimate of the cointegrating vector. The Ordinary Least Squares (OLS) method could be employed to estimate the cointegrating vector; however, the estimates so obtained would be biased due to the problems of endogeneity and serial correlation.

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4 These statistics are provided in Appendix II-A
In this regard, Pedroni (2000) has developed the Fully Modified Ordinary Least Squares (FMOLS) method for heterogeneous cointegrated panels that allows for considerable heterogeneity across individual members of the panel. This method takes care of the problems of serial correlation and endogeneity by using a serial correlation correction term and transformed endogenous variable in the conventional OLS estimator and produces unbiased estimates.

FMOLS produces two types of estimators, viz., the pooled panel or within dimension estimator and the group mean panel or between dimension estimator. The null hypothesis being tested under both the estimators is that the cointegrating parameter of each cross section $i$ ($\beta_i$) is equal to the hypothesized common value ($\beta_0$) i.e. $H_0: \beta_i = \beta_0$ for all $i$. The alternative hypothesis, however, varies for both these estimators. The alternative hypothesis in case of pooled panel estimator is $H_1: \beta_i = \beta_a \neq \beta_0$ for all $i$, where $\beta_0$ is the hypothesized common value for $\beta$ under the null, and $\beta_a$ is some alternative value for $\beta$ which is also common to all members of the panel.

Under the group mean estimator, the alternate hypothesis is $H_1: \beta_i \neq \beta_0$ for all $i$, where the values for $\beta$ are not necessarily constrained to be homogeneous across different members of the panel. The group mean estimator thus provides greater flexibility by allowing heterogeneity of the cointegrating vector.

### 2.2.4 PANEL VECTOR ERROR CORRECTION MODEL

If a set of variables are individually I (1) and a linear combination of them is I (0), then the variables can be represented by way of an error correction model. Canning & Pedroni (2008) constructs panel error correction model to estimate the direction of
long-run causality using a two-step procedure. In the first step, the cointegrating relationship is estimated using FMOLS method. Next, the disequilibrium term $\hat{e}_{it}$ is obtained from this estimated cointegrating relationship and the error correction model is then estimated. The bi-variate error correction for the variables investment ($I$) and dividend ($D$) is of the form given in equation (2.4).

$$\Delta l_{i,t} = c_{1i} + \lambda_{1i} \hat{e}_{i,t-1} + \sum_{j=1}^{k} \varphi_{11ij} \Delta l_{i,t-j} + \sum_{j=1}^{k} \varphi_{12ij} \Delta D_{i,t-j} + \varepsilon_{1i,t}$$

(2.4)

$$\Delta D_{i,t} = c_{2i} + \lambda_{2i} \hat{e}_{i,t-1} + \sum_{j=1}^{k} \varphi_{21ij} \Delta l_{i,t-j} + \sum_{j=1}^{k} \varphi_{22ij} \Delta D_{i,t-j} + \varepsilon_{2i,t}$$

where $\Delta$ is the first difference operator; $c_{1i}$ and $c_{2i}$ are the intercept terms; $\lambda_{1i}$ and $\lambda_{2i}$ are the speed of adjustment coefficients; $\hat{e}_{i,t-1}$ is the disequilibrium error, which is the residual from the cointegrating relationship; $\varphi$’s are the slope coefficients; $\varepsilon_{1i,t}$ and $\varepsilon_{2i,t}$ are white noise error terms.

The parameter $\lambda_{1i}$ indicates the presence or absence of long-run causality from dividend to investment, and $\lambda_{2i}$ indicates the presence or absence of long-run causality running from investment to dividend. Canning & Pedroni (2008) construct two tests, viz., group mean based test and lambda-Pearson test, to test for the existence of long-run causal relationship between the variables.

The group mean based test averages the individual $\lambda_{1i}$ and examines whether the long-run causal effect is zero on average for the panel. The group mean panel estimate for $\lambda_{1i}$ is computed as shown in equation (2.5)
\[
\tilde{\lambda}_1 = N^{-1} \sum_{i=1}^{N} \lambda_{1i}
\]  

(2.5)

The group mean panel test is computed as

\[
\tilde{\epsilon}_{\lambda_1} = N^{-1} \sum_{i=1}^{N} \epsilon_{\lambda_1i}
\]  

(2.6)

where, \(\epsilon_{\lambda_1i}\) is the individual t-statistic for the null hypothesis that \(\lambda_{1i} = 0\). Similarly, the group mean panel test is computed for \(\lambda_{2i}\). The test statistics \(\tilde{\epsilon}_{\lambda_1}\) and \(\tilde{\epsilon}_{\lambda_2}\) follow a standard normal distribution.

The Lambda-Pearson test examines whether the long-run causal effect is pervasively zero for the panel. It makes use of the probability value associated with t-statistic of each individual cross section and computes the test statistics for the panel as shown in equation (2.7).

\[
P_{\lambda_1} = -2 \sum_{i=1}^{N} \ln p_{\lambda_{1i}}
\]  

(2.7)

where, \(\ln p_{\lambda_{1i}}\) is the log of the \(p\) value associated with t-test of each individual cross section, for the null hypothesis that \(\lambda_{1i} = 0\). Similarly, the lambda-Pearson test is computed for \(\lambda_{2i}\). The test statistics \(P_{\lambda_1}\) and \(P_{\lambda_2}\) are distributed as a \(\chi^2\) with \(2N\) degrees of freedom.

### 2.3 Empirical Results

The empirical investigation of separation principle has been carried out using panel data consisting of annual time series data over the period 1999-2008 and cross section data pertaining to three sectors. As initial sample, all the sectoral indices of
National Stock Exchange (NSE) were considered, which yielded a total of ten sectors. Of these, only those sectors that had a minimum of eight firms with continuous annual data on investment and dividend over the sample period were considered. This screening yielded a final sample of three sectors, the details of which are given in Table 2.1.

### Table 2.1: Details of final sample

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Sector</th>
<th>No. of firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PSE</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>PSU Bank</td>
<td>08</td>
</tr>
<tr>
<td>3</td>
<td>Service</td>
<td>13</td>
</tr>
</tbody>
</table>

*Note: PSE – Public Sector Enterprises; PSU – Public Sector Undertaking*

Dividend is measured as the amount of annual equity dividend paid by the firm and investment is measured as the sum of the investments made in gross land and building, plant and machinery, transport and communication equipment, furniture, social amenities and other fixed assets. The investment and dividend series is log transformed. The required data is collected from Prowess database, provided by the Centre for Monitoring Indian Economy (CMIE).

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3 National Stock Exchange (NSE) is the leading stock exchange in India that operates in more than 1,500 locations with more than 2,30,000 terminals. The features of NSE are transparency, speed & efficiency, safety and market integrity. The exchange has to its credit state-of-art technology that offers an efficient and transparent trading, clearing and settlement mechanism. It provides a modern and fully automated screen-based trading system called ‘National Exchange for Automated Trading’ (NEAT) system and trading takes place through approved workstations, located at different places. NSE offers the following products: equities, derivatives, debt.

6 List of the sample firms under each sector is provided in Appendix II-B.
2.3.1 PANEL UNIT ROOT TEST RESULTS

The results of Fisher-ADF and Fisher-PP test for the variable investment are reported in Table 2.2\(^7\). For the sectors under consideration, the test results fail to reject the null hypothesis that investment in level is non stationary. This necessitates testing for stationarity of investment in first difference; upon testing, it is found that investment in first difference is stationary for all the sectors under consideration. These findings reveal that investment data pertaining to each of the sectors under consideration follow an I (1) process.

Table 2.2: Panel Unit Root Test Results for Investment

Null hypothesis (H\(_0\)): Investment series has unit root

<table>
<thead>
<tr>
<th>Sector</th>
<th>Investment in Level</th>
<th>Investment in First Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fisher-ADF test</td>
<td>Fisher-PP test</td>
</tr>
<tr>
<td>PSE</td>
<td>9.53 (1.00)</td>
<td>9.76 (1.00)</td>
</tr>
<tr>
<td>PSU Bank</td>
<td>3.71 (1.00)</td>
<td>3.86 (1.00)</td>
</tr>
<tr>
<td>Service</td>
<td>5.49 (1.00)</td>
<td>4.54 (1.00)</td>
</tr>
</tbody>
</table>

*Note: Numbers in (#) are p-values; PSE – Public Sector Enterprises; PSU – Public Sector Undertaking*

Table 2.3 reports the results of panel unit root test for the variable dividend. For all the sectors under consideration, the results of Fisher-ADF and Fisher-PP test for dividend in level fail to reject the null hypothesis that dividend in level is nonstationary. Hence, dividend in first difference is tested for stationarity. As is evident from the table, for each of the chosen sectors, the null hypothesis is rejected

\(^7\) The panel unit root tests have been carried out in Eviews.
for dividend in first difference, implying that dividend becomes stationary upon first differencing. The results of table 2.3 thus indicate that dividend follows an I (1) process, for all the sectors under consideration.

**Table 2.3: Panel Unit Root Test Results for Dividend**

<table>
<thead>
<tr>
<th>Sector</th>
<th>Dividend in Level</th>
<th>Dividend in First Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fisher-ADF test</td>
<td>Fisher-PP test</td>
</tr>
<tr>
<td></td>
<td>Fisher-ADF test</td>
<td>Fisher-PP test</td>
</tr>
<tr>
<td>PSE</td>
<td>3.36 (1.00)</td>
<td>4.11 (1.00)</td>
</tr>
<tr>
<td></td>
<td>92.60 (0.00)</td>
<td>101.25 (0.00)</td>
</tr>
<tr>
<td>PSU Bank</td>
<td>0.71 (1.00)</td>
<td>0.42 (1.00)</td>
</tr>
<tr>
<td></td>
<td>58.88 (0.00)</td>
<td>65.63 (0.00)</td>
</tr>
<tr>
<td>Service</td>
<td>0.78 (1.00)</td>
<td>0.48 (1.00)</td>
</tr>
<tr>
<td></td>
<td>53.59 (0.00)</td>
<td>69.74 (0.00)</td>
</tr>
</tbody>
</table>

*Note: Numbers in (#) are p-values; PSE – Public Sector Enterprises; PSU – Public Sector Undertaking*

The results of the Fisher-ADF and Fisher-PP test (tables 2 and 3) reveal that both investment and dividend series are integrated of order one. Having established the stationarity of the data, the panel cointegration test is employed to test whether the variables investment and dividend are cointegrated or not, the results of which are reported in Table 2.4⁸⁻⁹.

### 2.3.2 PANEL COINTEGRATION TEST RESULTS

The results of Group-ADF test statistic contained in table 2.4 indicate that, for each of the sectors under consideration, the null hypothesis that there is no cointegration

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⁸ Panel-ADF and Group-ADF statistics have better small sample properties as compared to other statistics (Lee and Chang, 2008). Of these two statistics, the group-ADF statistic allows potential heterogeneity across individual members of the panel. Hence, the Group-ADF test statistic is considered for the test of cointegration.

⁹ The panel cointegration test is performed in Eviews.
between investment and dividend is rejected. This indicates that the variables investment and dividend are cointegrated i.e. a long-run equilibrium relationship exists between investment and dividend.

**Table 2.4: Panel Cointegration Test Results**
Null hypothesis (H₀): No cointegration

<table>
<thead>
<tr>
<th>Sector</th>
<th>Group-ADF test statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSE</td>
<td>-5.34 (0.00)</td>
</tr>
<tr>
<td>PSU Bank</td>
<td>-3.77 (0.00)</td>
</tr>
<tr>
<td>Service</td>
<td>-6.89 (0.00)</td>
</tr>
</tbody>
</table>

*Note:* Numbers in (#) are *p*-values; PSE – Public Sector Enterprises; PSU – Public Sector Undertaking

### 2.3.3 GROUP MEAN PANEL FMOLS RESULTS

The investment and dividend series being cointegrated, the group mean panel FMOLS method is employed to obtain the estimate of the cointegrating parameter. The estimate of the cointegrating parameter and the corresponding t-statistics for the sectors under consideration are reported in Table 2.5.¹⁰

**Table 2.5: Group-mean panel FMOLS Results**

<table>
<thead>
<tr>
<th>Sector</th>
<th>β coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSE</td>
<td>0.41 [4.92]***</td>
</tr>
<tr>
<td>PSU Bank</td>
<td>0.80 [7.29]***</td>
</tr>
<tr>
<td>Service</td>
<td>0.11 [2.14]**</td>
</tr>
</tbody>
</table>

¹⁰The estimates are obtained using the RATS code provided by Peter Pedroni.
Note: Numbers in [#] are t-values; PSE – Public Sector Enterprises; PSU – Public Sector Undertaking; β is the cointegrating parameter; *** and ** denote significance at 1% and 5% level respectively.

The group mean panel FMOLS results reported in Table 2.5 indicate that the coefficient β is positive and significant, for each of the sectors under consideration. This implies that dividend has a significant and positive impact on investment.

2.3.4 PANEL LONG-RUN CAUSALITY TEST RESULTS

The final step is to infer the direction of causality between investment and dividend by estimating the error correction model. To this end, the error correction model of the form given in equation (2.4) is estimated and the results are reported in Table 2.6.

Table 2.6: Panel Long-run Causality Test Results

Null Hypothesis (H₀):
\[ \lambda_1 - \text{Dividend has no long-run causal effect on investment} \]
\[ \lambda_2 - \text{Investment has no long-run causal effect on dividend} \]

<table>
<thead>
<tr>
<th>Sector</th>
<th>( \lambda_1 ): ( D_{i,t} \rightarrow I_{i,t} )</th>
<th>( \lambda_2 ): ( I_{i,t} \rightarrow D_{i,t} )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimate</td>
<td>Test</td>
</tr>
<tr>
<td>PSE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Mean</td>
<td>-0.90</td>
<td>-3.27</td>
</tr>
<tr>
<td>Lambda-Pearson</td>
<td>-</td>
<td>688.33</td>
</tr>
<tr>
<td>PSU BANK</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Mean</td>
<td>-0.94</td>
<td>-1.87</td>
</tr>
<tr>
<td>Lambda-Pearson</td>
<td>-</td>
<td>88.50</td>
</tr>
<tr>
<td>SERVICE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group Mean</td>
<td>-0.71</td>
<td>-3.72</td>
</tr>
<tr>
<td>Lambda-Pearson</td>
<td>-</td>
<td>814.71</td>
</tr>
</tbody>
</table>
Note: $D$ – Dividend; $I$ – Investment; PSE – Public Sector Enterprises; PSU – Public Sector Undertaking

The parameter $\lambda_1$ reported in table 2.6 indicates the long-run causal effect of dividend on investment. For each of the sectors under consideration, the results of group mean based test reject the null hypothesis that dividend has a zero average long-run effect on investment. The lambda-Pearson based test yields similar results; the null hypothesis that the long-run effect of dividend on investment is pervasively zero is rejected for all the chosen sectors. These results indicate that, for each of the chosen sectors, dividend has long-run causal effect on investment.

The long-run causal effect of investment on dividend is captured through the parameter $\lambda_2$. In case of PSU Bank sector, both the group mean based test and lambda-Pearson based test reject the null hypothesis, implying that investment has long-run causal effect on dividend. For the sectors PSE and service, while the group mean based test fails to reject the null that investment has a zero average long-run effect on dividend, the lambda-Pearson based test rejects the null hypothesis that the long run effect of investment on dividend is pervasively zero.

This variation in the results of group mean based test and lambda-Pearson based test can occur when the values of individual $\lambda$’s are significantly positive for some fraction of the panel and significantly negative for the remaining portion of the panel. In such situations, it can be inferred that a long run causal effect is present, even though it is positive for some members of the panel and negative for others (Canning and Pedroni, 2008). The test results of $\lambda_2$ thus indicate that, for the chosen sectors, investment has long-run causal effect on dividend.
The finding of the existence of long-run causal effect of dividend on investment and investment on dividend indicates that there exists bi-directional long-run causality between investment and dividend for each of the chosen sectors. This finding of bi-directional long-run causality implies that, in the Indian context, the investment and dividend decisions of firms are interdependent\(^{11}\). Separation principle, therefore, does not hold in the Indian market.

### 2.4 CONCLUSION

Separation principle asserts that investment and dividend decisions of a firm are separable i.e. these decisions are made independent of each other. However, the empirical examination of the validity of separation principle has yielded mixed evidence, with some studies providing evidence in support of separation principle, and some providing contradictory evidence. With no consensus arrived at, this issue remains debatable providing scope for its empirical investigation. This chapter attempted to test the validity of separation principle for the Indian market.

To test whether separation principle holds in the Indian market, panel data consisting of cross section data pertaining to three sectors, viz., PSE, PSU Bank and Service and annual time series data over the period 1999-2008 is used. The empirical investigation of this issue is carried out using panel unit root tests, panel cointegration test, FMOLS method and panel error correction model. The results of error correction model indicate that there is bi-directional long-run causality between investment and dividend, for each of the chosen sectors. This finding reveals that

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\(^{11}\) Similar evidence is reported by Bhaduri & Durai (2006) for Indian market.
investment and dividend decisions of firms are interdependent. Separation principle, therefore, does not hold in the Indian market.