MARKETABLE PROFIT-AND-LOSS SHARING CONTRACTS: BROADENING THE GLOBAL NON-EQUITY CAPITAL MARKETS

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Abstract

In this paper we have provided the theoretical foundation for a "profit-and-loss sharing contract" as a practicable alternative to corporate bonds. We mathematically demonstrate that the standard pricing model for a straight coupon bond is obtainable as a special case of a profit-and-loss sharing contract valuation model. We also show that the returns to the holder of a profit-and-loss contract, even in the presence of market friction, can be potentially greater than those from a straight corporate bond if there is a substantial default risk premium. Our analysis provides a means of broadening the global market for non-equity capital by offering an alternative to interest-bearing debt which is not socio-religiously acceptable in some cultures and can be of special relevance, for example, to many emerging markets in Asia and Middle East.

Keywords: Bond Pricing Model, Debt Alternatives, Profit-and-loss Sharing, Emerging Markets

JEL classification: G12, G20, G32

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1 Introduction

The role of debt as a form of non-equity component in corporate capital structure has been quite an extensively researched area. Modigliani and Miller's cornerstone works (1958, 1961 and 1963) advocated that firms would gravitate towards increasing percentage of debt in their capital structures in the presence of taxes due to the "tax shield" advantage of interest on debt. Kraus and Litzenberger (1973) challenged the omnipotence of debt financing by proclaiming that an optimal capital structure is born out of a "trade-off" between the tax advantages of debt and increase in financial distress costs due to increase in debt. Myers (1984) revived the age-old "pecking order theory" and contended that it performs at least as well as the static trade-off theory in explaining firms' capital structure choices in a real world.

Up until the global financial crisis (GFC) that was principally borne out of the US sub-prime mortgage crisis in late 2007, there was a fair deal of support for a trade-off theory of capital structure, especially in its dynamic form, (Leary and Roberts, 2005; Hennessy and Whited, 2005; Strebulaev, 2007) and also for a revived pecking order theory (Halov and Heider, 2005; Lemmon, Roberts and Zender, 2008). Frank and Goyal (2007) have provided a rather exhaustive review of the extant theories of leverage as of 2007 that sought to explain firms' reliance on debt as a component of their capital structures. However post-GFC, finance researchers are seriously looking at other forms of non-equity capital that can perhaps replace traditional debt; allowing alternative risk appraisals (Gepp, Kumar and Bhattacharya, 2009).

Although a lot of research, both theoretical as well as empirical, has gone into the determinants of corporate capital structure, the extant literature is quite thin when it comes to considering the effective alternatives to corporate bonds as marketable non-equity securities. While there is a range of "mezzanine" securities (mainly the different classes of preference shares), these are rarely of a truly marketable nature and many stock markets restrict their listing. Also preference shares are more often than not issued mainly for strategic reasons, e.g. to satisfy certain regulatory requirements without diluting the equity base, rather than as an alternative form of long-term non-equity capital (Kieso, Weygandt and Warfield, 2007). While institutional (i.e. non-marketable) debt e.g. long-term bank loans may dominate marketable debt securities in the total debt of many corporations owing to limited access to actively traded corporate bond markets, corporations may be better off raising a significant portion of their non-equity capital via issue of marketable securities as it can offer more flexibility. Also by virtue of being graded by reputable third parties like Moody's or Standard & Poor's, marketable debt securities do offer potential lenders (i.e. prospective bond holders) an informative insight into the current and expected financial states of the businesses. However with debt financing come a set of restrictions in the form of 'debt covenants' that can impede future capital raising, earnings retention and payout policies of a corporation. Nevertheless, there hasn't yet been, at least in the context of conventional Western financial systems, a lot of work aimed at finding alternatives to debt as marketable non-equity capital.

Any form of debt that entails an obligatory 'servicing' via payment of interest is abhorred in certain cultures, which therefore already have in place effective means of attracting alternative external funding. In recent times there has been a rapidly growing fascination of conventional banks and financial institutions with exploring financial systems that can function without interest payments mainly to be able to extend their operations globally; but also to be able to learn from those time-tested business financing modes that offer an alternative to debt – something especially relevant in current financial times (Elasrag, 2010).

Although any form of interest payment on capital is strictly forbidden in some cultures, business financing based on some form of "profit-and-loss sharing" (hereafter PLS) is permissible universally across cultures (Presley and Sessions, 1994; Khan, 2010). One of the distinct advantages, as argued by Weitzman (1983), is that PLS has the potential to automatically counteract inflationary or contractionary shocks while maintaining the advantage of decentralised decision-making and these desirable properties are robustly preserved throughout a variety of economic activities. There most important feature of such a PLS as explained by Anwar (1995) is that it has to be based on an "equitable contract" where none of the parties can have unfair advantage over the other. Aggarwal and Yousef (2000) further demonstrated with the help of a formal model that engineered financial instruments with very similar characteristics to conventional debt instruments are a rational outcome borne out of the "contracting environments" within which such non-conventional systems operate. However the cultural acceptability of these engineered financial instruments has not been very strong as they are often seen as disguised interest-bearing securities that have been "re-badged" only to appear acceptable. As an example, there already exists a class of tradable bond-type securities called "sukuk" listed on some of the world's major stock exchanges. The cash flows to the capital provider (i.e. holders of sukuk) closely resemble those from conventional coupon paying bonds. The most common mechanism via which this is achieved takes the form of a binding contract to repurchase the asset by the issuer. The final repurchase is akin to maturity of a conventional corporate bond. While the financial asset is being held by the capital provider prior to the final purchase, it accrues a "rental" often pegged to some benchmark interest rate (Safari, 2011). However these types of instruments are not considered sacrosanct in many countries as they are seen only as a disguised version of a conventional fixed-interest bearing security. The fact that the "rental" is pegged to a benchmark interest rate in fact makes the disguise rather poor. That financial institutions canvass these poorly disguised debt instruments as the panacea of cultural incongruities often makes the situation worse by increasing the cultural rift and reducing the trust on conventional financial systems.

When MacDonald's can sell their burgers in almost every country of the world by culturally adapting to the local beliefs and sentiments, why cannot corporations raise non-equity capital globally in ways that are truly respectful of local cultures while also being practically viable? We posit that this can be done in theory and have provided a seminal exposition of this fact. It would only take an innovative packaging exercise to structure a marketable PLS contract (hereafter MPLS) that may be floated by firms in countries where debt securities are barred.

Our research question has two parts – firstly; whether a MPLS contract can be valued on the same lines as a straight coupon bond and secondly; if that is the case; then under what pricing conditions would one have a higher present value of future expected cash flows coming to the holder of a MPLS contract vis-à-vis the holder of a straight coupon-paying corporate bond?

We show below that, in purely present value terms, the returns to the holder of such a MPLS contract can be as much (or in some cases more) than returns to the holder of a conventional debt security. To the best of the authors' knowledge, securities like MPLS contracts are not offered in any capital market as yet but we firmly believe that following the publication of our work; they may be introduced and even become popular in few of the emerging markets!

2 Valuing MPLS contract as a generalization of a conventional straight coupon bond

In conventional finance, large corporations are able to raise debt capital through the issuance of long-term debt securities simplest of which are the straight coupon bonds that have to be serviced periodically via fixed interest payments over a length of time (i.e. a fixed amount paid on the face value) and on the bond's maturity, the face value together with the last installment of interest is normally paid in a single lump-sum payoff. The bond holder is firmly entitled to receive the fixed periodic interest payments together with an assured repayment of capital on maturity while the bond issuer is obligated to service the debt till maturity irrespective of the cash returns got from the project that was funded with that debt financing. This is viewed as an asymmetric risk distribution between the two parties – hence this type of financing contravenes the necessary requirements of an "equitable contract" under certain religious beliefs. As the periodic coupon interest must be paid irrespective of the investment outcome, these arrangements are deemed 'unfairly onerous' on the borrower. However a financing agreement based on sharing of profits/losses is more equitable as the payout to the contract holder depends on the investment outcome. For any PLS contract, the holder's account should get credited with a fixed amount from the profits earned in each period (or debited with the same amount in case of a loss) over the length of the holding period (Presley and Sessions, 1994). Therefore, effectively, the holder of a MPLS contract should either receive a certain amount of cash every period (if there is a positive cash flow from investment in that period) or pay an identical amount (if the cash flow from the investment in that period is negative). The periodic amount, just like in case of straight debt securities, can be expressed as a percentage of the face value of the contract. That being the case, we demonstrate here that the valuation model for a MPLS contract becomes a generalized version of the pricing model for a straight bond. In other words, if there is a finite probability that the periodic cash inflows to the funding provider (bond holder in case of conventional finance) can be negative (which is exactly the case if there was a simple profit/loss sharing agreement between the provider and user of the funds), then we posit that the valuation model for a straight bond is obtained as a special case when such probability is zero. With imposition of the condition of zero probability of negative cash inflows to the bond holder (i.e. the provider of debt capital), the MPLS contract converges to the standard bond pricing model. The general formula for the present value of expected future cash flows to the capital provider from a MPLS contract is as follows (full derivation shown in the Appendix):

$$\text{PV of } E_n(\text{MPLS}) = [(VR^*)/(1+R)][\Sigma_t(1 + R)^{-t}] + I(1 + R^*)/(1+R)^n \tag{1}$$

$$R^* = (\pi/V)\,(2\rho - 1) \tag{2}$$

Here π is a fixed dollar amount of profit (or loss) made in a single period, V is the principal capital provided, R is the applicable discounting rate (i.e. opportunity cost of capital), ρ is the a priori probability of $\pi > 0$ in any given period (i.e. a priori probability that a positive cash inflow shall come to the capital provider in that period) and n is length of investment horizon. We also show that the classical pricing model for straight bonds is a special case of equation (1) when the a priori probability of positive cash flow to the bond holder is set equal to unity.

MPLS contracts quite different from sukuk because they need not be pegged to a benchmark rate of interest – and in that sense they are better adapted to the cultures that abhor payment of interest in any form. They are also not convertible bonds that have an embedded equity conversion feature – because unless and until the holder exercises the embedded option to convert; such bonds would still be considered interest-bearing debt securities. MPLS contracts rather give the capital provider a right to participate in the net proceeds from the investment on a periodic basis. The understanding is that if the net proceeds are zero or negative in any period, then the capital provider incurs a nil or negative return in that period. This is where it differs from the straight bond where a periodic coupon interest needs to be paid to the capital provider (i.e. bond holder) irrespective of whether or not a positive net return on the investment is realized. The fair price of a MPLS contract can be mathematically determined, exactly like that in case of a straight coupon-paying corporate bond, in terms of the present value of expected future cash flows to the contract holder i.e. the capital provider.

It would appear that the value of the straight bond to the holder as evaluated by the standard pricing model would always be greater than the present value of cash flows to the capital provider in a MPLS contract. This is because of the fact that present value of cash flows is maximized when there is a zero probability of negative cash inflow to the capital provider (i.e. bond holder in conventional finance). However, it is also important to note that the discounting rate as applied in standard bond pricing formula incorporates a premium to compensate for the risk of default by the bond issuer and hence it is effectively higher than a pure opportunity cost of capital in strict sense of the term. In case of a MPLS contract, obviously the default risk consideration is not really pertinent as it is agreed beforehand that the lender will participate in both profits as well as losses arising out of the deployment of the 'borrowed' funds. So the 'borrower' does not have an obligation to 'service the debt' if there is a loss in any period. The standard pricing model gives the price of a bond that has a zero risk of default so that the appropriate discounting rate is purely the opportunity cost of capital for the funds provider. In real life however, this would only be limited to treasury bonds that are backed by a sovereign and solvent government. Corporate bonds, irrespective of their credit rating, would carry a default risk premium that would always have to be factored into the discounting rate in the pricing formula when valuing such bonds. It is essentially due to the factoring in of the default risk premium that on average, bond traders do earn more than the risk-free rate by holding corporate bonds (Hull, Predescu and White, 2005). Using the pure opportunity cost of capital as the discounting rate without any need for factoring in a default risk premium would imply that the present value of a MPLS contract could be better than the value of a straight bond to the holder even with a non-zero probability of negative inflow! It is pertinent to note that although the holder of a MPLS contract will not need to factor in default risk for valuation of the contract (much like an equity share pricing model does not need to account for risk of default to the shareholder), the MPLS contract is not an equity instrument per se. In terms of analogical proximity with conventional securities, a MPLS contract may be seen as being closest to a non-cumulative, redeemable preference share but is also a fully marketable security much like a corporate bond. In its material form, one may view it as a debenture-preference share hybrid for nomenclature purposes.

If a capital user uses capital effectively and efficiently, selecting and investing in positive net-present-value projects then probability of negative inflow can be expected to be close to zero most of the time assuming the capital users always use their best judgment i.e. there is an absence of moral hazard. This is a reasonable assumption since failure to use best judgment would also adversely affect the returns to the capital user i.e. it would be 'lose-lose' outcome. By its very structure, MPLS contracts can effectively eliminate 'win-lose' and 'lose-win' outcomes so that the only two outcomes are 'lose-lose' when the best investment decisions are not taken and 'win-win' when the best investment decisions are taken. Given that the discounting rate is purely an opportunity cost of capital with no default risk premium factored in; the present value of cash flows to the capital provider from a MPLS contract can be expected to be comparable with or in some cases even better than a straight bond. In the next section we provide a hypothetical numerical illustration in order to better elucidate this point.

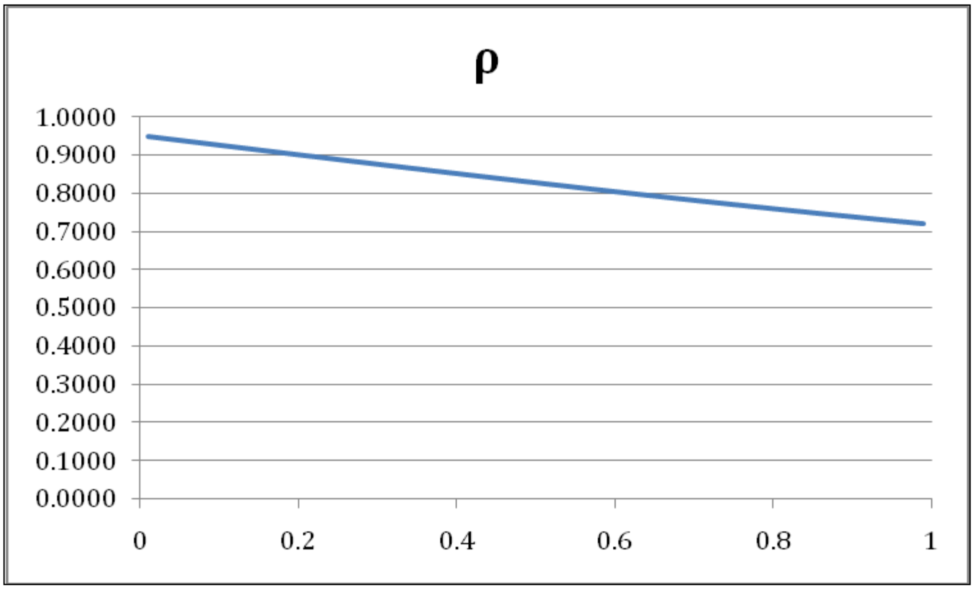
3 Financial viability of MPLS as an alternative to marketable debt securities

If a capital user employs capital efficiently, selecting and investing in positive net-present-value projects then the probability, ρ, of a positive cash flow outcome to the capital provider can be expected to be quite close to unity most of the time. So, the less are the information acquisition costs (i.e. search costs) for a capital provider to find such an efficient capital user, the higher is the return to the capital provider. Let the search costs be c. Then; as c tends from zero to a very high value (say c_{Max}), ρ would tend from unity to ρ_{Min}. When the value of c is very large (i.e. close to c_{Max}), it means there's a very high degree of information asymmetry. In that case, a MPLS contract could be inefficient for the capital provider. On the other hand, a negligibly low value of c (say c_{Min}) would mean that the capital providers can costlessly identify the best quality MPLS contracts which can make MPLS more efficient than conventional debt securities (as the discounting rate for valuing the latter would be higher with a default risk premium). In between these two 'boundary scenarios', there would be expected to be points of dominance of the MPLS contract over conventional debt securities like straight coupon bonds and vice versa; given that a value of $\rho < 1$ decreases the present value of cash flows from a MPLS contract but at the same time it has a lower discounting rate than a straight bond due to the absence of default risk premium. So, ultimately, it is the difference between the search costs of MPLS and the default risk premium for a straight bond that determines which one offers a higher return to the provider.

We show a numerical illustration with hypothetical figures to demonstrate the comparative performance of a conventional debt security against a MPLS contract. The results are interesting and illuminating as far as the veracity of the MPLS contract is concerned. For sake of simplicity we assume that ρ (i.e. the probability of getting a positive cash flow) is an inverse logistic function of c (i.e. the capital provider's search costs to find the right investor).

Our function plot is given in Figure 1 below where c goes from 0.01 to 0.99 in step sizes of 0.01 and ρ is expressed as an inverse logistic function of c such that $\rho = k - [1/(1 + e^{-c})]$; where k is a positive constant set at 1.45 yielding an effective range of 0.50 (ρ_{Min}) to 1 (ρ_{Max}). It is to be noted that our choice of the inverse logistic function has no bearing on our analysis as it can easily be substituted with any other suitable function where there is a strictly inverse relationship between c and ρ (as is intuitive). If we represent ρ as a continuous, differentiable function of c such that $\rho = f(c)$, then any function f(c) will suffice as long as we have $f'(c)<0$.

Figure 1. Plot of ρ as an inverse function of *c*



The probability that the cash flow to the capital provider in any period will be positive in sign intuitively bears an inverse relation with the search cost to the capital provider in identifying the best quality MPLS contracts; which is shown here.

Table 1 below contains the hypothetical figures that we used for the numerical illustration.

Table 1. Seed values for numerical illustration of comparative cash flows

Investment	$100.00
Cash flow from investment	$12.50
Opportunity cost of capital	5% p.a.
Term (years)	30

We use the numbers given below to compute present value of cash flows under the two different set-ups.

Table 2 below shows the computed present values of cash flows to the capital provider under a MPLS contract and those under a conventional debt security in the form of a straight coupon bond. The present value (PV) of PLS is calculated using equation (1) [fully derived in the Appendix], R* stands for a single-period IRR (internal rate of return) and the discounting rate for bond valuation is got by adding a default risk premium to the floor discounting rate.

Table 2. Numerical computation results

C	ρ	R*	PV of PLS	Default risk premium	Floor discounting rate	PV of bond
0.01	0.95	11.19%	$195.12	0.000%	5.000%	$215.29
0.02	0.95	11.13%	$194.16	0.225%	5.225%	$209.02
0.03	0.94	11.06%	$193.20	0.450%	5.450%	$203.03
0.04	0.94	11.00%	$192.24	0.675%	5.675%	$197.30
0.05	**0.94**	**10.94%**	**$191.27**	**0.900%**	**5.900%**	**$191.83**
0.06	0.94	10.88%	$190.31	1.125%	6.125%	$186.59
0.07	0.93	10.81%	$189.36	1.350%	6.350%	$181.58
0.08	0.93	10.75%	$188.40	1.575%	6.575%	$176.77
0.09	0.93	10.69%	$187.44	1.800%	6.800%	$172.18

Table 2. Numerical computation results (continuation)

C	ρ	R*	PV of PLS	Default risk premium	Floor discounting rate	PV of bond
0.10	0.93	10.63%	$186.48	2.025%	7.025%	$167.77
0.11	0.92	10.56%	$185.52	2.250%	7.250%	$163.54
0.12	0.92	10.50%	$184.56	2.475%	7.475%	$159.49
0.13	0.92	10.44%	$183.61	2.700%	7.700%	$155.60
0.14	0.92	10.38%	$182.65	2.925%	7.925%	$151.87
0.15	0.91	10.31%	$181.69	3.150%	8.150%	$148.29
0.16	0.91	10.25%	$180.74	3.375%	8.375%	$144.84
0.17	0.91	10.19%	$179.78	3.600%	8.600%	$141.53
0.18	0.91	10.13%	$178.83	3.825%	8.825%	$138.35
0.19	0.90	10.07%	$177.88	4.050%	9.050%	$135.29
0.20	0.90	10.00%	$176.93	4.275%	9.275%	$132.34
0.21	0.90	9.94%	$175.98	4.500%	9.500%	$129.50
0.22	0.90	9.88%	$175.03	4.725%	9.725%	$126.77
0.23	0.89	9.82%	$174.08	4.950%	9.950%	$124.14
0.24	0.89	9.76%	$173.13	5.175%	10.175%	$121.60
0.25	0.89	9.70%	$172.18	5.400%	10.400%	$119.15
0.26	0.89	9.63%	$171.24	5.625%	10.625%	$116.79
0.27	0.88	9.57%	$170.29	5.850%	10.850%	$114.52
0.28	0.88	9.51%	$169.35	6.075%	11.075%	$112.32
0.29	0.88	9.45%	$168.41	6.300%	11.300%	$110.19
0.30	0.88	9.39%	$167.47	6.525%	11.525%	$108.14
0.31	0.87	9.33%	$166.53	6.750%	11.750%	$106.16
0.32	0.87	9.27%	$165.59	6.975%	11.975%	$104.24
0.33	0.87	9.21%	$164.66	7.200%	12.200%	$102.38
0.34	0.87	9.15%	$163.72	7.425%	12.425%	$100.59
0.35	0.86	9.08%	$162.79	7.650%	12.650%	$98.85
0.36	0.86	9.02%	$161.86	7.875%	12.875%	$97.16
0.37	0.86	8.96%	$160.93	8.100%	13.100%	$95.53
0.38	0.86	8.90%	$160.00	8.325%	13.325%	$93.95
0.39	0.85	8.84%	$159.08	8.550%	13.550%	$92.42
0.40	0.85	8.78%	$158.15	8.775%	13.775%	$90.94
0.41	0.85	8.72%	$157.23	9.000%	14.000%	$89.50
0.42	0.85	8.66%	$156.31	9.225%	14.225%	$88.10
0.43	0.84	8.60%	$155.39	9.450%	14.450%	$86.74
0.44	0.84	8.54%	$154.47	9.675%	14.675%	$85.42
0.45	0.84	8.48%	$153.56	9.900%	14.900%	$84.14
0.46	0.84	8.42%	$152.65	10.125%	15.125%	$82.90
0.47	0.83	8.37%	$151.73	10.350%	15.350%	$81.69
0.48	0.83	8.31%	$150.83	10.575%	15.575%	$80.51
0.49	0.83	8.25%	$149.92	10.800%	15.800%	$79.37
0.50	0.83	8.19%	$149.02	11.025%	16.025%	$78.26
0.51	0.83	8.13%	$148.11	11.250%	16.250%	$77.18
0.52	0.82	8.07%	$147.21	11.475%	16.475%	$76.12
0.53	0.82	8.01%	$146.32	11.700%	16.700%	$75.09
0.54	0.82	7.95%	$145.42	11.925%	16.925%	$74.10
0.55	0.82	7.90%	$144.53	12.150%	17.150%	$73.12
0.56	0.81	7.84%	$143.64	12.375%	17.375%	$72.17
0.57	0.81	7.78%	$142.75	12.600%	17.600%	$71.25
0.58	0.81	7.72%	$141.86	12.825%	17.825%	$70.34
0.59	0.81	7.67%	$140.98	13.050%	18.050%	$69.46

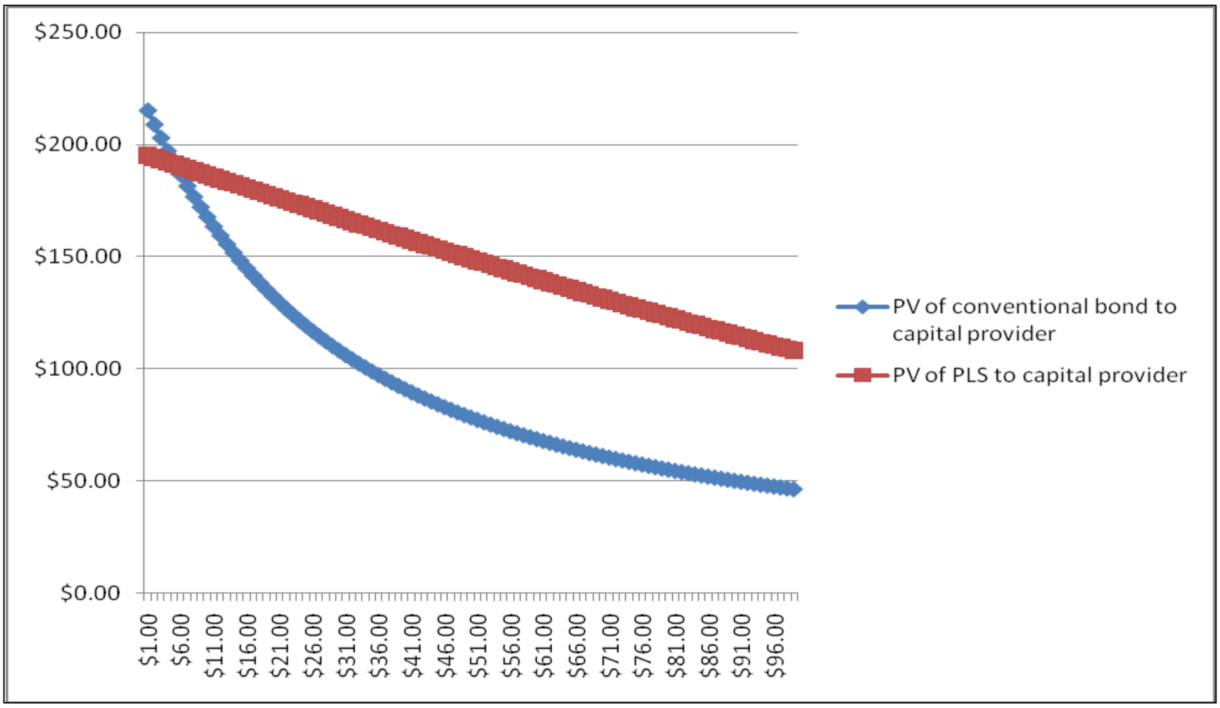
Table 2. Numerical computation results (continuation)

C	ρ	R*	PV of PLS	Default risk premium	Floor discounting rate	PV of bond
0.60	0.80	7.61%	$140.10	13.275%	18.275%	$68.60
0.61	0.80	7.55%	$139.22	13.500%	18.500%	$67.77
0.62	0.80	7.49%	$138.35	13.725%	18.725%	$66.95
0.63	0.80	7.44%	$137.47	13.950%	18.950%	$66.15
0.64	0.80	7.38%	$136.60	14.175%	19.175%	$65.37
0.65	0.79	7.32%	$135.74	14.400%	19.400%	$64.61
0.66	0.79	7.27%	$134.87	14.625%	19.625%	$63.86
0.67	0.79	7.21%	$134.01	14.850%	19.850%	$63.13
0.68	0.79	7.16%	$133.15	15.075%	20.075%	$62.42
0.69	0.78	7.10%	$132.29	15.300%	20.300%	$61.73
0.70	0.78	7.05%	$131.44	15.525%	20.525%	$61.05
0.71	0.78	6.99%	$130.59	15.750%	20.750%	$60.38
0.72	0.78	6.93%	$129.74	15.975%	20.975%	$59.73
0.73	0.78	6.88%	$128.90	16.200%	21.200%	$59.09
0.74	0.77	6.83%	$128.06	16.425%	21.425%	$58.47
0.75	0.77	6.77%	$127.22	16.650%	21.650%	$57.85
0.76	0.77	6.72%	$126.38	16.875%	21.875%	$57.26
0.77	0.77	6.66%	$125.55	17.100%	22.100%	$56.67
0.78	0.76	6.61%	$124.72	17.325%	22.325%	$56.10
0.79	0.76	6.55%	$123.89	17.550%	22.550%	$55.53
0.80	0.76	6.50%	$123.07	17.775%	22.775%	$54.98
0.81	0.76	6.45%	$122.25	18.000%	23.000%	$54.44
0.82	0.76	6.39%	$121.43	18.225%	23.225%	$53.91
0.83	0.75	6.34%	$120.62	18.450%	23.450%	$53.39
0.84	0.75	6.29%	$119.81	18.675%	23.675%	$52.88
0.85	0.75	6.24%	$119.00	18.900%	23.900%	$52.38
0.86	0.75	6.18%	$118.19	19.125%	24.125%	$51.89
0.87	0.75	6.13%	$117.39	19.350%	24.350%	$51.41
0.88	0.74	6.08%	$116.59	19.575%	24.575%	$50.93
0.89	0.74	6.03%	$115.80	19.800%	24.800%	$50.47
0.90	0.74	5.98%	$115.01	20.025%	25.025%	$50.01
0.91	0.74	5.92%	$114.22	20.250%	25.250%	$49.56
0.92	0.73	5.87%	$113.43	20.475%	25.475%	$49.12
0.93	0.73	5.82%	$112.65	20.700%	25.700%	$48.69
0.94	0.73	5.77%	$111.88	20.925%	25.925%	$48.27
0.95	0.73	5.72%	$111.10	21.150%	26.150%	$47.85
0.96	0.73	5.67%	$110.33	21.375%	26.375%	$47.44
0.97	0.72	5.62%	$109.56	21.600%	26.600%	$47.04
0.98	0.72	5.57%	$108.80	21.825%	26.825%	$46.64
0.99	0.72	5.52%	$108.04	22.050%	27.050%	$46.25

We tabulate the results of illustrative numerical computations using the seed values defined in Table 1. In this table, *c* stands for capital provider's search cost, ρ stands for the probability that cash flow in a particular period is positive in sign and R* is single-period internal rate of return to the capital provider from MPLS contract. The discounting rate is a sum of the opportunity cost of capital and a default risk premium and the bond's present value is obtained via the standard bond pricing formula.

Figure 2 below plots the PV of MPLS against the straight bond value as given in Table 2 above. For the hypothetical figures we have used in our numerical illustration, there is a point of indifference about **c ≈ 0.05** for a default risk premium of **0.900%** over and above the floor rate. If the degree of information asymmetry increases so that c rises above this level, even then the MPLS contract can dominate the straight bond if the default risk premium keeps rising as well (as is shown). However the straight bond dominates the MPLS contract in terms of the present value of cash flows to the capital provider if the default risk premium is very small relative to the level of the search costs c.

Figure 2. Graphical comparison of the present value of cash flows to the capital provider



A graphical plot of the present values of cash flows from a straight corporate bond versus a MPLS contract. The data have been drawn from the relevant columns in Table 2

4 Conclusion: what we brought forth

We started off with a two-part research question both of which we have fully answered. We have mathematically demonstrated (derivation shown in the Appendix) that if a MPLS contract was indeed floated by a company looking to raise non-equity as well as non-debt capital, then the model yielding the fair value of such a contract is obtainable as a generalization of the standard bond pricing model. Furthermore, our computational analysis clearly demonstrates that even in the presence of non-negligible search costs to identify an efficient capital user, the MPLS contract can indeed be an economically viable non-equity financing mode to straight debt if due consideration is given to the often highly significant default risk premium component of the cost of conventional debt capital. The fair price of a MPLS contract packaged as a marketable security calculated at any time would, like a straight coupon bond, either exceed the issue price (i.e. sell at a premium) or be equal to the issue price (i.e. sell at par) or fall short of the issue price (i.e. sell at a discount). While we have clearly shown here the intrinsic characteristics of a MPLS contract as a financial security, we leave it to future researchers as to finding an appropriate packaging approach. As previously stated, such interest-free non-equity financing methods have successfully survived the test of time in many cultures; and the recent global turmoils involving conventional financial systems justify a deeper study of these alternative methods of business financing.

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Appendix A

Retaining the definitions of all terms as previously introduced; the expected present value of cash flows for a one-period investor (i.e. capital provider) in a MPLS contract is as follows:

$$\text{PV of E(MPLS)} = \{V + \pi(2\rho - 1)\}/(1 + R) \tag{A1}$$

The internal rate of return (IRR) of this investment is then obtained as R*, where we have:

$$\text{PV of E(MPLS)} = V \tag{A2}$$

Substituting for PV of E(MPLS) from (A2) and solving for the IRR we therefore get:

$$\begin{gathered} V + VR^* = V + \pi(2\rho - 1) \\ \text{i.e. } R^* = (\pi/V)(2\rho - 1) \end{gathered} \tag{A3}$$

Note that the above provides a formal derivation for equation (2).

By definition, for t = 0, PV of E_0(MPLS) = $(V + 0)/(1 + R)^0 = V$.
For one-period horizon,

$$\begin{gathered} \text{PV of } E_1\text{(MPLS)} = (V + \pi)\rho/(1 + R) + (V - \pi)(1 - \rho)/(1 + R) = \\ = (\rho V + p\pi - pV + V - \pi + \rho\pi)/(1 + R) = \{V + (2\rho\pi - \pi)\}/(1 + R) = \{V + \pi(2\rho - 1)\}/(1 + R) \end{gathered} \tag{A4}$$

For two-period horizon,

$$\begin{gathered} \text{PV of } E_2\text{(MPLS)} = \rho\pi/(1 + R) - (1 - \rho)\pi/(1 + R) + (V + \pi\rho)/(1 + R)^2 + \{V - \pi(1 - \rho)\}/(1 + R)^2 = \\ = \pi(2\rho - 1)/(1 + R) + \{V + \pi(2\rho - 1)\}/(1 + R)^2 = [\text{PV of } E_1\text{(MPLS)}] - V/(1 + R) + \\ + [\text{PV of } E_1\text{(MPLS)}]/(1 + R) = [\text{PV of } E_1\text{(MPLS)}] + [\text{PV of } E_1\text{(MPLS)}]/(1 + R) - V/(1 + R) \end{gathered} \tag{A5}$$

For three-period horizon,

$$\begin{gathered} \text{PV of } E_3\text{(MPLS)} = \rho\pi/(1 + R) - (1 - \rho)\pi/(1 + R) + \pi\rho/(1 + R)^2 - \pi(1 - \rho)\}/(1 + R)^2 + \\ + (V + \pi\rho)/(1 + R)^3 + \{V - \pi(1 - \rho)\}/(1 + R)^3 = \pi(2\rho - 1)/(1 + R) + \pi(2\rho - 1)/(1 + R)^2 + \\ + \{V + \pi(2\rho - 1)\}/(1 + R)^3 = [\text{PV of } E_2\text{(MPLS)}] - V/(1 + R)^2 + [\text{PV of } E_1\text{(MPLS)}]/(1 + R)^2 = \\ = [\text{PV of } E_2\text{(MPLS)}] + [\text{PV of } E_1\text{(MPLS)}]/(1 + R)^2 - V/(1 + R)^2 \end{gathered} \tag{A6}$$

For four-period horizon,

$$\begin{gathered} \text{PV of } E_4\text{(MPLS)} = \rho\pi/(1 + R) - (1 - \rho)\pi/(1 + R) + \pi\rho/(1 + R)^2 - \pi(1 - \rho)\}/(1 + R)^2 + \pi\rho/(1 + R)^3 - \\ - \pi(1 - \rho)\}/(1 + R)^3 + (V + \pi\rho)/(1 + R)^4 + \{V - \pi(1 - \rho)\}/(1 + R)^4 = \pi(2\rho - 1)/(1 + R) + \\ + \pi(2\rho - 1)/(1 + R)^2 + \pi(2\rho - 1)\}/(1 + R)^3 + \{V + \pi(2\rho - 1)\}/(1 + R)^4 = [\text{PV of } E_3\text{(MPLS)}] - \\ - V/(1 + R)^3 + [\text{PV of } E_1\text{(MPLS)}]/(1 + R)^3 = [\text{PV of } E_3\text{(MPLS)}] + \\ + [\text{PV of } E_1\text{(MPLS)}]/(1 + R)^3 - V/(1 + R)^3 \end{gathered} \tag{A7}$$

For t-period horizon,

$$\begin{gathered} \text{PV of } E_t\text{(MPLS)} = \pi(2\rho - 1)/(1 + R) + \pi(2\rho - 1)/(1 + R)^2 + \pi(2\rho - 1)\}/(1 + R)^3 + \pi(2\rho - 1)\}/(1 + R)^4 + \\ \ldots + (V + \pi\rho)/(1 + R)^t + \{V - \pi(1 - \rho)\}/(1 + R)^t = [\text{PV of } E_{t-1}\text{(MPLS)}] + [\text{PV of } E_1\text{(MPLS)}]/(1 + R)^{t-1} \\ -V/(1 + R)^{t-1} \end{gathered} \tag{A8}$$

Therefore, for (t+1)-period horizon,

$$\text{PV of } E_t\text{(MPLS)} = [\text{PV of } E_t\text{(MPLS)}] + [\text{PV of } E_1\text{(MPLS)}]/(1 + R)^t - V/(1 + R)^t \tag{A9}$$

$$\begin{gathered} \text{PV of } E_{t+1}\text{(MPLS)}] = \pi(2\rho - 1)/(1 + R) + \pi(2\rho - 1)/(1 + R)^2 + \pi(2\rho - 1)\}/(1 + R)^3 + \pi(2\rho - 1)\}/(1 + R)^4 \\ + \ldots + \pi(2\rho - 1)\}/(1 + R)^t + \{V + \pi(2\rho - 1)\}/(1 + R)^{t+1} = [\text{PV of } E_t\text{(MPLS)}] - V/(1 + R)^t + [\text{PV of} \\ E_1\text{(MPLS)}]/(1 + R)^t = [\text{PV of } E_t\text{(MPLS)}] + [\text{PV of } E_1\text{(MPLS)}]/(1 + R)^t - V/(1 + R)^t \end{gathered} \tag{A10}$$

As (A9) is the same as (A10) and as we have shown this to be the case for t = 1, 2, 3 and 4 by the principle of mathematical induction the general formula for n-period investment horizon is derived as follows:

$$\text{PV of } E_n(\text{MPLS}) = [\text{PV of } E_{n-1}(\text{MPLS})] + [\text{PV of } E_1(\text{MPLS})]/(1 + R)^{n-1} - V/(1 + R)^{n-1} \quad \text{(A11)}$$

Expanding (A11), we may write as follows:

$$\text{PV of } E_n(\text{MPLS}) = [\{\pi(2\rho - 1)\}/(1 + R)][1 + 1/(1 + R) + 1/(1 + R)^2 + \ldots + 1/(1 + R)^{n-2}] + \\ + \{V + \pi(2\rho - 1)\}/(1 + R)^n \quad \text{(A12)}$$

Now substituting $\pi(2\rho - 1)$ by VR^*, [as $R^* = (\pi/V)(2\rho - 1)$], reduces equation (A12) to (1).
So what does exactly happen when $\rho = 1$? We explore this below:

$$\text{PV of } E_n(\text{MPLS}) = [(VR^*)/(1+R)][\Sigma_t(1 + R)^{-t}] + V(1 + R^*)/(1+R)^n = [(VR^*)/(1 + R)]\,[1 + 1/(1 + R) + \\ 1/(1 + R)^2 + \ldots + 1/(1 + R)^{n-2}] + V(1 + R^*)/(1+R)^n \quad \text{(A13)}$$

Now let S be a finite positive number s. t. $S = [(VR^*)/(1 + R)]\,[1 + 1/(1 + R) + 1/(1 + R)^2 + \ldots + 1/(1 + R)^{n-2}]$.
Also let ${}^1/_{(1+R)} = \lambda$. Then we may re-write the expression for S as follows:

$$S = (VR^*)\,\lambda\,[1 + \lambda + \lambda^2 + \ldots + \lambda^{n-2}]; \text{ so that } {}^S/_{(VR^*)\,\lambda} = 1 + \lambda + \lambda^2 + \ldots + \lambda^{n-2} \quad \text{(A14)}$$

Now multiplying both sides of (A13) with λ we get:

$$ {}^S/_{VR^*} = \lambda + \lambda^2 + \lambda^3 + \ldots + \lambda^{n-1} \quad \text{(A15)}$$

$$ {}^S/_{(VR^*)\,\lambda} - {}^S/_{VR^*} = 1 - \lambda^{n-1} \quad \text{(A16)}$$

Solving (A16) for S we get:

$$S = (1 - \lambda^{n-1})/({}^1/_\lambda - 1) \quad \text{(A17)}$$

Now putting back the values of S and λ in (A16) and simplifying, we get the following:

$$\text{V of } E_n(\text{MPLS}) = \{(VR^*)/R\}[1 - 1/(1 + R)^{n-1}] + \{V(1 + R^*)\}/(1 + R)^n \quad \text{(A18)}$$

But $R^* = (\pi/V)(2\rho - 1)$, so; if $\rho = 1$; it thus reduces R^* to π/V; and (A18) then reduces to the standard pricing model for a conventional straight coupon bond which is stated as follows:

$$\text{PV of } E_n(\text{MPLS}) = (\pi/R)\,[1 - 1/(1 + R)^{n-1}] + (V + \pi)/(1 + R)^n \quad \text{(A19)}$$

This now conclusively proves that the pricing model for a straight coupon paying bond is simply obtainable as a special case of our above-derived valuation model for a MPLS contract.