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Hempenius, A.L.

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DIVIDEND POLICY OF LARGE
DUTCH CORPORATIONS

A.L. Hempenius       juni 1984

KATHOLIEKE HOGESCHOOL TILBURG
DIVIDEND POLICY OF LARGE DUTCH CORPORATIONS

A.L. Hempenius

1. Introduction

This paper studies the dividend policy in a sample of large Dutch trading and industrial corporations listed in Appendix 1. The economic importance of explaining variations in dividend payments is twofold: firstly, and most importantly, explaining dividend behaviour of corporations means explaining retained earnings of corporations, which are the main source for financing capacity expansion, and secondly, dividends constitute income for shareholders and thus are a (small) component of national income.

In Section 2 it is argued that the generally used additive dynamic models have attractive alternatives in the multiplicative version of these models. Section 2, moreover, shows the limited dependent variable character of dividends, resulting from a two-stage decision process with respect to dividend payments.

Section 3 describes the data used and the measurement problem with respect to the profit variable. In that section an expression for the systematic error from using different asset evaluation systems is derived and a solution for the presence of this error is suggested. Attention is also paid to the consequences of random errors in measuring profits.

Section 4 presents estimation results for separate and pooled cross-sections of corporations and for the pooled models of Section 2.

2. The models

2.1. The type of models

As the interest in this paper is on observed dividend policies of firms, the rationality of dividend payments is not discussed.1) For a review of studies before 1966 the reader may consult Brittain (1966). The seminal paper is the

one by Lintner (1956), who uses an additive partial adjustment model which has been extensively tested at the firm level by Fama and Babiak (1968). All other studies also seem to use additive models. It will be shown that there are good reasons for using a multiplicative model relating cash dividends and profits of this and possibly previous years.

The simplest case for a multiplicative model can be made from a model for the payout ratio $D/P$, with $D$ denoting total cash dividends and $P$ total profits after taxes. Assuming, for the time being, that both $D$ and $P$ are positive, the payout ratio $\alpha_{it} \equiv D_{it}/P_{it}$ shows fluctuations both in time $(t)$ and over companies $(i)$. Explaining these fluctuations by means of the vector of variables $x_{it}$ results in the following, at least partly multiplicative, model:

$$(2.1) \quad D_{it} = \alpha_{it} (x_{it}) P_{it}.$$ 

A fully multiplicative model needs positively valued variables $D$, $P$ and $x$.

The complete model for the dividend decision is a limited dependent variable model:

$$(2.2.a) \quad D = 0, \text{ for "low" values of } P,$$

$$(2.2.b) \quad D > 0, \text{ for "high" values of } P,$$

for given $x_{it}$. Assuming that firms follow a two-stage decision process in their dividend decisions, the following two-stage research procedure is suggested:

(i) the explanation of the decision to pay cash dividends or not (in order to protect equity capital and (or) to invest at low levels of $P$) by means of, say, a logistic or discriminant function with appropriate "regressors";

(ii) a multiplicative model for positive dividend payments of the type:

2) See e.g. Judge c.s. (1980) or Maddala (1977) for reviews on limited dependent variable models.

3) See also Cragg (1971).
(2.3) \[ D_{it} = \alpha_i(x_{it})P_{it}e^{\varepsilon_{it}}, \]

where it has been assumed that \( \alpha_i(x_{it}) = \alpha(x_{it}) \) and an error term has been added. This paper concentrates on stage (ii).

The extensively used additive regression model can handle zero and negative profits but does this very poorly, both theoretically (see (2.2.a and b)) and practically. Inclusion of non-positive profits deteriorates forecasting ability, because from zero and negative profits in practice no cash dividends are paid (which the additive model cannot predict) and the resulting estimated model predicts dividends of regular years worse because of the inclusion of irregular years. The multiplicative model (2.3) for positive dividends is a practical solution as the multiplicative model can by definition not handle non-positive profits.

2.2. The multiplicative dynamic models

Lintner's (1956) main conclusions from interviews with executives of 28 companies were: (i) the majority of these companies had a target payout ratio which they tried to approximate, and (ii) changes in dividend payments were determined by this target and by current net profits, with companies trying to adjust to target dividends over a period of several years. Lintner (1956) then suggested the additive partial adjustment model (with a constant (trend) term), with desired (or target) dividends \( D_{it}^{*} \) for company \( i \) in year \( t \) determined by

(2.4) \[ D_{it}^{*} = \alpha_i P_{it}, \]

\( \alpha_i \) being the target payout ratio of firm \( i \).

There are no compelling reasons for the additive formulation of partial adjustment and good reasons for the multiplicative one. Although the multiplicative version of partial adjustment is well-known in other fields of economics, this is not the case in the field of modelling dividend policies. Therefore, in somewhat more detail:

(2.5) \[ D_{it} = D_{i,t-1} \times \text{adjustment factor}. \]
The adjustment factor is assumed to equal \((D_{it}/D_{i,t-1})^{\gamma_i}\), with \(0 \leq \gamma_i \leq 1\), meaning instantaneous adjustment to \(D^*_{it}\) if \(\gamma_i = 1\) and less instantaneous adjustment if \(\gamma_i < 1\). Substituting \(D^*_{it}\) from (2.4) and adding a multiplicative disturbance term, one gets:

\[
D_{it} = \alpha'^*_i \Pi_{it} D_{it} \epsilon_{it},
\]

with \(\alpha'^*_i = (\alpha^*_i)^{\gamma_i}\).

The implied model for the payout ratio is:

\[
\frac{D_{it}}{\Pi_{it}} = \left(\frac{D_{i,t-1}}{\Pi_{it}}\right)^{1-\gamma_i} \epsilon_{it},
\]

so that the present payout ratio is the weighted (geometric) mean of the target payout ratio and the payout ratio resulting from unchanged dividends, with weights \(\gamma_i\) and \(1-\gamma_i\), respectively. Evidently a high value of \(\gamma_i\) leads to a fast adaptation of the payout ratio to the target ratio \(\alpha^*_i\).

In the following the restriction of this particular model that the sum of the elasticities of \(\Pi_{it}\) and \(D_{i,t-1}\) is 1, is not imposed:

\[
D_{it} = \beta_i \gamma_i \Pi_{it} D_{i,t-1} \epsilon_{it}.
\]

This model may, of course, also be derived from the assumption of "habit persistence" or from the assumption of dividends paid from "permanent profits".\(^4\) The long-run elasticity of \(D_i\) with respect to \(\Pi_{it}\), implied by (2.8), is \(\beta_i/(1-\gamma_i)\). This follows from repeatedly substituting (2.8), first for \(D_{i,t-1}\), then for \(D_{i,t-2}\), etc. In the partial adjustment model \(\beta_i + \gamma_i = 1\). The habit persistence and permanent profit interpretations of (2.8) have no such restriction.

A more sophisticated partial adjustment model would not use the transitory component of \(\Pi_{it}\) in \(D_{it}\): the target is set with respect to the permanent part of \(\Pi_{it}\). This means that (2.6) would read\(^5\):

\[
D_{it} = \alpha^*_i \Pi_{it} D_{i,t-1} \epsilon_{it}.
\]

\(^4\) See Prais (1959) for the permanent profits assumption.

\(^5\) Note that this implies a kind of double safeguard against unjustified dividend jumps: companies use a smoothed value \(\bar{P}\) and moreover \(\gamma \leq 1\).
with $\bar{P}_{it}$ the permanent part of $P_{it}$. Assuming that $\bar{P}_{it}$ is a weighted geometric mean of the previous $P_i$-values\(^6\), one may transform (2.9) to:

\[\ln D_{it} = \beta_i \ln a_i + \beta_i \ln P_{it} + (2-\beta_i)\ln D_{i,t-1} + (1-\beta_i)(1-\gamma_i)\ln D_{i,t-2}.\]

This somewhat more sophisticated model will also be estimated. Note that (2.10) restricts the three coefficients of $P_{it}$, $D_{i,t-1}$ and $D_{i,t-2}$, as there are only two parameters ($\beta_i$ and $\gamma_i$). Again, a certain form of habit persistence also leads to formulation (2.10), without the restriction on the coefficients, of course.

2.3. A residual funds model with target dividends

Instead of modifying $D_{i,t-1}$ in order to get $D_{it}$, this model modifies $D_{it}^*$ as follows. From their cash flow $E$ (profits plus depreciation) and their external funds firms pay their gross investment $I$ and their cash dividend. So gross investment and dividend compete for these funds. The residual funds theory of dividends\(^7\) postulates that gross investment is served first from the cash flow, after which dividend payments are decided upon. Because of the assumed reluctance of attracting external funds, the "residual" cash flow then is an important determinant of dividend payments. The residual cash flow, $E_{it}-I_{it}$, determines the extent to which the target dividend will be reached:

\[D_{it} = D_{it}^* \frac{E_{it}-I_{it}}{D_{it}^*},\]

where $f$ is a function such that $0 < f < 1$ and $f' > 0$, and $E_{it}-I_{it}$ is assumedly positive. Theoretically a function of the type $f(x) = x^\gamma$ is not satisfactory, but it will be used as an approximation, in the same vein as e.g. linear

\[6) \text{In terms of logarithms: } \ln \bar{P}_{it} = \sum_{j=0}^{\infty} (1-\beta_i)^j \beta_i \ln P_{i,t-j}.\]

\[7) \text{See Weston and Brigham (1981) for a theoretical exposition, and Higgins (1972) for an empirical application.}\]
demand functions. Using this specification for \( f \) leads to:

\[
D_{it} = \frac{\alpha_1}{P_{it}^{1-\gamma_1} E_{it-I_{it}}^{\gamma_1}},
\]

i.e. to a payout ratio being the weighted (geometric) mean of the target payout ratio \( \alpha_1 \) and the payout ratio without external financing of investment and dividend. If \( \gamma_1 = 0 \), the company is indifferent to its way of financing. A positive value of \( \gamma_1 \) indicates a reluctance for external funds. A value of \( \gamma_1 = 1 \) indicates a "pure" form of the residual funds theory. As one may want to test whether the coefficients of \( P_{it} \) and \( E_{it-I_{it}} \) add up to 1, the following model is used:

\[
D_{it} = \alpha_1 P_{it}^{\gamma_1} (E_{it-I_{it}})^{\gamma_1} e^{it}.
\]

Models (2.13) and (2.8) may naturally be nested for reasons of testing these two competing theories.

3. The data and the measurement problem

3.1. Description of the data

The main source of the data used is the publication of the Nederlandse Middenstandsbank: Aandelenanalyses (1983), which gives financial data and analyses of 34 large Dutch industrial and trading companies (see Appendix 1) over the six year period 1977-1982. Among the 204 profit figures there are 21 losses. A loss in a given period invariably leads to zero dividends in the same period. About the same number of cases, 18, shows no dividend while there is a positive profit. Out of 34 companies there are 21 so-called "regular" companies showing positive dividends and positive profits in all six years.

The sample is certainly a representative one. However, it is not a random sample. This could be a factor contributing to non-zero contemporaneous correlation in dividends.

8) There is one curious case in this respect: Océ-van der Grinten in 1981 has a net profit of 30.1 million guilders, reorganization expenses of 38 million of their English participations excluded. Dividend in 1981 is 7.3 million. In their own annual report the company relates this dividend to profit before reorganization expenses.
3.2. The measurement problem

Dividend payments are, at least in principle, measured without error: dividend is declared and the amount (per share or in total) is assumedly the same. The measurement process is a very simple one.

In sharp contrast to this "clean" measurement of dividends are the regressor variable profit's measurement difficulties, due to the large spectrum of possibilities in measuring a firm's assets. It will now be assumed that firms use only one of two systems: valuation at historic prices or at current prices. Denote by \( A_t^h(T) \) the undepreciated part, in period \( t \), of an individual asset of age \( T \) and at historic prices (of period \( t-T \)). Letting \( p(t-j) \) be the price index in period \( t-j \) of the asset with respect to the base period \( t-T \), the current value, \( A_t^c(T) \), of the asset in period \( t \) is:

\[
(3.1) \quad A_t^c(T) = A_t^h(T) \prod_{j=1}^{T} p(t-j),
\]

where \( p(t-T) = 1 \). The relation between \( A_t^r \) and \( A_t^h \) may thus be written as:

\[
(3.2) \quad A_t^r(T) = A_t^h(T) (1+\bar{p}_t)^T,
\]

with \( \bar{p}_t \) the moving geometric average price increase the previous \( T \) periods, including the current period \( t \):

\[
(3.3) \quad 1+\bar{p}_t = \left\{ \prod_{j=1}^{T} p(t-j) \right\}^{1/T}.
\]

If this moving average remains reasonably stable over some time interval and if the same holds for the mean age \( T \) (in fact \( T_t \)) for an aggregate of similar assets, then one expects (3.2) to hold, for this time interval, where \( A \) now denotes aggregate assets. As the time interval of the data used is six years, (3.2) will be assumed to hold.

This still leaves the following question: what is the effect of relation (3.2) on profits, which question can only be answered very approximately. Assuming profits, before the deduction of depreciation charges, to be proportionate to the value of assets, with differences in depreciation charges according to the valuation system used, one has for measured profits:
(3.4.a) \[ p^R_t = c A^R_t - C^R_t , \]

(3.4.b) \[ p^h_t = c A^h_t - C^h_t , \]

with \( C \) denoting depreciation charges. As relation (3.2) also holds if \( A \) is replaced by \( C \), one has the following relation between \( p^R \) and \( p^h \):

(3.5) \[ p^R_t = (1+p^-)^T p^h_t . \]

If one assumes (more realistically) profits before depreciation in either case to be proportional to the current value of assets \( (A^R) \) then (3.5) should be replaced by:

(3.6) \[ p^R_t = p^h_t - (1+p^-)^T (1+p^-)^{-1} C^h_t . \]

Relation (3.5) fits well into a multiplicative model and it will be assumed to hold approximately, in the sense that:

(3.7) \[ p^R_{it} \approx b p^h_{it} , \]

with the previously mentioned assumption of \( (1+p^-)^T \) being approximately constant over the time interval considered and with the extra assumption of \( (1+p^-)^T \) being the same for all firms.

Of course, the probably more realistic expression (3.6) may also be used, but it is more complicated in the sense that one needs \( p^- \) and \( T \). It is therefore preferable to use (3.7) as an approximation of (3.6). Note that, for time intervals in which current asset prices increase, if (3.6) is the true relation, one expects \( b < 1 \), whereas \( b > 1 \) if (3.5) would be the true relation. So a rough test of either (3.5) or (3.6) may be made through \( b \) of (3.7). Incorporation of (3.7) into a multiplicative model in which \( p^h \) is a regressor, may be done by using a dummy variable for the difference in measured profits due to the valuation system, as follows.

Suppose one wants to estimate the parameters in (2.8) where \( p_{it} \) is the "true" value of profits, i.e., the value according to the valuation system one chooses as the base system. One has measured \( \tilde{p}_{it} \) for the profit variable, where
(3.8) \[ \hat{P}_{it} = b_{it} p_{it}^{b_{it}} \]

connects measured and true value. Suppose one chooses historic valuation as the base system then \( b_{it} = 1 \) if firm \( i \) uses this system in period \( t \) and \( b_{it} = b \) (from equation (3.7)) if firm \( i \) uses the other system. Substituting (3.8) into (2.8) gives:

(3.9) \[ D_{it} = a_{i}(b_{it})^{-\beta} \hat{P}_{it} D_{i,t-1} + e_{it}. \]

One may then use, in the transformed (logarithmic) model (3.9), a dummy variable to represent the two possible values of \( a_{i}(b_{it})^{-\beta} \), namely \( a_{i} \) and \( a_{i}(b)^{-\beta} \). Note that \( b \) is identifiable.

One might be tempted to get rid of the measurement problem (3.8) by using percentage changes (with respect to the previous period's value) or first differences of logarithms. Assuming \( b_{it} = b_{i} \) the first differences of logarithms transformation (applied to the transformed equation (3.9)) removes the whole term \( \ln a_{i} - \beta \ln b_{i} \). As the two transformations mentioned are almost equivalent for not too large percentage changes (say < 10%), attention will be centered on first differences of logarithms. Taking first differences of the logarithmic version of model (3.9) gives for \( b_{it} = b_{i} \):

(3.10) \[ \Delta \ln D_{it} = \beta \Delta \ln \hat{P}_{it} + \gamma \ln D_{i,t-1} + \Delta e_{it}. \]

One gains degrees of freedom, but evidently these transformations are justified only when the \( e_{it} \) are strongly autocorrelated for each firm \( i \). The danger of introducing autocorrelation is almost always there, because of the inevitable random measurement errors. This may be seen as follows.

In addition to a systematic measurement "error" the profit variable exhibits the inevitable random measurement error:

(3.11) \[ \hat{P}_{it} = b_{i} p_{it}^{u_{it}}, \]

where \( b_{i} \neq 1 \) represents a systematic error and \( u_{it} \neq 0 \) a random error. Equation (3.10) then becomes:

(3.12) \[ \Delta \ln D_{it} = \beta \Delta \ln \hat{P}_{it} + \gamma \ln D_{i,t-1} + (\Delta e_{it} - \beta \Delta u_{it}). \]
As it is reasonable to assume that the random errors $u_{it}$ are for each $i$ uncorrelated over time, even time-uncorrelated terms $\Delta \epsilon_{it}$ lead to autocorrelation of the term $(\Delta \epsilon_{it} - \beta \Delta u_{it})$ for each firm $i$.

The conclusion must be that one should hesitate to apply the percentage change or $\Delta \ln$ transformations to the multiplicative model if one suspects considerable random measurement variations: one also transforms the random measurement terms, leading to higher covariances (in time) the higher the variances of the random errors $u_{it}$ are for each $i$.

The additive error model:

\[(3.13) \quad \tilde{\epsilon}_{it} = (P_{it} + b_{it}) + u_{it}\]

could be combined with an additive regression model to give exactly the same conclusions. Equation \((3.6)\) gives the following specification for $b_{it}$ if one uses historic valuation as the base system: $-b_{it} = (\ln P_{it})^T C_t - C_t^h - C_t^r$, i.e., the extra depreciation charges because of increasing asset prices\(^9\), if firm $i$ values at current prices, and $b_{it}$ is zero otherwise.

In the following section the multiplicative combination \((3.9)\) and \((3.11)\) is applied to the problem of explaining variations in cash dividend.

4. Estimation results

4.1. Cross-sectional behaviour of dividends with respect to profits

In this subsection the cross-sectional behaviour of dividends with respect to profits is investigated on the assumptions:

(i) that the only long-run determinant of cash dividends is profit, and
(ii) that cross-sectional behaviour reflects long-run characteristics of individual firms.

The model thus is, for each sample value of $t$:

\[(4.1) \quad \ln D_{it} = \beta_0 + \beta_1 \ln P_{it} + \epsilon_{it}, \quad (i = 1, \ldots, n).\]

For the $n = 21$ "regular" companies having positive dividends and profits (used

9) See also the excess depreciation of Brittain (1966), pp. 67-69. Brittain, however, uses the additive model with non-positive profits included in the analysis; see his footnote on p. 174 regarding the logarithmic transformation.
in the next section for analysing short-run behaviour) the results are stated in Table 1. The pooled estimates have also been stated. One

Table 1: CROSS SECTION RESULTS

<table>
<thead>
<tr>
<th>Year</th>
<th>$\hat{\beta}_0$</th>
<th>$\hat{\sigma}_{\hat{\beta}_0}$</th>
<th>$\hat{\beta}_1$</th>
<th>$\hat{\sigma}_{\hat{\beta}_1}$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>-0.935</td>
<td>0.228</td>
<td>0.977</td>
<td>0.055</td>
<td>0.949</td>
</tr>
<tr>
<td>1978</td>
<td>-0.866</td>
<td>0.221</td>
<td>0.966</td>
<td>0.054</td>
<td>0.943</td>
</tr>
<tr>
<td>1979</td>
<td>-0.486</td>
<td>0.222</td>
<td>0.870</td>
<td>0.053</td>
<td>0.935</td>
</tr>
<tr>
<td>1980</td>
<td>-0.674</td>
<td>0.212</td>
<td>0.930</td>
<td>0.051</td>
<td>0.947</td>
</tr>
<tr>
<td>1981</td>
<td>-0.195</td>
<td>0.297</td>
<td>0.829</td>
<td>0.071</td>
<td>0.879</td>
</tr>
<tr>
<td>1982</td>
<td>-0.591</td>
<td>0.163</td>
<td>0.926</td>
<td>0.039</td>
<td>0.968</td>
</tr>
<tr>
<td>Pooled</td>
<td>-0.620</td>
<td>0.093</td>
<td>0.913</td>
<td>0.022</td>
<td>0.931</td>
</tr>
</tbody>
</table>

may also estimate (4.1) for all company-years for which $D_{it}$ and $P_{it}$ are positive.\(^{10}\) The result is almost the same as the pooled results, as may be seen from the table. The long-run multiplicative model implied by the pooled result of the regular companies is:

\[
\hat{D}_t = 0.52 \hat{P}_t^{0.91} .
\]

As to the issue of heteroskedasticity, Figure 1 reveals no evidence of it, for the transformed variables, nor does inspection of the residuals.

There is quite some variability in the implied constant ($\exp(\hat{\beta}_0)$) of the multiplicative model over the years in Table 1: the range is from 0.4 to 0.8, approximately. The variability in the long-run elasticities $\hat{\beta}_1$ is much smaller: they range from 0.87 to 0.98. The (unweighted) averages of the $\hat{\beta}_0$ and $\hat{\beta}_1$ are 0.62 and 0.92, respectively. The pooled estimates of $\beta_0$ and $\beta_1$ are very close to these values. These pooled estimates may be interpreted as matrix weighted averages of the cross-sectional vectors $(\hat{\beta}_0(t), \hat{\beta}_1(t))$, as follows.

\(^{10}\) This regression has been done with and without the very large Koninklijke Olie (Royal Dutch Oil), resulting in very small differences in $\hat{\beta}_0$ and $\hat{\beta}_1$; $R^2$ dropped to 0.893.
Define \( y = \ln D \) and \( x = \ln P \) and write \( y_t = X_t b_t + e_t \) \((t = 1, \ldots, 6)\) for the cross-sectional regressions, with \( y_t \) and \( e_t \) of order \( n \times 1 \), \( X_t \) of order \( n \times 2 \) and \( b_t = (\beta_0(t), \beta_1(t)) \) or order \( 2 \times 1 \). The pooled regression, assuming an equal number of companies (although this is not essential to the argument), may be written as \( y = Xb + e \), with \( y' = (y'_1, \ldots, y'_6) \), \( X' = (X'_1, \ldots, X'_6) \), \( b = (\beta_0, \beta_1) \) and \( e' = (e'_1, \ldots, e'_6) \). One then has:

\[
(4.3) \quad b = (X'X)^{-1} X'y
\]

\[
= \sum_{t=1}^{6} (X'_t X_t)^{-1} \sum_{t=1}^{6} X'_t y_t
\]

\[
= \sum_{t=s}^{r} X'_t X_t b_t
\]

\[
= \sum_{t=s}^{r} [(X'_t X_t)^{-1} X'_t X_t] b_t.
\]

The sum of the matrix weights \((X'_t X_t)^{-1} X'_t X_t\) is the unity matrix \( I \) of order \( 2 \times 2 \). Evidently the pooled \( b \) is a matrix weighted average of the vectors \( b_1, \ldots, b_6 \), so that both \( \hat{\beta}_0(t) \) and \( \hat{\beta}_1(t) \), \( t = 1, \ldots, 6 \), influence each of the pooled estimates \( \hat{\beta}_0 \) and \( \hat{\beta}_1 \).
Using a dummy $d_{it}$, which is 1 if company $i$ uses the current value system and 0 if it uses the historical value system, results (for all company-years) in:

\[(4.4) \quad \ln D_{it} = -0.689 + 0.916 \ln P_{it} + 0.082 d_{it}, \quad R^2 = 0.929 \]

\[
\begin{array}{c}
\text{(0.085)} \\
\text{(0.020)} \\
\text{(0.070)}
\end{array}
\]

There is no significant effect of the valuation system, meaning that in the long run the value $b$ of (3.7) is approximately 1, or explicitly stated: in the long run profits are measured independently of the valuation system companies use. In the long run the measurement system can hardly be expected to influence profits, as under any system replacements of assets have to be made and at the same prices. In the short run provisions for replacement may be different and thus influence reported profits. As the sample used consists of only six periods, the existence of the measurement effect is tested.

Another economically significant result is the value of the elasticity of cash dividends with respect to profits: it is somewhat smaller than 1. In 1977 and 1978 the average elasticity is 0.97, but in the four years 1979-1982 it is on the average 0.89. The pooled estimates with their low standard errors show a statistically very significant departure from 1. Another way of stating this result is in terms of the (long-run) payout ratio:

\[(4.5) \quad \frac{D}{P} = 0.5 P^{-0.1}, \]

meaning that the payout ratio decreases slightly with increasing profits, of (the same thing) the retention ratio increases slightly with increasing profits.

The reason for a decreasing payout ratio in the long run might be a departure from the adjustment model with the short run elasticities of $P_t$ and $D_{t-1}$ summing to 1, as follows. If the short run model is:

\[(4.6) \quad D_t = a P_t^{b} D_{t-1}^{y}, \]

then the equilibrium solution may be written as:

\[(4.7) \quad \frac{D}{P} = a P^{b} \]
with \( a = \alpha^{1/(1-\gamma)} \) and \( b = (\beta + \gamma - 1)/(1-\gamma) \). If \( \beta + \gamma < 1 \), then \( b < 0 \). The above result (4.5) is thus evidence against the multiplicative partial adjustment model. A multiplicative habit persistence model, meaning a dividend policy of rather stable dividend payments thus might be the (somewhat) more appropriate model.

In the above nominal figures have been used. In Appendix 2 one may find this choice motivated.

4.2. Short-run behaviour of dividends

The OLS estimation of (2.8) with \( a_1 = \alpha, \beta_1 = \beta \) and \( \gamma_1 = \gamma \) results in:

\[
\ln D_{it} = -0.175 + 0.291 \ln P_{it} + 0.691 \ln D_{i,t-1} \\
(0.046) \quad (0.030) \quad \quad (0.032) \\
R^2 = 0.988
\]

where the sample consists of the 21 "regular" persistently profit making companies. The reason for using this sample will be evident: one is interested in the short run behaviour of these companies. If a company has, say, one loss in its series of 6 observations (and an accompanying dividend of zero), its behaviour in subsequent periods is dominated by caution and it may very well again declare a dividend of zero in a profit period following the loss period. Specification (2.8) may, of course, also be estimated for all company-years for which this is possible, as has been done in the previous section. The result will again be similar to the result of using the regular companies only.

The estimated covariance of the estimated coefficients of \( \ln P_{it} \) and \( \ln D_{i,t-1} \) is -0.0048 from which one may compute a \( t \)-ratio of -0.7 for testing \( \beta + \gamma = 1 \). Evidently the (simple) partial adjustment model (2.6) cannot be rejected.

As \( R^2 = 0.988 \) in (4.8) it is very difficult to improve on this result by adding terms like \( D_{i,t-2} \) (see (2.10)) or dummy variables which differentiate the constant term and/or the elasticities. Besides the previous dummy variable for distinguishing between valuation systems another dummy has been used to distinguish between national and multinational companies (AKZO, Philips, Unilever and Royal Dutch Oil). As may be predicted no significant additions to the estimated model (4.8) were found in this way. Even a strongly
collinear regressor like $D_{1,t-2}$ is not a significant addition\(^{11}\); see Table 2.

Table 2: OLS-RESULTS SHORT-RUN MODELS*

<table>
<thead>
<tr>
<th>Constant</th>
<th>$\ln P_{it}$</th>
<th>$\ln D_{1,t-1}$</th>
<th>$\ln D_{1,t-2}$</th>
<th>$\ln (E_{it}-I_{it})$</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-0.172</td>
<td>0.302</td>
<td>0.580</td>
<td>0.099</td>
<td>0.099</td>
<td>0.986</td>
</tr>
<tr>
<td>(-3.15)</td>
<td>(8.44)</td>
<td>(5.40)</td>
<td>(1.03)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.182</td>
<td>0.285</td>
<td>0.683</td>
<td>0.022</td>
<td>0.022</td>
<td>0.984</td>
</tr>
<tr>
<td>(-2.75)</td>
<td>(5.36)</td>
<td>(14.31)</td>
<td>(0.67)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.760</td>
<td>0.916</td>
<td>0.024</td>
<td>0.024</td>
<td>0.932</td>
<td></td>
</tr>
<tr>
<td>(-7.39)</td>
<td>(16.97)</td>
<td>(0.43)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.175</td>
<td>0.291</td>
<td>0.691</td>
<td></td>
<td></td>
<td>0.988</td>
</tr>
<tr>
<td>(-3.78)</td>
<td>(9.73)</td>
<td>(21.73)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Between parentheses t-ratio's are stated.

Model (2.8), the dynamic model, and model (2.13), the residual funds model, may be nested by adding the residual funds variable $E_{it}-I_{it}$ to specification (2.8). Table 2 shows that the residual funds specification (2.13) should be rejected in favour of the dynamic specification (2.8). As the multicollinearity in the set regressors of the nested specification is rather high (the three simple correlations are approximately 0.9), dropping $D_{1,t-1}$ (as required by the residual funds specification) could result in substantial shifts in the estimated coefficients, while retaining approximately the same $R^2$. Table 2 shows that this is not the case: while the coefficient of $\ln P_{it}$ changes drastically (almost to its long-run value), $\ln (E_{it}-I_{it})$ is still useless, so that $R^2$ drops significantly. The crucial test, however, is done in the nested specification, leading to a clear rejection of the residual funds theory.

In order to take random measurement errors in $\ln P_{it}$ into account, specification (2.8) has also been estimated by the instrumental variables technique. Two instruments for $\ln P_{it}$ have been tried: the (natural) logarithms of the balance sheet total and of cash flow.\(^{12}\) See Table 3 for the

\(^{11}\) The regressors $\ln P_{it}$, $\ln D_{1,t-1}$ and $\ln D_{1,t-2}$ have the following simple correlations:

$$
\begin{bmatrix}
1 \\
0.939 \\
0.921 \\
0.990
\end{bmatrix}
$$

\(^{12}\) The simple correlations with $\ln P_{it}$ are, respectively: 0.896 and 0.957. (The correlations with the residuals of (4.8) are, or course, low: 0.061 and 0.009.)
results.

Table 3: IV-RESULTS FOR (2.8)*

<table>
<thead>
<tr>
<th>Instrumental variable</th>
<th>Constant</th>
<th>ln P&lt;sub&gt;it&lt;/sub&gt;</th>
<th>ln D&lt;sub&gt;t-1&lt;/sub&gt;</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance sheet total</td>
<td>-1.004</td>
<td>1.133</td>
<td>-0.150</td>
<td>0.891</td>
</tr>
<tr>
<td></td>
<td>(0.71)</td>
<td>(0.79)</td>
<td>(-0.10)</td>
<td></td>
</tr>
<tr>
<td>Cash flow</td>
<td>-0.196</td>
<td>0.312</td>
<td>0.670</td>
<td>0.988</td>
</tr>
<tr>
<td></td>
<td>(-3.13)</td>
<td>(5.97)</td>
<td>(12.54)</td>
<td></td>
</tr>
</tbody>
</table>

* Between parentheses t-ratio's are stated.

As cash flow seems less subject to measurement errors<sup>13</sup), and as it is highly correlated with profits, its use as IV seems evident. The results of using cash flow as IV are approximately the same as the OLS-results in (4.8).

The result in (4.8) may again be interpreted as a matrix weighted average, but now of company regressions over the years. In obvious notation: the vector $b$ of estimated coefficients in (4.8) may be written as:

\[
(4.9) \quad b = \frac{1}{n} \sum_{i=1}^{n} \left( \sum_{j=1}^{n} x_{i}^{*} x_{j}^{*} \right)^{-1} \sum_{j=1}^{n} x_{j}^{*} x_{j}^{*} b_{i}^{*}
\]

where the stars denote company regressions.

One final remark: theoretically the random effects model is not unattractive (if all systematic variations in the $a_{i}$ have already been accounted for). There is, however, no room for another parameter in addition to the result (4.8).

Concluding, from (4.8): the short run elasticity of dividends with respect to profits is rather low. The long run elasticity is approximately 1, which does not contradict the average cross-section results of Section 4.1, because the estimated long run elasticity calculated from (4.8) is 0.94 and very small changes in the estimated coefficients in (4.8) produce a value smaller than 0.9. The differences in measurement systems are not detectable.

<sup>13</sup> See also Brittain (1966).
REFERENCES


APPENDIX 1

This appendix contains the sample of companies studied, in alphabetical order, with the number in brackets indicating the rank (according to sales in 1982) among the top 100 companies on the Amsterdam stock exchange.

1. ACF Holding (50)
   Ahold (5)
   AKZO (4)
   Bols (41)
5. Borsumij Wehry (30)
   Bührmann-Tetterode (16)
   Caland
   Ceteco (40)
   CSM (34)
10. Deli-Maatschappij (21)
    Desseaux (70)
    Elsevier-NDU (28)
    Fokker (26)
    Gamma (44)
15. Gist-Brocades (24)
    Heineken (9)
    Internatio-Müller (15)
    KLM (7)
    Kluwer (38)
20. Koninklijke Olie (1)
    KNP (31)
    Meneba (29)
    Naarden International (52)
    Nedlloyd Groep (8)
25. Nutricia (47)
    Océ-van der Grinten (22)
    Ommeren (35)
    Pakhoed (39)
    Philips (3)
30. Telegraaf (51)
    Unilever (2)
    VMF-Stork (20)
    VNU (27)
34. Wessanen (13)

* Not among the top 100.
APPENDIX 2

If there would be no money illusion the relations would be between real variables. Denoting the consumer price index by \( PI \) the following long-run relation would hold (for constant \( \alpha_i \) and \( \beta_i \)):

\[
\frac{D_{it}}{P_{it}} = \alpha \left( \frac{P_{it}}{P_{i(t-1)}} \right)^\beta,
\]

so that in

\[
D_{it} = \alpha P_{it}^\beta P_{i(t-1)}^\gamma
\]

one would test whether \( \beta + \gamma = 1 \) (no money illusion).

The result, to be compared with the pooled result in Table 1, is for the 21 regular companies:

\[
\ln D_{it} = -4.21 + 0.912 \ln P_{it} + 0.784 \ln P_{i(t-1)}
\]

with ratio's: \(-2.16\) \(41.21\) \(1.85\)

The estimated coefficient of \( \ln P_{it} \) is the same as in Table 1 where no regressor \( P_{i(t-1)} \) has been used. (Although \( \ln P_{i(t-1)} \) is hardly significant (and thus could be eliminated as regressor), one might want to test whether the hypothesis \( \beta + \gamma > 1 \) could be accepted. With a t-ratio of 1.6 this is not the case.)
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