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Agency Problems and Capital Expenditure Announcements*

This article examines the market valuation of announcements of new capital expenditure. Prior research suggests that the firm's growth opportunities and cash flow position condition the market response. This study jointly examines the role of growth and cash flow, and the interaction between them. Using a new data set of Australian firms that avoids problems associated with expectations models, the results are remarkably strong and support a positive association between growth opportunities and the market valuation, in addition to supporting the role of free cash flow. The findings have implications for the relationship between general investment information and stock prices.

I. Introduction

New investment is the lifeblood of a firm. Typically new investment arises through either capital expenditure or business acquisitions. Much of the research concerning acquisitions has focused on change of control transactions such as mergers and takeovers. Corporate capital expenditures have received less attention. The few studies in the area that examine the market reaction to capital expenditure announcements all report a significant positive price response.[1] One view is that capital expenditure announcements provide information about a firm's future earnings prospects that is not provided by current earnings. In this sense, capital expenditure announcements convey a signal regarding the firm's available projects. Hence, a significant positive relation between investment information and stock returns is expected.

However, investment information should not be seen in absolute terms; rather, it is context specific.

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1. These studies are McConnell and Muscarella (1985), Woolridge (1988), Chen and Ho (1997), Chung et al. (1998). While Chung et al. (1998) do not report abnormal returns for the whole sample, it can be interpolated from their evidence that a small positive return is observed at the announcement date.

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For instance, John and Mishra (1990) argue that individual firm factors such as growth will affect the valuation of capital expenditures. Failure to control for firm differences can result in seemingly weak market responses (e.g., Livnat and Zarowin 1990). A typical response in the literature is to control for industry membership (Lev and Thiagarajan 1993). However, this approach has been criticized for its coarse nature (Kerstein and Kim 1995). It is likely that the market's perception of new investment will be contextualized within the firm's opportunity set. Hence, the interaction of investment and growth opportunities is important when analyzing the market's reaction.

The purpose of this study is to examine the market response to capital expenditure announcements in the context of the agency problems created by differences in growth and free cash flow environments. A firm operating in a constrained growth environment is likely to send different signals to the market compared to a firm operating in a high growth environment. However, growth opportunities themselves must also be examined in light of the firm's available set of free cash flows (Jensen 1986). While prior studies have examined the impact of growth and to a lesser extent free cash flow on the valuation response to capital expenditure announcements, they have done so separately. This article employs a method that allows for the joint consideration and separate identification of these effects. While growth and free cash flow have been shown to be relevant factors in conditioning the market response in other acquisition transactions such as mergers (e.g., Lang, Stulz, and Walking 1989, 1991), these factors have not been found to be similarly relevant in the context of capital expenditures.

In this article, capital expenditures are examined using a previously untested data set from the Australian market that removes much of the noise that has potentially plagued prior work. The results are quite definitive. They demonstrate that the quality of growth opportunities is singularly the most important variable in explaining the market reaction to physical asset expenditure announcements. The significance of this variable is unaffected by other control variables. Further, the article documents a significant interaction between growth and cash flow, thereby supporting the role of free cash flow. Specifically, the market reaction is negatively associated with a free cash flow environment.

The results have several implications. First, they shed new insight on the interaction between investment, growth, and free cash flow that has implications for valuation signals and managerial investment decision making. Specifically, they show the importance of growth and free cash flow when assessing market valuations. Hence, the findings aid in the understanding of why the market reacts the way it does. Second, the article demonstrates the importance of analyzing market reactions to investment announcements in specific contexts and, hence, has implications for broader research areas. Third, the research method allows for a finer partitioning based on firm-specific characteristics which enables a disentangling of effects that in turn provides

a reconciliation of the extant inconsistent evidence concerning the role of free cash flow in a mergers context vis-à-vis a capital investment context.

The article is organized as follows. Section II provides a review of the literature concerning capital expenditure and develops the hypotheses. The research method is described in Section III, while Section IV provides a description of the data and the explanatory variables. Descriptive statistics are contained in Section V. The results are discussed in Section VI, and Section VII provides a summary of the study, its implications, and directions for future research.

II. Hypothesis Development

A. *Growth Opportunities*

The few studies that have investigated the valuation impact of capital expenditure announcements generally report a significant positive market reaction to the announcements. Some of these studies have extended the analysis to examine the role of growth opportunities (Szewczyk, Tsetsekos, and Zantout 1996; Chen and Ho 1997; Chung, Wright, and Charoenwong 1998). Using the well-known q ratio as a proxy for growth opportunities, these studies report similar results in that positive abnormal returns around the announcement of increases in capital expenditure are associated with firms possessing high q ratios. The positive market reaction is generally attributed to the newly acquired growth opportunities. However, market reactions to announcements of increases in capital expenditure by firms possessing low q ratios are mixed. While Chung et al. report significant negative market reactions for low q ratio firms, Szewczyk et al. and Chen and Ho report an insignificant market response to increases in capital expenditures made by low q ratio firms.[2]

The above evidence is consistent with the definition of the q ratio as a proxy to distinguish between firms that have positive net present value (NPV) investment opportunities under current management from those that do not. Firms with high q ratios are likely to have positive NPV projects. Hence, these firms are expected to invest their resources in profitable projects. For these firms, an increase in new investment is perceived as having a positive effect on the valuation of the firm's equity. In contrast, firms with low q ratios face limited growth prospects, and for these firms additional investment is not perceived as generating a positive NPV. Hence, growth interacts with the market valuation of the announcement signal. Specifically, positive valuations are expected to be greater for firms with higher growth prospects.

2. An alternative approach is undertaken by Kerstein and Kim (1995), who examine the value relevance of capital expenditure announcements in the context of earnings response coefficients. They report that unexpected capital expenditure announcements provide value-relevant information beyond unexpected current earnings after controlling for various mediating variables, including growth.

TABLE 1 The Interaction between Cash Flow and Growth Opportunities

	Growth Opportunities	
Cash Flow	Low	High
High	A	B
Low	C	D

B. Free Cash Flow

Jensen (1986) broadly defines free cash flow as cash flow in excess of what is required to fund positive NPV investments. Free cash flow is a manifestation of agency problems because excess cash may not be returned to shareholders. When firms have free cash, any acquisitions made by these firms are, by definition, negative net present value investments because these firms face an investment opportunity set in which there are no favorable growth prospects. It has been asserted that firms that face unfavorable investment opportunity sets undertake a diversification strategy (Jensen 1986; Lang and Stulz 1994; Harford 1999). Furthermore, it has been widely documented that diversification is a value-destroying strategy in these circumstances (Lang and Stulz 1994; Berger and Ofek 1995; Servaes 1996).

In the context of capital expenditures, Szewczyk et al. (1996) and Chen and Ho (1997) undertake a limited examination of the impact of free cash flow and find some evidence to support the free cash flow argument above. In other contexts, such as tender offers, the evidence is stronger (Lang et al. 1991; Smith and Kim 1994). Given that firms with free cash flow that undertake new investment are likely to be investing in projects with negative NPVs, it is suggested that the market will react negatively to announcements of capital expenditure made by these firms.

The definition of free cash flow, in an empirical sense, varies considerably. However, consistent with the spirit of Jensen (1986), we define free cash flow firms as those firms operating with high cash flow in a low growth environment. As free cash flow is cash flow in excess of requirements, high cash flow alone is not a sufficient condition for free cash flow to be present, as a high cash flow firm may have a sufficiently large pool of positive NPV investment projects. Hence, a low growth environment is also necessary. A matrix of growth opportunities and cash flow is provided in table 1. Free cash flow is likely to occur in panel A of table 1. However, the existence of free cash flow in panel A is not exhaustive. The combinations of cash flow and growth opportunities in panels B, C, and D do not preclude the possible existence of free cash flow, as long as these panels satisfy the general condition that cash flow exceeds the financing required for growth from positive NPV projects. However, panel A is the most likely combination that would result in a free cash flow environment. We will return to this table when analyzing the results.

C. Capital Market Monitoring

The capital market monitoring hypothesis argues that when managers visit the capital market for external funds, the capital market has an opportunity to evaluate managers (Donaldson 1984; Easterbrook 1984). The issuance of securities forms a relationship between the firm and the capital market such that it allows the capital market to monitor the firm's future performance on a continuous basis.[3] Firms that lack internally generated cash, and hence are dependent on the capital market for funds, are expected to have greater incentives to make value-maximizing investment decisions. Otherwise, these managers will be penalized by the market through higher borrowing costs or the cessation of the supply of funds.[4] Alternatively, firms with high cash flow can escape capital market monitoring by avoiding visiting the market.[5] Hence, it follows that firms with low cash flow are more likely to make value-maximizing investment decisions than firms with high cash flow, holding constant all other factors.

There are few empirical studies specifically concerned with the capital market monitoring hypothesis. The majority of research on the role of cash flow has been tested in the context of free cash flow. In part, this is due to the fact that both the capital market monitoring and free cash flow arguments are grounded in the same theory. The discriminating feature between the capital market monitoring and free cash flow arguments is that high cash flow is a sufficient condition for non-value-maximizing behavior under the weaker capital market monitoring hypothesis. However, cash flow alone is not a sufficient condition for non-value-maximizing decisions under the free cash flow argument. The article also examines whether firms with low cash flow experience a greater positive market valuation associated with capital expenditure announcements than firms with high cash flow.

D. Other Relevant Explanators

As discussed above, capital expenditure announcements should be examined within the context of firm-specific measures of growth opportunities, free cash flow, and cash flow. However, it is known from the literature on mergers that other variables have the potential to affect the market reaction. Hence, to avoid model misspecification, we also include as control variables the size of the transaction (Asquith, Bruner, and Mullins 1983), prior management performance (Roll 1986; Morck, Shleifer, and Vishny 1990), the level of managerial

3. The term "future" in this context refers to the time outstanding before the securities mature.

4. There is an implicit assumption here that the monitoring mechanism is efficient. But there are several other disciplinary mechanisms by which managers are forced to make value-maximizing decisions (see Jensen [1993] for a discussion that argues that the most effective of these disciplinary mechanisms is the external capital market).

5. Of course the source of funds itself can convey an information signal. For instance, the pecking order arguments of Donaldson (1961) and Myers and Majluf (1984) are relevant. However, a clear identification of the source of finance is required to test the signal (Mikkelson and Partch 1986). In our sample, there is no disclosure by firms of specific sources of finance associated with the expenditure announcements.

shareholdings (Jensen and Meckling 1976; John and Mishra 1990), and leverage (Jensen 1986, 1989; Stulz 1990).

1. *Size of capital expenditure*. Asquith et al. (1983) argue that insignificant abnormal returns to bidders may be explained by the relative size of targets to bidders, and they find that bidders' cumulative abnormal returns are positively related to target size. This result is consistent with a materiality argument in that the market reacts only to announcements that have a potentially significant impact on the bidder's value. Consistent with this view, a positive relationship is expected between the size of the capital expenditure (relative to firm size) and any abnormal returns.

2. *Prior managerial performance*. Morck et al. (1990) argue that managers whose prior performance record is better than others are more likely to make better investment decisions, simply because good managers make better decisions than bad managers, on average. Conversely, Roll (1986) suggests that managers of well-managed firms suffer from hubris and overpay for their investments. Roll conjectures that firms with good prior performance are more likely to overpay for an acquisition than poorly managed firms, and as a result the equity market discounts their share price when an acquisition is announced. However, the empirical work of Lang et al. (1989) does not support the hubris hypothesis.

3. *Managerial shareholdings*. Berle and Means (1932) and Jensen and Meckling (1976) argue that managerial shareholdings are likely to reduce agency conflicts between management and shareholders due to the implicit bonding and signaling roles of managerial shareholdings. The convergence-of-interests hypothesis proposed by Jensen and Meckling (1976) suggests that as the level of managerial shareholdings increase, the costs borne by managers for not making value-maximizing decisions also increase. Hence, the convergence-of-interests hypothesis predicts that higher managerial shareholdings should be associated with lower agency costs.

Alternatively, the entrenchment hypothesis suggests that managerial shareholdings may entrench managers with a high level of ownership and impair monitoring mechanisms. This leads to greater opportunities for managers to pursue their own interests at the expense of shareholders (Morck, Shleifer, and Vishny 1988). This hypothesis predicts greater agency conflicts at high levels of managerial share ownership, although the empirical results in this area are somewhat mixed.[6]

Further, the signaling model of John and Mishra (1990) predicts that the market response to unexpected changes in investment will be related to the proportion of insider ownership. Specifically, John and Mishra argue that the intensity of the market response will be a positive function of insider holdings. Consequently, the proportion of managerial shareholdings is included as a control variable.

6. For instance, see Kole (1994) and Cho (1998), who question endogeneity in previous research of McConnell and Muscarella (1985) and Morck et al. (1988).

4. *Leverage*. Jensen (1986, 1989), Hart and Moore (1990), and Stulz (1990) argue that debt can mitigate against managerial inefficiency. When leverage is sufficiently large, managers are unlikely to make wealth-destroying investment decisions because they are under legal obligations to service debt payments, and negative NPV projects increase the probability of bankruptcy. In the event of bankruptcy or near bankruptcy, managers' reputations are adversely affected, and their job security is threatened. Since long-term continued employment is generally considered to be a management objective (Shleifer and Vishny 1989), when the debt level is sufficiently high, managers are reluctant to make non-value-maximizing investment decisions. Moreover, debt itself is a control for agency problems. Hence, it is expected that managers of highly levered firms are more likely to use funds for positive NPV projects than managers of low levered firms, ceteris paribus.

III. Research Method

This article uses a previously untested data set. The sample includes capital expenditure announcements made by listed Australian firms. The use of an Australian data set has several advantages. First, it avoids the general criticism of data mining whereby further studies are conducted on a set of data originally used in discovery. This issue has not been previously tested in the Australian market, and thus, in this respect, the data can be regarded as "clean." Second, unlike many other markets, Australian firms rarely announce periodic capital expenditure plans. Rather, capital expenditure announcements are typically made during the course of the year as separate releases. Hence, the announcements are not contaminated by other information.[7] Third, as a result of this practice of not announcing periodic capital expenditure plans, each announcement can be regarded as containing unexpected news. In comparison to prior studies where there is a need to form an expectations model, no such issue arises here. Of course, it is naïve to assume that the market has no expectations; however, given the unpredictable nature of these announcements, prediction errors should average zero across a sample. We explicitly address this issue later, and the evidence supports our assertion. Finally, Schipper and Thompson's (1983) prior capitalization argument is not applicable in the case where firms do not generally announce a separate capital expenditure budget.

The article focuses upon the market valuation of announcements of capital expenditure. In order to eliminate noise and create a clean experiment, transactions data are used. For each announcement, all trades are collected for 5 trading days either side of the announcement. Returns are constructed from the transaction data using a time-weighted approach (McInish and Wood

7. Further, we explicitly control for any news contamination in the sample collection and construction of abnormal returns.

1992). Abnormal returns are initially calculated using market-adjusted returns.[8] Market returns are based on matching the transaction to the nearest 1-minute index return on the All Ordinaries Index.[9] The first step in calculating abnormal returns is to employ the standard market adjustment as follows:

$$AR_{it}^{a} = R_{it} - R_{mt}, \tag{1}$$

where R_{it} is the observed return of ith stock at t, and R_{mt} is the market return at t.

Returns from a control period are then used to remove any effects of abnormal information flow surrounding the announcement. The control periods are obtained by taking the same firm and collecting transactions over an equivalent length window exactly 1 year prior to the announcement date (to nearest trading day). The control period then represents an equivalent "news-free" period. In order to ensure a clean control period, if the 1-year pre-announcement control period contains an announcement of any type, the period is moved backward by 1 trading day at a time until a clean period is found.[10] The choice of 1 year prior is made to avoid any seasonal effects.

Abnormal returns over the control period are used as a benchmark, as they represent market-adjusted returns from periods that are not subject to any announcement news. Market-adjusted returns over the control period are subtracted market-adjusted returns over the announcement period to provide the abnormal return series used in the analysis, namely,

$$AR_{it} = AR_{it}^{a} - AR_{i,T-1}^{c}, \tag{2}$$

where AR_{it}^{a} is the market-adjusted return at announcement as in (1) and AR_{iT-1}^{c} is the market-adjusted return from the control period 1 year prior to the announcement and is calculated as $R_{iT-1} - R_{mT-1}$. The abnormal returns in (2) are then free of any information effects other than the capital expenditure announcements. Abnormal returns are also constructed using the standard market model, and these results are discussed as part of the sensitivity analysis below. An 11-day event period spanning 5 days before and after the announcement date is used.

8. A firm-specific risk adjustment is not employed, as beta measures at this high frequency can distort the abnormal returns. For instance, Kim, Lockwood, and McInish (1998) reveal that beta is unstable through the trading day. Kim et al. question the previous research that treats betas of individual firms as constant over the trading day (see, e.g., Cohen et al. 1983). Further, any risk adjustment at this frequency is likely to be inconsequential. Nevertheless, robust results to risk-adjustment procedures are discussed in a later section of the article.

9. The All Ordinaries Index (AOI) is widely regarded as the market indicator in the Australian stock market. It comprises around 330 stocks that represent around 90% of the total market capitalization. The index is value weighted and computed on a minute basis.

10. For instance, assume company X makes an announcement on July 25, 1997, and cumulative abnormal returns for a [−5, +5]–day window cover the period July 18, 1997–August 1, 1997. The control portfolio consists of abnormal returns on the same firm over the window July 18, 1996–August 1, 1996. If there was an announcement made on July 23, 1996, then the window is moved back to July 8, 1996–July 22, 1996, assuming there were no announcements made during that period.

IV. Data

A. Definitions

The study adopts a narrow definition of capital expenditure, which only includes expenditure that is strictly physical in nature. Such expenditure includes expenditures on plant, machinery, property, equipment, and other forms of physical asset expenditures, including construction of new plant, installation of new plant, and upgrading of existing plant but excluding assets acquired through mergers and takeovers. Some construction and acquisitions of a new plant are undertaken via joint ventures that facilitate the sharing of technology, management expertise, and resources. Expenditures undertaken via joint ventures are included in the analysis. The appendix provides some examples.

Mergers and takeovers are excluded due to valuation problems associated with merger and takeover studies.[11] A further reason for excluding takeovers relates to dis-synergies associated with some of the target's assets, for which a confounding valuation effect is likely to eventuate. This confounding valuation effect can be minimized by focusing on individual transactions rather than "bundles of assets" found in takeover targets. Moreover, given the inherent difference in market reactions reported at takeover announcements in previous studies, we wish to obtain a "clean" sample of capital expenditure announcements. Similarly, the definition does not include expenditure associated with acquiring businesses and divisions of a business.

Expenditure on upgrades specifically excludes maintenance. Expenditure on upgrading an existing plant is different from maintenance expenditure in that expenditure on upgrading is often associated with an increase in production capacity and employment, whereas maintenance is an operating item and expected by the market. The classifications of upgrading, construction, and installation sometimes overlap because some upgrades involve construction and installation of new facilities.[12]

The definition of physical asset expenditure does not include research and development expenditure (R&D) because most R&D expenditure is not physical, and where capitalized, R&D that satisfies the accounting requirement that future benefits are likely to eventuate beyond reasonable doubt is rare. Further, capitalized R&D is typically announced with other information.[13]

11. The valuation problems associated with mergers and takeovers are widely documented. See, e.g., Holland and Hodgkinson (1994) concerning information leakage, Asquith et al. (1983) concerning multiple bidders, and Holderness and Sheehan (1985) regarding news of substantial shareholdings.

12. See the appendix for some examples of this type of expenditure.

13. In a random sample of 30 large firms over the period 1995–97, 28 of the 30 firms announce capitalized R&D concurrently with the year-end announcement relating to current year events and future prospects. The remaining two firms announced capitalized R&D separately. Hence, it is difficult to disentangle the market response to capitalized R&D from the other information contained in the year-end announcement.

B. *Sample Selection*

The announcement data are provided by the Securities Industry Research Centre of Asia-Pacific (SIRCA). The initial data set contains 3,133 acquisition and disposal related announcements[14] (classified under subcode 07) made by 816 listed firms between July 1, 1995, and December 31, 1997.[15]

Several filters were applied. First, related announcements were identified, and the earliest date of the related announcement was taken as the announcement date. Announcements made before and after the official ASX trading period between 10:00 A.M. and 4:00 P.M. were excluded. These steps resulted in 1,334 and 304 exclusions, respectively. Further exclusions were made for concurrent announcements. Concurrent announcements included chairperson addresses, announcements related to option agreements, asset swaps, court decisions over a particular acquisition, completion of acquisition announcements, divestiture announcements, acquisition of shares, business, merger, and takeover announcements. This category resulted in a further 914 exclusions.

Announcements of permit, right, distribution, and acquisitions of interest in projects by mining companies were also excluded since they do not represent physical asset expenditures. This category resulted in a further 288 eliminations. There were also 65 announcements of contracts being awarded. Because of the nature of the announcement and the ambiguity of the announcement, these were also discarded. A final 58 exclusions related to those announcements that did not have information related to the consideration of the transaction, accounting information, and intraday share prices, leaving a final sample size of 170.

C. *Accounting Proxies*

Accounting information was collected from several sources.[16] Growth opportunities are measured by the market to book (M/B) ratio.[17] The measurement definitions in Fama and French (1993, 1996) are followed. The use of this proxy is consistent with prior research in the area and elsewhere. However,

14. The announcements are taken from the live "signal G" feed provided by the Australian Stock Exchange. Signal G is an electronic feed provided to the market and commercial subscribers and carries time-recorded company announcements. Given the electronic nature of this feed, accurate collection of the event time can be achieved.

15. Under subcode 07, company announcements are further classified into 18 categories. The 18 subcodes, respectively, are: takeover announcements, shareholder details, periodic reports, quarterly activities report, quarterly cash flow report, issued capital, asset acquisition and disposal, notice of meeting, stock exchange announcement, dividend announcement, progress report, company administration, notice of call, CAP test, chairman's address, letter to shareholders, ASX query, and warrants.

16. The primary source was the Connect 4–Annual Reports Service held at the Australian National University supplemented by the ASX Datadisc and annual reports stored on microfiche at the National Library of Australia.

17. Tobin's q is a common proxy used to measure growth opportunities (see, e.g., Lang and Litzenberger 1989; Lang et al. 1989, 1991). Tobin's q is typically defined as the ratio of the firm's market value to its replacement cost value. The difficulties in the use of Tobin's q are noted in Chung and Pruitt (1994).

the market to book ratio is subject to criticism as it is only one, among several, proxies that could be adopted. In defence, tests later in the article demonstrate that the results are unrelated to any market to book effect per se. Moreover, given the strength and robustness of the results to various research design methods, there is evidence that this proxy is sound.

Another proxy for growth that has been employed is the difference between rates of return (on equity) and the required rate of return (ROE − RRR). Following the arguments of Lang and Stulz (1994), we favor the market to book ratio as the measure of growth because it contains an ex ante estimate of growth prospects and hence captures expectations. In contrast, the calculation of ROE − RRR relies on ex post realizations. In this regard, ROE − RRR captures how the firm has performed. Moreover, the article tests the sensitivity of the analysis to the use of ROE − RRR as a measure of managerial performance with no substantive change in the results. A firm is (initially) considered to be a high growth firm if its market to book ratio is greater than the sample median and, conversely, a low growth firm if its market to book ratio is less than the sample median.[18]

Cash flow is calculated using the approach of Lang et al. (1991) as follows:[19]

$$CF = EBIT + DEP - TAX - DIV - INT, \quad (3)$$

where EBIT is earnings before interest and tax and extraordinary items, DEP is depreciation expense, TAX is tax paid, DIV is dividend paid on ordinary and preferred shares, and INT is interest expense on short- and long-term debt.

Managerial shareholding is defined as the fraction of common shares, not including options, held by officers and directors of the board. This definition is consistent with the literature, including Morck et al. (1988), McConnell and Servaes (1990), and Cho (1998). Managerial shareholding is the sum of all the common stocks owned by the directors and officers divided by the number of shares outstanding in that year, expressed as a percentage.

Managerial past performance is proxied by the beta risk-adjusted cumulative abnormal return calculated over the 3 years prior to the capital expenditure announcement using monthly price data. The standard market model is employed. In addition, a different proxy being the difference between return on equity (ROE) and the required rate of return (RRR) is employed with no substantive difference in the results.[20] The size of the expenditure is measured

18. An alternative categorization is used later in the article where the value of one is used to segregate firms. The results are robust.

19. This definition is widely used in the literature (see Lehn and Poulsen 1989). Though alternative measures have been proposed (see, e.g., Bowen, Burgstahler, and Daley 1986; Smith and Kim 1994), Lang et al. (1991) provide evidence that their results do not alter substantially when different cash flow measures are used.

20. ROE is estimated as EBIT based on market value of equity from the immediately preceding financial year, while RRR is calculated from the CAPM where beta is estimated from 1 year of prior daily data (using Scholes-Williams). The difference between these measures, ROE − RRR, is then used as the measure of managerial performance.

by the dollar value of the transaction normalized by the book value of total assets of the firm.[21]

V. Descriptive Statistics

Table 2 provides the descriptive statistics for the full sample and for subsamples grouped by high and low market to book ratio delineated by the median value. Variables include the size of firms (represented by total assets, net assets, and market capitalization), capital structure (represented by leverage ratio), earnings before tax normalized by total assets, market to book ratio, cash flow to total assets ratio, and level of managerial shareholding.

Table 2 reveals that the sample consists of a range of firms.[22] Panels B and C present characteristics for the low and high market to book ratio sample, respectively.[23] Panel D presents the difference in means of the variables between the low and high market to book ratio firms. Apart from the market to book ratio that is different by construction, the only variables where there is a significant difference in means are net assets and market capitalization, which are both larger for the high market to book ratio group.

The size of the capital expenditure transactions in the sample ranges from $2.55 million to $1.5 billion, as reported in table 3. The mean and median transaction size is $58.8 million and $33.65 million, respectively. More than 90% of the physical asset expenditure transactions are below $100 million, with three transactions worth more than $250,000 million. Although there is no comparative mean and median transaction size for mergers and takeovers, the size of these transactions would be below those of takeovers and mergers.

Table 4 reports the frequency distribution of announcement by time of the day, day of the week, month, and year. Panel A shows that announcements tend to occur during the first hour and the last hour of the trading day.[24] It should be noted that the table is constructed using announcements made only during the ASX trading hours.[25]

21. Book value instead of market value is employed to avoid potential problems of multicollinearity with other price-based variables. Further, the use of market values instead of book values is unlikely to have a substantial impact due to the high correlation of 0.95 between the two series.

22. For instance, the smallest firm is Red River Limited with a total market capitalization of just over $2 million (as of June 1996), compared to National Australia Bank Limited with total assets of over $148 billion (as of September 1998).

23. There are two observations with negative market to book ratio, both from Centaur Mining and Exploration Limited, which made announcements on October 25, 1995, and June 3, 1996.

24. This is consistent with the findings of Wood, McInish, and Ord (1985) and McInish and Wood (1990), and the Australian evidence of Aitken, Brown, and Walter (1994), all of whom find evidence that the variance of the intraday returns tends to be greater at the start and end of the trading day, such that a general U-shaped curve is observed.

25. When a firm's shares are frequently traded, the time-weighting approach to calculate returns approximates the "true" return. In order to examine the potential impact of stale prices, it is necessary to know to what extent the announcements were followed by active trading. While not detailed here, for 51.8% of the announcements, trading occurred within the first 15-minute interval. Further, for more than 85% of the announcements, trading occurred within 1 hour following the announcement.

TABLE 2 Firm Characteristics by Market to Book Ratio

	TA ($m)	TL ($m)	TL/TA	NA ($m)	MC ($m)	EBT/TA	M/B	CF/TA	MS
	Panel A. Full Sample								
N	170	170	170	170	170	170	170	170	170
Mean	3,823	2,759	.383	1,063	1,806	.040	1.280	.055	.123
Median	254	52	.375	152	164	.060	1.102	.068	.001
Max	148,123	136,245	3.275	15,746	34,568	.283	4.574	.301	.713
Min	.875	.090	.09	−31	2.092	−.581	−3.546	−.297	.000
SD	16,846	14,946	.378	2,918	5,967	.103	.861	.094	.203
	Panel B. Low Market to Book Ratio (Market to Book Ratio Less Than Median)								
N	85	85	85	85	85	85	85	85	85
Mean	2,902	2,365	.344	537	399	.041	.654	.055	.148
Median	226	37	.214	140	126	.062	.810	.068	.001
Max	109,285	99,164	3.275	10,121	5,180	.198	.983	.301	.689
Min	5.144	.090	.009	−31	2.765	−.422	−3.546	−.297	.000
SD	16,126	14,755	.503	1,469	873	.094	.755	.094	.217
	Panel C. High Market to Book Ratio (Market to Book Ratio Greater Than Median)								
N	85	85	85	85	85	85	85	85	85
Mean	4,744	3,153	.422	1,590	3,212	.039	1.833	.051	.099
Median	294	143	.448	151	250	.058	1.675	.071	.001
Max	148,123	136,245	.920	15,746	34,568	.283	4.574	.224	.713
Min	.875	.143	.030	.732	2.092	−.581	1.103	−.338	.000
SD	17,583	15,212	.177	3,796	8,177	.112	.621	.095	.185
	Panel D. Mean Difference between Low and High Market to Book Ratio Firms								
Difference	−1,842	−788	−.078	−1,504	−2,813	.002	−1.180	.004	.049
t-statistic	−.71	−.34	−1.26	−1.96*	−3.38**	−.13	−10.83**	.25	1.54

NOTE.—A univariate comparison is presented of mean measures of firm characteristics of 170 observations for the period between July 1995 and December 1997. Characteristics are total assets (TA), total liabilities (TL), leverage ratio (TL/TA), net assets (NA), market capitalization (MC), earnings before tax to total assets ratio (EBT/TA), market to book ratio (M/B), cash flow to total assets ratio (CF/TA), and percentage level of managerial shareholding (MS).

* Represents a 5% level of significance.

** Represents a 1% level of significance.

TABLE 3 **Summary Statistics of Dollar Size of Capital Expenditure Announcements of 170 Observations for the Period between July 1995 and December 1997**

	Size of Expenditure (AU$'000)
N	170
Mean	58,797
Median	33,650
Min	2,550
Max	1,500,000
SD	134,374
Less than $100 million (%)	85
Greater than $250 million (%)	1

TABLE 4 **Frequency Distribution of Capital Expenditure Announcements of 170 Observations for the Period between July 1995 and December 1997 by Time of the Day, Day of the Week, Month, and Year**

	Number of Announcements	Percentage
A. Frequency distribution by time:		
10:00–11:00	36	21
11:01–12:00	22	13
12:01–13:00	28	16
13:01–14:00	25	15
14:01–15:00	18	11
15:01–16:00	41	24
B. Frequency distribution by week:		
Monday	41	24
Tuesday	25	15
Wednesday	36	21
Thursday	42	25
Friday	26	15
C. Frequency distribution by month:		
January	2	1
February	8	5
March	12	7
April	10	6
May	11	6
June	14	8
July	13	8
August	19	11
September	15	9
October	24	14
November	16	9
December	26	15
D. Frequency distribution by year:		
1995	30	18
1996	61	36
1997	79	46

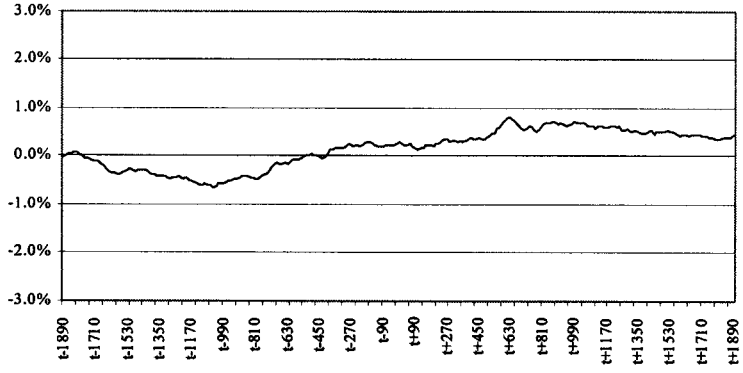

FIG. 1.—Mean cumulative abnormal returns calculated over 15-minute intervals using transaction data for 170 observations for the period between July 1995 and December 1997. The window is specified in minutes and covers [−1,890, +1,890], or [−5, +5] days. The announcement time is $t = 0$. Abnormal returns are calculated using a control period $AR_{it} = AR^{a}_{it} - AR^{c}_{i,T-1}$.

Panel B shows that the announcements occur evenly on Monday, Wednesday, and Thursday and slightly less on Tuesday and Friday. Panel C shows that while a majority of announcements occur during the second half of the year (namely, 67% occur between July and December and 33% occur between January and June), the spread across months is indeed even. Recall that the sample period is July 1995–December 1997; hence, we expect the second half of the year to be overrepresented by a ratio of 3:2. Finally, panel D shows that 46% of the announcements occur in 1997, with 36% in 1996, and 18% in 1995 (again, recall that the sample period is July 1995–December 1997).

VI. Results

A. *Announcement Effects*

Figure 1 presents the mean cumulative abnormal return for the 170 announcements over a [−1,890, +1,890]–minute window (equivalent to a [−5, +5]–day window). Abnormal returns are calculated over 15-minute intervals, using the method that employs a control period, as discussed earlier.

The cumulative abnormal returns (CARs) in figure 1 show some small positive market reaction around the announcement period, but there is no clear evidence that the announcements are associated with significant positive abnormal returns. The lack of statistical significance around the announcement period is confirmed in table 5, which shows that the mean CARs are insignificant across various windows. While not shown here, the abnormal returns for each 15-minute interval are also insignificant over the window. These findings are similar to those typically observed for bidders in merger and takeover studies.

TABLE 5 **Summary of Mean Cumulative Abnormal Returns Calculated over 15-Minute Intervals Using Transaction Data for 170 Observations for the Period between July 1995 and December 1997**

	Intraday Windows			Daily Windows		
Window Length:	[−120, +120]	[−60, +60]	[0, +360]	[−5, +5]	[−2, +2]	[−1, +1]
Mean CAR (%)	−.060	.013	.039	.448	.921	.150
t-statistic	−.47	.52	.11	.67	1.12	.69

NOTE.—The windows are specified either in minutes or days. The announcement time is $t = 0$. Abnormal returns are calculated using a control period $AR_{it} = AR^{a}_{it} - AR^{c}_{i,T-1}$.

The lack of significant abnormal returns around the announcement does not of itself lead to the generalization that the market does not react to capital expenditure announcements. The insignificant market response may be due to the comingling of growth and cash flow factors, as argued earlier. This possibility is explored in the next section.

B. Growth Opportunity Effects

Figure 2 presents the mean cumulative abnormal returns for four subsamples sorted on the basis of market to book ratio, with the lowest market to book quartile denoted by Q1 and highest quartile denoted by Q4. For the lowest market to book ratio quartile, a CAR of −4% is observed over the [−1,890, +1,890]–minute window. In contrast, a CAR of +5% is observed for the highest market to book quartile over the window. That is, there is a large difference of over 9% between the two extreme quartiles. It is interesting to note that the CARs for both the middle market to book ratio quartiles are generally flat across the window. The insignificant CARs for the two middle groups suggest that the market may not be able to distinguish between marginal growth firms.

Table 6 confirms the graphical results of figure 2, that is, significant positive (negative) CARs are observed for the highest (lowest) market to book ratio quartile. This result is robust over various windows. The difference in CARs between the highest and lowest market to book ratio quartiles is statistically significant across all windows.[26] However, for the middle quartiles, the mean CARs and the difference in CARs between the two quartiles are insignificant. The finding that the market does not respond in any significant manner to the middle quartiles is a valuable finding in itself since prior research fails to separate these samples into finer groups.

The results in figure 2 and table 6 are consistent with the signaling model of John and Mishra (1990). In their model, higher (lower) than expected investment announcements are good (bad) news for growth firms and bad (good) news for firms in decline. For mature firms in the middle, there is little news value. As illustrated above, to the extent that market to book proxies for growth opportunities, the market reacts favorably for high growth firms

26. Tests for differences between samples are conducted under the assumption of unequal sample variances.

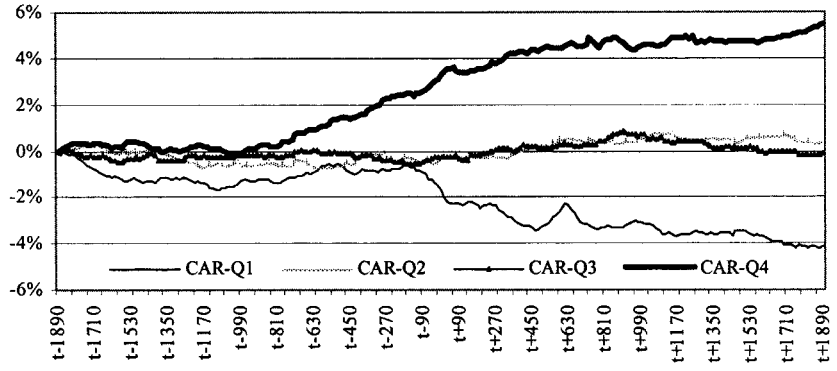

FIG. 2.—Mean cumulative abnormal returns calculated over 15-minute intervals using transaction data for 170 observations for the period between July 1995 and December 1997 sorted by market to book quartiles. Q1 represents the lowest market to book quartile, and Q4 represents the highest market to book quartile. The window is specified in minutes and covers [−1,890, +1,890], or [−5, +5] days. The announcement time is $t = 0$. Abnormal returns are calculated using a control period $AR_{it} = AR^{a}_{it} - AR^{c}_{i,T-1}$.

and negatively for low growth firms. Mature firms experience little market response.

The results above need to be interpreted with care, since it could be argued that the difference in CARs between the two types of firms (high and low market to book ratio firms) might have eventuated in the absence of any capital expenditure announcement. If this assertion is correct, then the difference in the CARs between the quartiles should be evident over the whole window, not just around the announcement time. If significant abnormal returns are observed only around the announcement period, it follows that the abnormal returns are associated with the announcement and not a more general market to book effect. Hence, by examining the abnormal returns around the announcement period, one can reasonably conclude whether the difference in CARs between the two groups of firms is the result of the announcement or the result of the equity market persistently discriminating between the two groups of firms.

Table 7 presents abnormal returns for the highest and lowest market to book quartiles by 15-minute intervals over 1 trading day either side of the announcement. From this table, significant positive abnormal returns occur mainly around 2 hours before and 30 minutes after the announcement minute for the highest market to book quartile, while significant negative abnormal returns are observed for the lowest market to book quartile at the announcement and in the 2 hours before the announcement. The differences in the price reaction between the highest and lowest market to book quartiles are significant in the 2 hours before the announcement, at the announcement itself, and up to 30 minutes after the announcement. Table 7 therefore provides support for

TABLE 6 **Summary of Mean Cumulative Abnormal Returns and Differences between Mean CARs Calculated over 15-Minute Intervals Using Transaction Data for 170 Observations for the Period between July 1995 and December 1997 Sorted by Market to Book Quartiles**

	Panel A					
	Minute Windows			Daily Windows		
	[−120, +120]	[−60, +60]	[0, +360]	[−5, +5]	[−2, +2]	[−1, +1]
Highest market to book quartile:						
N	44	44	44	44	44	44
Mean CAR (%)	.985	.921	1.089	5.484	4.074	2.594
SD	.031	.020	.035	.076	.056	.048
t-statistic	2.10*	3.01**	2.08*	4.80**	4.80**	3.55**
Second highest market to book quartile:						
N	42	42	42	42	42	42
Mean CAR (%)	.182	.190	.267	−.140	.447	.161
SD	.020	.012	.023	−.063	.048	.030
t-statistic	.58	1.03	.76	−.14	.61	.35
Second lowest market to book quartile:						
N	42	42	42	42	42	42
Mean CAR (%)	.097	.138	.222	.376	1.019	−.087
SD	.028	.023	.029	.086	.061	.042
t-statistic	.22	.39	.50	.28	1.08	−.13
Lowest market to book quartile:						
N	42	42	42	42	42	42
Mean CAR (%)	−1.556	−1.239	−1.470	−4.167	−2.008	−2.184
SD	−.040	−.024	−.039	−.095	−.088	−.095
t-statistic	−2.54*	−3.33**	−2.44*	−2.89**	−1.49	−1.49

	Panel B. Test for Difference in Mean CARs					
Difference in mean CARs between the highest and lowest market to book ratio quartiles:						
$CAR_{highest} - CAR_{lowest}$	2.541	2.160	2.559	9.651	6.082	4.778
t-statistic	3.28**	4.52**	3.21**	5.19**	3.80**	2.92**
Mean difference in CARs between the second highest and second lowest market to book ratio quartiles:						
$CAR_{high} - CAR_{low}$	.085	.052	.044	−.516	−.572	.248
t-statistic	.03	.13	.08	−.31	−.48	.31

NOTE.—Q1 represents the lowest market to book quartile, and Q4 represents the highest market to book quartile. The window is specified in minutes and covers [−1,890, +1,890], or [−5, +5] days. The announcement time is $t = 0$. Abnormal returns are calculated using a control period $AR_{it} = AR^{a}_{it} - AR^{c}_{i,T-1}$.

* Represents a 5% level of significance.

** Represents a 1% level of significance.

TABLE 7 **Mean Abnormal Returns over 15-Minute Intervals Using Transaction Data for 170 Observations for the Period between July 1995 and December 1997 Grouped into Quartiles Based on Market to Book**

	Highest Market to Book Quartile			Lowest Market to Book Quartile			Difference between Highest and Lowest Market to Book Quartiles	
Event Time	*AR* (%)	*t*-Statistic	*AR* > 0 (%)	*AR* (%)	*t*-Statistic	*AR* > 0 (%)	Difference in Abnormal Returns	*t*-Statistic
$t - 360$	−.136	−1.14	54.5	−.041	−.77	40.5**	−.177	1.35
$t - 345$	−.067	−.76	54.5	−.044	−.86	54.8	−.023	.23
$t - 330$	−.080	−1.12	61.4**	−.025	−.44	47.6	−.105	1.16
$t - 315$	−.037	−.81	54.5	−.067	−.90	52.4	−.104	1.19
$t - 300$	−.058	−1.16	65.9**	−.097	−1.92	59.5**	−.039	−.55
$t - 285$	−.192	−2.81**	63.6**	−.056	−1.21	59.5**	−.136	1.65
$t - 270$	−.063	−1.46	56.8	−.039	−.40	46.3	−.102	.96
$t - 255$	−.022	−.56	52.3	−.001	−.01	66.7**	−.023	.23
$t - 240$	−.084	1.95	56.8	−.024	−.53	57.1*	−.060	.97
$t - 225$	−.005	−.12	56.8	−.006	−.11	47.6	−.011	−.16
$t - 210$	−.052	−1.40	63.6**	−.024	−.49	59.5**	−.028	.46
$t - 195$	−.009	−.20	47.7	−.096	−1.82	61.9**	−.106	−1.49
$t - 180$	−.049	−.74	56.8	−.065	−1.53	47.6	−.015	−.19
$t - 165$	−.054	−1.31	59.1**	−.001	−.06	47.6	−.056	1.19
$t - 150$	−.017	−.29	52.3	−.117	−2.01*	38.1**	−.100	1.22
$t - 135$	−.105	−1.69	36.4**	−.004	−.10	45.2	−.109	−1.50
$t - 120$	−.082	−1.96*	56.8	−.126	−2.47*	38.1**	−.209	3.15**
$t - 105$	−.021	−.26	59.1**	−.012	−.26	47.6	−.033	.35
$t - 90$	−.097	−1.96*	56.8	−.083	−1.71	31.0**	−.180	2.60**
$t - 75$	−.079	−2.02*	56.8	−.073	−1.17	40.5**	−.152	2.05*
$t - 60$	−.093	−2.12*	65.9**	−.181	−2.30*	38.1**	−.274	3.04**
$t - 45$	−.121	−2.12*	60.5**	−.066	−1.18	42.9*	−.187	2.33*
$t - 30$	−.129	−1.90	65.1**	−.083	−1.54	42.9*	−.212	2.45**
$t - 15$	−.126	−1.97*	53.5	−.213	−2.90**	31.0**	−.339	3.48**
$t - 0$	−.183	−2.24*	58.1*	−.171	−2.63**	36.6**	−.354	3.39**

$t + 15$	−.106	−1.93	60.5**	−.227	−1.82	47.6	−.333	2.44**
$t + 30$	−.126	−2.14*	65.1**	−.251	−1.84	33.3**	−.377	2.54**
$t + 45$	−.023	−.34	48.8	−.069	−.66	52.4	−.046	.37
$t + 60$	−.061	−.69	51.2	−.023	−.32	52.4	−.039	.34
$t + 75$	−.130	−.67	51.2	−.027	−.37	54.8	−.103	−.50
$t + 90$	−.066	−.64	48.8	−.025	−.38	45.2	−.041	−.33
$t + 105$	−.007	−.15	41.9*	−.019	−.28	51.2	−.026	.32
$t + 120$	−.026	−.50	50.0	−.050	−.74	59.5	−.075	−.89
$t + 135$	−.008	−.21	56.8	−.059	−1.18	57.1	−.051	−.82
$t + 150$	−.053	−.94	56.8	−.004	−.08	45.2	−.058	.72
$t + 165$	−.065	−.61	56.8	−.021	−.53	47.6	−.086	.76
$t + 180$	−.073	−1.73	52.3	−.097	−1.78	40.5**	−.170	2.46**
$t + 195$	−.002	−.03	54.5	−.128	−1.64	33.3**	−.130	1.14
$t + 210$	−.004	−.08	54.5	−.087	−.54	42.9*	−.084	−.49
$t + 225$	−.026	−.41	54.5	−.007	−.10	50.0	−.019	.20
$t + 240$	−.058	−.91	50.0	−.086	−.88	42.9*	−.028	−.24
$t + 255$	−.155	−1.77	59.1**	−.045	−1.22	38.1**	−.201	2.11*
$t + 270$	−.038	−.80	59.1**	−.033	−.55	45.2	−.005	−.07
$t + 285$	−.029	−.77	68.2**	−.223	−.96	48.8	−.252	1.07
$t + 300$	−.129	−1.79	61.4**	−.021	−.39	42.9*	−.150	1.67
$t + 315$	−.066	−.84	56.8	−.126	−1.23	40.5**	−.192	1.49
$t + 330$	−.134	−1.52	61.4**	−.138	−1.30	45.2	−.272	1.97*
$t + 345$	−.047	−.57	47.7	−.020	−.20	45.2	−.067	.51
$t + 360$	−.039	−.60	52.3	−.137	−1.61	40.5	−.176	1.64

NOTE.—Abnormal returns presented for (Q1) the lowest market to book quartile, (Q4) the highest market to book quartile, and the difference between abnormal returns for Q4–Q1. The window is specified in minutes and covers [−360, +360] or [−1, +1] trading day. The announcement time is $t = 0$. Abnormal returns are calculated using a control period $AR_{it} = AR^{a}_{it} - AR^{c}_{i,T-1}$. T-ratios are tests for difference from zero and the column $AR > 0$ (%) is the percentage of positive abnormal returns in each 15-minute interval, where the test for statistical difference is a nonparametric binomial test using 50% of observations as the null hypothesis.

* Represents a 5% level of significance.

** Represents a 1% level of significance.

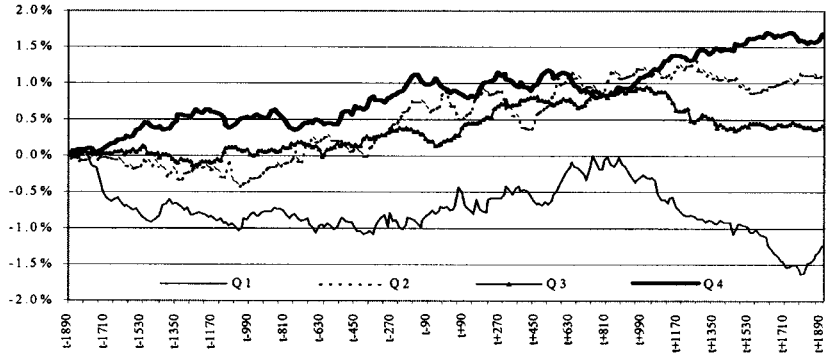

FIG. 3.—Mean cumulative abnormal returns calculated over 15-minute intervals using transaction data for 170 observations for the period between July 1995 and December 1997 sorted by cash flow to total assets ratio. Q1 represents the lowest cash flow quartile, and Q4 represents the highest cash flow quartile. The window is specified in minutes and covers [−1,890, +1,890], or [−5, +5] days. The announcement time is $t = 0$. Abnormal returns are calculated using a control period $AR_{it} = AR^{a}_{it} - AR^{c}_{i,T-1}$.

the hypothesis that the market reaction to capital expenditure announcements is dependent on the firm's growth prospects (as measured by market to book ratio) rather than on the market to book effect per se.

An alternative test of this proposition is to analyze the abnormal returns over the control period. If the argument holds that the results are due to the capital expenditure announcement and the interaction with growth prospects, then there should be no significant returns observed in the news-free control period. Indeed, this is the case (results not reported here). In the control period, the differences in abnormal returns between the two portfolios are never significant in any of the intervals. This result compares to table 7, which shows that there are significant differences in abnormal returns between the portfolios clustered around the announcement time.

C. *Cash Flow Effects*

It was hypothesized above that when firms announce new capital expenditure, the equity market should react such that firms with low cash flow ratios experience a significantly higher abnormal return than firms with high cash flow ratios. Figure 3 presents the CARs grouped by the cash flow to total assets ratio. No clear pattern exists, which suggests that the role of cash flow in the capital market assessment of the signal is limited. The results in figure 3 also seem to suggest that the market reacts negatively to the announcements made by the lowest cash flow group and most positively to the highest cash flow group. Hence, these results appear prima facie contradictory to the capital market monitoring hypothesis. However, unlike the market to book quartiles,

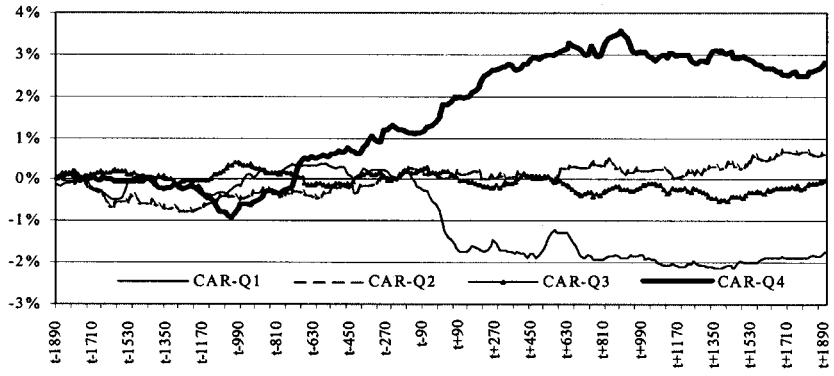

FIG. 4.—Mean cumulative abnormal returns calculated over 15-minute intervals using transaction data for 170 observations for the period between July 1995 and December 1997 sorted by the magnitude of the ex post abnormal return at announcement $t = 0$. Q1 represents the lowest *AR* quartile, and Q4 represents the highest *AR* quartile. The window is specified in minutes and covers [−1,890, +1,890], or [−5, +5] days. The announcement time is $t = 0$. Abnormal returns are calculated using a control period $AR_{it} = AR^{a}_{it} - AR^{c}_{i,T-1}$.

the 15-minute abnormal returns are generally insignificant for the cash flow quartiles.

D. Foster, Olsen, and Shevlin's Method

Brown and Warner (1980) and Foster, Olsen, and Shevlin (1984) specify a method of examining cumulative abnormal returns based on ex post realized returns. This method involves grouping the abnormal returns at the announcement time $t = 0$ by their sign. If prices reflect a rational reaction to the news at announcement time, then positive abnormal returns reflect "good news" and negative abnormal returns reflect "bad news." This approach allows a comparison between abnormal returns on the good (bad) news portfolios and abnormal returns on the previously formed high (low) growth portfolios (as in fig. 2). If the CARs based on the Foster et al. ex post method resemble the CARs of the ex ante market to book ratio groups, then it can be argued that the market to book ratio is a good proxy for assessing the value of the growth opportunities of firms.

Figure 4 separates the sample into quartiles sorted by the magnitude of abnormal returns observed at the announcement time. The bottom (top) quartile contains those firms that experienced the lowest (highest) abnormal returns at $t = 0$. A mean abnormal return of −0.34% (*t*-statistic: −5.94) is observed for the lowest quartile, while for the highest quartile, a mean abnormal return of +0.33% (*t*-statistic: 2.59) is observed. These figures compare to −0.17% and +0.18% for the lowest and highest quartiles grouped by ranking on the

market to book ratio (from table 7). Moreover, figure 4 shows a striking resemblance to figure 2, with a clear differentiation in the two extreme quartiles and relatively flat lines for the middle two quartiles. The consistency between these figures here and the abnormal return behavior is indicative of the market reacting to good and bad news at announcement. In this sense, the announcements convey unexpected news. Recall that in earlier discussion we argued that capital expenditure announcements in Australia were likely to contain news because of the lack of periodic capital expenditure reports. These results are consistent with that argument.

E. Randomization Approach

In this section, we differentiate between the market to book and cash flow effects. The approach adopted here is similar to the Fama and French (1992) method in which all observations are first sorted by their market to book ratio (or cash flow ratio) and then grouped into quartiles. In each quartile, observations are subsequently re-sorted by their cash flow ratio (market to book ratio). This method allows for an examination of the cash flow (market to book) effect after randomizing on the market to book (cash flow).

Table 8 provides the results of the randomization.[27] In panels A (B) and C (D), the value in each cell is the mean (median) CAR. In panels A and B, the market to book effect is neutralized, while in panels C and D, the cash flow effect is neutralized.

Panels A and B reveal that when the market to book effect is controlled, the lowest and highest cash flow quartiles do not exhibit either consistent positive or negative CARs. If indeed the cash flow effect is dominant, the difference in CARs between the highest and lowest cash flow firms should be significant. The results in panels A and B show that this is not the case.

In contrast, in panels C and D, when the cash flow effect is controlled, the lowest market to book quartile exhibits negative CARs across all cash flow sorts, and the highest market to book quartile exhibits positive CARs across all cash flow sorts. Panels C and D reveal a significant difference in both mean and median CARs between the two extreme quartiles.

In summary, the market to book effect is dominant and remains after controlling for the cash flow effect. In contrast, the cash flow effect is weak in the presence of the market to book effect.

F. Free Cash Flow Analysis

It was found earlier that the cash flow variable does not explain the market response to capital expenditure announcements. In this section, the role of

27. Note that the original analysis included two observations with negative market to book values, namely, CTR 25/10/95 and CTR 3/6/96. The negative market to book values were due to negative net assets in both years. The exclusion of these two observations does not affect the results. In fact, the inclusion of the two observations strengthens the results since the CARs associated with the two outliers are −9.17% and −4.55%, respectively.

TABLE 8 **Cumulative Abnormal Returns Based on Abnormal Returns Calculated over 15-Minute Intervals Using Transaction Data for 170 Observations for the Period between July 1995 and December 1997 Grouped into Quartiles Based on Market to Book**

	Market to Book			
Cash Flow	.105–.871	.872–1.091	1.101–1.675	1.675 – 4.574
	Panel A. Cash Flow Effect after Controlling for Market to Book (Mean CARs)			
Lowest (%)	−5.11	−1.06	−2.59	6.65
Low (%)	−5.37	−1.56	−.93	6.65
High (%)	−3.49	−.78	−.22	1.70
Highest (%)	−2.93	−1.89	−.71	5.81
Difference in means (%)	−2.18	−2.95	−1.88	.84
t-statistic	−1.10	−1.47	−.93	.22
	Panel B. Cash Flow Effect after Controlling for Market to Book (Median CARs)			
Lowest (%)	−5.13	−.01	−1.71	−4.02
Low (%)	−4.49	−.30	−.55	−6.10
High (%)	−4.19	−1.39	−.14	−1.24
Highest (%)	−2.54	−2.22	−1.67	−4.59
Difference in medians (%)	−2.59	−2.23	−3.38	−.57
t-statistic	−.88	−1.57	−.96	−.53
	Cash Flow			
Market to Book	−.338–.034	.036–.068	.068–.094	.096–.301
	Panel C. Market to Book Effect after Controlling for Cash Flow (Mean CARs)			
Lowest (%)	−4.41	−5.80	−2.10	−3.63
Low (%)	−.96	−.62	−.79	−.88
High (%)	−.11	−1.95	−2.11	−3.25
Highest (%)	−3.14	−4.80	−2.52	−5.98
Difference in means (%)	−7.55	−10.60	−4.62	−9.61
t-statistic	−2.60*	−2.15*	−2.46*	−3.45**
	Panel D. Market to Book Effect after Controlling for Cash Flow (Median CARs)			
Lowest (%)	−4.25	−4.49	−2.43	−3.20
Low (%)	−.51	−.41	−1.45	−1.31
High (%)	−.56	−2.25	−1.72	−2.75
Highest (%)	−4.02	−6.22	−3.67	−5.80
Difference in medians (%)	−8.27	−10.71	−6.10	−9.00
t-statistic	−2.23*	−2.02*	−1.98*	−2.29*

NOTE.—Abnormal returns are calculated using a control period $AR_{it} = AR^{a}_{it} - AR^{c}_{i,T-1}$. The value in each cell represents mean CAR over the [−5, +5]–day window. In panel A, observations are sorted into quartiles based on M/B ratio, and within each quartile, observations are sorted into quartiles based on the cash flow to total assets (CF/TA) ratio. In panel B, the same sort is repeated using median CARs. In panel C, the CARs are sorted on CF/TA first, and then on M/B ratio. The same process is repeated for panel D. The *t*-ratio is for the difference from zero in mean/median CAR between the highest and the lowest groups.

* Represents a 5% level of significance.

** Represents a 1% level of significance.

TABLE 9 **Cumulative Abnormal Returns Based on Abnormal Returns Calculated over 15-Minute Intervals Using Transaction Data for 170 Observations for the Period between July 1995 and December 1997**

	Growth Opportunities	
Cash Flow	Low	High
A. Median value used as the cut-off for cell groupings:		
High	(A)	(B)
	−2.002%	3.865%**
	(−1.72, .074, 40)	(3.07, .083, 43)
Low	(C)	(D)
	−1.828%	1.722%
	(−1.14, .107, 45)	(1.63, .066, 42)
B. Value of 1.0 used as the cut-off for cell groupings:		
High	(A)	(B)
	−2.067%	3.243%**
	(−1.98, .075, 33)	(2.92, .076, 50)
Low	(C)	(D)
	−2.230%	1.605%
	(−1.25, .111, 39)	(1.65, .067, 48)

NOTE.—Abnormal returns are calculated using a control period $AR_{it} = AR^{\tau}_{it} - AR^{\tau}_{i,T-1}$. The value in each cell represents mean CAR over the [−5, +5]–day window. In panel A, observations are grouped according to the median market to book and median cash flow to total assets ratios (CF/TA). In panel B, observations are grouped using the value of 1.0 as the cut-off for the market to book and cash flow to total assets ratios (CF/TA). Values in parentheses are *t*-statistic, standard deviation, and number of observations, respectively. Two-way ANOVA test, *F*-statistic = 6.162.

** Represents the 1% level of significance.

cash flow is examined more thoroughly by investigating the interaction between cash flow and market to book effects.

Jensen (1986) argues that when firms lack growth opportunities and have excess cash flow, managers may undertake negative net present value investments. Based on this line of reasoning, it is argued that the agency costs of discretionary cash flow are likely to be substantial when firms face low growth environments. Hence, the market is expected to react negatively to new investment announcements under these circumstances. Recall that table 1 presented a matrix of combinations of growth and cash flow. It was argued earlier that free cash flow firms were most likely to be found in cell A (i.e., low growth and high cash flow). Conversely, the market may perceive the best environment to be one of high growth (i.e., cells B and D). In order to test the impact of free cash flow, the difference in CAR between free cash flow firms (cell A) and nonfree cash flow firms is examined in table 9.

Table 9 provides the mean CARs for each of the four cells over the [−1,890, +1,890]–minute or [−5, +5]–day window. Panel A uses the median values of the market to book and cash flow to total assets ratios for cell groupings, while panel B uses the value of 1.0 as the cut-off for cell groupings. The results from these two approaches are very similar. The table indicates that free cash flow firms (cell A) suffer significant negative cumulative abnormal returns of around −2%. Firms with low cash flow and high growth opportunities (cell D) exhibit an insignificant CAR, while firms with high cash flow

and high growth prospects (cell B), enjoy the highest CAR of over 3%, which is significant. Firms with low growth and low cash flow (cell C) exhibit an insignificant CAR. The differences in CARs between firms in cells A and B, and A and D are both significant, with values of −5.87% (*t*-statistic: −3.40) and −3.72% (*t*-statistic: −2.40), respectively.[28]

The results in table 9 indicate that the role of cash flow is twofold. In a low growth environment, where the agency costs of discretionary cash flow are likely to be significant, the equity market reacts negatively to these firms (especially for firms in cell A), consistent with the free cash flow theory. Conversely, in a high growth environment, cash flow avoids underinvestment problems (Myers and Majluf 1984). Significant positive CARs are evident for firms in cell B.[29] In summary, the market valuation is negative for firms likely to suffer from free cash flow and is positive for firms with high growth prospects.

G. A Multivariate Model

As previously noted, the three main factors that are most likely to influence the abnormal returns of capital expenditure announcements are growth opportunities, capital market monitoring, and free cash flow. Noted earlier as well, there are also other factors that may influence the abnormal returns at such announcements. These factors are the size of the transaction, prior managerial performance, the level of managerial shareholding, and leverage.

Prior studies use a two-way free cash flow dummy classification, where a dummy of one is used for firms with high cash flow and low market to book ratios (i.e., free cash flow firms) and zero for all other nonfree cash flow firms. However, as documented earlier, a finer partition may be warranted to capture both the market to book and cash flow effects. Hence, a finer free cash flow dummy is employed in following regression:

$$\begin{aligned} \mathrm{CAR}_i = {} & \alpha + \beta_1 MBD_{H,i} + \beta_2 MBD_{L,i} + \beta_3 CFD_{H,i} \\ & + \beta_4 CFD_{L,i} + \beta_5 (MBD_L \times CFD_H)_i \\ & + \beta_6 SIZE_i + \beta_7 PASTPERF_i \\ & + \beta_8 MS_i + \beta_9 LEV_i + \varepsilon_i, \end{aligned} \tag{4}$$

where $MBD_{H,i} = 1$ for the highest market to book ratio quartile and 0 otherwise; $MBD_{L,i} = 1$ for the lowest market to book ratio quartile and 0 otherwise; $CFD_{H,I} = 1$ for the highest cash flow ratio quartile and 0 otherwise; $CFD_{L,i} = 1$ for the lowest cash flow ratio quartile and 0 otherwise; $(MBD_L \times CFD_H)_i$ is the interactive term, where 1 is free cash flow, and 0

28. These numbers are derived from panel A of table 9. Similar results apply to panel B.

29. The same analysis was also conducted for a narrower [−60, +60]–minute window. These results are essentially the same as those reported here.

otherwise; $SIZE_i$ is size of the capital expenditure; $PASTPERF_i$ is prior managerial performance; MS_i is managerial shareholdings; and LEV_i is the leverage ratio.

The proxies for each variable were discussed earlier. The regression results are provided in table 10.[30] Ramsey's (1969) Reset test is used as a regression specification test.

Model 1 consists of the three key variables only—market to book, cash flow, and free cash flow. Model 2 consists of all variables. Morck et al. (1988) and Stulz (1988) argue that the relationship between the level of managerial shareholdings and firm value may not be linear. Both Morck et al. and McConnell and Servaes (1990) find a curvilinear relationship between managerial share ownership and firm value. The nonlinearity of this relationship is incorporated in model 3, by the addition of a quadratic term to the regression equation. Model 4 excludes the managerial shareholding variable since it can be argued that while higher managerial shareholdings alleviate agency problems, this is already reflected in the market to book ratio. Model 5 excludes the leverage ratio as the impact of debt in forcing managers to make value-maximizing investment decisions may be already reflected in the cash flow ratio.[31]

Consistent with the growth opportunities hypothesis, table 10 shows that positive CARs are associated with firms possessing high market to book ratios, and negative CARs are associated with firms possessing low market to book ratios. The cash flow variables are not significant except in their interaction with the market to book ratio (i.e., in a free cash flow context). The finer partition of market to book and cash flow ratios clearly captures a free cash flow effect, as evidenced by the significant negative coefficient on the interaction variable. All control variables are insignificant. The results are robust across all five models. The model diagnostics indicate a reasonable fit in all cases.

In summary, these results strongly support the role of growth opportunities and free cash flow in the market valuation of capital expenditure announcements. This suggests that previous research that fails to support free cash flow as an important variable may be due to the coarse proxy employed.

H. Sensitivity Analysis

The analysis presented to date uses a definition of abnormal returns that employs a control news-free period, as in equation (2). Sensitivity analysis is conducted on all tests above to examine whether the results above are sensitive to a different abnormal return measure. We repeat the analysis using the more common abnormal return measure that involves the constrained (0,

30. Several heteroskedasticity tests are provided that are Breusch-Pagan-Godfrey (B-P-G) and ARCH tests. Both standard *t*-statistics and White's heteroskedastic-consistent adjusted *t*-statistics are provided.

31. For example, low cash flow firms that visit the capital market are invariably forced by the capital market to make value-maximizing decisions.

TABLE 10 Multivariate Regression Results of Equation (4) in the Text

	Model 1	Model 2	Model 3	Model 4	Model 5
Constant	−.001	.006	.007	.003	.009
	[−.09]	[.27]	[.33]	[.16]	[.55]
	{−.14}	{.35}	{.43}	{.20}	{.77}
MBD_H	.042**	.044**	.043**	.043**	.043**
	[3.18]	[3.30]	[3.29]	[3.24]	[3.23]
	{3.72}	{3.92}	{3.92}	{3.80}	{3.81}
MBD_L	−.038*	−.040*	−.041*	−.040*	−.038*
	[−2.22]	[−2.14]	[−2.18]	[−2.16]	[−2.16]
	{−2.09}	{−2.17}	{−2.24}	{−2.10}	{−2.00}
CFD_H	.016	.015	.013	.014	.013
	[1.01]	[.89]	[.76]	[.86]	[.80]
	{.97}	{.89}	{.78}	{.88}	{.79}
CFD_L	.006	.003	.002	.004	.002
	[.37]	[.21]	[.14]	[.22]	[.14]
	{.47}	{.26}	{.16}	{.26}	{.18}
$MBD_L \times CFD_H$	−.040*	−.043*	−.042*	−.042*	−.041*
	[−1.98]	[−2.09]	[−2.04]	[−2.03]	[−2.01]
	{−2.52}	{−2.65}	{−2.60}	{−2.54}	{−2.60}
LEV		−.003	−.005	−.003	
		[−.41]	[−.64]	[−.37]	
		{−.46}	{−.70}	{−.43}	
MS		.000	.000		
		[1.25]	[.71]		
		{.71}	{.99}		
MS^2			−.000		
			[−.71]		
			{−.98}		
PASTPERF		−.000	−.000	−.000	−.000
		[−1.18]	[−1.21]	[−.57]	[−.55]
		{−.84}	{−.86}	{−.60}	{−.57}
SIZE		.003	.002	.002	.003
		[.80]	[.57]	[.74]	[.91]
		{1.10}	{.85}	{1.02}	{1.17}
Adjusted R^2	.123	.119	.116	.116	.121
Prob value of *F*-test	.000	.000	.000	.000	.000
B-P-G test	3.135	13.424	14.900	3.697	3.505
ARCH test	1.491	2.261	2.135	1.670	1.719
Ramsey Reset test					
Reset (2)	2.619	.004	.047	1.114	.937
Reset (3)	1.301	.107	.094	.641	.550
Reset (4)	.890	.489	.731	.588	.554

NOTE.—The dependent variable is the cumulative abnormal returns for the [−60, +60]–minute window based on abnormal returns calculated over 15-minute intervals using transaction data for 170 observations for the period between July 1995 and December 1997. Abnormal returns are calculated using a control period $AR_{it} = AR^a_{it} - AR^c_{i,T-1}$. *t*-statistics are in brackets; White adjusted *t*-statistics are in braces.

* Represents the 5% level of significance.

** Represents the 1% level of significance.

1) market model as specified in equation (1). The results from this alternative analysis are consistent with those presented above. Growth remains strongly significant while the cash flow effects are not significant once the market to book ratio is controlled. Support is again found for the role of free cash flow in both the two-way contingency test and regression analysis.

As another alternative method to the estimation of abnormal returns, a risk

adjustment is also employed. This method involves the use of the market model with parameters estimated using 1 year of daily data prior to the event window. The beta estimates are obtained from the Scholes-Williams adjustment using one lead and one lag term. The market model parameters are then applied to the intraday returns over the event window. Again, the results are remarkably robust. For instance, all coefficient signs and significance of the regressions reported in table 10 under this method are identical to those reported in the text.

VII. Summary

This article represents a substantial extension of the literature into the market valuation of announcements of capital expenditure. Such announcements represent potentially valuable news to investors concerning the future earnings of a firm. Prior research is limited and has shown that generally new investment announcements are perceived as favorable news by the market. In this study, we argue that the value of this news must be conditioned on the firm's operating environment. Specifically, the firm's opportunity set as represented by its growth opportunities and its cash flow position in relation to those opportunities affect the market valuation. The hypotheses are tested in a framework that allows for a joint consideration of these factors.

This study utilizes a previously untested data set and employs a method that eliminates much of the noise potentially present in prior work. The method involves the construction of abnormal returns that are news free except for the capital expenditure announcement itself, and market features avoid the need to prespecify an expectations model. In this sense, the analysis is very "clean."

The results show that growth opportunities are singularly the most important variable in explaining the market reaction to physical asset expenditure announcements. The significance of the growth opportunities variable is unaffected by other control variables. Moreover, cash flow itself is not a relevant variable in the context of growth but, rather, has a role interacting with growth such that free cash flow becomes relevant. This evidence is consistent with research into announcements of merger activity and helps to explain the current inconsistency in the capital expenditure literature.

The strength of the results in this context has implications for managers and other researchers. The conditioned market response supports the role of agency costs in market valuations. While this is not a unique finding in general, the finding in this area has consequences for how managers appreciate the context of their investment decision making. Other studies that examine the relationship between more general investment information and stock prices, such as the earnings response literature, can utilize these results to partition their data and condition their variable association. Further, the finding that the response is essentially restricted to the extreme quartiles suggests that the market does not differentiate well at the margin. Moreover, the use of a finer

variable to capture free cash flow effects suggests that previous research that fails to segregate the market to book and cash flow ratios into finer partitions might mask key results.

Finally, this research also provides new insight into the literature concerning mergers and acquisitions. For instance, Asquith et al. (1983) show that the relative size of target to bidder is an important variable in explaining the abnormal returns in mergers and takeovers. However, this research presents evidence that transaction size is not an important variable. Rather, the overriding important variable is the quality of a firm's growth opportunities.

Appendix

Examples of Announcements Made of Varying Classifications

Upgrades

"AGL was now proceeding with planned upgrade of the Roma to Brisbane natural gas pipeline system. The upgrade is expected to cost up to $100M by the time the project is complete. AGL plans to double the capacity of the Roma to Brisbane natural gas pipeline."

"CSR has announced that it will upgrade its Hannan South treatment to 600,000 tonnes per annum capacity. Capital costs are $1.8M. The company aims to lift gold production to 36,000 ounces in 1994/95 and to 42,000 ounces in 1995/96."

"Contracts have been signed with Thiess Contractors to facilitate the expansion of the Burton Coal Mine. The capital cost of the upgrade will be less than A$60M and will employ 130 people on an ongoing basis."

Joint Ventures

"The cinema joint venture between Village Roadshow, Greater Union and Warner Bros announced plans to construct a total of seven new multiplexes in Westfield Shopping towns around Australia for $200M." [Announcement made by Village Roadshow]

"Amcor announced that it will have an 83% interest in a $16M folding carton JV with the Chinese Government in Beijing. Amcor will invest $13M and the balance of the capital will be contributed by the China National Tobacco Corporation."

"BHP Minerals will proceed with the development of the Hartley Platinum Project in Zimbabwe in a joint venture with Delta Gold. BHP Minerals will spend $310 million over three years to develop a platinum mine and processing facility."

Contracts Awarded

"Listed contracting group, Macmahon Holdings Limited, has won a joint bid for the $63 million contract to upgrade the Royal Australian Air Force's Learmonth base at Exmouth on the central coast of Western Australia. The contract, won by a joint venture between Macmahon Contractors (WA) Pty Ltd and Transfield Construction, will result in a major operational upgrading of the Learmonth base, 36 kilometres south of Exmouth." [Announcement made by Macmahon Holdings Limited]

"Fleetwood Corporation Limited has been awarded by BHP Iron Ore Pty Ltd a contract to supply and install a further 25 manufactured homes in Port Hedland for BHP'S Capacity Expansion 30ect associated with the HBI Development. The contract value is $3,000,000 with completion due in June 1997." [Announcement made by Fleetwood Corporation Limited]

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