Rediscovery of discount rate.

We have been conditioned to think that the principal value, interest rate and duration are the only three negotiable parameters of any cash loan or bond sale transaction. Until now that seemed to have been the case. There is a fourth parameter: discount rate that has largely been forgotten and is now mentioned usually in a historical context.

Discount rate used to be understood as the type of interest rate on a loan or a bond that was applicable upfront, at a time of signing a deal, as opposed to the 'interest rate' payments that are carried out at regular intervals during the lifespan of a loan or a bond. During the 19-th century many of the business loans were performed for short periods of time like 6-12 months and the interest payment was charged by the merchant bank to a borrower by subtracting - by "discounting" the payment from the principal value of the loan in the beginning. For example, if a borrower wanted to borrow 950$ for 12 months, he would issue a personal bond for 1000$ nominal, thus 50$/1000$ that is 5% would be the "discount rate". The borrower really borrowed 1000$ but got only 950$ because of the "discounting". The same loan treated as the modern day bank loan would be described in terms of "interest rate" as 950$ loan with a 950$+50$=1000$ repayment after 12 months at the end of the term, thus the nominal "interest rate" would in this case be 50/950$ = 5.26%. In both cases we are talking about the same thing.

Could both discounting and interest rate calculation be applied for the same transaction, one upfront and then the second at the end? Yes but the effect, in most cases (but not all as we see later) would be a simple arithmetic addition of the discount rate to the interest rate!

For example, let us apply a discount rate of 2% as well as interest rate of 3%, to a principal bond value of 1000$ repayable after 12 months. The borrower gets 980$ of cash in the beginning, then after 12 months she has to pay additional 3% of 980$ (that is 29.4$) plus the full principal amount of 1000$. The 29.4$ would really come out of the original 980$ of cash therefore the net amount of cash that the person has really borrowed would be 980-29.4=950.6$, the same as if she borrowed 1000$ minus 4.94% discount that is almost the same as the sum of both rates. Therefore we do not really have to apply both (again in most cases) just one or the other since the only difference is a slightly different way of calculation. In mathematical terms we can say that discount and interest rates are are not truly independent parameters, so we can fix one at zero and use only the other one.

If we denote the discount rate by d and the interest rate by i and apply only one or the other then applying d=i/(1+i) is equivalent of applying only i alone, and applying i=d/(1-d) is equivalent of applying only d alone [1].

What if we apply d and i together (one before and the other after)?

P=principal amount (12 months term).

N=net amount after both discount and interest are deducted
$N = P - P*d - P*(1-d)*i = P*(1 - d - i + d*i)$

So applying both a discount rate d and an interest rate i is equivalent of discounting the principal amount by the effective

$d' = d + i - d*i$

or by the effective

$i'=d'/(1-d')$

(where d,i are expressed as fractions, that is for example 5%=0.05).

Since d*i is usually very small value and absolute values of both i and d are much less than 1, thus

$d' \sim= i' \sim= d + i$ (approximately.)

Therefore the effective combined discount rate d' and the effective combined interest rate i' are approximately equal and both equal to the sum of the nominal discount rate d and the nominal interest rate i, approximately.

An immediate conclusion is that bond discounting (for government treasury bonds and bills) may offset the effects of the officially imposed nominal interest rate i. For example if the interest rate is set too high or too low (especially if it is negative), different from the market expectations, then the discounting process would bring the effective rates (effective bond yield!) more in line with the investor's expectations. In the case if the interest rate i is set to be negative, bond discounting will most likely become imperative not optional!

Customers and their bankers were all conditioned to think only in terms of interest rate i and assuming that d is always zero and can be forgotten. It worked very well for years, so why bother using a notion of the discount rate at all? It all changes when the tables reversed and the small customers begun buying bonds from the banks as interest bearing investment vehicles, and when the banking system together with their governments begun manipulating interest rates downwards. It is in the interest of the bond buyers that the effective bond yields (that is the sum of d+i) are sufficiently high to generate a decent return on investment, as every retiree must acknowledge.

Conveniently for the banks and for the governments, people forgot that the bond yields are really described by $y \sim= i + d$ mathematics (and y is not the same as i) and that the d part of the sum can be determined by sales negotiation at the time of the bond purchase rather than being always assumed or decreed to be zero! From the bond buyer's point of view, the lower the interest rate i the higher the discount d must be to maintain the overall yield.

When the governments and their central banks were pushing the interest rates downwards, it was convenient for the governments because they could refinance their budgets cheaply and without asking the voters/taxpayers to pay more taxes, and it was convenient for large financial institutions because even a low bond yield of 3% (even without discounting) could have been leveraged 10 (by banks) to 33 times (hedge funds etc), or after 2008, even by a larger factor. Unfortunately it was a bane of the retiree investors and they seemed to have been the main victims of the rigged bond markets where the discounting mechanism was not applied, or **putting it in simple terms - the bond sale prices were most likely notoriously overvalued in the past**. Because of the missing d term, the fiction of d=0 for government bonds was maintained!

The only bond market where some kind of risk-mediated discounting seem to have taken place in recent few decades were junk bond markets.

Now that the interest rates on government bonds are below 1%, a fiction of low yields and d=0 is harder to maintain since the only bond buyers left are probably governments and very large banks. That is probably sufficient for now for large institutional bond buyers but not for everybody else and probably not for very long.

The fiction of zero discounting will have to be broken by the negative interest rate policy!

Under negative interest rates no regime, no bank, not even a large institution could afford to be foolish enough to buy negative interest bearing bonds, not even US Treasury Bonds, at par value, without some kind of discounting!

As a side note, discounting rates will have to be huge especially for long term bonds since the discount rate at the time of sale must offset (plus some incentive) the compounded interest rate payments that the bond buyer will have to pay to the bond issuer until maturity.

Lets use as an example a 1000$ nominal value, 10-year government bond bearing an interest rate i=-1%. The total interest payments by the bond-holder over the bond's life are 10*1000$*0.01 = 100$. Therefore such a bond would have had to be sold with the 10% initial discount (for 900$ instead of 1000%) just to break even!

Conclusions.

Some implications of bond discounting under negative interest rate policy (NIRP) are as follows:

- Central banks will not be able to avoid discounting of the government-issued bonds (otherwise they would be risking their own insolvency)
- Collateral assets held by the banking system will be losing value (since the discounting would have to be accounted for).

- Total market capital value of the entire bond market will probably keep growing faster [deleted --be gradually declining---] in relation to monetary mass in circulation, due to discounting mechanism during the roll-over refinancing at maturity. (At roll-over the borrower must re-pay the principal amount by issuing a higher nominal amount of bonds to offset the discounting).
- Bond market will have to be made working under the truly open market rules controlled by supply and demands rather than by market administrators. Under NIRP the market will not be able to tolerate mispricing or distorsions in the discounting mechanism, because it requires accounting for cash losses or gains upfront leaving very little scope for deferrals and creative accounting. Any attempts at manipulating the discount rate back towards 0, would result in buyers (even government buyers) walking away.
- If discounting by the market causes the combined effective yields i' ~= d + i to be increasing (a turning point is probably the current rate i for 10-year US treasury bonds of around 2%), it will very seriously undermine the stock market which has recently been supported by low yields and lack of low-risk high-yielding alternatives other than stocks.

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