Pricing Hybrid Securities: The Case of Malaysian ICULS

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Abstract

This paper provides an indepth analysis of Irredeemable Convertible Unsecured Loan Stocks or ICULS. A Malaysian variant of the convertible bond, ICULS are a hybrid security. Despite their introduction and trading since the late 1980's, not much work have been done on them. This paper presents the first empirical evidence on the pricing of ICULS. We propose a pricing model for ICULS, built on the replication technique of options. Using 30 months (2½ years) of daily price data, we test our model on a sample of 34 ICULS. Though on average ICULS are underpriced by 2.3%, we find an equal number of under and overpriced ICULS. Our findings show that not only does the market misprice ICULS, the mispricing is sustained over quite a while. Infact, even over a one year window period, marginal mispricing remains. We argue that issuers of ICULS benefit much more than investors do.

ICULS or Irredeemable Convertible Unsecured Loan Stocks appear to be a uniquely Malaysian hybrid security. Aside from the fact that there are no equivalent instruments traded elsewhere, there appears to be a dearth of literature and no systematic means of pricing the ICULS traded. This, despite the fact the ICULS have been around since the late 1980's, are listed and exchange traded and have traded volumes much higher than other hybrids like convertible bonds (CULS), warrants and derivative instruments like options. All of these makes the study of ICULS interesting and worthwhile.

This paper presents the first empirical evidence on the pricing of ICULS. We undertake a systematic evaluation of ICULS, identify its salient features and build a pricing model based on the breakdown of cash flows. We next examine the pricing efficiency of the market for ICULS by using our proposed model. We identify significant deviations in pricing. When examined over time, we find a very slow reduction in mispricing. Convergence towards equilibrium values takes place only after significant time lapse. We next ask why, arbitrage, which could have quickly eliminated the inefficiencies has been absent. We identify institutional and the regulatory frameworks that hinder arbitrage and enable sustained mispricing.

That there has been no prior work on ICULS despite their relative popularity nor any attempt at pricing them post issuance have been the motivation and justification for this paper.

1.1 : What are ICULS?

An Irredeemable Convertible Unsecured Loan Stock (ICULS) is a hybrid instrument that has the features of both debt and equity. In essence, it resembles a fixed income debt

instrument until converted into equity at predetermined dates, at or prior to maturity. At first glance, one would be tempted to think of ICULS as being similar to Convertible Bonds. Indeed, its two variants, CULS (Convertible Unsecured Loan Stocks), and RCLS (Redeemable convertible Loan Stocks) can be considered the Malaysianised version of convertible bonds. What differentiates RCLS/CULS from ICULS is that the latter is "irredeemable" meaning, can never be redeemed for cash. The fact that ICULS ***must be*** converted to the underlying stock, substantially changes the risk profile of an ICULS from that of a convertible bond. As we will see later, this has important implications for cash flow and pricing. Similar to convertible bonds, ICULS carry fixed interest, coupons, payable either semi-annually or annually. It is unsecured and normally subordinated to all other obligations of the company. ICULS have fixed maturity dates and holders of ICULS must convert their ICULS into the underlying ordinary shares either at predetermined exercise points before maturity or at maturity as specified by the issuer. Conversion is done automatically, regardless of whether the holder of ICULS surrenders them or not. This means that unlike convertible bonds where partial dilution is possible, ICULS ultimately result in full dilution.

The price at which the ICULS can be converted into the underlying shares is determined by the conversion price[1]. The conversion price can be satisfied by tendering the ICULS or a combination of ICULS and cash. Thus, if the ICULS expires in-the-money, given the predetermined conversion price, the holder receives the stipulated number shares without having to pay anymore. On the other hand, should the ICULS expire out-of-the-money, i.e. stock price is less than the conversion price, the holder will be required to pay the

[1] *The conversion price can be subject to adjustments under certain circumstances in accordance with the terms and conditions set out in the document called trust deed.*

difference between the conversion price and the stock price in order to receive the underlying shares.

Thus, ICULS are never redeemable for cash. While a holder may delay conversion when the ICULs is out of the money, he ultimately has to convert. ICULS have a nominal value which is usually set at RM1.00 and are tradeable in board lots of RM1,000.00 nominal amounts.

Any new shares issued upon conversion of ICULS will rank pari passu in all respects with the then existing shares. However, the new shares will not be entitled to dividend, rights, allotments or other distributional entitlements which are before the conversion date of the ICULS. Neither would accrued interest since the last coupon date, be payable. As ICULS are not redeemable for cash, the requirement for bond rating is exempted. This enables companies with weak financial standing to gain access to finding new capital[2].

In a sense both ICULS and RCLS are convertible bonds since they both begin as debt securities. However, while RCLS like convertible bonds may be redeemed for cash, ICULS always end up being converted to the underlying stock. Thus, the issuer of ICULS not only has no further cash outflow at maturity but could potentially have inflows if the ICULS expire out of the money.

Given that the motivation of this paper is to subject the market for ICULS, in particular the pricing of these instrument, to rigorous analysis, we attempt the study by way of addressing several research questions. Based on a survey of similar work, in particular on

[2] *On the other hand CULS or RCLS which like convertible bonds can be redeemed for cash require ratings prior to issuance.*

convertible bonds in foreign markets, we designed the study to address the following five research questions:

(i) How do we price an ICULs?

(ii) How efficient is the market in pricing ICULS?

(iii) If there is mispricing how sustained are the deviations?

(iv) How do the ICULS compare to the underlying stock in terms of returns and volatility?

(v) What are the key determinants of mispricing for ICULS?

A sixth, and obvious question would be the implications for policy from the above findings. We address this in our concluding remarks. This paper is divided into five sections. Section two below, is a review of relevant literature. Section 3, details our data and methodology. The following section (Section 4), presents the results and analysis. The final section, Section 5 concludes and discusses implications for policy.

SECTION 2 : Literature Review

Since ICULS are uniquely Malaysian and have not been previously researched, we looked at literature on similar hybrid securities in other markets. Since the closest hybrid security to ICULS is the convertible bond, we examined relevant literature on convertibles. The literature reviewed below can be categorized into two broad categories, previous studies on pricing and those that examine why companies issue convertibles and why investors buy them. We then adapt the underlying logic/principles of these studies to our task of investigating ICULS.

2.1: Pricing Mechanism and Efficiency of the Market for Convertibles

Among the earliest work on the pricing of convertible bonds were those of Brennan and Schwartz (1977) and Ingersoll (1977a). They used the firm value as a stochastic variable with credit risk being modeled endogenously by assuming that default occurs when the firm value falls below the value of the debt.

In similar vein, McConnell and Schwartz (1986), present a pricing model based on the stock value as stochastic variable. To account for credit risk, they use an interest rate that is 'grossed up' to capture the default risk of the issuer rather than the risk-free rate. Since they implicitly use a constant credit spread, they do not consider that the credit risk of a convertible bond varies with respect to its moneyness.

Other researchers such as Bardhan et al (1993) and Tsiveriotis and Fernandes (1998) proposed an approach that splits the value of a convertible bond into a stock component and a straight bond component. These two components belong to different credit risk categories as the former is risk free because a company is always able to deliver its own stock whereas the latter is risky because coupon and principal payment depend on the issuer's capability of distributing the required cash amounts. It is easy to discount the stock part of the convertible with the risk-free interest rate and the straight bond component with a risk-adjusted rate. When the convertible is deep out of the money, the straight bond component is very high and so is its defaultable part.

Ammann, Kind and Wilde (2003), propose another approach. They examine the pricing of French convertible bonds to find out whether prices observed on secondary

markets are below their theoretical fair values. Instead of using a firm-value model, they used stock-based binomial tree model with exogenous credit risk. They found that the theoretical values for the convertible bonds were on average more than 3% higher than the observed market prices. The difference between market and model prices is greater for out-of-the-money convertibles than for at-or in-the money convertibles. Additionally, they find a positive relationship between underpricing and maturity. Mispricing decreases as time to maturity reduces. These findings are contrary to previous research on the subject by King (1986) who found a negative relationship between underpricing and maturity where there is increasing mispricing for bonds with shorter time to maturity.

Yigitbasiouglu (2002) studied the pricing of convertibles using a comprehensive theoretical framework taking into account interest rate, equity, credit, currency and volatility risk and employed a quasi five factor model incorporating most of the contractual features. He observes that it was surprising that despite the huge USD 400 billion convertible bond market, there is little consensus on the best way to price these instruments, unlike bonds or other securities. He found that convertible bond prices display the same sensitivity to short and medium term volatility as other exotics.

Greiner et. al. (2002) study 1,357 callable-convertible bonds in Japan and find evidence of substantial underpricing. The underpricing grows as bonds age and remain underpriced throughout the period of study from 1982 to 1992. Convertible bondholders therefore responded to the extreme underpricing by choosing to convert to equity rather than sell the bonds.

2.2: Reasons Why Firms Issue Convertible Bonds

The underlying reasons for firms to issue convertible bonds vary from being 'backdoor equity' to being a method to control sequential financing problem. Brennan and Schwartz (1988) observed that "to the perplexity of academics, however, the popularity of convertibles has shown little sign of abating. Consequently, we have been faced with the task of finding a convincing explanation for the corporate use of convertible, one that is consistent with rational investors and sophisticated financial markets".

According to Stein (1992), convertible bond is actually a "backdoor equity" financing technique. Corporations use it as an indirect way to get equity into their capital structures particularly, when adverse-selection problems make a conventional stock issue unattractive. In his model, he finds that the call feature is important to force investors to exercise their conversion option early and to tempt them to swap their bonds for shares of stocks. This call option is also valuable as it helps avoid possible financial distress.

Mayers (1998) viewed convertibles as a method to resolve the sequential financing problem where managers have investment options with a future maturity date. If funds are already available upfront for both the initial project and subsequent investment options, it creates a conflict between managers who are the investment decision makers and their shareholders. This conflict is similar to the overinvestment problem of Free Cash Flow presented by Jensen (1986). Thus, convertible debt is an attractive alternative to straight debt, as it can reduce issue costs and simultaneously control the overinvestment problem. In Mayer's model, the paramount purpose of a call provision is to provide flexibility for future financing whenever the needs for funding profitable investment arises.

Isagawa (2000) found that convertible bonds are superior to common debt and equity in controlling managerial opportunism. When managers have both empire-building tendencies and fears of default, over-investment can occur under low debt levels and under-investment occurs under high-debt levels. With convertible bonds, the firm can adjust its debt levels via the conversion option and the inefficiencies caused by managerial opportunism can be reduced.

Chang, Chen & Liu (2003), find further support for Mayer's model in that, firms issue convertible debt to minimize security issue costs and agency costs of over-investment. This was particularly true for firms with promising growth opportunities to finance a sequence of potential investment options. Bancel and Mittoo (2003) study 295 convertibles issued by 229 companies across 16 European countries. Their finding provides support for Stein (1992). They conclude that firms issue convertible bond as a "delayed equity" which means that firms already have the expectation that the debt would eventually be converted to equity. They argue that most managers viewed convertible bonds as cheaper than straight debt and value the delayed impact of convertibles on earnings per share dilution relative to the equity alternative.

Convertibles also allow firms to take advantage of the tax deductibility of the coupon payments until conversion occurs. As long as the firm ensures that all of the tax savings obtained are not passed on to the convertible bondholders, it stands to increase the value of existing equity by using convertible debt financing.

Convertible debt also allows companies to push their debt capacity beyond what is normally considered acceptable by creditors, due to the expectation that with future

conversion, a consequent reduction in gearing is likely to occur. One of the main attraction of convertible debt is that it can be self-liquidating whereas straight bond must be redeemed at maturity.

If there are rational reasons why firms might want to issue hybrid instruments like convertibles, there are similar reasons for why investors should want to invest in hybrids. A hybrid instrument such as a convertible combines the fixed income certainly of a bond with the right to participate in the potential capital appreciation of a company's equity. In essence a defensive form of equity exposure to a particular issuer. As Das (2001) puts it, convertible bonds provide a middle ground between the relative stability of a fixed interest instrument and the relative volatility of an equity instrument.

SECTION 3 : Data and Methodology

3.1: What differentiates ICULS from Convertible Bonds

Though, ICULS are a convertible security, they differ from conventional convertible bonds in significant ways–especially from a cash-flow viewpoint. A convertible bond, in its basic form is a combination of a straight bond and a call option on the issuing company's stock. Thus, the value of a convertible at exercise or maturity can be determined as follows;

Value of Convertible at Maturity / at Exercise.

$$= \sum_{t=1}^{n} \frac{C_t}{(1+r)^t} + \frac{FV_n}{(1+r)^n} + \left[\left[MPS - CP \right] x \frac{FV}{CP} \right] \text{.....(1)}$$

$$s.t : MPS > CP; O$$

where;

C_t = amount of coupon, FV_n = Face Value of bond

r = discount rate /required return, MPS is current market price of stock and CP is the conversion price.

Thus, the value of a convertible bond at maturity or at exercise (if exercise is before maturity) is equal to the value of the straight bond and conversion premium. In Eq.(1); the conversion premium is shown within brackets. This conversion value equals 0 if MPS, the current market price of stock is less than its conversion price. In other words, conversion premium is worthless if the convertible expires out of the money.

The value of the convertible bond ***prior*** to exercise / maturity is given by ;

$$= \sum_{t=1}^{n} \frac{C_t}{(1+K)^t} + \frac{FV_n}{(1+K)^n} + [Call\ Value] \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

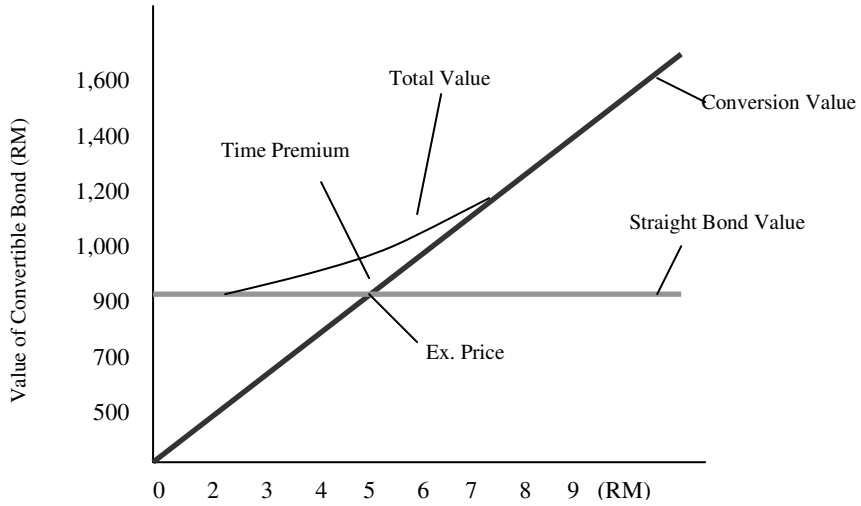
What differentiates Eq. (2) from Eq. (1) is that the call value in Eq. (2) includes the *'time value'* of the option whereas at maturity or at exercise time value is always zero. Since time value is always positive before maturity[3], the call value in Eq. (2) will always be greater than the conversion value in Eq. (1).[4]

Fig. 1 below shows the value profile of a hypothetical convertible bond with the following features; 3 years to maturity, annual coupon of 10%, FV of RM1,000, required return, r of 12% and a conversion ratio of 200 common shares or conversion price of RM5.00 per share. (Note: The value of the straight bond using equations 1 or 2; will be RM951.96).

[3] *This is true even for deep out of the money options*

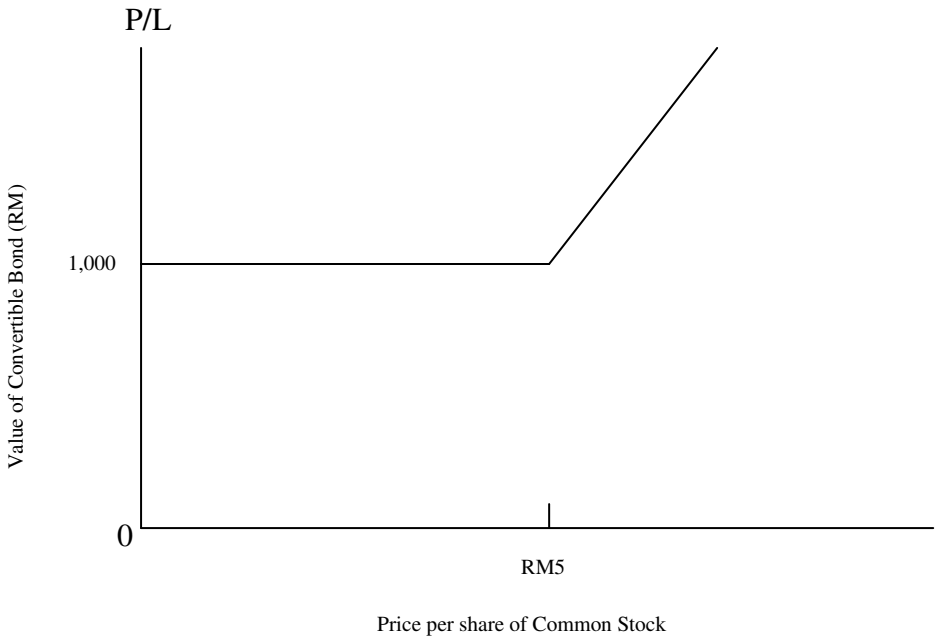
[4] *The logic here is the same as that of why it never makes sense in normal circumstances to exercise early an American style option.*

Figure 1 – Conversion, Time and Total Value for A Convertible Bond



The payoff profile to the above convertible bond at maturity is given by Fig. 2 below.

Figure 2 : Payoff Profile to Convertible Bond At Maturity



Notice from Fig. (2), that the payoff profile is a minimum RM1,000 for common stock values below RM5.00 and higher for subsequent common stock values. Note that this is precisely

the payoff profile to a combined *Long Call* position on the stock at an Exercise price of RM5.00 and a long straight bond position with RM1,000 Face Value.

3.2: Payoff Profile to ICULS.

Recall from our description earlier that an ICULS provides fixed predetermined interest payments, much like the coupon above and has a conversion feature. Thus, at first glance it appears similar to a convertible bond. However, there is a key difference which consequently leads to a very different payoff profile for ICULS. This key difference is the fact that conversion is compulsory with ICULS. Unlike the convertible holder who can decide between either receiving the face value of the bond or converting to stocks, the holder of ICULS must convert to stocks even *if it is unfavourable* for him to do so. Thus if as in the above example, an ICULS with a nominal value of RM1000 has a conversion ratio of 200 stocks implying a conversion price of RM5.00, the holder has no choice but receive the 200 underlying stocks even if their current market price is less then RM5.00. For example, if their current market price was RM2.00, he effectively gets at maturity stocks worth RM400 when converting the ICULS. Therefore unlike convertible bonds where loss is not possible and a minimum value equivalent to the RM1,000 face value is received, there is no such guarantee with ICULS. Losses are entirely possible.

Seen from the viewpoint of payoff profiles the ICULS has a risk profile similar to that of a long stock position. In essence, when an investor buys an ICULS with a nominal value of RM1,000, his exposure is essentially that of being invested in the stock for RM1,000. Subsequent declines in stock prices hurt him while increases add to his potential profit. This potential gain / loss is independent of the fixed interest income. Thus, the difference between a long stock and long ICULS position is the fixed interest received on ICULS. Where the

ICULS has a zero coupon interest, the ICULS and long stock position would essentially be the same in risk profile terms.

In terms of component parts, ICULS like convertible bonds, have two parts. A fixed rate/annuity portion and a convertible portion. Algebraically;

$$ICULS = \sum \frac{C_t}{(1+r)^t} + CP \quad \ldots\ldots\ldots\ldots\ldots\ldots(3)$$

where;

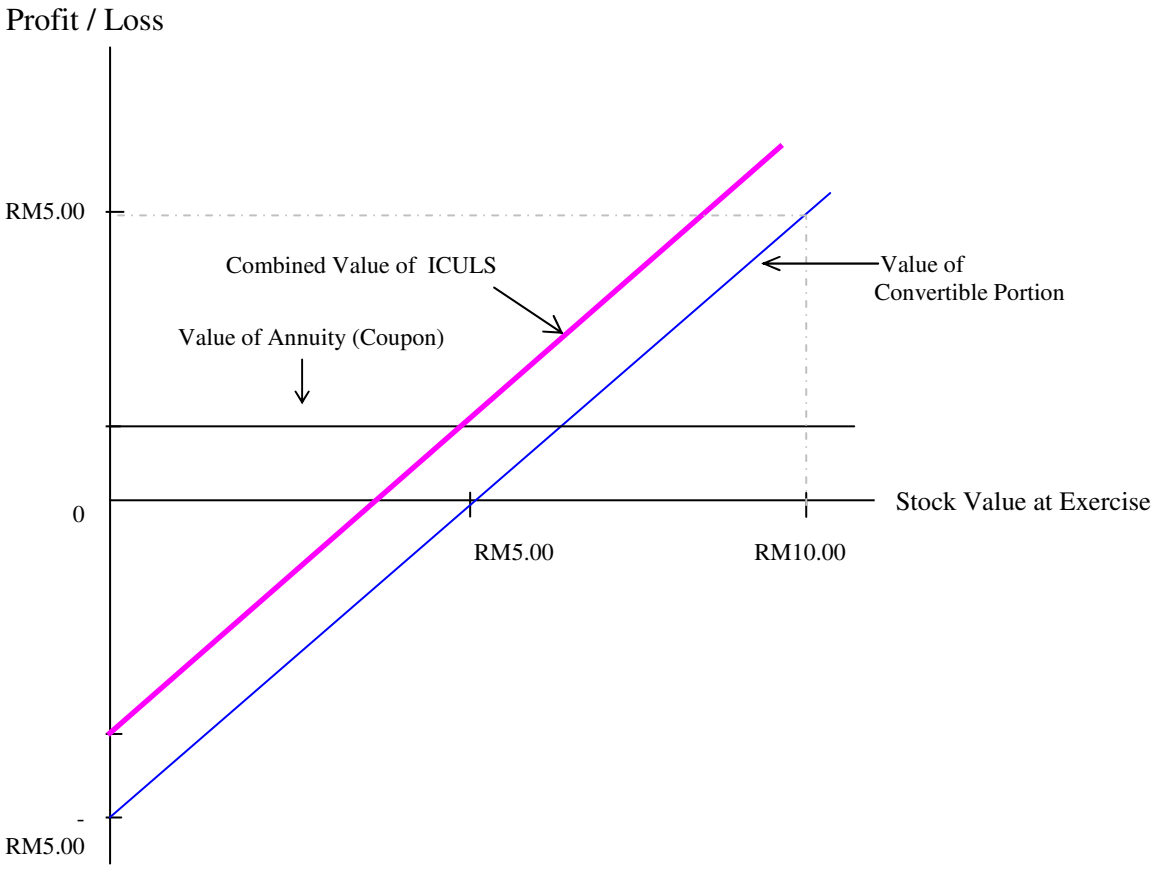
C_t = annual coupon amount

r = required return

CP = Value of convertible portion

In terms of Cash flow/Payoff Profile these two components can be shown as follows:

Figure 3 – Payoff Profit to ICULS



Notice that the value of the convertible portion is entirely dependent on the value of the underlying stock. Where the underlying stock has a value above RM 5.00, the ICULS is in the money and the convertible portion has positive value. On the other hand when the underlying stock is less than RM 5.00, the ICULS is out of the money and so the convertible portion has a negative value. The second component, the value of the fixed rate annuity portion is constant regardless of underlying stock value. Combining the two payoffs gives us the overall payoff profile of ICULS. The bold line showing the combined value of the ICULS is to the left and parallel to the value of the convertible portion. The parallel distance between the two lines represents the value of the annuity portion.

There are two important implications from our analysis thus far. First, given the obligation to convert, the convertible portion of an ICULS has a payoff profile *identical* to that of a long position in the underlying stock at a price equal to the exercise price. The second implication comes from the first. Since an ICULS also has an annuity portion, a long ICULS position would always *dominate* a long stock position where the stock has been purchased at a price equal to the exercise price of the ICULS; i.e RM 5.00 in our example above. To put it another way, if an ICULS had been issued at-the-money [5] and one investor had bought the ICULS while another the underlying stock, the holder of the ICULS would always be better off than the stockholder, regardless of subsequent stock price movement.

In arriving at a pricing model for ICULS we have established one point, i.e ; when the ICULS is at the money, it's value must be higher than that of the underlying stock by the value of the annuity portion.

[5] *At-the-money means the exercise price of the ICULS equals the current value of the stock.*

At the money;

ICULS – Stock Value = Value of annuity

or ICULS > Stock Value ; by the amount of annuity value.

3.3: A Pricing Model For ICULS

To arrive at a pricing model let us first summarize three key points from our analysis above:

(i) for ICULS at the money, we know that the premium of the ICULS must be worth at least the PV of the annuity. The PV of the annuity thus, establishes the lower boundary.

(ii) to the above value of the PV annuity, we must account for the fact that since there is time left to maturity, the ICULS could become in-the-money in the future (or otherwise) and therefore be more (less) profitable. This probability that more (less) profits are possible in the future has a value, and is denoted "time-value" in options literature.

(iii) We know that with the exception of the annuity portion, ICULS have a payoff profile exactly as a long underlying stock position established at a price equal to the exercise price of the ICULS.

Taking all these into consideration, we turned to options literature on synthetics and replication for a pricing model. As a derivative, but one with compulsory conversion, the ICULS has a payoff profile similar to that of the long underlying position. Going by PUT-CALL parity which is:

$$S = C + - P \quad \text{.....(4)}$$

or

$$S - \frac{K}{(1+r)^t} = C + -P \quad \text{.....(5)}$$

One could argue that value of the convertible portion of an ICULS is equivalent to being long an at-the-money, call and short an at-the-money put on the underlying stock. Thus, the value of this convertible portion of the ICUL should equal the cost of the net premiums for the long call and short put. Since the ICULS has a fixed annuity portion, we add to this net premium the PV of annuity. Thus, the value of an ICULS given Eq. (5) is:

$$ICULS - K(1+r)^{-t} = C + -P + \ Value\ of\ \ Annuity \text{ .....(6)}$$

or rearranged as:

$$ICULS = C + -P + K(1+r)^{-t} + \sum \frac{C_t}{(1+r)^t} \text{ .....(7)}$$

where;

C = Value of an at the money Call on underlying

P = Value of an at the money Put on underlying stock

$K(1+r)^{=t}$ = PV of Exercise Price of Call/Put

C_t = RM Amount of Coupon received on ICULS

Since the exercise of ICULS results in the issuance new shares, there obviously is dilution. As conversion is compulsory, dilution is a certainly with ICULS. In accounting for this dilution, we multiply Eq. (7) by the ratio of the number of outstanding stocks pre to post dilution.

$$ICULS = \left[C + -P + K(1+r)^{-t} + \sum \frac{C_t}{(1+r)^t} \right] \bullet \left(\frac{\theta}{\Pi} \right) \text{.....(8)}$$

$$s.t : ICUL > 0$$

where;

θ is the number of existing shares pre-dilution

Π is the number of shares post dilution

Π = (θ + No. of ICULS issued x Conversion Ratio)

The logic of Eq. (7) and (8) is straight forward. The long call, short put and PV of Exercise price of options essentially replicate a long stock position. When the ICUL is in the money, the call premium is higher while put premium low. This leads to a high value for the ICULS. When the ICULS is out of the money, i.e; stock price is lower than ICULS exercise price, the call's value is lower whereas put value is high, thus the net premium would be negative making the combined value of ICULS *less than* its annuity value. As in the case of deep out of the money options, the ICULS cannot have negative values; thus the 'subject to' constraint.

In estimating the values of the call and Put Options in Equation (8), we use the standard Black-Scholes Option Pricing Model (BSOPM). The parameter inputs such as volatility, were estimated using the historical volatility of the underlying stock. Time to maturity of the options equals the time to maturity of the ICULS. The prevailing 3 month KLIBOR rate is used as estimate for the risk-free rate. Since both the options are assumed to be at-the-money, their exercise price equals the exercise price of the ICULS[6]. Thus, the call and Put Values are estimated respectively as Eq. (9) and (10).

[6] *Though restrictive, several of the assumptions underlying the BSOPM are congruent to ICULS. For example the assumption of no dividends is appropriate since ICULS holders do not receive dividends paid on underlying stock. Credit risk is irrelevant since, unlike convertible bonds where redemption for cash is possible and therefore a default by issuer, ICULS are non redeemable for cash. Finally, though the assumption is of European style exercise and ICULS may be exercised prior to maturity, early exercise is not advantageous here as in the case of American style options where no large dividend payments are due. As in the case of American style options on non-dividend paying stocks, it is always more sensible for the ICULS holder to sell rather than exercise the ICULS. As with options, selling lets him capture Time Value which exercising would not.*

$$C = S \bullet N(d_1) - Ke^{-rt} \bullet N(d_2) \ldots\ldots\ldots\ldots\ldots(9)$$

$$P = Ke^{-rt} \bullet N(-d_2) - S \bullet N(-d_1) \ldots\ldots\ldots\ldots\ldots(10)$$

where;

$$\text{if } N(d_1) = x, \text{ then } N(-d_1) = 1 - x$$

$$d_1 = \frac{In\left(s/k\right) + \left[r + \left(\sigma^2/2\right)\right] T}{\sigma\sqrt{T}}$$

and;

$$d_2 = d_1 - \sigma\sqrt{T}$$

3.4: Data & Methodology

This study covers a period of two and a half years or 30 months from 2nd January 2001 to 30th June 2003. Daily price data of Irredeemable Convertible Unsecured Loan Stocks (ICULS) and their underlying stocks were collected for the 30 month period. The ICULS outstanding were identified from *Investor's Digest,* a monthly publication of the Kuala Lumpur Stock Exchange. There were a total of 53 different ICULS listed for trading. However, of these 19 ICULS had to be dropped due to illiquid trading and / or other problems of data. This left us with 34 ICULS to be included as sample for this study. Of these 34 issues, 30 ICULS were issued by firms listed on the Main Board of the KLSE while the remaining four, by Second Board Companies.

Table 1 in Appendix provides a list of our study sample. While most of the ICULS were issued with 5 year maturity, several had 10 year maturity while two ICULS were each

of 3 year and 7 year maturity. Over the 30 month study period, a total of 11 ICULS matured while 12 were newly issued during the study period.[7]

With the exception of 2 ICULS, all had fixed coupon rates. These range from 0.5% to 8%. Most were also exercisable at anytime until maturity. Table 2 in appendix shows the key features of the 34 sample ICULS. In addition to these, the daily quotes of the 3 month KLIBOR were collected. The average daily 3 month KLIBOR rate over the 30 month study period was 3.03%. This was used as the input for the risk free rate in calculating the option values.

In addressing our five research questions we use different methodologies as required. In determining how to price an ICULS we use the earlier mentioned replication technique We determine the theoretical value of an ICULS using Equation 8. In addressing question 2 and 3, we examine the extent of mispricing and the duration of mispricing; i.e how long does it take for convergence. We calculate mispricing as follows;

$$\%\ daily\ mispricing = \left[\frac{I_t^{(a)} - I^*}{I^*}\right] x\ 100 \qquad \ldots\ldots\ldots\ldots (11)$$

where; $I_t^{(a)}$ is the actual/quoted price of ICUL on day t.

I^* is the theoretical price of ICUL from Eq. 8

In examining how sustained the mispricing is, we examine the percentage returns from a buy ICULS, convert to stock at end of window and immediately sell the stock, trading strategy for 4 different window periods. These being one, three, six months and one year.

[7] *Thus, while many had 611 days of daily price data (full 30 months) others had less since due to their maturing or being newly issued.*

In identifying which parameters are key determinants of mispricing (question 5), we estimate the coefficients of multiple regression model, regressing percentage mispricing on parameters such as maturity, % dilution, size of coupon, moneyness, stock and ICULS volatility and exercise style. Our model is specified as;

$$\begin{aligned} \%\ Misp = \alpha &+ \beta_1\ (Mat.) + \beta_2\ (\%\ dil.) + \beta_3\ (Coupon\ \%) \\ &+ \beta_4\ (moneyness) + \beta_5\ (Stock\ Vol.) + \beta_6\ (ICULS\ \ vol.) \\ &+ \beta_7\ (Conv.Type) + e_t \quad \text{.....(12)} \end{aligned}$$

The final variable is input as dummy variable with a value of one if conversion is fixed and 0 otherwise.

4. 0 : Results & Analysis

In this section we provide the results for the various tests / analysis described earlier. For ease of elucidation we provide the results and analysis in the order of our five research questions. The first question of how should we price an ICUL, has been answered. Our proposed pricing model for ICULS is given in Eq. (8). We address our second research question using Eq. (8).

So, how efficient is the market in pricing ICULS? Tables 3 and 4 provide the answer. Table 3 shows the extent of mispricing among the 34 samples ICULS when our pricing model is applied. The % mispricing has been ranked in ascending order. Interestingly, we have an equal number of underpriced and overpriced ICULS, i.e. 17 underpriced while the remaining 17 are overpriced. Our pricing model does not include transaction costs. Using a

liberal 2% margin on either side of the theoretical price to account for transaction costs, 32 of the 34 ICULS, or 94% of the ICULS in our study are mispriced. The extent of mispricing, as Table 3 shows, is indeed substantial. Ranging from –85% to 124%.

Table 4 shows the descriptive statistics for the overall sample and by category. Overall, Malaysian ICULS are on average underpriced by about 2.3%. These results are consistent with Amman et.al (2003), who find French convertible bonds to priced on average 3% lower than theoretical values and Greiner et.al (2002) who find underpricing of Japanese convertible bonds. Though an average underpricing of 2.3% does not seem much, notice the large standard deviation, the range of mispricing is indeed large. Columns (b) and (c) show the breakdown by category. Underpriced ICULS have a mean underpricing of 43% while overpriced ones, 38%. Thus, the mean mispricing of 2.3% hides substantial deviations in pricing.

The results in Table 5, further confirm the extensiveness of mispricing. Recall the argument in Section 3, that according to our pricing model, if an ICULS is issued at-the-money, i.e. its exercise price equals the stock price at time of issue, than the ICULS should always be worth more than the stock. Furthermore, since we had argued that a long position in ICULS is equivalent to a long position in stock given compulsory conversion, their valuations should be close. The difference being due to the fixed annuity portion of ICULS. To see if ICULS prices and underlying stock prices are close, we checked the ratio of their prices. Column (A) of Table 5 shows that on average, ICULS prices are only 80% of their underlying stock's prices. This despite their having a fixed annuity portion. Underpriced ICULS (Column B) have prices approximately 60% lower than their underlying stock prices[8].

[8] *Since the mean of the ratio is 41.7% in Column (B)*

Overpriced ICULS have on average, prices 14% higher than their underlying stocks. While these confirms that mispricing is indeed extensive, it also raises the question of why ICULS, despite having a fixed annuity portion should be at such a substantial 'discount' to their underlying shares. Since we are comparing actual prices relative to each other and not to a theoretical price, the only logical explanation would be that most of the ICULS were issued deep out of the money. That is, the exercise prices were set much higher than prevailing stock price at time of ICULS issue. To see if this is true, we checked the moneyness of all our ICULS. Table 6 shows the results as at 30th June 2003, the last day of our study period. With the exception of 5 ICULS, the remaining 29 or 85% of the ICULS were indeed out of the money. Of the 5 that were in the money, three were only marginally so.

4.2 : Extent and Duration of Mispricing

If on average ICULS are underpriced relative to their stocks, then a trading strategy that arbitrages between the two should provide superior returns. Additionally, wth arbitrage, such pricing deviations should disappear quickly. To test if both these implications hold, we examined the returns from a strategy of buying an ICULS holding it for a given window period, then converting it to stock and selling the stock on the same day of exercise. To see if such a strategy does indeed provide 'superior' returns, we compare it to returns from investing in the underlying stocks; i.e. a simple buy & hold strategy for the same window period[9]. Chart 1 below shows the results.

[9] *The last day of each window period corresponds with the last day of our study period; 30/6/03.*

Chart 1

Window Period	% Returns ICULS Strategy	% Returns; Buy & hold Stocks
1 month	-28.8	0.52
3 months	-8.12	17.86
6 months	-4.50	16.97
1 year	-1.49	0.02

Two observations stand out from Chart 1. First, not only do we not get superior returns, the returns are hugely negative. The simple, buy, hold and sell stock strategy is much superior. For the shorter window periods, there appears to be no resemblance whatsoever between the returns from the ICULS and stock strategies. This result is surprising, since, ICULS are a derivative instrument and derivatives derive their value from their underlying asset. Recall, that a long position in ICULS is similar to a long position in the underlying stock. Yet, the returns are very different. This we believe, is testimony to how inefficient the market for ICULS are. The saving grace however is this, and it comes from the second observation. The negative returns from the ICULS strategy is progressively smaller for longer window periods. For the full 1 year window period, the returns from ICULS comes 'close' to stock returns. While there appear to be a movement towards convergence, it is obvious from the length of time involved that the market for ICULS is anything but efficient.

An interesting question that arises is, why are the returns to the ICULS strategy so disastrous relative to their stocks eventhough they are underpriced? We believe this must be because the ICULS are mostly out of the money, i.e., their exercise price is higher than the current stock price. Thus, a strategy of buying the underpriced ICULS though sensible, incurs losses when we then convert them to stock, by buying at the predetermined exercise price and selling them at the lower market prices. As such, while their being underpriced

should provide positive returns, the substantial loss incurred on exercise leads to overall negative returns.

In Chart 2 below, we split the ICULS into underpriced and overpriced ones[10]. We use the same ICULS strategy as above for the underpriced ones but vary the strategy for overpriced ICULS. Since the appropriate trading strategy for an overpriced asset would be to short it first and then buy it back later, we used this strategy for the 4 window periods.

Chart 2

Window Period	% Returns to Strategy Underpriced ICULS	% Returns to Strategy Overpriced ICULS
1 month	-10.78	0.012
3 months	-11.49	-0.0011
6 months	-5.64	-0.0013
1 year	-2.54	0.0015

The returns to the same strategy but confined to underpriced ICULS alone produces the same negative returns. It reinforces our argument that despite being undervalued relative to the underlying stock, the high conversion price causes losses on exercise and therefore negative returns to the strategy. The returns to a strategy of shorting the overpriced ICULS barely produces any returns at all. The consistent near zero returns despite different window periods, implies that the mispricing remains the same even over a one year period.

4.3: Comparative Analysis Returns & Volatility

If the above analysis provided evidence of market inefficiency, the results to our fourth research question appears to provide further confirmation. Table 7 provides the results

[10] *Recall that we had 17 underpriced and 17 overpriced ICULS.*

of our comparative analysis of the returns and volatility of ICULS versus their underlying stocks. The results show the mean, std. deviation and correlation of returns for the entire 30 month period of study. Across all 34 ICULS and their respective stocks, we see little difference in the mean and standard deviation of returns. This is to be expected. Since ICULS are a derivative and have a payoff profile equivalent to long stock position, similar returns are logical. Infact, even the marginally higher volatility of ICULS is to be expected. What is not consistent is the low correlation between the returns of ICULS and their underlying stock. The analysis gets more interesting when we examine the results of underpriced and overpriced ICULS with their respective underlying stocks.

Underpriced ICULS have mean returns *lower* than their underlying stocks. Though the correlation is higher than the overall average, the volatility of ICULS returns are marginally lower than those of their stocks. Overpriced ICULS on the other hand have much higher mean returns than their underlying stocks. With mean returns more than 4 times higher, the difference is statistically significant[11]. The correlation between returns is barely 30%.

These results are contrary to expectations. In rational markets, one would expect underpriced assets/instruments to earn higher than normal returns while overpriced ones, lower returns. This does not appear to be the case here. The logical arbitrage strategy of going long underpriced ICULS and shorting their respective stocks would have provided disastrous results. Similarly, shorting overpriced ICULS and buying their underlying stocks would also have been disastrous. It appears that underpriced ICULS remain underpriced over the entire 30 months of the study whereas overpriced ones remain so. Taken together with

[11] *Based on pair-wise t-tests; at 10% significance.*

the low correlation, it appears that ICULS and their underlying stocks may be taking their own price paths with little of no arbitrage to bring them in line. While these results are contrary to efficient markets, they are consistent with our findings in Section 4.2 above. They are also consistent with Greiner et. al (2002), who found Japanese convertible bonds to remain underpriced throughout their 4 year period of study.

Our final research question was an attempt to identify the key determinants of mispricing. We did this by estimating the coefficients of the multiple regression model of Eq. (12). The results are shown in Table 8. The goodness of fit measure, R^2 is 0.58, the F-test that all coefficients are equal is rejected. Two of the seven estimated coefficients are significant at 5%. These are, Time to Maturity and underlying stock volatility. Given that both coefficients are positive, the longer the time to maturity and the higher the underlying stock volatility, the greater is the mispricing. These results are contrary to King (1986), who found a negative relationship between time to maturity and mispricing, but are consistent with Amman et.al (2003) who find a positive relationship between the two. Amman et.al (2003), also find moneyness to be an important determinant of mispricing. Our results however do not show this to be the case.

4.4: Limitations of Study

Before concluding, it should be useful to point out some of the potential limitations of the study. We see three limitations. First, in pricing the ICULS, we have ignored the potential for exercise before maturity of some of the ICULS (see Table 2). We have valued the embedded options as European options. While many ICULS do allow for exercise on fixed predetermined periods before maturity, one should be mindful of the fact that selling off

an option would always be superior to exercising – even if it is deep in the money.[12] The second limitation arises from our use of the Black-Scholes option pricing model. Specifically, the model's assumptions of constant volatility and interest rates. Malaysia's highly regulated interest rate regime however, blunts somewhat the extent of this limitation. The final limitation has to do with our use of the replication technique. The Put-Call parity assumes the options are traded. However, the embedded options within the ICULS are not detachable and not traded. The absence of such traded options and therefore the impossibility to arbitrage may also explain the very significant and extended deviations that we find in pricing.

5.0: Summary & Conclusion

This paper provides an indepth study of Irredeemable Convertible Unsecured Loan Stocks or ICULS. A Malaysian variant of the convertible bond, ICULS are a hybrid security. Despite its long presence and listed trading status, there appears to be a dearth of literature and no means of pricing them. This paper presents the first empirical evidence on the pricing of ICULS. We propose a pricing model of ICULS built on the replication technique of options. The basic premise of our model is the same as that of Bardhan et.al (1993) and Tsiveriotis et.al (1998). We split the value of an ICULS into its annuity and convertible components. The value of conversion is determined through replication. Testing our pricing model on the sample ICULS, we find extensive mispricing. Though on average ICULS are underpriced by 2.3%, there were an equal number of over and underpriced ICULS.

[12] *This is due to the fact that while exercising only allows one to realize the intrinsic value, selling the option would mean receiving the premium that includes both the intrinsic and time values. The only exception would be just prior to a large unexpected dividend payout by the underlying stock's firm.*

Our findings show that not only does the market misprice ICULS, the mispricing is sustained over quite a while. Infact, even over a one year window period, marginal mispricing remains. Furthermore, logical trading strategies to arbitrage the mispricing produce inconsistent results. Based on these, we can only conclude that the market for ICULS in Malaysia is a highly inefficient one. This however, raises a number of questions. The most obvious one being, who is being helped and who is hurt in such a market situation? Our analysis leads us to believe that issuers of ICULS stand to benefit from the current situation to the detriment of investors.

Recall that ICULS unlike convertible bonds have no ratings requirement, furthermore we have noted that most ICULS have such high Exercise prices that they are out-of-the-money for most of their life. Infact most ICULS that expired during the study period did so, out of the money. Add to this the fact that there is forced conversion and we can see why the odds are stacked against investors but in favour of issuers.

Even a financially weak company with adverse-selection problems that make a conventional stock issue unattractive, can get "backdoor equity" financing by way of ICULS, Stein (1992)[13]. Infact, it is possible that it may even be cheaper than straight debt for a financially weak company.

While there is pressure on managers of companies that have issued convertible bonds to increase firm value in order to ensure a high rate of conversion or face huge cash outflows through cash redemption, companies issuing ICULS have no such pressure. Seen in this light, the main theoretical argument for hybrids such as this, the sequential financing

[13] *Stein uses this argument for convertible bonds.*

argument, does not hold[14]. This brings us to the next question of; what then, is the value added of having ICULS? Particularly if with a high exercise price and forced conversion, an investor is squeezed.

Regulation can affect this state of affairs in two important ways. For a start, removing short-selling regulation can go a long way towards enabling arbitrage and thereby reducing mispricing. While hybrid instruments can add to "completing the markets", their usefulness will be limited if regulation is restrictive. A change in regulatory philosophy could also help. Though an investor ought to know what he is getting into, in emerging markets, caveat venditor may be better suited than caveat emptor[15].

[14] *Especially where ICULS can be exercised at anytime, sequencing financing is not possible.*
[15] *Caveat Venditor – let the seller beware, caveat emptor, let the buyer beware.*

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Table 7
Comparative Analysis of Returns & Volatility ICULS Vs. Underlying Stocks

DESCRIPTIVE STATISTICS OF ALL ICULS

Stk Returns %		*ICULS Returns %*	
Mean	0.329285356	Mean	0.3220132
Standard Error	0.138909009	Standard Error	0.152997779
Standard Deviation	15.49629453	Standard Deviation	17.06799777
Sample Variance	240.1351443	Sample Variance	291.3165478
Count	12445	Count	12445

CORRELATION OF RETURNS : 0.596139

DESCRIPTIVE STATISTICS OF UNDERPRICED ICULS

Stk Returns %		*ICULS Returns %*	
Mean	0.430189272	Mean	0.307996209
Standard Error	0.257031881	Standard Error	0.236133605
Standard Deviation	19.90462584	Standard Deviation	18.28625715
Sample Variance	396.19413	Sample Variance	334.3872005
Count	5997	Count	5997

CORRELATION OF UNDERPRICED ICULS : 0.794609528

DESCRIPTIVE STATISTICS OF OVERPRICED ICULS

Stk Returns %		*ICULS Returns %*	
Mean	0.068577791	Mean	0.324460529
Standard Error	0.07372959	Standard Error	0.197834485
Standard Deviation	5.919985645	Standard Deviation	15.8847664
Sample Variance	35.04623004	Sample Variance	252.3258037
Count	6447	Count	6447

CORRELATION OF OVERPRICED ICULS : 0.298702951