The Market Valuation of Cash Dividends: The Case of the CRA Bonus Issue

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ABSTRACT: In 1996 Australia's CRA and UK's RTZ merged to form the world's largest mining company, but the companies remained separately listed on their domestic exchanges. In order to equalise the price of the two companies' shares, prior to the dual listing, CRA made a bonus issue. Shares in the bonus issue were not entitled to the next CRA dividend, which carried imputation tax credits. The contemporaneous price differences between the old shares and the bonus shares are used to measure the market value of dividends and associated tax credits. Consistent with imputation tax credits adding value to the dividend, one dollar face value of dividends was observed to have a market value significantly greater that its face value. The market value of the dividend varied depending on the proximity of observations to the ex-dividend date. Close to the ex-dividend date the premium of market value over face value was smaller. The results are consistent with dividend values set by short-term traders about the ex-dividend date and by long-term investors at other times.

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1. Introduction

For over forty years researchers have sought to establish the relationship between the face value of dividends and the dividend's market value, and this remains a controversial issue. A key barrier to resolving the controversy is the lack of experiments which provide a clean measure of the market value of a dividend.

One experimental design for obtaining a measurement of dividend value is to observe contemporaneous trading in two classes of securities that are identical in all aspects except for their dividend entitlement. The contemporaneous differences in prices of the two securities should provide a clean measure of the market value of the dividends. One study of this type was undertaken by Chu and Partington (2001) who studied the price difference between old shares and newly issued shares that were not entitled to the next dividend. They found that, under Australia's imputation tax system, a dollar face value of fully franked dividends had a market value of about $1.50, which suggests that the tax credits (franking credits) provided by dividend imputation have substantial value.

A contrasting result is found in Cannavan et.al (2004) who study the price difference between derivatives and the underlying stock. They find that franking credits have a relatively low value and that following the introduction of the 45 day rule, designed to restrict trading in franking credits, that the franking credits have no value.

In this paper, therefore, we set out to provide further evidence on the value of dividends and franking credits by examining a different type of seasoned equity issues. That is bonus share issues, where the newly issued bonus shares are identical to the existing shares in all aspects except for dividend entitlement. Such bonus issues are labelled *non-parri-passu* (NPP) bonus issues. The study of NPP bonus issues is a natural extension of Chu and Partington's (2001) study of NPP rights issues, and therefore provides an opportunity to examine the generalisability of their results.

Unfortunately, only one NPP bonus issue suitable to analysis was found, the CRA bonus issue. However, the CRA case is interesting for several reasons. First the bonus issue has an interesting source, springing from the creation of the then largest mining company in the world, through a dual listing merger. Second, it has been suggested that overseas investors are the price setting investors in the Australian market and that they will place little or no value on the imputation credits since they cannot use them (see for example Cannavan et.al. (2004)). It is also suggested that overseas investors tend to have larger holdings in the extractive industries and that consequently franking credits will have little or no value in such industries (see for example Wood (1991)). CRA was one of Australia's largest mining companies, thus if the preceding conditions hold, the CRA NPP bonus issue should provide little or no evidence that franking credits have value.[1] Third, as explained later, CRA's NPP bonus share issue has a number of attractive features in relation to measuring the market value of dividends.

The contemporaneous price differences between the bonus shares and the existing shares of CRA, which were observed repeatedly over a ten week period, provide a low noise

measure of the market value of the dividend. The results show that the market value of the dividend is significantly greater than its face value. The observed market value of the dividend is consistent with franking credits having a substantial value, but a lesser value than suggested by Chu and Partington (2001). The market value of the dividend is also found to depend upon when the value is measured. Close to the ex-dividend date the value is lower, and is consistent with a value being set in short-term trading of dividends.

The remainder of the paper is organised as follows. In Section 2 we review some of the literature on the traditional ex-dividend approach to estimating the market value of dividends and explain the Australian imputation tax system. Some of the problems with the ex-dividend method are highlighted, and some recent alternatives to traditional ex-dividend studies are considered. Section 3 describes the procedure used to search for NPP bonus issues and discusses the features of bonus issue trading. Details of the CRA issue are also discussed. In Section 4 the nature of the data set and the research method are explained. Section 5 contains the results, first the descriptive statistics, followed by hypothesis tests. Section 6 interprets the results and provides the conclusions.

2. Previous studies

2.1 The traditional ex-dividend approach to dividend valuation

Following Elton and Gruber (1970) an extensive literature has developed that attempts to estimate the market value of dividends by studying ex-dividend price behaviour. Much of this literature is based upon an analysis of the ex-dividend drop off ratio (the ex-dividend price drop divided by the dividend). Elton and Gruber showed that the equilibrium value

[1] CRA had at least one large overseas shareholder as prior to the merger RTZ had a forty-nine percent shareholding.

for the drop-off ratio under a classical tax system is given by the ratio of the after tax value of dividends to the after tax value of capital gains, $(1-t_i)/(1-t_g)$, where: t_i is the income tax rate on dividends and t_g is the tax rate on capital gains. Empirically, they observed the drop-off ratio to be less than one, which was consistent with their hypothesis that dividends were tax disadvantaged relative to capital gains. This view was challenged by Kalay (1982) who suggested that a drop-off ratio that was not equal to one presented an arbitrage opportunity to investors who were equally taxed on dividends and capital gains. Such arbitrage would tend to drive the drop-off ratio towards one. However, because of the transactions costs of such arbitrage, the equilibrium drop-off ratio might diverge from one. In this case, a drop-off ratio less than one would be interpreted as a transaction cost effect rather than a tax effect. Kalay's estimate of the drop-off ratio was less than one but the difference from one was not significant.

There have been many subsequent ex-dividend studies, most of which have taken place in the context of a classical tax system. Such studies either find that dividends have a market value less than their face value as in Michaely (1991), or find a market value equal to the dividend's face value as in Boyd and Jaganathan (1994). There has been increasing recognition that the ex-day price drop arises from a complex interaction of the type of trader (eg. long-term or short-term), taxes, transaction costs, risks, and bid ask spreads, see for example Karpoff and Walkling (1988, 1990), Grammatikos (1989), Fedenia and Grammatikos (1993), Boyd and Jaganathan(1994), Koski(1996), and Michaely, et.al. (1997).

There has also been a growing volume of work on aspects of market microstructure that may lead to a bias in ex-day price movements as an estimate of dividend value. For

example, bid-ask bounce, Frank and Jagannathan (1998), price discreteness arising from minimum tick sizes, Bali and Hite (1998), and settlement effects Lasfer (1995), and Kadapakkam (2000). However, Graham et.al. (2003) suggest that there is little support for tick size and bid-ask bounce explanations of ex-dividend price movements.

The issues discussed above make the interpretation of ex-dividend price movements difficult, but there is also another problem inherent in the traditional ex-dividend approach to dividend valuation. Ex-dividend drop-off ratios are extremely noisy. For example, in the US market Bhardwaj and Brooks (1999) reported that the ex-dividend drop-off ratio for stocks with regular taxable dividends in 1986 range between –84.46 and +65.38. In the Australian market, a similar range of ex-dividend drop-off ratios were also documented in Clarke (1992).

2.2. Ex-dividend valuation under the Australian imputation system

Australia operates an imputation tax system, where dividends paid from profits subject to Australian corporate tax have tax credits attached, which are called franking credits. Australian residents are taxed at their marginal income tax rate on the pre-tax profit from which the dividend is distributed. However, they receive credit for the corporate tax paid via the franking credit. The net effect is that corporate taxes wash out and resident shareholders are taxed on distributed profits at their marginal personal tax rates. Overseas investors and, at the time of the study, tax exempt investors, were not entitled to the tax credits.

The mechanics of the system for taxable Australian residents are as follows. Assuming the dividends are fully franked,[2] the shareholder's taxable income is computed by grossing up the dividend to its pre-corporate tax equivalent. This is done by multiplying the dividend by $1/(1-t_c)$, where t_c is the corporate tax rate. Tax is then levied on the grossed up value at the shareholder's marginal income tax rate, t_i but a tax credit is allowed for the corporate tax paid. The after personal-tax dividend receipts based on a dividend D are therefore: $D - \frac{D}{(1-t_c)}(t_i - t_c) = D\left(\frac{1-t_i}{1-t_c}\right)$.

Walker and Partington (1999) show that under the Australian imputation tax system the equilibrium drop-off ratio for short-term traders can be written as:

$$\frac{P_{CD} - P_{XD}}{D} = \left(\frac{1-t_i}{(1-t_c)(1-t_g)(1-a)}\right) - \left(\frac{2a}{1-a}\right)\frac{P_{CD}}{D}$$

Where: P_{CD} is the price of the cum-dividend share

P_{XD} is the ex-dividend price

D is the dividend to be paid (assumed fully franked)

t_c is the corporate tax rate

t_i is the investor's tax rate on dividends

t_g is the capital gains tax rate

a is the one way transactions cost as a percentage of the price.

For long-term investors the decision is whether to transact cum-dividend, or ex-dividend and since they incur transactions costs at either date, the transactions costs are largely

[2] Dividends may be fully or partially franked depending upon whether the income from which they have been paid has been fully or partially taxed in Australia at the corporate tax rate. If the dividend has been partially franked, gross up factors and imputation tax credits are reduced accordingly.

irrelevant to their decision. As a consequence, the equilibrium drop-off equation for long-term investors can be closely approximated by:

$$\frac{P_{CD} - P_{XD}}{D} = \left(\frac{1 - t_i}{(1 - t_c)(1 - t_g)} \right)$$

This is equivalent to taking Elton and Gruber's (1970) equation for the drop-off ratio under a classical tax system and multiplying it by $1/(1-t_c)$, in order to reflect the grossing up of the dividend by the franking credits.

The above equations for equilibrium drop-off ratios show that, assuming equal tax rates, the equilibrium drop-off ratios of long-term investors and short-term traders will differ. The equilibrium drop off ratios of short-term traders will be lower, due to the burden of the two-way transaction costs that they incur.

The above equations ignore discounting for delays in the cash flows for dividend payments and taxes, and do not discount for price risk between the cum-dividend and ex-dividend days. In the current study discounting for price risk is not applicable since the prices of shares with and without dividends can be simultaneously observed. Discounting for time lags in cash flows is a second order effect and usually has an insignificant impact on the value of the drop-off ratio.[3] The key drivers of the drop-off ratio, or dividend valuation ratio (DVR) as we call it in our study, are the tax rates on dividends, capital gains, and corporate profits for long–term investors, and these tax rates and transactions costs for short-term traders.

[3] There is one exception, discounting for time can be significant for long-term buyers, in that tax cash flow from realising capital gains may be long delayed.

Australia's switch to the imputation tax system increased after tax dividend receipts for all classes of investors able to fully utilise the franking credit. Therefore, as hypothesised by Brown and Clarke (1993), it was expected that the market value of dividends would increase following the introduction of the imputation tax system. However, Brown and Clarke found that, immediately following the switch to imputation in 1987, there was a decline in the average ex-dividend drop-off ratio although it increased in subsequent years.

Following the introduction of the imputation tax system in 1987, there was another important tax change in 1988, when superannuation funds, which had previously been tax-exempt, became subject to tax at a flat rate of 15%. Corporate tax rates in Australia have been 30% or more during the imputation tax system; consequently superannuation funds enjoy surplus franking credits which give rise to an effective negative tax rate. This makes franked dividends very attractive to such funds. In the words of the Association of Superannuation Funds of Australia:

> "*Neither a part nor full exemption of dividends from tax, nor a partial tax credit, would substitute for the effective negative 15% tax rate that presently applies to franked dividends derived by Australian superannuation funds*." ASFA (2002, p.7)

As a consequence superannuation funds are strong demanders of fully franked dividends in the Australian market. This led Chu and Partington (2001) to argue that superannuation funds trading as long-term investors are likely to set dividend values. They argue, therefore, that the market value of franked dividends will be close to the face value grossed up for imputation tax credits.

Subsequent to Brown and Clarke's (1993) study ex-dividend research in Australia has generally suggested that franking credits have value, Bellamy (1994), Bruckner, Dews and White (1994), Hathaway and Officer (1998), Walker and Partington (1999).

2.3 Alternatives to traditional ex-dividend studies

A substantial part of the noise associated with the ex-dividend drop-off ratio arises from the non-contemporaneous observation of cum-dividend and ex-dividend prices. In response to this problem new experiments have been developed where there is contemporaneous trading in two classes of securities that only differ in their dividend entitlements. In these experiments the contemporaneous price differences between the two securities provide a measure of the market value of dividends.

Several experiments of this type have been conducted in Australia. In a modification of the traditional ex-dividend experiment, Walker and Partington (1999), examine the contemporaneous trading of shares cum-dividend in the ex-dividend period. The market value of dividends in that setting is estimated at $1.23 per dollar of face value when computing an average value across trades, and $1.15 when computing an average by ex-dividend events. Walker and Partington suggest that these values are consistent with dividend pricing dominated by short-term traders. Their results also show that most of the noise in ex-dividend drop-off ratios can be eliminated by contemporaneous observation of cum-dividend and ex-dividend prices.

An alternative design used by Twite and Wood (1997) compares the price of individual share futures and the underlying stock. They estimate that the value of the dividend plus franking credit averages $1.13 per dollar of the dividend's face value. Cannavan et. al.

(2004) extend this experiment by considering not only individual share futures but also low exercise price options. Their results suggest that the value of dividends plus credits initially exceeded the face value of the dividend.[4] However, following the introduction of the 45 day rule, which was designed to restrict trading in imputation credits, they suggest that franking credits had zero value.

The preceding three experiments were based on a no arbitrage equilibria involving round trip transactions costs. The dividend valuations they provide are therefore affected by transactions costs. Chu and Partington (2001), provide another experimental design and argue that their results are based on an equilibrium for long-term investors that is largely unaffected by transactions costs. They study a set of *non-parri-passu* (NPP) rights issues where the newly issued shares and the existing shares are identical in all respects except for their entitlement to the dividend immediately succeeding the rights issue. In that setting the market value of dividends is estimated as $1.50 per dollar of fully franked dividends. While this estimate is based on thousands of trades, the trades are drawn from only twenty-four rights issue events. Whether the results from the study can be generalised is therefore open to question, and in part this is a question that we set out to address in the current study.

It is widely recognised in the traditional ex-dividend literature that dividend pricing might be affected by price risk (Heath and Jarrow (1989) and Michealy and Vila (1996)), transaction costs (Kalay (1982), Karpoff and Walking (1988) and Lakonishok and Vermealen (1986)), and bid-ask spread (Koski (1996), Frank and Jaganathan (1998)). Price risk is mitigated in this study because the prices of shares with and without

[4] The estimates from their "constant slope model" Table 3, p.188 suggest that, before the introduction of the

dividends can be simultaneously observed. However, even with simultaneous trades another source of risk may arise from uncertainty about the magnitude of the dividend, and this was the case for some observations in the Chu and Partington (2001) study. Uncertainty about the dividend is minimised in our experiment because the intended dividend was announced before the contemporaneous trading in the bonus share and the pre-existing shares commenced.

The effect of transactions costs will only arise if prices are set by short-term traders engaged in dividend arbitrage, and we account for bid-ask spread in our empirical analyses. The tick size problem identified by Bali and Hite (1998) does not arise because the dividend is a multiple of the price tick.

The expected dividend of thirty-five cents is relatively large which should result in a strong signal of the dividend's market value relative to the noise caused by random disturbances.[5] A further advantage of the experiment arises from the simultaneous observation of prices. The effect of information releases on price levels should wash out in the price difference between the old and the bonus share. Only information relevant to the value of the current dividend should affect the observed price difference.

Other work, with close parallels to this study, has investigated investor's preference for cash dividends or capital gains, using shares that are identical except for the form of the dividend. This work is based on companies that issue two classes of shares; one that pays a stock dividend while the other pays a cash dividend. Studying the case of Citizens Utilities, Long (1978) concluded that, if anything, it was the shares paying cash dividends that had a slight premium, but Poterba (1983), studying the same company, disputed this

45 day rule, a dollar of fully franked dividends is worth about $1.10 per dollar of face value.

conclusion and also pointed out that ex-dividend day price movements suggested that the stock dividends had more value. Bailey (1986) examined the trading of nine pairs of dual-dividend-class shares. He found that shares paying cash dividends had a premium over shares paying stock dividends. However, the face value of cash dividends was greater than the stock dividend times the share price on the dividend payment date, and this difference appeared to explain the premium on the cash dividend shares.

In contrast to the work of Long (1978), Poterba (1986), and Bailey (1988), the valuation difference studied here is only driven by cash dividends. Another difference is that in this study the trades are time matched to the minute, rather than the day. While this paper is primarily concerned with the market value of cash dividends, if that value is greater than one dollar, the implication is that a dollar of dividends is worth more than a dollar of capital gains.

3. Identification of NPP bonus issues and the CRA issue

3.1 Searching for NPP bonus issues

Bonus issues in Australia offer existing shareholders additional shares at no cost.[6] The number of bonus shares that each shareholder is entitled to receive is proportional to their existing shareholding. For instance, a one-for-ten bonus issue allows each existing shareholder to receive one bonus share for every ten shares held. Following the announcement of a bonus issue there are three dates that are important to our study: the ex-bonus date, the books closing date, and the allotment date.

[5] The mean dividend in Chu and Partington's (2001) study was 9.5 cents.
[6]The equivalent of bonus issues in the US and UK are stock dividends and scrip issues, respectively.

The ex-bonus date is the first date on which shares are traded without the right to receive bonus shares. On the books closing date, the issuer's share registry is closed in order to determine who is entitled to receive bonus shares. The allotment date is the date on which holding certificates are despatched, or securities entered as holdings in the Clearing House Electronic Sub-register System (CHESS).

Bonus shares on the Australian Stock Exchange (ASX) can be traded before the allotment date on a deferred settlement basis. At the time of the study, deferred settlement trading began seven business days before the books closing date and ended on the business day after the allotment date. The ex-bonus date was normally seven business days before the books closing date. Therefore, the commencement of the deferred settlement trading period usually coincided with the ex-bonus date.

In order to be included in the study the bonus share must meet two conditions. First, the bonus shares must be issued before the next ex-dividend date. That is to say, the allotment date for the bonus issue must precede the next ex-dividend date. Second, the bonus shares must be identical to the existing shares in all aspects except for the entitlement to the next dividend.

The Securities Industry Research Centre of Asia Pacific (SIRCA) database was used to identify the incidence of NPP bonus issues in the period between 1st January, 1991 and 31st December, 1998. This was done by tracking the changes in ASX security codes associated with bonus issues.

An ASX code is used to uniquely identify a particular issue of a security The ASX code consists of two components; the issuer code and the security code. The issuer code

contains 3 letters and is used to represent the issuing company and its ordinary shares. The security code is suffixed to the issuer code and can also be up to 3 letters long. It is used to signify specific capitalisation events. The security code pertaining to bonus issues is usually “BN”. For example, the ASX code used to signify bonus shares issued by Coca-Cola Amatil would be CCLBN. The bonus share code (BN) should continue to exist as long as there is some difference in characteristics between the bonus shares and the existing shares. Since a difference in dividend entitlement is only one of the possible differences in characteristics between the two classes of shares, tracking changes in bonus share codes only provides identification of *potential* NPP bonus issues.

When the bonus shares do not rank equally with the existing shares for the next dividend payment (but rank equally for all subsequent dividend payments) then the bonus share code ceases to exist after the next ex-dividend date. The disappearance of the bonus share code can be identified in the SIRCA database by a message sent out by the ASX. This message, known as code change message, indicates that the bonus share code has reverted back to the normal issuer code.

This coding convention is employed to identify the *potential* NPP bonus issues as follows. First, all ex-dividend dates in SIRCA database were identified. A search was then conducted for all share codes that ceased to exist within 20 days of the ex-dividend date. Those cases which were bonus issue share codes were identified and the dates relevant to each bonus issue were obtained. Using this procedure 62 *potential* NPP bonus issues were identified.

In order to single out those issues which conform to the type of NPP bonus issues required for this study, we collected and reviewed the text announcement for each of the

62 bonus issues. This information was collected from ASX Signal G announcements and the ASX annual market summaries.[7] This analysis revealed that thirty-six out of the sixty-two issues are actually *pari-passu* bonus issues, that is, it is stated explicitly in the bonus issue announcement that the bonus shares will rank equally with the existing shares for the next dividend payment. The code change therefore relates to some other aspect of these issues.

For the remaining twenty-six issues, the terms of the announcement indicate that the bonus share will not rank equally with the existing shares for the immediately succeeding dividend payment. However, for twenty-four issues all the dates relevant to the bonus issues coincide with the set of dates for the next dividend payment. That is, the ex-bonus date coincides with the ex-dividend date, the books closing date for determining entitlements to bonus shares coincides with the books closing date for determining entitlements to dividends, and the allotment date for bonus shares coincides with the dividend payment date. In these cases, excluding deferred settlement trading, there is no trading in shares with differential dividend entitlements to observe. The existence of bonus share codes only signifies deferred settlement trading in the bonus shares in the period between the ex-bonus date (ex-dividend date) and the allotment date. The code change messages signals the cessation of the deferred settlement trading.

The two remaining issues are the required NPP bonus issues. However, one of the issues involves a firm paying an unfranked dividend and the dividend is of small magnitude. The small magnitude means a low signal to noise ratio and the unfranked nature of the dividend makes it unsuitable for triangulation of Chu and Partington (2001) who only

[7] Signal G announcements from SIRCA database are only available for the period after September 1992.

considered fully franked dividends. This leaves only one NPP bonus issue for empirical analysis. This is CRA's bonus issue.

3.2 The case of CRA's NPP bonus issue

The CRA bonus issue was announced on 9th October, 1995 as part of a proposed merger between CRA Ltd (CRA) and RTZ Corporation PLC (RTZ) to form a dual listed company (DLC).[8] CRA shareholders were to retain their shares in CRA, which would remain an Australian company listed on the ASX. Equally, RTZ shareholders would retain their shares in RTZ, which would remain a UK company listed on the London Stock Exchange. However, the DLC would have a common board of directors and unified management. It was intended that once the DLC was in place, the dividend and capital rights of each CRA and RTZ share would be equal. This required the share prices of CRA and RTZ to be equalised before the merger became effective.

The period beginning 1 January 1995 and ending 6 October 1995 was used to determine the share price of CRA relative to the share price of RTZ. During that period the closing share price of CRA (translated into a common currency) was, on average, 1.075 times the share price of RTZ. Consequently, CRA decided to make a bonus share issue to their existing shareholders in a ratio of 7.5 bonus shares for every 100 CRA shares already held. The number of bonus shares to be issued was 44,840,000 shares. The dilution effect of the bonus issue was expected to make the CRA share price equal to the RTZ share price. The bonus shares ranked equally with the existing shares in all aspects (including

For those bonus issues made prior to that time, details of the announcements are obtained from the ASX annual market summaries.

[8] CRA Ltd (CRA) subsequently became Rio Tinto Ltd. and RTZ Corporation PLC (RTZ) became Rio Tinto plc.

voting rights), except that they were not entitled to the final dividend for the year to 31 December, 1995.

The final dividend in the prior year was thirty cents and this value would normally form a basis for estimating the 1995 final dividend, which would fall due for payment about March/April 1996. However, uncertainty about the 1995 final dividend was largely resolved on 16th November, 1995. On that day CRA announced its intention to pay a 1995 final dividend of thirty-five cents per share. They also announced the intention that, conditional on the government passing into legislation the new corporate tax rate and franking arrangements, announced in the 1995 budget, the dividend would be fully franked at the 36% tax rate. This would result in a grossed-up value for the dividend of 54.69 cents.

While the statement of intentions regarding the next dividend payment was made in November, the formal declaration of the dividend was not made until March 7, 1996. We have assumed no substantial uncertainty about the magnitude of the dividend over the period that we observe prices (January through March) and thus we have taken the expected dividend to be thirty-five cents per share. To the extent that there was any dividend uncertainty, our estimate of dividend value is likely to be conservative.[9]

The ex-bonus date, books closing date and allotment date for the bonus issue were 29 December 1995, 9 January 1996, and 15 January 1996, respectively, whereas the ex-dividend date, books closing date for the dividend, and the dividend payment date were 22 March 1996, 1 April 1996 and 15 April 1996, respectively. Consequently, concurrent

[9] For example, if the expected dividend is taken to be last year's final dividend of thirty cents before the formal dividend announcement and thirty-five cents thereafter, the mean market value of $1.00 face value

trading in the bonus share and the existing share could be observed in the period between 16 January 1996 and 21 March 1996. We call this period the NPP trading period. The allotment date (15 January 1996) was excluded from the NPP period, because the price of the bonus share on that date might still reflect deferred settlement trades. As it turned out the first trade that met our selection criteria was observed on 23 January 1996.

4. Data and method

A record of all trades in the existing share and the bonus share during the NPP trading period was obtained from the SIRCA database. All of these trades were time-stamped to the nearest second. We were able to form matched pairs of trades in the existing and bonus shares as follows. We first identified all trades in the bonus share. We then formed matched pairs of trades where the trade in the old share occurred within one minute of the trade in the bonus shares. Where there was more than one matching trade in the old share, which occurred within the one minute window, we selected the trade with the highest volume. Once a particular trade in the old share was used to form a pair of matched trades, that trade was not re-used for any subsequent matching. This provided us with 336 pairs of matched trades. We also restricted our observations to normal trading by excluding trades which were (1) outside the ASX normal trading hours (10 am to 4 pm) (2) at the opening of a trading day (3) executed under ASX crossing or special arrangements (4) reported as an exercise of options, and (5) short sales. We found no incidence of short sales in the bonus share and only two short sales in the old share. We further restricted our sample to include only those matched pairs of trades in the old share

of fully franked dividends is $1.47 and the median is $1.5, values that are considerably higher than those reported later in this paper.

and the bonus share with a minimum volume of 100 securities. The resulting sample contained 154 pairs of matched trades.

For each pair of matched trades the dividend valuation ratio (DVR) was computed as follows:

$$DVR_t = \frac{P_{old,t} - P_{bonus,t}}{D} \quad (3)$$

where DVR_t is the dividend valuation ratio for the matched pair of trades observed at time *t*, $P_{old,t}$ and $P_{bonus,t}$ are matched prices of the old share and the bonus share, respectively observed in the one-minute window at *t*, and D is the final dividend (35 cents) for the year to 31 December 1995. Since no dividend reinvestment plan (DRP) was in place for that dividend, no adjustment was required for the value effect of DRP discounts on the measurement of the DVR.

Estimates of the DVR are formed using two samples. We call the first sample of 154 pairs of matched trades the full matched sample. The second sample is formed in order to control for bid-ask bounce. This sample was restricted to cases where the matched trades in the old share and the bonus share either both occurred at the ask, or both occurred at the bid. This sample, which we call the no-spread sample, contained 85 pairs of matched trades.

5. Results

5.1 Price behaviour and changes in the DVR

Figure 1 provides a plot of the sequence of trades for the matched prices of the old and bonus shares during the NPP trading period. Figure 1 suggests that the two price series

track one another closely. Fluctuations in price, presumably due to the arrival of market-wide and company specific information, appear to be very similar for the two shares. Visually the difference between the two price series appears reasonably stable, although there is some variation. For example, there is some narrowing of the price difference towards the end of the period of observation.

The narrowing of the price difference is more clearly evident in Figure 2, where we plot the price differences observed each day against the date. Figure 2 shows a noticeably lower price difference and hence lower dividend values as trading gets closer to the ex-dividend date. The lower price difference, resulting in a lower DVR, is quite pronounced from the dividend declaration date, March 7, onwards.

We had not anticipated this lower DVR *a-priori*. However, if dividend values are set by dividend arbitrageurs close to the ex-dividend date and by long term investors at other times, then the pattern of dividend valuation in Figure 2 is what would be expected. Some investors not entitled to the dividend, such as overseas investors, will trade to avoid dividends by selling cum-dividend. In so doing they capture some, or all of the credit, depending on the extent to which it is capitalised into prices. Such sales would take place in the old stock and create downward price pressure in that stock. An offsetting source of demand would arise from dividend capture traders buying cum-dividend. However, dividend capture traders are unlikely to bid cum-dividend prices back up to the level of dividend values set by long-term investors able to use the imputation credits. This is because dividend capture traders buy the stock cum-dividend and resell it ex-dividend.[10]

[10] They might also buy the old share and sell the bonus share short; delivering the old share after it has gone ex-dividend in order to close their position. However, we observed no short sales in the bonus shares.

consequently, they receive the dividend net of the substantial two way transactions costs that have to be incurred in the dividend's capture, as in Walker and Partington (1999).

An alternative explanation for the narrowing in the price gap, and hence the lower DVR, is liquidity. If the bonus share is less liquid than the old share and consequently sells at a liquidity discount, that discount would be expected to diminish as the ex-date approaches. At the ex-date the two shares become identical and any liquidity effect disappears.

We rule out a third explanation for the lower DVR post the dividend-announcement, which is market overestimation of the size of the dividend. Such an overestimate would cause the price of the old share to drop at the time of the dividend announcement. We rule this explanation out because the magnitude of the intended dividend had been made public by CRA well before the formal dividend announcement.

The two competing explanations for the lower DVR may be distinguished empirically. If short-term dividend trading is the explanation, then it is expected that the cum-dividend price of the old share will tend to be depressed prior to the ex-dividend date.[11] Whereas, if a liquidity discount on the bonus share is the explanation, then the price of the bonus share would be expected to rise as the ex-dividend date approaches, while the cum-dividend price of the old share would be relatively unchanged.

[FIGURES 1 AND 2 ABOUT HERE]

5.2 Descriptive statistics

Figure 3 provides a histogram of the observed DVRs for the full matched sample together with a density trace. Ten of the observations lie below one, with seventeen observations

above 1.56. In other words, a substantial majority of the observations (82 percent) lie between the face value of $1.00 of dividends and the grossed up value, including franking credits of $1.56.[12]

Below the histogram is a dot plot. An interesting feature of the dot plot is the appearance of pronounced striations, where dense lines are created by the observation of identical values for the DVR. The strongest of these concentrations correspond to price differences of $0.50 and then $0.40, which together represent twenty-three percent of the sample. It is almost as though there are two groups of investors trading who have different dividend valuations. Other noticeable concentrations, each in excess of five percent of the sample, are at price differences of $0.43, $0.44 $0.45, and $0.49 which together represent twenty-nine percent of the sample. We note that these observations are not simply a product of multiple trades occurring with no changes in the price of the shares, nor are they simply concurrent sequences of trades.

Descriptive statistics are given in Panel A of Table 1 for the full matched sample. These statistics describe prices, price differences, and the DVR. Panel B provides descriptive statistics for the no-spread sample. There is almost no difference in the results for the two samples. Given the similarity in results we confine our discussion to the full matched sample. The mean and median price difference between the old and bonus shares is $0.45. With a $0.35 dividend this translates to a DVR of 1.29 for both the mean and median. The range of the observations for the DVR is from 0.91 to 1.83.

[11] Cum-prices may start to rise again on the last cum-dividend day as dividend capture purchases reach their peak volumes.
[12] Computed as 1/(1 - 0.36).

In Panels D and E of Table 1 descriptive statistics are presented for the period before the dividend declaration date and for the period from the dividend declaration date until the last cum-dividend day. We only present results based on the full matched sample since almost identical results arise from the no spread sample. The DVR is noticeably lower in the post-dividend declaration period. In the period before the dividend is declared the mean DVR is 1.34 and the median 1.37, while post the dividend declaration the mean is 1.12 and the median 1.14. The maximum DVR is also much lower in the post-dividend declaration period at 1.29 as opposed to 1.83 in the prior period. It is apparent that the mean price of the bonus share has changed very little following the dividend announcement at $19.22 before the announcement and $19.19 afterwards. However, there is a noticeable decline in the mean prices of the old share, at $19.69 before the dividend announcement and $19.58 afterwards.

<TABLE 1 AND FIGURE 3 ABOUT HERE >

5.3 Hypothesis tests

In the analysis that follows we present the results of hypothesis tests, however, it is arguable that our repeated measures of the DVR may not be independent. In which case the significance levels for the tests of the DVR may be overstated, and therefore they should be interpreted with caution.

In Panel A of Table 2, the DVR is tested against two benchmarks. A natural bench mark for the DVR is a value of one. We test the null ($H_{0,1A}$) that the market value of fully franked dividends is less than or equal to the face value of dividends (DVR $\leq$ 1) against the alternative that the market value of fully franked dividends exceeds the face value of

the dividend. We also test the null ($H_{0,2A}$) that the DVR is equal to 1.50 in order to examine the generalisability of Chu and Partington's (2001) results. Table 2, Panel A shows using both a *t*-test and the Wilcoxon signed ranks test that the DVR is significantly above one, and is also significantly different from 1.50.

Panels B and C of Table 2, repeat the foregoing tests for the pre-dividend declaration and post dividend declaration periods respectively. As for the full sample the DVR is significantly above 1 and significantly different from 1.50 in both periods.

Panel D of Table 2 examines the differences in drop off ratios and share prices before and after the dividend declaration date using both a *t*-test[13] and the Wilcoxon signed ranks test. The DVRs and the prices of the old shares change significantly between the two periods, but there is no significant difference in the price of the bonus shares.

6. Conclusions

A single case cannot be used to make sweeping generalisations, but it does provide some evidence to weigh in the balance. Furthermore, observation of contemporaneous trades in shares which are identical except for their dividend entitlement provides much cleaner evidence on dividend value than has traditionally been available.

Our results strongly suggest that in the CRA case one dollar of fully franked dividends was worth significantly more than one dollar, which in turn implies that franking credits have value. In this case, at least, the joint proposition that foreign investors set prices with no value accorded to imputation credits, and that this effect is particularly strong in the extractives industry, is not supported for this particular mining company.

[13] Since the variances are unequal between the periods, the Aspin-Welch unequal variance *t*-test was used.

The mean DVR is significantly below the 1.50 suggested by Chu and Partington (2001). Consequently, their result is not generalisable to the current case. Perhaps the explanation for the lower value observed in this study is that substantial overseas shareholdings do depress the combined market value of dividend plus franking credit, but not to the point where the franking credit becomes worthless.

The dividend was $0.35 and the overwhelming majority of price differences observed were greater than this figure. Price differences of $0.50 and $0.40, corresponding to DVRs of 1.14 and 1.43, were particularly prevalent in the data, representing almost a quarter of the sample. Overall, the mean and median DVRs were both 1.29 and these values were unchanged after controlling for the effect of bid-ask spread. However, there was a noticeable drop in the magnitude of the DVR following the dividend declaration date, from a mean of 1.34 to a mean of 1.12. This latter figure is close to the DVR estimates of 1.13 from Twite and Wood (1997) and 1.10 from Cannavan et. al. (2004) and it is not far below the 1.15 from Walker and Partington (1999).[14] Walker and Partington argue that the DVR that they observe is set by short-term traders. Our results also suggests that dividend values are set by short-term traders close to the ex-dividend date, but the higher DVR observed before the dividend declaration date is more consistent with dividend values set by long-term investors.

The key conclusions of the paper are first, that the market value of the dividend exceeds its face value. It seems that taxes do matter in dividend valuation and that imputation credits add value. Second the observed market value of the dividend varies depending on

[14] The 1.15 was Walker and Partington's (1999) value by event, their value by trades was higher at 1.23. Assuming short-term trading, a lower value would be expected in the CRA case as the dividend yield, about 1.8 percent, was less than half the average dividend yield in the Walker and Partington study at 3.88 percent.

where it is measured relative to the dividend declaration and ex-dividend dates. It seems that different groups of investors may dominate the setting of dividend values at different times.

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Table 1: Statistics for the CRA Case

Variables	Count	Mean	Median	Std Dev	Minimum	Maximum
Panel A: Full Matched Sample						
P_{bonus}	154	19.22	19.21	0.29	18.30	19.82
P_{old}	154	19.67	19.67	0.28	18.78	20.21
P_{old}-P_{bonus}	154	0.45	0.45	0.07	0.32	0.64
DVR	154	1.29	1.29	0.20	0.91	1.83
Panel B: No-Spread Sample						
P_{bonus}	85	19.19	19.20	0.29	18.35	19.72
P_{old}	85	19.64	19.65	0.28	18.78	20.21
P_{old}-P_{bonus}	85	0.45	0.45	0.07	0.32	0.64
DVR	85	1.29	1.29	0.19	0.91	1.83
Panel C: Pre-Dividend Declaration (Partition of the Full Matched Sample)						
P_{bonus}	120	19.22	19.30	0.32	18.30	19.82
P_{old}	120	19.69	19.70	0.31	18.78	20.21
P_{old}-P_{bonus}	120	0.47	0.48	0.07	0.32	0.64
DVR	120	1.34	1.37	0.19	0.91	1.83
Panel D: Post-Dividend Declaration (Partition of the Full Matched Sample)						
P_{bonus}	34	19.19	19.16	0.14	19.00	19.55
P_{old}	34	19.58	19.55	0.16	19.35	20.00
P_{old}-P_{bonus}	34	0.39	0.40	0.04	0.32	0.45
DVR	34	1.12	1.14	0.11	0.91	1.29

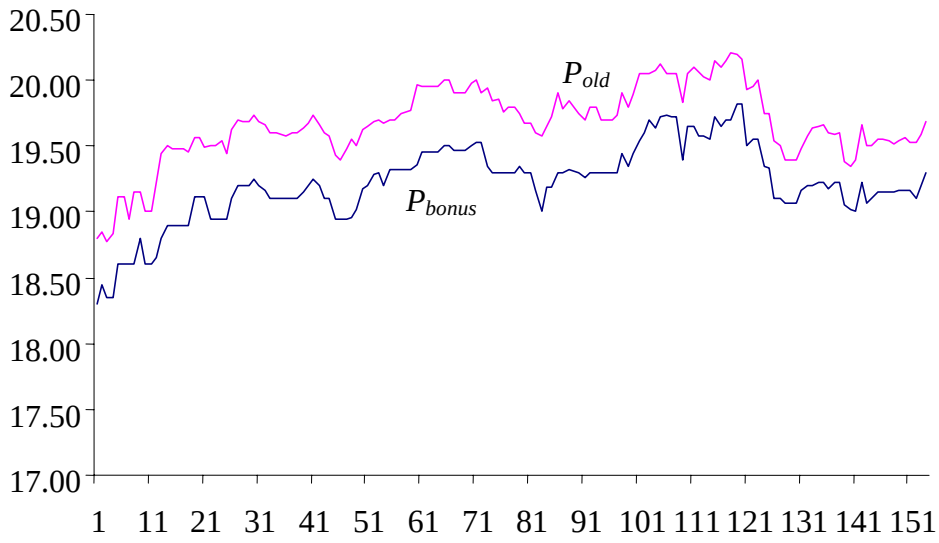
$DVR = (P_{old} - P_{bonus})/D$, where P_{old} is the price of the old share, P_{bonus} is the price of the bonus share, D is the dividend of thirty-five cents, fully franked at the thirty-six percent corporate tax rate. The bonus shares are not entitled to the dividend. The full matched sample is based on paired trades where prices in bonus and old shares are observed within plus or minus one minute. The no-spread sample was restricted to cases where the matched trades occurred either both at the bid, or both at the ask. The pre-dividend declaration period covers the period before the dividend was declared and the post-dividend declaration period is from the dividend declaration date to the last cum-dividend date inclusive.

Table 2: Hypothesis tests

	***t*-test**	***p***	**Wilcoxon test**	***p***
Panel A: DVR Full Matched Sample				
$H_{0,1A}$: DVR ≤ 1	18.54	<0.001	$Z = 10.58$	< 0.001
$H_{0,2A}$: DVR = 1.50	-12.92	<0.001	$Z = 9.11$	<0.001
Panel B: DVR Pre-Dividend Declaration (Partition of the Full Matched Sample)				
$H_{0,1B}$: DVR ≤ 1	19.88	<0.001	$Z = 9.43$	< 0.001
$H_{0,2B}$: DVR = 1.50	-9.03	<0.001	$Z = 7.14$	<0.001
Panel C: DVR Post-Dividend Declaration (Partition of the Full Matched Sample)				
$H_{0,1C}$: DVR ≤ 1	6.70	<0.001	$Z = 4.61$	< 0.001
$H_{0,2C}$: DVR = 1.50	-20.99	<0.001	$Z = 5.089$	<0.001
Panel D: DVR and Price Comparison Pre and Post-Dividend Declaration				
$H_{0,1D}$: $DVR_{(post)} = DVR_{(pre)}$	-6.56	<0.001	$Z = -6.25$	<0.001
$H_{0,2D}$: $P_{bonus\,(post)} = P_{bonus\,(pre)}$	-0.83	0.41	$Z = 1.60$	0.11
$H_{0,3D}$: $P_{old\,(post)} = P_{old\,(pre)}$	-2.89	0.04	$Z = -3.53$	<0.001

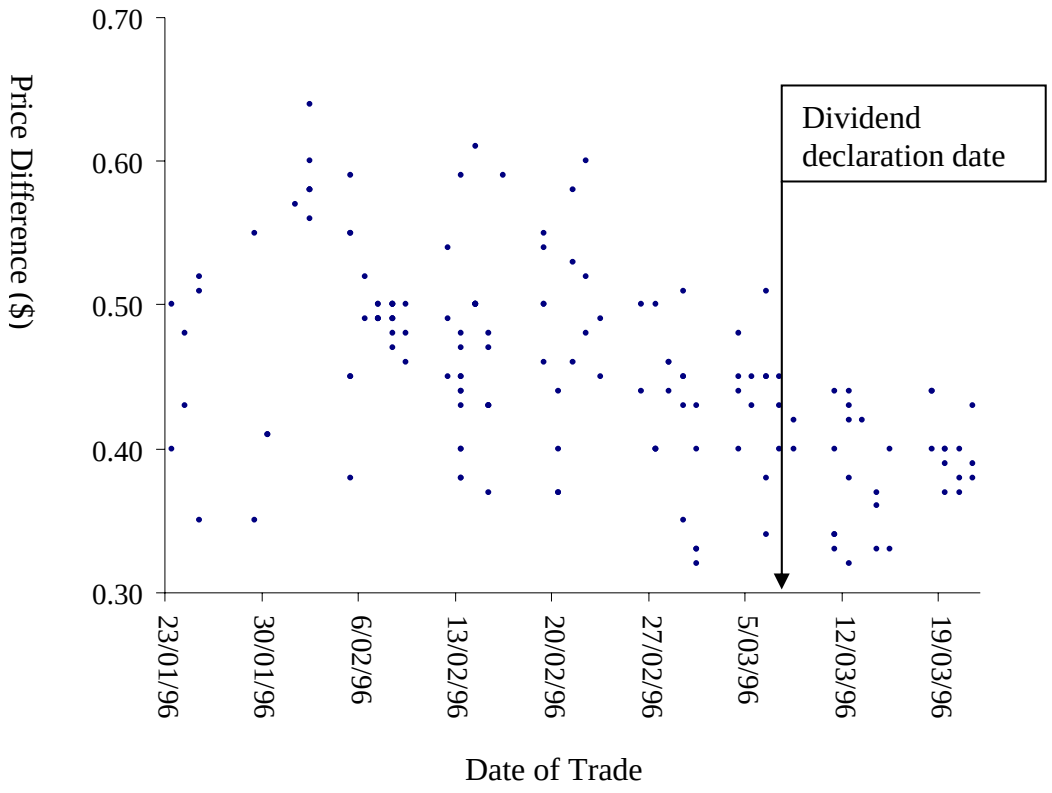
This table presents the results for the *t*-test and the Wilcoxon signed rank test comparing the DVR against two bench-marks, 1 and 1.50. Tests are also conducted to determine the significance of differences in DVRs, and differences in prices before and after the dividend declaration date. $DVR = (P_{old} - P_{bonus})/D$, where P_{old} is the price of the old share, P_{bonus} is the price of the bonus share, D is the dividend of thirty-five cents, fully franked at the thirty-six percent corporate tax rate. The bonus shares are not entitled to the dividend. The full matched sample is based on paired trades where prices in bonus and old shares are observed within plus or minus one minute. The pre-dividend declaration period covers the period before the dividend was declared and the post-dividend declaration period is from the dividend declaration date to the last cum-dividend date inclusive.

Figure 1: Matched Prices of the Old and Bonus Shares in Trade Sequence



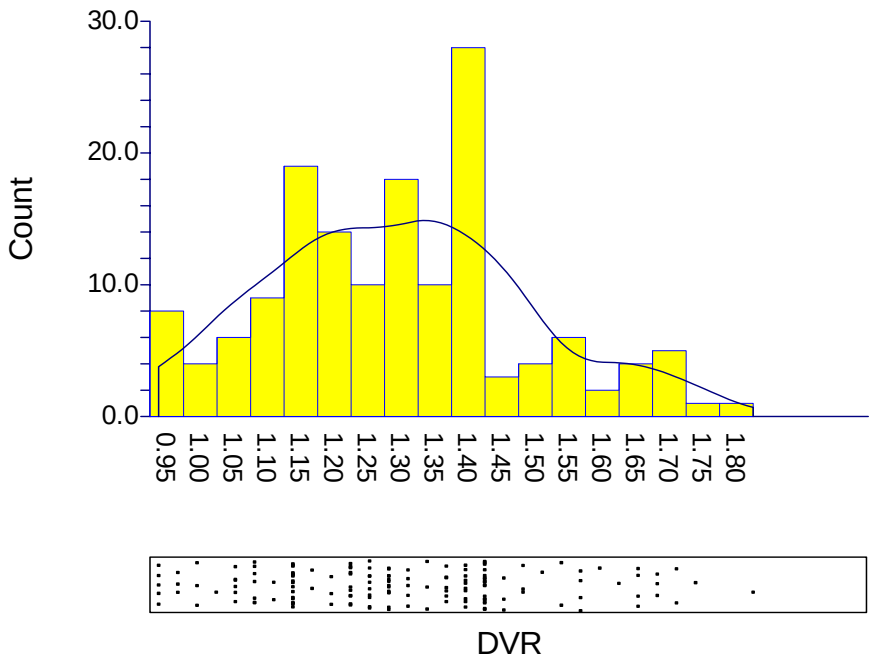
This graph presents the times series, in trade sequence, for the matched prices of old and bonus shares, following CRA's NPP bonus issue. P_{old} is the price of the old share, P_{bonus} is the price of the bonus share. The old shares paid fully franked dividends, while the bonus shares did not pay dividends. Trades in the bonus shares were matched against trades in the old shares occurring within plus or minus one minute. Where there was more than one old share as a candidate for matching with a trade in the bonus share, the trade with the highest volume was selected.

Figure 2: Price Difference by Date Observed



This figure presents the price difference (calculated as, $P_{old} - P_{bonus}$, where P_{old} is the price of the old share, P_{bonus} is the price of the bonus share) plotted against the day on which the price difference was observed. The last day of trading immediately precedes the ex-dividend date. The data for the calculations is based on sample containing 154 contemporaneous paired trades, where old and bonus shares have different dividend entitlements. The dividend difference was thirty-five cents fully franked. Trades in the bonus shares were matched against trades in the old shares occurring within plus or minus one minute. Where there was more than one old share as a candidate for matching the trade with the highest volume was selected.

Figure 3: Distribution of the observed DVR



This figure presents a histogram of the dividend valuation ratio, overlaid with a density trace (the single line) and with a dotplot at the foot of the histogram. The dividend valuation ratio is calculated as $DVR = (P_{old} - P_{bonus})/D$, where P_{old} is the price of the old share, P_{bonus} is the price of the bonus share, D is 35 cents fully franked at 36% corporate tax rate. The data for the calculations is based on sample containing 154 contemporaneous paired trades where old and bonus shares have different dividend entitlements. Trades in the bonus shares were matched against trades in the old shares occurring within plus or minus one minute. Where there was more than one old share as a candidate for matching the trade with the highest volume was selected.