

## PARTIAL – ADJUSTMENT – MODELS OF DEIVIDEND POLICY BEHAVIOUR FOR INDUSTRIAL JORDANIAN FIRMS

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### Abstract

This study examined the inter-temporal Dividend-Per-Share (DPS) behaviour. The estimated partial-adjustment-models included Lintner's (1956), Darling's (1957) and Brittain's (1966) models. The results reported from the partial-adjustment-models indicated that Lintner's model was the best-fit model for Jordanian firms. Previous dividends and current earnings had the most influence on the DPS inter-temporal behaviour, indicating that Jordanian firms follow a persistent dividend policy. While dividends are persistent, Jordanian firms smooth dividends less than their counterparts in developed markets.

**Keywords:** Lintner Model, Brittain Model, Darling Model, Jordan, Panel Data, Dynamic Panel Data, SYS-GMM, Tobit

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### 1. Introduction

Financial markets play a crucial role in facilitating the intermediation between savers and borrowers, thereby helping translate savings into investments. The more efficient this process is, the less the cost of investing, and subsequently, the higher the rate of investment/saving. The development of stock exchanges is crucial to achieve economic growth for developing economies. The increasing globalisation of financial markets has heightened interest in emerging markets. However, much of the research in accounting and finance has focused on developed markets, in particular, the US and European markets. The assumptions which underpin the models employed in developed markets provide a challenge when examining emerging markets such as Jordan.

The topic of dividend policy remains one of the most controversial issues in corporate finance. For more than half a century financial economists have engaged in modelling and examining corporate payout policy. Research into dividend policy has shown not only that a general theory of dividend policy remains elusive, but also that corporate dividend practice varies over time, between firms and across countries, especially between developed and emerging capital markets (Glen *et al.* (1995)). On average, dividend payout ratios in developing countries are only about two thirds that of developed countries. Therefore, firms in emerging capital markets face more financial constraints and limited resources to finance their

investment opportunities, which may result in more reliance on retained earnings and accordingly lower payout ratios. This explanation is largely speculative, since little research has been done on dividend policy in emerging equity markets.

Inter-temporal behaviour studies provide the opportunity to understand the markets' assessment of dividend payments, and consequently, to help for a better understanding of the dividend policies of Jordanian firms. This is important for investors, regulators, and management. However, the passage of time and methodological developments now call for a further contribution to the existing Jordanian evidence. The major contribution to Jordanian literature was provided by Omet and Abu-Ruman (2003) and Omet (2004). This study follows the econometric approach to study the inter-temporal behaviour of dividend policies for Jordanian firms. Specifically, this study builds upon Omet (2004). Omet applied Lintner's model to examine the inter-temporal behaviour of dividend policies for a sample of Jordanian firms, whereas this study will test the applicability of three partial-adjustment-models: Lintner's, Darling's and Brittain's models. Omet estimated Lintner's model using the Fixed-Effect and Random-Effects estimators. These estimators fail to account for the dynamic specification of Lintner's model which biases the coefficient estimates. Consequently, this affects the computation of the speed-of-adjustment and the implicitly-target-payout-ratio parameters and the conclusion drawn with

respect to the stability of dividend payments. This study will correct these misspecifications by using the Dynamic-Panel-Data approach, including the GMM-SYS estimators. Furthermore, partial-adjustment-models in this study will be adjusted to account for Non-Paying-Dividend firms along with Paying-Dividend firms, which mitigate the potential for sample selection bias. Using the GMM-SYS estimator mitigates the bias associated with unobserved heterogeneity and controls for endogeneity. This has the potential to impact upon the absolute value of the point estimates and their significance, and the subsequent economic interpretation.

The remainder of this study is structured in the following manner. Section 2 reviews the literature. Section 3 highlights the variable definitions and hypothesis development. Section 4 provides the sample selection, with section 5 introduces the methodological approach. Section 6 discusses the results. The final section provides the conclusion of this study.

## 2. Literature Review

The partial-adjustment-models have been developed under two methodological approaches. The first surveyed Chief Executive Officers (CEO) and Chief Financial officers (CFO) to assess their views on the inter-temporal behaviour of dividend payments. The second developed econometric models to examine empirically dividend-payments-behaviour. The seminal work was conducted by Lintner (1956), who used both approaches. First, he interviewed the management of twenty-eight firms to determine the factors they considered important in setting the firm's dividend payments. He found that management sought to avoid increases in dividend payments that might have to be reversed in future. Next, Lintner developed an econometric model to explain dividend behaviour. His equation was fitted to aggregate economic data taken from the national income accounts for the period 1918 to 1941, and was tested on similar data from the period 1918 to 1951. Lintner (1956) also tested the model on each of the twenty-eight companies which were polled in the earlier part of his study. Although the model was aggregative, it proved accurate in explaining the dividend action of the twenty-eight companies he surveyed. His empirical study found that corporations determine a target DPR and that dividend policy is adjusted according to the target DPR, which was determined in a way that the corporation can sustain its capital investments and could achieve its target growth in the long-run. Additionally, Lintner found that corporations follow stable dividend policies and in a case of a substantial increase in earnings, dividends are not increased by a substantial amount, but they are gradually increased proportional to the target DPR. He also reported that managers believe that investors prefer corporations that followed stable dividend policies. Corporations do not tend to decrease

dividends and even if there is a downturn in earnings, corporations try to pay out the same level of dividends that was distributed in previous years. Any change in the dividend amount is based on a substantive change in the corporation's operations and corporations only increase dividends when management believes that there is a permanent increase in earnings. If there is an indication that corporations will not be able to maintain the change in the dividend policy, corporations will not implement the change.

Despite the major contribution of Lintner's research, the study fails to fully inform the reader of all the factors which were investigated or to divulge the relative importance of the factors in the determination of dividend policy. However, Brittain (1964) pointed out that the ability of Lintner's model to explain dividends over a long time period during which everything else in the economy has changed is grounds for suspicion of the results, rather than satisfaction. Specifically, the major weakness is attributed to reliance on aggregate data taken from national income accounts relating dividends directly to profits-after-tax. This may be appropriate for selected time periods to which the model is applied; however, since the beginning of the World War II, liberalised amortisation provisions have largely obscured the meaning of tax-return data. For example, since the World War II the dividend to net-profit-ratio has doubled while the ratio of dividends to cash flow has remained remarkably stable at about 30% (Brittain, 1964). La Porta *et al.* (1999) reported the ratio of dividends to cash flow for US firms was 11.38%, which is less than the ratio reported by Brittain in 1964, whereas the ratio of dividend to net-profit was 22.11%. Lintner (1956) reported the ratio of dividends to net-profit of 22.5%.

In the study which followed Lintner's (1956) effort, Darling (1957) proposed a theory to explain how dividend decisions are made. He argued that a target payout-ratio and speed-of-adjustment factor could not give proper weight to all the factors which might be expected to affect dividend decisions. He proposed more elaborate hypotheses to explain dividend behaviour but did not alter Lintner's primary emphasis on payout-ratio as the central element in dividend policy. Therefore, Darling (1957) modified Lintner's basic formulation to include expectations and liquidity in the determination of dividend policy. Darling (1957) based his work on the presumption that the ultimate goal of the management group is to maintain, and if possible enlarge, its control over corporate affairs. He further theorised that this goal depends on the growth of the firm relative to the rest of industry, the degree of liquidity maintained by the firm, and the extent of dispersion of stock ownership. Darling (1957) proposed a more complete explanation of dividend behaviour without changing Lintner's principal emphasis. Moreover, Darling mainly focused on managerial expectations and attitudes towards liquidity; but he hoped to gain an understanding of these by studying fluctuations in the

dividend-flow. Darling hypothesised that dividends are a function of current investment and current use of external funds as well as past dividends and current earnings.

Darling used aggregate time series data as Lintner did. He assumed the aggregate time series data, which he used for each of his variables, could be used as a collection of observations on individual firms. To be consistent he should have used an aggregate time series data for external funds and as well as an 'interest rate variable'. It can not be assumed that in each year the individual firms in Darling's aggregate data absorbed the same proportion of external funds; or, more importantly that none of these firms absorbed any external funds as is implied by his omission of them. Moreover, the aggregate time-series data which Darling used simply do not bear on his hypothesis of 'how dividend decision be made' within the individual firm. The criticism made of this methodological procedure in the work of Lintner applies with equal force here. Thus, despite Darling's effort, Michaelsen (1961) argued that Darling did not provide a satisfactory explanation of dividend behaviour than Lintner's did. Therefore, the conclusion of Darling's effort was that the current profit and lagged profit would offer a better explanation to the current levels of dividends and, moreover, two variables were added to his model to control for sources of funds and working capital requirements, these are depreciation and change in sales, respectively.

The early models were extended in subsequent empirical literature. Two approaches have been used: quantitative, using econometric models, and survey methodology. Fama and Babiak (1968) based their work on the partial-adjusted-model of Lintner (1956) and the extended work of Brittain (1966). They examined the dividend policy of 392 US industrial firms over a period of 19 years (1946-1964). The two variables in Lintner's model - lagged-dividends ( $D_{t-1}$ ) and current earnings ( $E_t$ ) - including a constant term performed well relative to other models which included either cash flow or net-income and depreciation as separate variables. Their study was based on examining the dividend policies of individual firms rather than aggregate dividends and also used per-share data. Finally, in the models tested by Fama and Babiak, serial dependence in the disturbances did not seem to be a serious problem, suggesting that omitted variables bias was not on issue.

Lintner's original findings were supported in later empirical works. Healy and Palepu (1988) examined earnings information conveyed by dividend initiations and omissions. Their results indicated that firms that initiate and omit dividends have significant increases and decreases in their annual earnings for at least one year before and the year of the dividend policy change. They reported that these findings are consistent with those reported by Lintner (1956),

Fama and Babiak (1968) and Watts (1973), and suggested that dividend initiations and omissions can be predicted by changes in past and current earnings. Benartzi *et al.* (1997) conclude that Lintner's model of dividends remains the best description of the dividend setting process available. They investigated the information content of dividend changes on future earnings of firms, and reported that their results were consistent with Lintner's model on dividend policy. They reported that firms which increase dividends are less likely than non-changing firms to experience a drop in future earnings. Another strand of empirical literatures have used Lintner's model to test dividend policy hypotheses. For example, Fama and French (2002) use Lintner-like specifications to test the implications of the pecking order theory of capital structure. Short *et al.* (2002) used Lintner's model to test the link between dividend policy and institutional ownership.

Dewenter and Warther (1998) used Lintner's model and apply it to a sample of US and Japanese corporations. For the time period 1982-1993, they found that US managers smooth out the dividends even more compared to the period of 1946-1964 in Fama and Babiak's study. The analysis reported that US firms change their dividends more frequently than Japanese firms and the speed-of-adjustment parameter estimates from Lintner's model indicated that Japanese firms adjusted dividends more quickly than US firms and therefore, Japanese dividend policy contains less information and is more responsive to performance than US dividend policy. Moreover, Japanese corporations are more willing to omit dividends and follow relatively less stable dividend policy compared to their US counterparts. Recently, Dai (2005) examined Norwegian data for the period 1989 to 2002 to test the determinants of the dividend payout policy. He focused on the tax-clientele model and the incomplete-contract-theory for dividends modifying Lintner's model. Dai reported that firm's decision to pay, and the level of payouts, are both significantly positively associated with past payouts and current earning of the firm which is consistent with Lintner. Since 1999 repurchases was introduced in Oslo Stock Exchange, and the amount of stock repurchases as a percentage of cash dividends rose from 25% in 1999 to 44% in 2001. Even though, Dai did not consider the effect of repurchases in his model and argued that this increase is related to liquidity supply and price support by the firms after the stock market crisis since September 11. Again the conclusion from the empirical literature gave a support to Lintner's model, and the results reported were consistent with those of Lintner.

The use of share repurchases, relative to dividends, as a payout policy was examined by Brav *et al.* (2005). The primary focus of their paper was to ascertain US managements' view on the motives behind the use of share repurchases as a means of returning value to investors. They identified key factors that influenced repurchases policy. Their

findings indicated that maintaining the dividend level is on a par with investment decisions, while repurchases are made out of the residual cash flow after investment spending. They argued that managers favour repurchases because they are viewed as being more flexible than dividends and can be used in attempt to time the equity market or to increase earnings-per-share. Given the enduring nature of Lintner's model in the empirical literature, they specifically examined manager's views on the contemporary applicability of Lintner's model. They reported that even after 50 years, Lintner's model is valid, but the link between dividends and earnings has weakened.

Studies of emerging markets have also adapted the two approaches employed by their counterparts in the developed markets: surveying managers' views and econometric modelling. Aivazian *et al.* (2003) provide a global analysis of the dividend policy behaviour for developed and emerging markets. They examined the dividend behaviour of firms operating in eight developing countries as well as 100 US firms over the time period 1981-1990. Aivazian *et al.* (2003) reported different levels of dividend stability. For example, the coefficient estimates of lagged-dividends for a sample of US firms ranged between 0.834 and 0.809, while in Turkey it ranged from 0.083 to 0.120 and from 0.611 to 0.580 in Zimbabwe. The results for Turkey were readily explained by the dividend payment regulations, while it was puzzling that among his sample of developing countries, Zimbabwe and Jordan displayed the 'stickiest' dividends, since both countries measured very poorly on his measures of financial market development.

The previous studies provide a global investigation of dividend policies for different emerging markets, whereas a number of researchers have focused on individual markets. Adaoglu (2000) tested Lintner's model for a sample of Turkish firms. The empirical analysis focused on two time periods: 1985-1994 and 1995-1997, as there was a significant change in the dividend regulations, which provided extensive flexibility in dividend policy decision making. He modified Lintner's model by applying dividend-per-share instead of dividend payments, and earning-per-share instead of the firm's profit following Fama and Babiak (1968). During both time periods, he found that Turkish firms followed unstable dividend policies, lending support to the suggesting that firms followed a residual dividend policy. Adaoglu reported that the main factor that determined the amount of cash dividends that will be distributed was the earnings of the corporation in that year. Mullah (2001) examined the dividend payout behaviour for 51 non-financial companies listed on the Bangladeshi market from 1988 to 1997. Mullah supported Lintner's partial-adjustment-model, but found that Brittain's dividend behavioural model was found to have the best-fit. Pandey (2001) examined the dividend policy behaviour of Malaysian companies. His results highlighted the influence of

industry on payout ratios, suggesting that payout ratios vary significantly across time. His results from multinomial logit analysis reveal that the dividend policy behaviour of Malaysian companies is sensitive to the changes in earnings. Employing Lintner's (1956) model and panel regression methodology, he found evidence of less stable dividend policies being pursued by Malaysian companies.

While there is a plethora of empirical evidence examining the inter-temporal behaviour of dividend policies in developed and emerging markets, the evidence for the Jordanian market is limited. Omet and Abu-Ruman (2003) surveyed the CFOs of 47 Jordanian manufacturing firms. Their survey results produced evidence that Jordanian financial managers viewed dividends as a signalling device, with 76 percent of the respondents agreeing that firms use dividends to convey information about their prospects. Also, 67 percent of the respondents agreed with the contention that dividend changes affected share prices. Omet and Abu-Ruman argued that these findings were consistent with the signalling hypothesis. They also reported that CFOs believed that current earnings, along with previous dividend levels, determined current dividend payments, but current earnings were more influential than lagged-dividends when setting the firm's current dividend policy. In contrast, Omet (2004) adopted the econometric approach to examine the inter-temporal behaviour of Jordanian firms' dividend payments. Omet addressed three issues. First, the degree of stability of Jordanian listed firms' cash dividend policies. Second, whether current dividends were more sensitive to past dividends or current earnings? Third, if the introduction of the 1996 dividend tax had any impact on the dividend behaviour of listed firms. The time period of study spanned from 1985 to 1999. The research period was divided into two sub-periods: 1985-1995 and 1996-1999, to account for the dividend tax introduced in 1996. Lintner's model was applied to a sample of 44 Jordanian firms, which was estimated using the Fixed-Effect and Random-Effects estimators. Omet reported point estimates for the lagged-dividend-per-share of 0.48 and earning-per-share of 0.041, both of which were significant at the 1 percent level. He concluded that these results provide evidence that Jordanian firms followed an independent dividend policy. He also reported a speed-of-adjustment factor of 0.52, indicating that Jordanian firms smooth their dividends but less than for firms in developed markets. Regarding his second issue, Omet reported that lagged-dividend-per-share was more important than current earnings-per-share in determining current dividend-per-share. Finally, Omet reported that the imposition of tax on dividends had no impact on the dividend behaviour for the sampled firms.

### 3. Variables Definition and Hypothesis Development

Following on from the literature review in section 2, three models are employed to examine inter-temporal dividend behaviour. These are Lintner's model, Darling's model and Brittain's model. Per-share data is used in this study in order to account for frequent capital increases. Adaoglu (2000), Aivazian *et al.* (2003) and Omet (2004) applied Lintner's model adjusted to per-share data, while Mullah (2001) scaled the dividends to sales rather than using the outstanding shares. A dummy variable is added to the model to control for firms where DPS was zero. The first model, therefore, is as follows:

$$DPS_{it} = \alpha_{i,t} + \beta_{1L}EPS_{it} + \beta_{2L}LDPS_{it} + \beta_{3L}DumLDPS_{it} + \varepsilon_{i,t}$$

Equation 1

The second model in this study is Brittain's partial-adjustment-model. It follows Lintner's model, and uses the cash-flow instead of earnings. Therefore, the second model is as follows:

$$DPS_{it} = \alpha_{i,t} + \beta_{1B}CFPS_{it} + \beta_{2B}LDPS_{it} + \beta_{3B}DumLDPS_{it} + \varepsilon_{i,t}$$

Equation 2

The third model in this study is Darling's partial-adjustment-model. It includes lagged earnings instead of lagged dividends, and also includes amortisation per-share and cash-flow-per-share variables. This model is defined as follows:

$$DPS_{it} = \alpha_{i,t} + \beta_{1D}EPS_{it} + \beta_{2D}LEPS_{it} + \beta_{3D}APS_{it} + \beta_{4D}CSPS_{it} + \varepsilon_{i,t}$$

Equation 3

where,

- $DPS_{i,t}$  is the dividend-per-share for firm  $i$  at time period  $t$
- $EPS_{i,t}$  is the earning-per-share for firm  $i$  at time period  $t$
- $LDPS_{i,t}$  is the dividend-per-share for firm  $i$  at time period  $t_{-1}$
- $CFPS_{i,t}$  is the cash-flow-per-share for firm  $i$  at time period  $t$
- $LEPS_{i,t}$  is the earning-per-share for firm  $i$  at time period  $t_{-1}$
- $APS_{i,t}$  is the amortisation per-share for firm  $i$  at time period  $t$
- $CSPS_{i,t}$  is the change in sales per-share for firm  $i$  at time period  $t$
- $Dum.LDPS_{i,t}$  is a dummy variable of the LDPS for firm  $i$  at time period  $t$ , which takes a value of 1 if the LDPS is zero and 0 otherwise
- $\alpha_{i,t}$  is the constant term

➤  $\beta_{1L}, \beta_{1B}$  and  $\beta_{1D} = c_i \times r_i$  Where,  $c_i$  is the speed-of-adjustment, and  $r_i$  is the firm's target payout-ratio.

➤  $\beta_{2L}, \beta_{2B}$  and  $\beta_{2D} = 1 - c_i$

➤  $\beta_{3L}$  and  $\beta_{3B}$  is the coefficient of the dummy variable

➤  $\beta_{3D}$  is the coefficient of amortization per-share

➤  $\beta_{4D}$  is the coefficient of the change in sales-per-share

➤  $\varepsilon_{i,t}$  is the error term

The dependent variable in this study is the Dividend-Per-Share (DPS). Most studies which test Lintner's model use per-share data rather than aggregate data (e.g., Adaoglu, 2000 and Omet, 2004). Analysing per-share data allows for the application of panel data techniques which are capable of effectively modelling inter-temporal dividend behaviour and dynamics. Econometric issues are dealt with in details in section 5. The DPS is calculated as the amount of total dividends divided by outstanding shares, where dividend is the annual equity dividend and outstanding shares is the shares held by investors. It is defined as:

Dum.LDPS is a dummy variable. It takes a value of 1 if the LDPS is zero and 0 otherwise. Ideally, an estimation technique which accounts for a dynamic specification and a censored dependent variable is required. Theoretically, this would be a mixture of Dynamic-Panel-Data techniques and Panel Tobit. The inclusion of Dum.LDPS goes some way to accounting for such a specification in the absence of an all encompassing methodology.

Table 1 provides a concise summary of each independent variable in the partial-adjustment-models, its associated variables abbreviation, variables description and the prediction of the sign for each coefficient.

#### [Insert Table 1 About Here]

Lintner's model includes three independent variables: EPS, LDPS and Dum.LDPS. The coefficient estimates for EPS and LDPS are expected to be positive and be between the values 0 and 1. The coefficient estimate for the Dum.LDPS is expected to be negative; including Non-Paying-Dividend firms should bias the coefficients upwards, and therefore, controlling for this misspecification should produce a negative coefficient estimate for Dum.LDPS. Three possibilities exist from examining the inter-temporal behaviour: independent, residual or simultaneous dividend policies. Independent or simultaneous dividend policy provides evidence that firms' dividend policies are persistent. The interpretation of the coefficients is as follows:

➤ If  $\beta_{1L} = 0$  and  $\beta_{2L} > 0$ , then firms' dividend policies are independent.

➤ If  $\beta_{1L} > 0$  and  $\beta_{2L} = 0$ , then firms' dividend policies are residual.

➤ If  $\beta_{1L} > 0$  and  $\beta_{2L} > 0$ , then firms' dividend policies are simultaneous.

The value of the LDPS coefficient also provides evidence for the level of dividend stability. As the LDPS coefficient increases, so to does the degree of dividend stability. Brittain's model uses CFPS variable instead of EPS variable. The interpretation of the coefficient estimates in Brittain's model is the same as in Lintner's model.

Darling's model includes four independent variables: EPS, LEPS, APS and CSPS. The coefficient estimates for EPS, LEPS and APS are expected to be positive, whereas the coefficient estimate for CSPS is expected to be negative. Again, the significance of the coefficients estimates for EPS and LEPS have the same econometric interpretation as in Lintner's model. Also, significant point estimates for APS and CSPS variables provide evidence in favour of Darling's model.

The initial hypotheses tested is that all the slope coefficients are equal to zero. The null hypothesis is  $H_0$  and the alternative is  $H_1$  are defined as follows:

$$H_0 : \beta_{1,L,D,B} = \beta_{2,L,D,B} = \beta_{3,L,D,B} = \beta_{4D} = 0$$

$H_1$  : Not all slope coefficients are simultaneously zero

Rejecting the null hypothesis provides evidence that all, or some, of the variables in the econometric model in equations 1, 2 and 3 have a significant influence on the DPS. Rejecting of the null hypotheses for individual coefficients provides evidence in favour of independent, residual or persistent dividend policies.

#### 4. Sample Selection

A seven years period is surveyed covering the years from 1996 to 2002. The ASE started its operation on the 1<sup>st</sup> of January 1978. The period from 1978 to 1995 was excluded from the sample. The justification for excluding this period is as follows:

1. To remove the effect of the economic crisis of 1988 when the Jordanian Dinnar lost its value by approximately 100 percent (before 1988, Jordanian Dinnar exchange rate was 1 US\$ = .33 JD, Comparing with 1 US\$ = 0.78 JD)<sup>12</sup>.

2. To remove the effect of the Gulf war between 1990 and 1991, this led to a dramatic decline in share prices.

3. The 1993 peace process, between the Arabs and Israel, encouraged investors to come and invest on the Jordanian Stock Exchange.

4. In 1992, the price index was revised and updated incorporated with the International Finance Corporation (IFC) of the World Bank, the methodology used to construct the price index was based on the market capitalisation and the base year was 1991.

5. A 10% tax on dividends was introduced in 1996.

6. Fayyumi (2003) showed that since 1996, the ASE has become more efficient because many changes have characterised the institutional, technical and regulatory framework.

The study spans the seven years from 1996-2002. Only industrial firms are analysed as Banking, Insurance, and Service firms are heavily regulated and their accounting conventions are different from Industrial firms (Impson (1997), Fukuda (2000), and Mullah (2001)). The raw data was collected from Amman Stock Exchange. It was downloaded from the Research department. The firms' reports and the stock market publications were also used in the data collation process. Table 2 reports the initial sample and the firms which are excluded.

#### [Insert Table 2 About Here]

The number of the firms in 1996 for the initial sample is 78 firms. Any firm which increased its capital by issuing new stocks or distributing dividends as stocks (stock dividend) or decreased its capital because it had financial problems was eliminated from the sample, this resulted in 8 firms being eliminated. Also, any firm that was suspended or reintroduced because of reporting problems or financial losses is eliminated from the study. Consequently, 9 firms were eliminated. Five firms were eliminated due to bankruptcy. Finally, 9 firms were eliminated due to missing data for the dependent or independent variables during the period of study.

#### 5. Methodological Approach

Dynamic-Panel-Data (DPD) methodology is appropriate to test Lintner's and Brittain's partial-adjustment-models because the two models include lagged dependent variables. Ignoring the dynamic aspects of the data is not only a loss of potentially important information, but can lead to serious misspecification biases in the estimation. Including lagged dependent variables in a model can also control, to a large extent, for omitted variables. Darling's partial-adjustment-model is estimated using Panel Tobit methodology. This methodology is appropriate for Darling's partial-adjustment-model as it does not include a lagged dependent variable. The results from the OLS regression model are reported along with the results obtained from the Panel and Dynamic-Panel-Data methodologies for comparison.

<sup>12</sup> The exchange rate was taken from the CBJ (Central Bank of Jordan), the Jordanian Dinnar was tied to the US\$ since 1992.

## 5.1 Panel Data

Panel data analysis is generally defined as a representation of regression and time series analyses with repeated observations of enough cross-sections. As outlined in the sample selection section, the dataset in this study consists of observations both cross-sectional and over time. Panel analysis permits the researcher to study the dynamics of change with short time series. The combination of time series with cross-sections can enhance the quality and quantity of data in ways that would be impossible using only one of these two dimensions (Gujarati, 1995). Thus, panel analysis can provide a rich and powerful study of a set of firms (e.g., individuals), if one is willing to consider both the individuals and time dimension of the data.

Panel data is also known as pooled cross-sectional time series analysis and is sometimes referred to as longitudinal data analysis. Some advantages of panel data analyses are summarised as follows:

1. Using the panel data increases the number of data points' availability and reduces collinearity among the explanatory variables thus improving the efficiency of the econometric estimates.
2. Panel data allows a researcher to analyse a number of important economic questions not readily answerable by either a cross-section or a time-series alone.
3. Dynamic effects cannot be estimated using cross-sectional data. Even time series data are imprecise in this regard. Panel data improves the ability to study dynamic relationships.
4. Panel data models can take into account a greater degree of the heterogeneity that characterises firms (e.g., individuals) over time.
5. Panel data models can also provide solutions to important econometric problems like testing a theory while there are either omitted or unobserved variables.

In its most general form, panel data models can be characterised as follows:

$$y_{i,t} = x_{i,t}'\beta + z_i'\alpha + \varepsilon_{i,t},$$

$$i = 1, \dots, n, \quad t = 1, \dots, T,$$

Equation 4

where,

- $y_{i,t}$  Observable scalar dependent variable
- $x_{i,t}$   $K \times 1$  vector of observable non-random regressors, does not contain an intercept
- $\beta$   $K \times 1$  vector of unobservable parameters
- $z_i'\alpha$  (scalar) heterogeneity or individual effect
- $z_i$   $H \times 1$  vector containing an intercept and individual / group specific

variables which may be observable or unobservable

- $\alpha$   $H \times 1$  vector of unobservable parameters

- $\varepsilon_{i,t}$  scalar random disturbance satisfying

$$E(\varepsilon_{i,t}) = 0, E(\varepsilon_{i,t}^2) = \sigma^2 \text{ and}$$

$$E(\varepsilon_{i,t}\varepsilon_{j,s}) = 0 \text{ if } i \neq j \text{ and } t \neq s$$

- $n$  number of cross sectional firms (e.g., individuals)

- $T$  number of time period (e.g., years)

Two types of panel data model are encountered in the literature. The first is known as a balanced panel data. A panel dataset is balanced if there are no missing observations over the time period of the study. A panel is unbalanced if one missing observation, or more, is observed over the time period of the study. Within this framework there are two distinctive approaches to modelling the quantities that represent heterogeneity among subjects. One approach is the fixed effects model, which treats subjects as fixed parameters to be estimated. Another approach is the random effects model, which treats subjects as drawn from an unknown population and thus as random variables. These models make it possible to construct and test more complicated models than purely cross-sectional or time series analysis (Hsiao, 1986).

Ordinary Least Square model (OLS) is simply stack the observations of each firm (e.g., individuals) over time on top of one another. This is the standard pooled model where intercepts and slope coefficients are homogeneous across all  $n$  cross-sections and through all  $T$  time periods. The straight application of OLS to this model discards the time and the individuals dimension and thus throws away useful information. The time dimension captures the 'within' variation in the data while the individual dimension captures the 'between' variation in the data. The pooled OLS estimator exploits both 'between' and 'within' dimensions of the data but does not do so efficiently. In addition, the consistency or unbiasedness of the estimator requires that the explanatory variables are uncorrelated with any cross-section specific effects (e.g., dummy variables). In this procedure each observation is given equal weight. The limitations of OLS in this type of application prompted interest in alternative procedures. Moreover, there are several assumptions to be fulfilled for the OLS regression model to be valid such as normality and homoskedasticity of the residuals. When the regression model does not meet these assumptions, the prediction and estimation of the model may become biased.

The Panel Tobit methodology is appropriate in this study because of the structure of the dataset and the characteristics of the DPR. The DPR has the value of zero for a number of observations. It is, thus, censored at zero. Therefore, the OLS regression model which assumes that the dependent variable is normally distributed is inappropriate in this case.

Given that  $y_{i,t}$  contains a significant number of zero observations, the Panel Tobit estimation procedure provides unbiased, consistent and efficient estimates of the parameters in the vector  $\beta$  (Wooldridge, 2002). This model is a special case of the censored regression model. The Tobit is a censored regression model; it allows left-censoring, right-censoring, or both. Censored observations occur when all of the population can be sampled but for some reason the observations on the dependent variable are bounded by an upper bound or lower bound or both, with several observations occurring in the boundary. The Panel Tobit is estimated as a random effects model. The fixed effects model cannot be estimated as the 0's in the dependent variable cannot be de-measured.

The results from the OLS regression model are reported along with the results obtained from the Panel Tobit regression model for comparison. Moreover, the balanced panel data methodology is preferable in this study over the unbalanced panel data methodology, because the later may cause attrition in the data, and in this case, the results may be meaningless. Applying the balanced panel data makes the model and the analysis more powerful, so, the balanced panel data is used to investigate the major determinants of the DPR for Jordanian firms.

The Tobit model can be estimated with maximum likelihood estimation, a general method for obtaining parameter estimates and performing statistical inference on the estimates. Applying equation (5), this model can be considered as the following assuming  $\epsilon_{i,t} \sim N(0, \sigma^2)$ :

$$y_{i,t} = x'_{i,t}\beta + \mu + u_i + \epsilon_{i,t}, \text{ if } y_{i,t} > 0$$

$$y_{i,t} = 0 \quad \text{otherwise}$$

Equation 5

### 5.2 Dynamic Panel Data

In practice there are two important econometric problems when estimating Dynamic-Panel-Data (DPD) models. The first is that parameters estimates are known to be biased in models with fixed effects and lagged dependent variables, and the second is that the homogeneity assumptions that are often imposed on the coefficients of the lagged dependent variable can lead to serious biases when in fact the dynamics are heterogeneous across the cross section units. Applying the DPD reduces both of these problems. The estimation of the model does not require instrumental variables and the model has the additional benefit of providing the researcher with diagnostic information about the extent of heterogeneity in the panel.

In its most general-form, the DPD model can be expressed as the following:

$$y_{i,t} = \beta y_{i,t-1} + \alpha_{i,t} + \epsilon_{i,t}$$

Equation 6

where,

$\epsilon_{i,t} = \mu_i + v_{i,t}$  and  $i = 1, \dots, N$  cross section units, and  $t = 1, \dots, T$  time periods.

There is a clear simultaneity problem as the lagged dependent variable  $y_{i,t-1}$  is correlated with the error term  $\epsilon_{i,t}$  by virtue of its correlation with the time-invariant component of the error term  $\mu_i$ . Andersen and Hsiao (1981) and Hsiao (1986) provided extensive discussions of this bias. They highlight that the usual approach for dealing with this problem is to first-difference the data to remove the  $\mu_i$ . The model can be then expressed as the following:

$$y_{i,t} - y_{i,t-1} = \beta(y_{i,t} - y_{i,t-1}) + \gamma(x_{i,t} - x_{i,t-1}) + (\epsilon_{i,t} - \epsilon_{i,t-1})$$

Equation 7

Then, because  $\Delta y_{i,t-1}$  is correlated with the first difference error term, it is necessary to instrument for it. Anderson and Hiso (1981) have suggested using  $\Delta y_{i,t-2}$  or  $y_{i,t-1}$  as an instrument as these terms are not correlated with  $\Delta \epsilon_{i,t} = v_{i,t} - v_{i,t-1}$ . Arellano (1989) showed that an estimator that uses the levels for instruments has no singularities and displays much smaller variances than does the analogous estimator that uses differences as estimators. In addition other instruments have been suggested by a succession of researchers such as Arellano and Bond (1991), Keane and Runkle (1992), Arellano and Bover (1995), and Ahn and Schmidt (1995).

The application of the instrumental variables (IV) estimator, in the context of the classical linear regression model, is straightforward. If the error distribution can not be considered independent of the regressors' distribution, then Instrumental Variable (IV) method can be employed to deal with endogeneity. An omnipresent problem in the empirical work is the heteroskedasticity problem. Although the consistency of the IV coefficient estimates is not affected by the presence of heteroskedasticity, the standard IV estimates of the standard errors are inconsistent, preventing valid inference. The usual forms of the diagnostic tests for endogeneity and overidentifying restrictions will also be invalid if heteroskedasticity is present. These problems can be partially addressed through the use of heteroskedasticity consistent or robust standard errors and statistics. The conventional IV estimator (though consistent) is, however, inefficient in the presence of heteroskedasticity.

The usual approach when facing heteroskedasticity of unknown form is to use the Generalized Method of Moments (GMM), introduced by Hansen (1982). GMM makes use of the orthogonality conditions to allow for efficient estimation in the presence of heteroskedasticity of unknown form. Many standard estimators, including



IV and OLS, can be seen as special cases of GMM estimators. If the disturbance term is heteroskedastic, OLS is no longer efficient but correct inference is still possible through the use of the White robust covariance estimator, and this estimator can also be derived using the general formula for the asymptotic variance of a GMM estimator with a suboptimal weighting matrix. Baum *et al.* (2003) contend that the advantages of GMM over IV are clear. If heteroskedasticity is present, the GMM estimator is more efficient than the simple IV estimator, whereas if heteroskedasticity is not present, the GMM estimator is no worse asymptotically than the IV estimator. A number of influential studies in the empirical dividend behavioural literature have estimated the partial dividend behavioural equations using cross-sectional time series analysis. Although there may be some theoretical support for using cross-sectional averages in panel data analysis, especially when one is interested in an average slope coefficient, the econometric literature shows that a cross-sectional model has a number of shortcomings. Firstly, averaging data over such long periods wastes valuable information on the dynamics of the phenomenon under analysis. This is particularly the case with the analysis of Lintner's and Brittain's behavioural adjustment models, which are dynamic by definition. Secondly, estimates from a cross-section equation will more likely suffer from an omitted variable bias due to heterogeneity. Thirdly, some variables explaining dividend behaviour will more likely be endogenous, which should be dealt with appropriately.

Consequently, the appropriate estimation approach in this study is the GMM-SYS regression. It is preferable to the OLS, Fixed-effect, and First-Difference regressions. This section explain the system GMM-SYS and the interpretation of applying this method of estimation. The GMM-SYS method addresses the problems of omitted variable bias, endogeneity, and unit root effects in the choice of instruments (see Blundell and Bond, 1998). The main advantage of the GMM over the Anderson Hsiao instrumental variable (IV) estimator is that it is more efficient and consistent (albeit asymptotically) as it uses more moment restrictions than the latter. In addition, if any of the variables in  $x_{i,t}$  are endogenous, appropriate instruments can be easily found using pre-determined and exogenous variables within the system. This is typically the case in the dividend behaviour regressions. The fact that internal instruments are available to help solve the problem of endogenous explanatory variables makes GMM an appealing estimation method.

## 6. Empirical Evidence

### 6.1 Univariate Analysis: Descriptive Statistics

Table 3 shows the initial analysis for the data for all the firms over the period 1996 to 2002. It reports the

mean, standard deviation, minimum, maximum, and the number of observations for the DPS, Lagged Dividend-Per-Share (LDPS), Earning-Per-Share (EPS), Lagged Earning-Per-Share (LEPS), Amortisation-Per-Share (APS), Change in Sales-Per-Share (CSPS), and Cash-Flow-Per-Share (CFPS). Table 3 also reports the descriptive results for the overall, between, and within group variation. The total number of the observations is 329, which consists of 47 cross-sections over 7 periods.

The mean DPS and LDPS for the sampled firms over the period 1996-2002 is 9.15% and 8.81%, respectively. Omet (2004) reported a mean DPS of 23.4% for his sample of firms listed on the ASE for the period 1985-1999. Omet (2004) employed all the firms in the Jordanian market including the banking, insurance, service, and industrial firms. The maximum DPS and LDPS are 75%. The between standard deviation is 12.05% and 11.44% for DPS and LDPS, respectively, while the within standard deviation is 5.23% and 5.77%, which indicates that the level of cross-sectional variation is higher relative to inter-temporal variation.

The mean EPS and LEPS over the period 1996-2002 is 15.90% and 15.82%. Omet (2004) reported a mean EPS of 66.3% for his sample of firms listed on the ASE for the period 1985-1999. This highlights the importance of sample selection, which indicates that Banking, Insurance and Service firms have higher EPS. The maximum EPS and LEPS is 131%. This obviously is an extreme observation, and raises the question as to whether it is a data error or can be logically accounted for. Examination of the data reveals that the earning-per-share ratio is not a mistake and reflects the exceptional financial circumstances of the Arab Chemical Detergents Industries firm. It reported a profit-after-tax of 872,000 in 2000, while its paid-in-capital was 665,000. The standard deviation between firms is 19.87% and 19.29% for EPS and LEPS, respectively, and the within standard deviation is 11.39% and 12.14%. Relative to the DPS, this suggests that earning exhibit a higher level of cross-sectional and inter-temporal variation.

### [Insert Table 3 About Here]

The mean APS is 11.31%, which measures the depreciation to outstanding shares. The maximum APS is 56%. The standard deviation is 8.90%, 8.33%, and 3.33% for overall, between and within time. The mean CSPS is -2.08% which measures the first difference in sales to outstanding shares. The maximum CSPS is 3.68 and the minimum is -4.69. Again, these percentages were reported by the Arab Chemical Detergents Industries firm. Its net-sales were 4.5 Million JD in 1996 and rose to 7 Million in 1997 before declining in 1999 to 5.76 Million from 8.88 Million in 1998. The CSPS standard deviation overall, between and within time is 83.76%, 45.31%, and 70.72%. This indicates a high level of variation in

sales between firms and overtime. Also, this study reports a mean CFPS of 24.11%. The maximum CFPS is 151%, which was reported by the Arab Chemical Detergents Industries firm in 2000. The minimum CFPS is -163% and was reported by Jordan Paper and Cardboard Factories firm in 2000. The negative CFPS reflects the definition of the CFPS variable which includes net-profit or loss, dividend and depreciation in its calculation. The CFPS standard deviation overall, between and within time is 30.74%, 25.61%, and 17.34%. Overall, the relatively low level of DPS within variation is an initial indicator of persistence.

## 6.2 Bivariate Analysis: Correlations

Table 4 reports bi-variate correlations, using both Pearson and Spearman correlation. Pearson's correlation is a parametric test, while Spearman's correlation is a non-parametric test based on ranking the variables. Column 1 in Table 6.3 reports Pearson's correlation between the DPS and the six independent variables outlined in Equations 1, 2 and 3. The independent variables are Lagged Dividend-Per-Share (LDPS), Earning-Per-Share (EPS), Lagged Earning-Per-Share (LEPS), Amortisation-Per-Share (APS), Change in Sales-Per-Share (CSPS), and Cash-Flow-Per-Share (CFPS). Five out of six independent variables are significantly correlated with the DPS and have the same predicted sign as reported in Table 1. Only CSPS is uncorrelated with the DPS. Row 1 in Table 4 reports the correlation between the DPS and the six independent variables using Spearman's non-parametric test. The results are qualitatively the same as these reported for Pearson's method. The only significant difference is the sharp reduction in the  $p$ -value for CSPS from 0.958 to 0.122, suggesting the presence of outliers.

[Insert Table 4 About Here]

## 6.3 Multivariate Analysis: Panel and Dynamic Panel Data

Table 5 presents the results for Lintner's Partial-Adjustment-Model, Equation 1. Column 1 lists the independent variables along with the time-effect control dummy variables. Column 2 contains the predicted sign of the relationship between each independent variable and the DPS. *A priori*, the signs of the coefficients on LDPS and EPS are expected to be positive, whereas the sign of the coefficient on Dum.LDPS is expected to be negative. The Pooled OLS results are also reported for comparison with the previous literature and with the GMM-SYS results.

The  $F$  statistics equal 310.43, 8.75 and 8.53 and is significant at 1 percent level for the Pooled OLS, GMM-SYS (1) and GMM-SYS (2) estimators. Consequently, the null hypothesis that all the slope coefficients equal zero is rejected. The  $R^2$  is 88.59% and the adjusted  $R^2$  is 88.30%, which suggests that the

model explains a significant proportion of the variance in DPS. The  $p$ -value for the  $AR(1)$  is 0.001 and 0.713 for the  $AR(2)$  for the GMM-SYS (1). Likewise, the  $p$ -value for the  $AR(1)$  is 0.001 and 0.698 for the  $AR(2)$ , for GMM-SYS (2). The  $p$ -values for the Sargan test are 0.423 and 0.567 for models (1) and (2).

Therefore, the significance level of the  $AR(1)$ ,  $AR(2)$  and the Sargan test support the validity of the GMM-SYS estimator in Table 5. The test for first-order autocorrelation rejects the null while the test for the second-order autocorrelation fails to reject the null hypothesis of no autocorrelation. First-differencing introduces  $AR(1)$  serial correlation when the time-varying component of the error term in levels is serially uncorrelated (Arellano and Bond, 1991). Therefore, the GMM-SYS estimator is consistent only when second-order correlation is not significant. With respect to Sargan test of over-identifying restrictions, the high  $p$ -value suggests that we can not reject the null hypothesis that the set of instruments is appropriate.

[Insert Table 5 About Here]

The results from the Pooled OLS indicate that the LDPS and EPS are significant at the 1 percent level. The coefficient estimates are 0.512 and 0.275, respectively. If this was the only estimation technique adopted, the econometric interpretation would be that Jordanian Industrial firms follow a persistent dividend policy. In contrast, using the GMM-SYS estimator (GMM-SYS (1)) leads to point estimates of 0.229 and 0.294 for the LDPS and EPS, with a  $p$ -value of 0.097 for LDPS. The  $p$ -value for EPS is still significant at the 1 percent level. The results from the GMM-SYS indicate that Jordanian firms follow a residual dividend policy. The conflicting results from the OLS and GMM-SYS estimators raise the question of the appropriate analysis required. When the dummy variable (Dum.LDPS) is introduced into the analysis to control for Non-Paying-Dividend firms, LDPS becomes significant again. The coefficient estimates are 0.395 and 0.335 for LDPS and EPS and are significant at the 1 percent and 5 percent level. The coefficient estimate for Dum.LDPS is -0.056 with a  $p$ -value of 0.061. This is consistent with the predicted sign reported in Table 1. The results from the GMM-SYS, after controlling the Non-Paying-Dividend firms, indicate that Jordanian firms' dividend policy is persistent.

Table 6 presents the results for Brittain's Partial-Adjustment-Model, Equation 2. The signs of the coefficients on LDPS and CFPS are expected to be positive, whereas the sign of the coefficient on Dum.LDPS is expected to be negative. The  $F$  statistics equal 238.09, 6.03 and 5.46, and are significant at the 1 percent level for the Pooled OLS, GMM-SYS (1) and GMM-SYS (2) estimators. Consequently, the null hypothesis that all the slope coefficients equal zero is rejected. The  $R^2$  is 85.62%

and the adjusted  $R^2$  is 85.26%, which suggests that the model explains a significant proportion of the variance of the DPS. The  $p$ -value for  $AR(1)$  is 0.001 and 0.539 for the  $AR(2)$  is 0.539, for the GMM-SYS (1). Likewise, the  $p$ -value for the  $AR(1)$  is 0.001 and 0.298 for the  $AR(2)$ , for the GMM-SYS (2). The  $p$ -values for the Sargan test are 0.650 and 0.567 for models (1) and (2).

**[Insert Table 6 About Here]**

Therefore, the significance levels of  $AR(1)$ ,  $AR(2)$  and the Sargan test support the validity of the GMM-SYS estimator in Table 6. The test of the first-order autocorrelation rejects the null while the test for the second-order autocorrelation fails to reject the null hypothesis of no autocorrelation. With respect to Sargan test of over-identifying restrictions, the high  $p$ -value suggests that we can not reject the null hypothesis that the set of instruments is appropriate.

The results from the Pooled OLS indicate that the LDPS and CFPS are significant at the 1 percent level, with point estimates of 0.680 and 0.132, respectively. Again, if this was the only estimation technique adopted, the econometric interpretation would be that Jordanian Industrial firms follow an independent dividend policy. In contrast, using the GMM-SYS estimator (GMM-SYS (1)) leads to point estimates of 0.284 and 0.193 for the LDPS and CFPS, with a  $p$ -value of 0.080 for LDPS. The  $p$ -value for CFPS is still significant at the 1 percent level. The results from the GMM-SYS indicate that Jordanian firms follow a residual dividend policy. These conflicting results from OLS and GMM-SYS estimators raise the question of the appropriate analysis required. When the dummy variable (Dum.LDPS) is introduced into the analysis for Non-Paying-Dividend firms, LDPS is still insignificant. The coefficient estimates are 0.351 and 0.198 for LDPS and CFPS, and are significant at the 1 percent for CFPS. The  $p$ -value for the LDPS is insignificant for both GMM-SYS estimators, with a point estimate of 0.351. The coefficient estimate for Dum.LDPS is -0.021 with a  $p$ -value of 0.545. This leads to the same conclusion from GMM-SYS (1). That is, Jordanian firms follow a residual dividend policy.

Table 7 presents the results for Darling's Partial-Adjustment-Model, Equation 3. Again, Column 1 lists the independent variables and the time-effect control dummy variables; Column 2 contains the predicted signs of the relationship between each independent variable and the DPS. The signs for the coefficients on EPS, LEPS and APS are expected to be positive, whereas, the sign of the coefficient for CSPS is expected to be negative.

**[Insert Table 7 About Here]**

Initially, the DPS model is estimated by OLS. The  $F$  statistics equals 153.46 and is significant at the 1 percent level. Consequently, the null hypothesis that

all the slope coefficients equal zero is rejected. The  $R^2$  is 82.83% and the adjusted  $R^2$  is 82.30%, which suggests that the model explains a significant proportion of the variance of the DPS. The equivalent test of the null hypothesis that all slope coefficients are equal to zero is the Wald  $\chi^2$  for the Panel Tobit methodology. Again, the null hypothesis that all the slope coefficients equal zero is rejected.

The results reported using the Panel Tobit approach are consistent with the OLS estimates. EPS and LEPS are significant, with  $p$ -values of 0.001. The coefficient estimate for EPS goes from 0.378 to 0.405, whereas the coefficient estimate for LEPS goes from 0.162 to 0.121. This would suggest that Jordanian firm follow a residual dividend policy.

The obvious issue now is which model best describes dividend payments. Darling's model built upon Lintner's model by adding the APS and CSPS variables and replacing LDPS with LEPS. However, given the insignificance of these two additional variables, and the much lower point estimate for LEPS compared to LDPS, and also that it neglects the reported significant dynamic effects, suggests that Lintner's model is superior. Lintner's model is also preferable to Brittain's model. The point estimates on LDPS are similar and significant at a reasonable probability level, whereas the point estimates for CFPS is much lower than the point estimate for EPS. Interestingly, the results reported in Tables 5, 6 and 7 for the time effect control dummy variables suggest that there has been an overall tendency for firms to increase their dividend payments in the region of 2-3 percent per annum.

#### 6.4 Speed-of-Adjustment and Implicit-Target-Payout-Ratio analysis

Having established that the Lintner's model has empirical support, the next step is to calculate the Speed-of-Adjustment factor (SOA) and the Implicit-Target-Payout-Ratio (ITPR). They are defined as follows:

$$SOA = 1 - \beta_{2L} \quad \text{Equation 8}$$

$$ITPR = \frac{\beta_{1L}}{SOA} \quad \text{Equation 9}$$

where,

- SOA is the speed-of-adjustment factor
- ITPR is the implicit-target-payout-ratio
- $\beta_{1L}$  is the coefficient estimate for the EPS
- $\beta_{2L}$  is the coefficient estimate for the LDPS

Table 8 reports the SOA and ITPR factors, which were computed from the coefficient estimates from Lintner's model. The ITPR factor provides evidence of how firms establish long-term target payout ratios and how they move toward that target. The ITPR factor is 0.56, 0.38 and 0.55 using OLS and GMM-

SYS estimators. Given that the mean DPR is 57.5%, and the ITPR factor for GMM-SYS (2) estimator is 0.55 indicates that Jordanian firms follow their long-run target payout ratio. The results for the ITPR factor from OLS and GMM-SYS (2) estimators are qualitatively similar, leading to the same conclusion.

The SOA factor shows how quickly a firm adjusted its dividends towards the target payout-ratio. The value of SOA factor should be between 0 and 1. A higher value for SOA factor indicates less smoothing of dividends, and therefore, a less stable dividend policy. The SOA factor is 0.488, 0.771 and 0.605 for the Pooled OLS and GMM-SYS estimators. Accepting that the GMM-SYS (2) estimator is the most appropriate for computing the SOA factor, then an SOA factor of 0.605 indicates that Jordanian firms smooth their dividends, and consequently follow stable dividend policies.

### [Insert Table 5 About Here]

For the purpose of comparison, the SOA factor is compared with studies from different markets. The SOA factor for a sample of US firms ranged from 5.5% to 36.6%. Lintner (1956) estimated a SOA factor of 30%. Fama and Babiak (1968) obtained a slightly higher SOA factor of 36.6%, whereas, Dewenter and Wather (1998) reported a SOA factor of 5.5%. This indicates that US firms smooth their dividends over time, and therefore, have stable dividend policies. The SOA factor's reported for emerging markets range from 39% to 100%. Adeoglu (2000) reported a SOA factor of 100% for a sample of Turkish firms, whereas Pandey and Bhat (2004) reported the same factor of 71% for a sample of Indian firms. Omet's Jordanian study reported a SOA factor of 52%, whereas this study reports a SOA factor of 60.5% using GMM-SYS (2) estimator for a sample of Jordanian Industrial firms, suggesting that dividend policy is less stable. However, Omet's study is not directly comparable with the results reported here for a number of reasons. First, Omet's sample included Banking, Insurance, Services and Industrial firms, whereas this study analysed industrial firms as Banking, Insurance, and Service firms are heavily regulated and their accounting conventions are different from Industrial firms. Second, this study spanned the years 1996 to 2002, whereas Omet included the years from 1984 to 1999. Third, while Omet excluded the Non-Paying-Dividend firms from his sample, this study analysed the Non-Paying-Dividend firms along with Paying-Dividend firms, thus eliminating sample selection bias. Finally, Omet used the Fixed-Effect and Random-Effects estimators, whereas this study utilised the theoretical superior GMM-SYS estimator.

## 7. Summary

The literature on dividend behaviour has traditionally followed two methodological approaches. Surveys

have been used to assess financial managers' views on the motives for paying dividends and their inter-temporal properties. Another strand of the literature has adopted the econometric approach to empirically test the inter-temporal behaviour of dividend payments. This analysis provided evidence of the degree of dividend stability, and consequently whether firms follow residual, persistent or independent dividend policies. This dual approach, with many papers adapting both, comes from Lintner's (1956) seminal paper which adopted both. The most striking feature of the developed markets literature is the persistent ability of the partial-adjustment-models to still model dividend behaviour and manager's contemporary views on the importance of dividends (Brav *et al.* (2005)).

This study followed the econometric approach to study the inter-temporal behaviour of dividend policies for Jordanian firms. Specifically, it built upon Omet (2004). Omet applied Lintner's model to examine the inter-temporal behaviour of dividend policies for a sample of Jordanian firms, whereas this study tested the applicability of three partial-adjustment-models: Lintner's, Darling's and Brittain's models for a sample of industrial firms listed on the ASE for the period 1996 to 2002. The Dynamic-Panel-Data methodology was used for Lintner's and Brittain's models because of their dynamic specification, whereas the Panel Tobit estimator was used for Darling's model. Omet estimated Lintner's model using the Fixed-Effect and Random-effects estimators. These estimators fail to account for the dynamic specification of Lintner's model which biases the coefficient estimates. Consequently, this affects the computation of the speed-of-adjustment and the implicitly-target-payout-ratio parameters and the conclusion drawn with respect to the stability of dividend payments. The results reported from the partial-adjustment-models indicated that Lintner's model was the best-fit model for Jordanian firms. The LDPS and EPS had the most influence on the DPS inter-temporal behaviour, indicating that Jordanian firms follow a persistent dividend policy. While dividends are persistent, Jordanian firms smooth dividends less than their counterparts in developed markets.

The results reported in this study highlighted the impact of applying the Dynamic-Panel-Data methodology. The results indicated that applying the GMM-SYS estimator, and controlling for the Non-Paying-Dividend firms, unobserved heterogeneity and endogeneity, impacted upon the absolute value of the point estimates and the significance of the lagged DPS variable, and the subsequent economic interpretation. This highlighted the importance of methodological choice when comparing the results with previous literature, and raises the issue as to whether the findings reported in the extant literature are robust to this criticism.

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## Appendices

**Table 1:** Description of the Independent Variables

Independent variable	Variable Abbreviation	Variables Description	Dividend Models Employed the Independent Variables	Predicted sign	Co-efficient
Earning Per-Share	EPS	Net profit-after-tax divided by outstanding shares	Lintner's Model, Darling's Model	Positive	$\beta_{1L}, \beta_{1D} > 0$
Cash Flow Per-Share	CFPS	Net profit-after-tax plus depreciation minus dividends divided by outstanding shares	Brittain's Model	Positive	$\beta_{1B} > 0$
Lagged Dividend Per-Share	LDPS	Lagged DPS divided by outstanding shares in the previous period	Lintner's Model, Brittain's Model	Positive	$\beta_{2L}, \beta_{2B} > 0$
Lagged Earning Per-Share	LEPS	Lagged net profit-after-tax dividend by outstanding shares	Darling's Model	Positive	$\beta_{2D} > 0$
Amortisation Per-Share	APS	Amortisation and depreciation divided by outstanding shares	Darling's Model	Positive	$\beta_{3D} > 0$
Change in Sales Per-Share	CSPS	The first difference of sales divided by outstanding shares	Darling's Model	Negative	$\beta_{4D} < 0$
Dummy Lagged Dividend Per-Share	Dum.LDPS	Dummy variable which takes a value of 1 if the LDPS is zero and 0 otherwise	Lintner's Model, Brittain's Model	Negative	$\beta_{3L}, \beta_{3B} < 0$

**Table 2:** Sample Selection

Sample	Firms
No. of Firms on the Market on 1996	78
Subtract	
Increased or Decreased Capital	8
Suspended or Reintroduced	9
Bankrupt	5
Missing Data	9
<i>Total No. of the Final Sample</i>	<i>47</i>

**Table 3:** Descriptive Statistics of the Variables

Variables	Mean	Std. Dev.			Min.	Max.	No. of Obs. (N*T)
		overall	Between	Within			
DPS	0.0915	0.1304	0.1205	0.0523	0.00	0.75	(47*7) = 329
LDPS	0.0881	0.1272	0.1144	0.0577	0.00	0.75	(47*7) = 329
EPS	0.1590	0.2274	0.1987	0.1139	0.00	1.31	(47*7) = 329
LEPS	0.1582	0.2264	0.1929	0.1214	0.00	1.31	(47*7) = 329
APS	0.1131	0.0890	0.0833	0.0333	0.00	0.56	(47*7) = 329
CSPS	-0.0208	0.8376	0.4531	0.7072	-4.69	3.68	(47*7) = 329
CFPS	0.2411	0.3074	0.2561	0.1734	-1.63	1.51	(47*7) = 329

Notes:

Overall : Measures the cross-sectional and time-series total variation.

Between : Measures the cross-sectional variation.

Within : Measures the time-series variation overtime.

Variables : DPS is the Dividend-Per-Share, LDPS is the Lagged Dividend-Per-Share, EPS is the Earning-Per-Share, LEPS is the Lagged Earning-Per-Share, APS is the Amortisation-Per-Share, CSPS is the change in Sales-Per-Share, CFPS is the Cash-Flow-Per-Share.

Table 4: Correlation Analysis Results: Pearson and Spearman Indices

Variables	DPS	LDPS	EPS	LEPS	APS	CSPS	CFPS
DPS		0.830 (0.001)	0.879 (0.001)	0.810 (0.001)	0.294 (0.001)	0.085 (0.122)	0.811 (0.001)
LDPS	0.901 (0.001)		0.778 (0.001)	0.876 (0.001)	0.298 (0.001)	-0.062 (0.258)	0.733 (0.001)
EPS	0.899 (0.001)	0.834 (0.001)		0.825 (0.001)	0.355 (0.001)	0.172 (0.001)	0.937 (0.001)
LEPS	0.838 (0.001)	0.900 (0.001)	0.861 (0.001)		0.350 (0.001)	-0.102 (0.062)	0.792 (0.001)
APS	0.281 (0.001)	0.281 (0.001)	0.321 (0.001)	0.310 (0.001)		0.131 (0.017)	0.573 (0.001)
CSPS	-0.003 (0.958)	-0.161 (0.003)	0.054 (0.325)	-0.228 (0.001)	0.111 (0.042)		0.211 (0.001)
CFPS	0.818 (0.001)	0.766 (0.001)	0.904 (0.001)	0.787 (0.001)	0.472 (0.001)	0.140 (0.010)	

Notes:

P-value are in parentheses, Spearman's Correlations are upper triangle, and Pearson's Correlations are reported in the lower triangle.

Variables: DPS is the Dividend-Per-Share, LDPS is the Lagged Dividend-Per-Share, EPS is the Earning-Per-Share, LEPS is the Lagged Earning-Per-Share, APS is the Amortisation-Per-Share, CSPS is the change in Sales-Per-Share, CFPS is the Cash-Flow-Per-Share.

Table 5: Lintner's Partial-Adjustment-Model

Variables	Predicted Sign	Pooled OLS		GMM-SYS (1)		GMM-SYS (2)	
		Coefficient	t-statistics	Coefficient	Z-statistics	Coefficient	Z-statistics
Constant		-0.008 (0.223)	-1.22	—	—	—	—
EPS	+	0.275 (0.001)	13.87**	0.295 (0.001)	5.65**	0.335 (0.001)	6.08**
LDPS	+	0.512 (0.001)	14.42**	0.229 (0.097)	1.66	0.395 (0.014)	2.45*
Dum.LDPS	-	—	—	—	—	-0.056 (0.061)	-1.88
Dum. 1997		0.011 (0.205)	1.27	0.009 (0.203)	1.27	0.013 (0.097)	1.66
Dum. 1998		0.008 (0.387)	0.87	0.009 (0.205)	1.27	0.013 (0.098)	1.65
Dum. 1999		0.009 (0.329)	0.98	0.010 (0.182)	1.33	0.011 (0.148)	1.45
Dum. 2000		0.012 (0.184)	1.33	0.011 (0.143)	1.46	0.011 (0.132)	1.51
Dum. 2001		0.021 (0.024)	2.26*	0.023 (0.003)	2.94**	0.024 (0.001)	3.21**
Dum. 2002		0.014 (0.123)	1.55	0.021 (0.012)	2.50*	0.023 (0.004)	2.86**
F-ratio		310.43**		8.75**		8.53**	
R <sup>2</sup>		88.59%					
Adj. R <sup>2</sup>		88.30%					
Sargan test				(0.423)	13.33	(0.567)	10.55
AR(1)				(0.001)	-4.22	(0.001)	-3.88
AR(2)				(0.713)	0.37	(0.698)	-0.39
No. of Obs.		329		282		282	

Notes:

\*\* Significant at 1 percent level

\* Significant at 5 percent level

P-value is in parentheses

DPS (Dividend-Per-Share) is the Dependent Variable, LDPS is the Lagged-Dividend-Per-Share, EPS is the Earning-Per-Share, Dum.LDPS is the Dummy Lagged-Dividend-Per-Share, Dum.1997-Dum.2002 is the Time Dummy Variables.

Table 6: Brittain's Partial-Adjustment-Model

Variables	Predicted Sign	Pooled OLS		GMM-SYS (1)		GMM-SYS (2)	
		Coefficient	t-statistics	Coefficient	Z-statistics	Coefficient	Z-statistics
<i>Constant</i>		-0.014 (0.072)	-1.80	—	—	—	—
<i>CFPS</i>	+	0.132 (0.001)	9.31**	0.193 (0.001)	4.63**	0.198 (0.001)	4.71**
<i>LDPS</i>	+	0.680 (0.001)	19.94**	0.284 (0.080)	1.75	0.351 (0.071)	1.80
<i>Dum.LDPS</i>	-	—	—	—	—	-0.021 (0.545)	-0.61
<i>Dum. 1997</i>		0.016 (0.121)	1.56	0.014 (0.128)	1.52	0.015 (0.101)	1.64
<i>Dum. 1998</i>		0.008 (0.437)	0.78	0.012 (0.200)	1.28	0.013 (0.165)	1.39
<i>Dum. 1999</i>		0.009 (0.398)	0.85	0.014 (0.149)	1.44	0.014 (0.141)	1.47
<i>Dum. 2000</i>		0.023 (0.025)	2.25*	0.026 (0.006)	2.74**	0.026 (0.005)	2.82**
<i>Dum. 2001</i>		0.025 (0.015)	2.44*	0.029 (0.002)	3.14**	0.029 (0.001)	3.24**
<i>Dum. 2002</i>		0.015 (0.153)	1.43	0.025 (0.012)	2.50*	0.026 (0.009)	2.60**
<i>F-ratio</i>							
<i>R<sup>2</sup></i>		238.09**		6.03**		5.46**	
<i>Adj. R<sup>2</sup></i>		85.62%					
<i>Sargan test</i>				(0.650)	10.53	(0.577)	10.44
<i>AR(1)</i>				(0.001)	-3.77	(0.001)	-3.82
<i>AR(2)</i>				(0.539)	-0.61	(0.298)	-1.04
<i>No. of Obs.</i>		329		282		282	

## Notes:

\*\* Significant at 1 percent level

\* Significant at 5 percent level

P-value is in parentheses

DPS (Dividend-Per-Share) is the Dependent Variable, LDPS is the Lagged-Dividend-Per-Share, CFPS is the Cash-Flow-Per-Share, Dum.LDPS is the Dummy Lagged-Dividend-Per-Share, Dum.1997-Dum.2002 is the Time Dummy Variables.

Table 7: Darling's Partial-Adjustment-Model

Variables	Predicted Sign	Pooled OLS		Panel Tobit	
		Coefficient	T-statistics.	Coefficient	Z-statistics.
<i>Constant</i>		-0.004 (0.596)	-0.53	0.011 (0.171)	1.37
<i>EPS</i>	+	0.378 (0.001)	12.33**	0.405 (0.001)	11.52**
<i>LEPS</i>	+	0.162 (0.001)	5.07**	0.121 (0.001)	3.88**
<i>ASP</i>	+	-0.024 (0.505)	-0.67	-0.036 (0.368)	-0.90
<i>CSPS</i>	-	0.004 (0.351)	0.93	-0.001 (0.988)	-0.01
<i>Dum. 1997</i>		0.008 (0.478)	0.71	0.001 (0.958)	0.05
<i>Dum. 1998</i>		0.011 (0.330)	0.97	0.001 (0.856)	0.18
<i>Dum. 1999</i>		0.016 (0.144)	1.46	0.001 (0.927)	0.09
<i>Dum. 2000</i>		0.014 (0.208)	1.26	0.004 (0.635)	0.48
<i>Dum. 2001</i>		0.021 (0.055)	1.92	0.010 (0.174)	1.36
<i>Dum. 2002</i>		0.022 (0.051)	1.96	0.019 (0.033)	2.13*
<i>F-ratio</i>			153.46**		



<i>Continue from table 7</i>		
<i>R</i> <sup>2</sup>	82.83%	
<i>Adj. R</i> <sup>2</sup>	82.30%	
<i>Wald Chi</i> <sup>2</sup>		266.54 (0.001)
<i>No. of Obs.</i>	329	329

*Notes:*

\*\* Significant at 1 percent level

\* Significant at 5 percent level

*P-value* is in parentheses

DPS (Dividend-Per-Share) is the Dependent Variable, EPS is the Earning-Per-Share, LEPS is the Lagged Earning-Per-Share, APS is the Amortisation-Per-Share, CSPS is the Change in Sales-Per-Share, Dum.1997-Dum.2002 is the Time Dummy Variables.

**Table 8: Speed-of-Adjustment and Target Payout-Ratio**

Estimator	ITPR	SOA
Pooled OLS	0.56	0.488
GMM-SYS (1)	0.38	0.771
GMM-SYS (2)	0.55	0.605