INDIAN CONVERTIBLE BONDS WITH UNSPECIFIED TERMS
AN EMPIRICAL STUDY

by

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Abstract

Indian convertible bonds have two peculiar features that make them possibly unique in the world: a) the bonds are compulsorily converted into equity without any option, and b) the conversion terms are not specified at the time of issue but are left to be determined subsequently by the Controller of Capital Issues (CCI) who is the government functionary regulating capital issues in India.

A naive model would say that the market simply forms an estimate of the likely conversion terms and then values the bond as if these terms were prespecified. This paper examines the market prices of one of the largest issues of Indian convertible bonds with unspecified terms. The empirical investigation convincingly rejects the naive model and demonstrates that changes in the market's expectation of the conversion terms are a significant factor affecting the pricing relationship. These changes are significantly correlated with the stock price itself. We do not, however, find any evidence that the market expects the CCI to adjust the conversion terms on the basis of the actual market price to protect the bondholder. But, there is strong evidence that changes in expected conversion terms affect the share price through the dilution effect. Since the unspecified terms have only added to the uncertainty of the bondholders without giving them any perceived benefits we recommend that this system should be abolished.

In a companion paper, Barua and Varma (1991) present a theoretical valuation model for the Indian convertible bonds with unspecified terms. The empirical results in this paper confirm the predictions of that model.

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Introduction

Convertible bonds are well known securities throughout the world. However, recent Indian convertible bonds have some peculiar features that make them possibly unique. First, the bonds are compulsorily redeemed by conversion into equity. There is no option in this regard either to the bondholder or to the issuing corporation. This is less serious than it might appear because the conversion terms have generally been so favourable as to make the conversion always beneficial to the bondholder. Therefore, even if the bond were to be vested with a genuine option to convert, such a deep-in-the-money option would behave just like the bond with compulsory conversion. The second and more serious problem is that the conversion terms are not specified at the time of issue. In other words, neither the exact time of conversion nor the conversion ratio (i.e. the number of equity shares into which each bond is to be converted) are prespecified. These are left to be determined at a subsequent stage by the Controller of Capital Issues (CCI) who is the government functionary entrusted with the regulation of issues of capital in the primary market.

At first sight, an instrument like this defies rational valuation. Nevertheless, these instruments are actively traded in Indian capital markets, and the market does place a value upon them. In fact, many practitioners and academics seem to think that all that is required is to form an estimate of the likely conversion terms and then value the bond as if these terms were prespecified. Apart from this additional complication of estimating the expected conversion terms, the Indian convertible bond with unspecified terms should, in this view, behave like an ordinary convertible bond.

In this paper, we examine the behaviour of market prices of one of the largest issues of Indian convertible bonds with unspecified terms, viz., Reliance Petrochemicals Limited (RPL). We find that the behaviour of these prices is quite different from that of ordinary convertible bonds. The fact that the terms are not prespecified makes a substantial qualitative difference to the pattern of price movements. In a companion paper, Barua and Varma (1991), we present a theoretical model for the valuation of Indian convertible bonds using the general theory of derivative securities (Cox, Ingersoll and Ross, 1985). The empirical results in the current study are consistent with the predictions of that theoretical model.

Data

In September 1988, RPL made a public issue of Rs. 6000 million divided into Rs. 300 million of equity shares (face value Rs. 10 each), Rs. 1200 million of Part B bonds (face value Rs. 40 each) and Rs. 4500 million of Part C bonds (face value Rs. 150 each). Both B and C bonds carried an interest rate of 12.5%. This interest rate is well below the market interest rate on non convertible bonds of comparable default risk; the investor clearly expected to be compensated for this by conversion into equity at favourable terms. B bonds were convertible 3 to 4 years after allotment, while for C bonds the conversion was after 5 to 7 years. Both bonds were wholly convertible into equity, but the terms of conversion (i.e. the conversion price, or equivalently, the number of equity shares to be allotted on conversion) were left to be determined by the CCI. Both bonds are actively traded on the stock markets.

The period of study is from February 1989 to October 1990; we have collected daily prices for this period giving us more than 330 sets of prices.

The Naive Model

The value of the convertible bond is the sum of two components: the present value of all interest payments receivable till conversion, and the present value of the shares to be received on conversion. Based on the yield to maturity (ytm) prevalent on corporate bonds in the Indian markets, and an assessment of the perceived riskiness of RPL, we can estimate the first component by discounting the interest payments at an interest rate of 22%. For this purpose, we assume that the conversion will take place at the end of the permissible period, i.e., 4 years after allotment for B and 7 years after allotment for C. In other words, we ignore, for the purpose of the study, the uncertainty attached to the conversion date itself. Subtracting the present value obtained by this discounting process from the market prices of the bonds, we get the implicit value that the market attaches to the conversion. Most of our analysis is based on these conversion values which we denote by V_B and V_C respectively. Our analysis indicates that our subsequent results are not very sensitive to the assumptions made in valuing the interest coupons. The main impact of any error will be to alter the conversion value of the bonds by almost a constant amount throughout the time period under study.

If the conversion terms were prespecified then the conversion value should be simply the conversion ratio times the current stock price. If, for example, the B bonds are to be converted into K_B equity shares, then V_B should be equal to K_B*S where S is the stock price. This simple result holds because the conversion is compulsory; there is no option to convert, and, therefore, no need for the option pricing model of Black and Scholes (1973). (We ignore the future dividends on the share upto the conversion date since RPL had not paid any dividends during the period under study, and the possibility of dividends in the immediate future were not very bright).

The naive model simply assumes that the market forms an estimate of the conversion ratio and then uses that ratio as if it were prespecified. The naive model thus asserts that V_B equals K_B times S where K_B (the expected conversion ratio) is a constant to be estimated.

Testing the Naive Model

Though we do not know the market's estimate of K_B, we can, according to the naive model, estimate this by simply running a linear regression of V_B on S. This linear regression does not, however, help us in testing the naive model as the model does not make any strong predictions about the regression slope. We have only the trivial prediction that the slope should be positive. The linear regression would lead to testable implications only if we can form an independent estimate of K_B.

We can, however, obtain a strong testable implication from the naive model by taking logarithms in the equation:

$$V_B = K_B * S$$

to get:

$$\ln(V_B) = \ln(K_B) + \ln(S)$$

Since K_B is constant, we get

$$\frac{d \ln(V_B)}{d \ln(S)} = 1$$

Stated in words, the elasticity of V_B with respect to S equals unity. As usual, elasticity is the percentage change in one variable when the other variable changes by one percent. The testable implication is that if we regress the logarithm of the conversion value on the logarithm of the stock price, the regression slope should be equal to unity.

This test can readily be carried out. Statistically, however, a regression of this kind is prone to spurious correlations arising from time trends in the data. For example, if both V_B and S are rising over time, the regression would produce a significant coefficient which is only a proxy for time. In our case, all the prices rise sharply towards the second half of 1990 as part of the overall boom in the stock market. This does lead to a considerable degree of spurious correlation. To avoid this problem, the preferred methodology is to difference both the variables and run the regression in terms of differences (changes) rather than levels. In our case, there is the added advantage that the change in the logarithm of prices or values is interpretable as the logarithmic return. (The logarithmic return is defined as the logarithm of the price ratio; for example, the log return on S is defined as $\ln(S_t/S_{t-1})$ which is clearly equal to $\ln(S_t) - \ln(S_{t-1})$). We are thus led to formulate our estimable regression model as follows:

Bret = a + b*Sret

where Bret is the (log) return on the B bond (net of coupon values) and Sret is the (log) return on the share. A similar model is formulated for the C bond.

The regression results were as follows:

Bret = 0.002 + 0.505 Sret (0.58) (7.81)	R^2 = .156	F(1,331) = 60.99 P = 0.000
Cret = -0.001 + 0.417 Sret (-0.37) (8.66)	R^2 = .187	F(1,327) = 75.03 P = 0.000

T statistics are in parentheses.

The result is, of course, a convincing rejection of the naive model. The slopes (elasticities) are 0.505 and 0.417 for B and C respectively; these are approximately half of the predicted value of unity . The hypothesis that the slope is equal to unity is rejected at the 0.1% level for both B and C (T-Statistics of 7.62 and 12.15 respectively).

The rejection of the naive model is essentially a rejection of the hypothesis that the market's expectation of the conversion ratio is constant over time. In looking for alternatives to the naive model, we have to focus on the changes in this market expectation.

<u>CCI's Policy: Conversion Ratio Could Depend on the Stock Price</u>

A crucial assumption in deriving equation (1) is that K_B and S are uncorrelated. This requires that K_B should not itself depend on S. If there were such a dependence, we will have:

$$\frac{d\ \ln(V_B)}{d\ \ln(S)} = \frac{d\ \ln(K_B)}{d\ \ln(S)} + \frac{d\ \ln(S)}{d\ \ln(S)} = \frac{d\ \ln(K_B)}{d\ \ln(S)} + 1$$

Stated in words, the elasticity of V_B with respect to S equals unity plus the elasticity of K_B with respect to S. Our empirical result could be explained if this latter elasticity were negative; that is to say if the conversion ratio were negatively related to the stock price.

To see why such a dependence may indeed be present we must look at what policies the CCI might follow while fixing the conversion terms.

During the period under study, the interest rates on corporate bonds were subject to a ceiling fixed by the government. The ceiling rate on convertible bonds was lower than that on ordinary bonds. To compensate for this, the conversion was usually at favourable terms; on conversion, the bondholder received equity shares with a market value exceeding the face value of the bond. Typically, conversion at favourable terms acts like a redemption premium that boosts the effective yield on the convertible bond above even the ceiling rate on ordinary bonds. The investor in Indian convertible bonds has thus come to expect a substantial part of his return to come from the conversion.

In fact, part of the rationale for leaving the conversion terms to be determined subsequently by the CCI rather than specifying them at the time of issue was to ensure that the conversion terms are favourable not only ex-ante but also ex-post. This is the context in which the CCI operates.

The CCI can, therefore, be expected to look closely at the value of the shares being transferred to the bondholders. The CCI would want to ensure that the conversion ratio times the market price of the share exceeds the face value of the bond by an amount adequate to compensate the bondholder for the low interest rate that he has received till conversion. He can do this quite simply by setting the conversion ratio equal to the target redemption value divided by the market price of the share at the time of conversion.

For example, the market might expect the Part B bond to be converted into shares having a value at conversion of M_B. In this case, V_B should equal the present value of M_B regardless of the current share price. A regression against the equity price would then yield a slope of zero.

The assumption that K_B is inversely proportional to S and therefore V_B is independent of S is, perhaps, as extreme as the assumption that K_B is independent of S and therefore V_B is proportional to S. It would be more realistic to assume that V_B would rise as S rises, but less than proportionately. If RPL is doing very well and the share prices are very high, the CCI would pass on some of this benefit to the bond holders but not all. The reason would be that the CCI may not wish the bond holders to obtain an unreasonable gain over and above the compensation for the lower coupon rate of interest.

Another way of looking at this situation is to regard the CCI as fixing not the conversion ratio but the conversion price (the price of the share for conversion purposes). The conversion ratio would then equal the face value divided by this conversion price. This would suggest that the CCI could use the same guidelines for share valuation that he has evolved for valuation of shares for various other purposes. The market price of the share is one of the inputs in determining fair value in accordance with these guidelines, but not the only one, nor even necessarily the most important one (Varma and Venkiteswaran, 1990).

What does all this mean for the elasticities of V_B and K_B with respect to S? If the CCI is expected to adjust the conversion ratio so as to transfer a fixed value, the elasticity of K_B would equal -1 reducing the elasticity of V_B to 0. If the CCI is expected to adopt a fixed conversion ratio regardless of the share price, the elasticity of K_B would equal 0 so that the elasticity of V_B equals 1. In general, one would expect the regression slope (elasticity of V_B) to lie between 0 and 1 implying a range of -1 to 0 for the elasticity of K_B.

Our earlier empirical results indicate an elasticity of 0.505 for V_B and of 0.417 for V_C implying elasticities of -0.495 and -0.583 for K_B and K_C. These values are near the middle of the range of values within which we should expect the elasticities to lie. The regression results appear to show that when the share price rises by one percent, the market expects the conversion ratios for both bonds to fall by roughly half a percent. The market seems to expect the conversion ratio to be a decreasing function of the share price but decreasing less than proportionately.

Reverse Causation: The Dilution Effect

There is, however, an entirely different reason for a negative elasticity of the conversion ratio with respect to the stock price. Not only does the share price influence the conversion ratio, but there is a reverse causation also. The expected conversion ratio does influence the value of the equity share because of the dilution effect. As pointed out in the beginning, the face value of the B and C bonds together amount to Rs. 5700 million as against the face value of the equity of Rs. 300 million. Even if the conversion is at a very high conversion price, the shares allotted on conversion can be expected to be several times the original number of shares. The market price of the equity share would reflect this dilution. Theoretically, the value of the share can be computed by taking the value of RPL as a whole (value of the firm, as it is called in finance theory), subtracting the value of all debt including the coupons on B and C bonds, and dividing the balance by the fully diluted share capital. If the market receives any information which suggests that the CCI is likely to grant a higher conversion ratio to the bond holder, then, the value of the firm remaining unchanged, the market price of the share must decline as the fully diluted share capital is now larger than it was earlier expected to be.

One can now think of two kinds of information coming to the market. First, there is information about the value of RPL itself (i.e. information about its project implementation, business prospects, etc.). This information changes the value of the firm, and causes the value of the equity and the bonds to change in the same direction but not necessarily by the same percentage. The bond values would change by a smaller percentage if the market expects the conversion ratios to change as a result of the change in share values. Hence, the return to bonds would be less than the returns to equity holders leading to a slope of less than one in our regressions. Second, there is information that comes in to the market about the likely stand of the CCI on the conversion ratios. This information may be in terms of the valuation used by the CCI in public issues or other conversion cases. It may also be information about the likely political situation in the country considering the high political profile of the Reliance group. Any such information would cause the share and bond prices to move in opposite directions. For example, information suggesting that the CCI may grant a higher conversion ratio would cause the equity to fall to reflect the higher dilution, while the bonds rise.

The regression slopes (elasticities of V_B and V_C) would thus be conditioned by both these factors. One causing a strictly positive relationship which may be of less than unit slope while the other causes a negative relationship. It is, therefore, interesting to examine whether the observed slope of about half results from the positive relationship itself having a low slope or whether a slope close to unity in the positive relationship is being counterbalanced by a strong negative component. This requires an indirect methodology.

Disentangling the Dilution Effect

It is usual in finance theory to regress security returns on the market returns (i.e. returns on a market index) in what is commonly called the market model. This model has its theoretical foundation in the Capital Asset Pricing Model (CAPM). The regression on the market return captures the effect of economy wide factors like inflation, GNP growth etc. which can be expected to influence the returns on all companies in general. The regression coefficient in the market model (beta) measures the responsiveness of the security to market wide factors; the residuals from the market model represent the impact of company specific factors unrelated to market wide movements. The market model thus allows us to decompose the total return in any security into two parts related to market wide information and company specific information respectively.

We would argue that the market wide information is essentially about the value of the firm. The company specific information could be either about the value of the firm or about the CCI attitudes. By using the market model, we can thus look at the impact on share and bond prices of information affecting only the value of the firm untainted by any information about the CCI's likely policy on conversion ratios.

We first run the market model for the share and for both bonds.

Sret = -0.003 + 1.307 Mret (-1.31) (9.18)	R^2 = .204	F(1,331) = 84.21 P = 0.000
Bret = -0.001 + 1.551 Mret (-0.24) (8.05)	R^2 = .164	F(1,331) = 64.84 P = 0.000
Cret = -0.002 + 0.994 Sret (-0.84) (6.62)	R^2 = .118	F(1,327) = 43.76 P = 0.000

T statistics are in parentheses.

The betas are 1.307, 1.551 and 0.994 for the share, the B bond and the C bond respectively. The beta coefficients indicate the responsiveness of the securities to market wide information. If we divide the betas of B and C by the beta of the share, we can compute the response of B and C to a one percent change in the share price induced by market wide information. This ratio is 1.551/1.307 = 1.187 for B and 0.994/1.307 = 0.761 for C. These ratios are much higher than the slopes of about half that we obtained in the earlier regression. One of the ratios is less than unity, and the other greater than unity, and we are unable to statistically reject the hypothesis that the two slopes are in fact equal to unity. (The T-Statistic for testing equality of the betas of the share and the B bond is 1.018; the corresponding statistic for the C bond is -1.515).

To examine the effect of company specific information, we regress the bond returns simultaneously on the share returns and the market return. In this multiple regression model, the coefficient of the share return represents the impact of information specific to RPL.

The regression results are as follows:

Bret =	0.000 +	0.381 Sret +	0.795 Mret		R^2 = .192
	(0.04)	(5.34)	(3.85)	F(2,328)=38.95	P=0.000
Cret =	-0.001 +	0.371 Sret +	0.291 Mret		R^2 = .195
	(-0.60)	(6.88)	(1.86)	F(2,324)=39.28	P=0.000

T statistics are in parentheses.

The coefficients of the share return are now well below half; the indicated elasticity of K_B is -0.619 and that of K_C is -0.629. The hypothesis that the coefficients of the share return are equal to unity is once again convincingly rejected at the 0.1% level (T-Statistics of 8.68 and 11.66 respectively).

These results enable us to identify the source of the negative correlation between K and S that led to the rejection of the naive model in the first place. First of all, there is no firm evidence of the dependence of K on S through the CCI's policy of ensuring a fair conversion value. If K were dependent on S in that manner, then any change in S, market related or not, should cause K to move in the opposite direction. Our empirical results show that when we look at market related changes in S, we are unable to reject the hypothesis that K is independent of S. The elasticity of V with respect to S as measured by the ratio of the bond beta to the share beta is not statistically significantly different from unity. We would like to add though that the standard errors of the betas are somewhat large and we hesitate to say that the data rejects the hypothesis that the CCI is expected to adjust the conversion ratio on the basis of the actual market price of the share. We prefer to make the more cautious statement that there is no statistical evidence for this hypothesis.

We have strong evidence for the presence of the dilution effect which predicts that exogenous changes in K cause S to change in the opposite direction. This is reflected in the fact that the negative elasticity between K and S which is present when we consider all changes in S disappears when we consider only market related changes where the dilution effect is absent. The negative elasticity becomes even more pronounced when we consider non market related changes where the dilution effect is expected to be stronger.

The observed elasticities may be summarized as follows:

	Elast. of V_B	Elast. of K_B	Elast. of V_C	Elast. of K_C
Market related changes in stock price	1.187	0.187	0.761	-0.239
Non market related changes in stock price	0.381	-0.619	0.371	-0.629
All changes in stock price	0.505	-0.495	0.417	-0.583

Conclusion

Our empirical results show that the convertible bond with unspecified terms is quite different from the ordinary convertible bond. We find that, with unspecified terms, the implications for the bond value of changes in stock price are quite complex, and require a disentanglement of the different sources of changes in stock price.

While the normal convertible bond is expected to move in tandem with the share, the bond with unspecified terms can and does move in an opposite direction. The empirical data shows that the market does revise its expectation of the likely conversion terms on the basis of whatever fresh information it receives. If such information causes the market to revise the expected conversion ratio upward (downward), the bond price rises (falls) and, because of the dilution effect, the stock price falls (rises). The empirical evidence that this effect is very pronounced indicates that the market does face considerable uncertainty about the likely conversion terms. This is a wholly needless source of uncertainty that has been created solely by the government's policy of encouraging the issuing corporation not to prespecify the conversion terms.

One of the justifications for the unspecified terms was that the CCI could ensure that the conversion terms are "fair" ex-post and not merely ex-ante. In other words, the CCI fixing the conversion terms at the time of conversion could ensure that the bondholders do not suffer from a severe adverse movement of the share price between issue and conversion. The empirical data does not provide any evidence that the market expects the CCI to protect their interests in this fashion. We are unable to statistically reject the hypothesis that the CCI is not expected to play any such moderating role.

This study, therefore, shows that unspecified terms have only added to the uncertainty of the bondholders without giving them any perceived benefits. The implication for government policy is that the system of unspecified conversion terms must be abolished.

In a companion paper, Barua and Varma (1991) have presented a theoretical model for the valuation of the convertible bond with unspecified conversion terms. That valuation model contains an unobservable state variable representing the market's expectation about the CCI's policy which makes it difficult to test the valuation equation itself. The principal testable implication of the model is that the elasticity of V with respect to S would be highest for market related changes in S, lowest for non market related changes, and in between for all changes put together. All these elasticities are predicted to be less than or equal to unity. These predictions of the model are confirmed in the above empirical results.

References

Barua, S.K. and Varma, J.R. (1991) Indian Convertible Bonds with Unspecified Terms: A Valuation Model, WP No. 991, Indian Institute of Management, Ahmedabad.

Black, F. and Scholes, M. (1973) "The Pricing of Options and Corporate Liabilities", Journal of Political Economy, 81, 637-654.

Cox, J.C., Ingersoll, J.E. and Ross, S.A. (1985) "An Intertemporal General Equilibrium Model of Asset Prices", Econometrica, 53(2), 363-384.

Varma, J.R. and Venkiteswaran, N. (1990) "Guidelines on Share Valuation: How Fair is Fair Value?", Vikalpa, 15, 3-10.