Conditions for turning the ex ante risk premium into an ex post redemption for EU government debt

Colignatus, Thomas

Thomas Cool Consultancy Econometrics

17 November 2011

Conditions for turning the ex ante risk premium into an ex post redemption for EU government debt

Thomas Colignatus, November 17 2011

http://www.dataweb.nl/~cool

JEL A10, E00, P16

Keywords: Economic stability; monetary policy; credit crunch; European Central Bank; CAPM; risk free rate; risk premium; liquidity premium; stigma effect;

■ Abstract

Basel III classifies government debt as risk free while actual interest rates in the European Union (EU) show large differences not only because of liquidity but mainly because of the risk of default, as also reflected in credit default swaps. Curiously such debt defaults may not happen so that creditors do not need to cover losses. The risk premium then becomes a reward for taking a risk that does not materialize. Contagious fears create risk premia that destabilize government debts and national economies. A solution is to regard the risk premia as potential redemption that turns into actual redemption when the loan is served to maturity. A EU law may make this mandatory without serious restrictions to the credit market. The rule would be that governments under threat of default would issue only annuity loans with a centrally determined rate of interest. The market sentiment of increased risk then shows up in shorter maturities. Governments that can borrow only at shorter maturities but at higher annual liquidity requirements meet with strong incentives to better manage their economies. The paper investigates the conditions involved. An important distinction appears to exists between the risk free rate, the credit default risk premium, the liquidity premium and a stigma factor. While much of the debate in the EU seems to be about reducing the risk premium, the distinction between ex ante risk and ex post redemption allows to identify that true EU policy costs concern irrational stigma factors. Notably, aversion against Southern European debt, that differs from the risk free rate and the risk and liquidity premiums, has no rational base but can persist because it is rewarded.

Introduction

Basel III classifies government debt as risk free while actual interest rates in the European Union (EU) show large differences not only because of liquidity but mainly because of the risk of default, as also reflected in credit default swaps (CDS). Curiously such defaults may not happen so that creditors do not need to cover losses. The risk premium then becomes a reward for taking a risk that does not materialize. Contagious fears currently create risk premia that destabilize government debts and national economies, while they increase private profits where those are not urgently needed. Credit default swaps have been invented by markets to both serve customers and own profits but the emphasis seems to be on the latter. We should rather be looking for credit non-default swaps (CNDS) as this is the most frequent situation for government debt.

A solution is to regard the risk premia as potential redemption that turns into actual redemption when the loan is served to maturity when the risk thus does not materialize. A EU law may make this mandatory without serious restrictions to the credit market.

We first look at the principle and then at the economic conditions that would be required to make it work. The idea will be grasped immediately by finance experts but the exposition below targets highschool students and might perhaps also serve Members of Parliament. For this reason we first restate the simple financial mathematics of a bond issue with a fixed rate of interest. The idea indeed can be implemented with standard annuities rather than complex instruments.

The discussion can best be seen in the context of Colignatus (2011ab) “An economic plan for Europe”. Some authors propose Eurozone bonds to equalize rates of interest and spread risks of defaults. In my analysis it is better to use market signals on the performance and risk of individual governments. There is also an issue of timing. The October 26-27 plan to have a 50% haircut on Greek debt held by private agents seems unwise because of policy errors made in the past and because the Treaty on the euro does not clearly deal with defaults. On short notice part of the Greek and Italian debt can be absorbed within the monetary system, provided that those governments provide some collateral as explained in that economic plan, to satisfy the no-bailout condition. For the longer term the Treaty can be amended for defaults. The present discussion is intended for that. Generally the default will not concern the whole debt but only a percentage - the haircut.

We use Cool (1999) "The Economics Pack. Applications of *Mathematica*" for our formulas.

Debt and redemption

Notation

The assumption of a flat (constant) rate of interest suffices to explain the mechanism.

We assume a sequence of equal periods with a well defined periodical payment and a final payment at maturity, with all payments at the end of the period. We use the following symbols:

- r rate of interest per period (coupon rate i)
- m maturity (number of periods)
- p instalment or periodical payment
- w payment at maturity (principal, worth)
- v present value (capital equivalent at the beginning)

Cashflow object

The basic object is a cash flow of p per period, for m periods, and a final payment of w. In effect, someone has borrowed w, pays periodic interest p at the coupon interest rate $i = p / w$, and returns the loan at maturity m.

```
example = {p → 10 Euro/Year, m → 10 Year, w → 100 Euro};

cf = CashFlow[p, m, w] /. example
```

$$\text{CashFlow}\left(\frac{10\ \text{Euro}}{\text{Year}},\ 10\ \text{Year},\ 100\ \text{Euro}\right)$$

A bullit loan has annual interest payment at rate i without redemption, and at maturity the redemption of the principal.

```
bul = Bullit[i / Year, m, w] /. example
```

$$\text{CashFlow}\left(\frac{100\ \text{Euro}\ i}{\text{Year}},\ 10\ \text{Year},\ 100\ \text{Euro}\right)$$

Discounting

Discounting is not immediately relevant for the present discussion. It can help understanding the formulas to mention it anyway. The Present Value differs from the principal if the coupon rate *i* differs from the market rate *r*.

With a cash flow of *p*[t] per period, we can discount each payment with a discount factor $\frac{1}{(1+r)^t}$. Since we assume equal payments, *p*[t] = *p*, we can add all discount factors:

```
total[r_, m_]  =  Sum[1 / (1+r)^t,  {t, m}]
```

$$\frac{(r+1)^{-m}\,((r+1)^m-1)}{r}$$

```
capital == PV[Bullit[i, m, w], r]
```

$$\text{capital} = \frac{i\,w\,(1-(r+1)^{-m})}{r} + w\,(r+1)^{-m}$$

Annuity table

Suppose you borrow capital *v* now. Without intermediate interest payments, you would have to repay *f v* with factor *f* = $(1+r)^m$ at maturity. Suppose that you only pay *w* at maturity. Then the remainder *f v* - *w* must be paid as interest or redemption in the period before. If the periodical payment is constant then it is called an annuity. A table contains payments of interest and amortisation, and remaining debt.

Suppose that a person is willing to pay an annuity of 30 per year for a period of 3 years, and an additional final sum of 100 at the end of those 3 years as well. When the rate of interest is 10% then the present value is almost 150.

Present value = 149.737

period	payment	interest	redemption	debt
1	30.00	14.97	15.03	134.71
2	30.00	13.47	16.53	118.18
3	30.00	11.82	18.18	100.00

The new mechanism

The new mechanism changes an ex ante risk premium into an ex post redemption if the risk does not materialize.

In effect, the original bullit bond can be recalculated as an annuity bond. The new EU law then would be that governments under threat of default would issue only annuity

loans. While creditor and debtor can in principle bargain on the rates of interest and risk, a regulator may cap the rate of interest to eliminate one degree of freedom. This regulation may be a mere law with no strings attached. See the section below on regulation.

It is a bit sobering that all this discussion in the EU about the Greek haircut, first of 21% in July and then of 50% last October, essentially boils down to change a bullit into an annuity scheme, plus the willingness to cap the effective rate of interest to the market risk free rate.

Assume a 5 year loan of 100 (million or billion) at 5% interest for risk free governments, as assumed in the finance textbooks and Capital Asset Pricing Model (CAPM). Let the risk premium be 10% for a government at risk. After 5 years roughly 50% of the loan will be paid in terms of risk premium. If the loan is served to maturity then the risk does not materialize, and the risk premium payments can be counted as redemption. Effectively the calculation gives an annuity table. At maturity a remaining debt of 44.74 has to be redeemed instead of the bullit value of 100.

Present value = 100.

period	payment	interest	redemption	debt
1	15.00	5.00	10.00	90.00
2	15.00	4.50	10.50	79.50
3	15.00	3.98	11.03	68.47
4	15.00	3.42	11.58	56.90
5	15.00	2.84	12.16	44.74

Suppose there is a default around year 3. At the end of year 2 almost 20% has been repaid and at the end of year 3 more than 30% has been repaid. The risk premium will be based upon fears about both the size of the potential haircut and the moment when it might occur. In this case, an implied haircut of 50% over 5 years puts a ceiling on the expectations. Given the risk free rate the risk premium affects maturity. If the risk of default is judged to be large, the creditor will agree only with shorter maturities. At renewal of the loan the risk can be smaller, resulting in a longer maturity, or the risk can be higher, resulting in an even shorter maturity.

The scheme limits the scope for creditors to spread risks. In the present situation a creditor might collect risk premia from say 10 customers to cover the actual default of 1 of them. Good customers effectively pay the redemption of the failing customer. Customers can have different rates of interest including risk premia depending upon risk status. A bit irrational, a customer with high risk may pay a higher premium, enlarging the risk, and, when the risk does not materialize, this weaker customer contributes most to the redemption of the customer who fails. In the new situation the rates of interest and

risk are (in principle) both negotiated between creditor and debtor on an individual basis. If the risk materializes then there might be a subsequent negotiation on the size of the haircut, while the creditor could still recover possible losses from overall proceeds from various customers, though without the ability to label risk free loans as risks.

The creditor can still diversify the risk of default by taking a portfolio of different maturities. In the example above, suppose that 1/5th is kept of each of these lines. The low risk premium cashed in the first tranche is balanced by a much larger risk premium cashed over time in the last tranche. On average a risk premium of about 25% is cashed and thus a haircut of about 25% can be carried without a loss to the normal risk free earnings on interest.

The debtor can negotiate for a lower rate of interest or a longer period by offering collateral. Credit default swaps should rather be forbidden since they create the sense of security associated with money, which is the monopoly of the Central Bank.

Application to Germany and Greece

The ECB (2011a) gives "the latest available harmonised long-term interest rates for assessing convergence among the EU Member States. The rates are secondary market yields of government bonds with a remaining maturity close to ten years." October 2011 gives an annual rate of 2% for Germany and 18% for Greece so that the liquidity and risk premium for Greece is 16%. The overall liquidity premium may be estimated as the difference in October 2010 between Germany 2.35% and Holland 2.58% or Finland 2.63% and thus as 0.25%.

The ex ante risk premium for Greece can be regarded as ex post redemption, if the loan is served to maturity indeed. Suppose that Greece takes a loan of 10,000 million euro. Markets now demand 18% but if Greece serves the loan till maturity then the proper market rate will be the German rate of 2% plus the liquidity premium of 0.25%. If the loan is served to maturity then it actually is redeemed already in the 6th year. Apparently a haircut of 50% is expected already in the 3rd year. For a portfolio of different maturities the non-losing haircut would still be 50% (because the final debt level is 0).

Present value = 9998.06

period	payment	interest	redemption	debt
1	1800.00	224.96	1575.04	8423.01
2	1800.00	189.52	1610.48	6812.53
3	1800.00	153.28	1646.72	5165.81
4	1800.00	116.23	1683.77	3482.05
5	1800.00	78.35	1721.65	1760.39
6	1800.00	39.61	1760.39	0.00

This looks decidedly simpler than what the Eurozone has concocted till now, see the critical Cabral (2011) and Hau (2011).

A higher annuity causes more distress for a government that is already short in funds. The advantage however is that the horizon becomes shorter, while the effective rate of interest is under regulation from a central regulator. This current rate of 18% seems rather excessive and it derives mainly from the present crisis, while a revised Treaty on the euro will have more balancing rules in an earlier stage. The regulator would start with such 2.25% but when it appears that new loans are made to cover payments on older loans, then it could raise that rate. The regulated rate namely controls the real losses suffered by the regulated government.

The advantage for Greece would be huge. If it would take a bullit loan of 10,000 million at 18% for 10 years, then the present value taken at the risk free German rate plus the liquidity premium amounts to almost 24 billion. Greece thus pays a risk premium of 14 billion, while, with a proper monetary and financial management, that risk need not materialize. The problem is not just Greece but also the Treaty on the euro.

```
PV[CashFlow[1800, 10, 10000], 0.0225]
```

23 964.3

To regulate or not to regulate

The proposed scheme relies on the strict difference between the market risk free rate and the risk premium, as used in finance textbooks and CAPM, while we allowed for a third aspect of market liquidity, meaning that German bonds may sell easier because of a better developed market than for Greek bonds. It seems that there may also be a fourth factor, call it stigma, bear market sentiment, country aversion, so that a country may fall prey to speculations on such sentiments. Such a stigma effect can be the only explanation why investors might require a rate of interest for Greece that is higher than

2.25% even when the risk of default does not materialize.

Assume a Greek market stigma of 3%. Then the Greek interest rate rises to 5.25% and the scheme to turn the ex ante risk premium into ex post redemption becomes as follows. Greece has to pay one term more, or loses 1,800 million because investors have lost trust and speculators fuel that. In a way it is an irrational sentiment in the market but it becomes rational again because it is rewarded by higher proceeds.

Present value = 10 321.8

period	payment	interest	redemption	debt
1	1800.00	541.89	1258.11	9063.65
2	1800.00	475.84	1324.16	7739.49
3	1800.00	406.32	1393.68	6345.82
4	1800.00	333.16	1466.84	4878.97
5	1800.00	256.15	1543.85	3335.12
6	1800.00	175.09	1624.91	1710.21
7	1800.00	89.79	1710.21	0.00

For regulation the important issue is the cost at the EU level. There are three kinds of regulated markets:

(1) The EU-costless regulated but uncapped market. The law only states that unmaterialized risk is translated into an annuity. Creditor and debtor negotiate about the split in risk free rate and risk premium. Stigma effects cannot be avoided. In the current situation it must be doubted however whether the Greek stigma really causes a true total rate of interest of 18%. It likely is lower.

(2) The EU-costless regulated but capped market. The law also instructs the regulator to cap the rate of interest, either with rules or discretion. The cap would consist of the risk free rate (Germany) plus the liquidity premium plus a tolerable level of stigma. It would be interesting to see what the maturity would become if stigma is set at zero, and whether Greece would be able to raise sufficient funds. In some respect the cap would be exactly at the market value (case 1) to generate sufficient funds but there may also be learning effects that allow a lower stigma to sink in. The country itself may make costs to achieve a lower stigma but it would be EU-costless.

(3) The regulated and capped market with costs for the EU. Regulation would likely become costly if there is a common policy to drive down stigma. Suppose that the regulator caps stigma to 1% while the market rate would be 3%. It depends upon the supply schedule but say that Greece then only covers 30% of its demand for funds. It would need 70% of funds from non-market sources. Here ideas on adaptation of the European Central Bank (ECB), the introduction of Eurozone bonds, or the extension of the European Financial Stability Fund (EFSF) enter the discussion.

With this analysis it is interesting to observe that much debate in the EU seemed to be about regulating default risk while it actually was about regulating irrational market stigma that fuels on itself since it is rewarded.

I have the impression that others have made similar remarks about herd behaviour, yet I also have the impression that it puts the matter in the spotlights by making the point in the context of the option to turn ex ante risk into ex post redemption. Perhaps when this analysis and cause have been accepted it will become possible to better evaluate the role of the ECB. Indeed, the ECB move to buy Greek and other debt on the secondary market can find a motivation in the desire to fight suddenly high market stigma when the fundamental belief is that there is no cause for default. The given argument of supporting the financial stability of Greece is vague when there would be no fundamental risk for default. Countries can do a lot themselves about reducing such stigma but joining a monetary union eliminates an instrument to handle stigma and thus there is some responsibility for the union to assist.

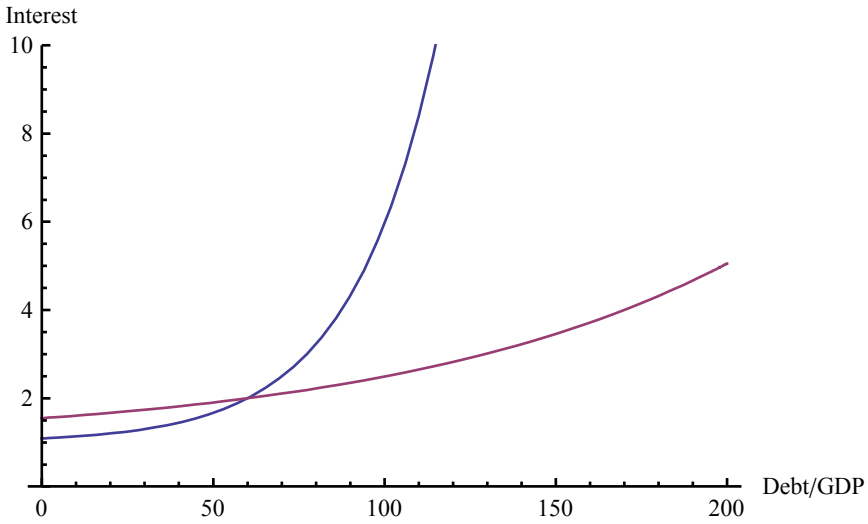
Macro-economic aspects in the EU in 2011

How would the Eurozone be affected by the new mechanism ? Our main interests are Germany and the average. Judging by the euro yield curve the average rate of interest for 10 year Eurozone debt still is fair at 2.72% on average, ECB (2011b) and Eurostat (2011).

The rate of interest for German government debt at 2% is so low because risk averse creditors flee from Southern Europe. Southern Europe still attracts funds, so it mainly is a redistribution. The apparent average of 2.72% is 0.5% higher than the 2.25% used above. The increased sense of risk with respect to Southern Europe apparently has a limited impact on the average. Given the limited impact of current fears it seems fair to take the regulatory target rate indeed as 2.25% (Germany + 0.25%) rather than 2.75% (Germany + 0.75%). In the new system, if countries under threat of default would disbehave then the regulator could indeed assign a higher rate of interest.

The regulator can let itself be guided by a formula to establish the rate of interest to be used in the annuity scheme of a government at risk of default. With d the Debt/GDP ratio the rate could be $r = 1 + e^{c\,(d\,-\,60)}$, both in percentages, with coefficient c. At $d = 60$ we have $r = 2$. We can distinguish operations in the normal state around $d = 60$, with coefficient $c = 0.04$, and the current period of crisis with coefficient $c = 0.01$. The latter

form can provide stability for the adjustment in the next decade and once debt values are sustainable then the regime switch takes place.



Thus there would be scope for a EU regulator to oversee the rate of interest for a member government that threatens to become in default. The 10 year German rate of 2% would likely not be much affected since Germany does not accept more risk and since the problem country remains responsible for its own debt. The country pays a price since the 10 year German rate may become its own 6 year rate. There is benefit in regulation and capping that rate, since it blocks somewhat irrational effects of private profit taking in current financial markets.

In the case of Eurozone bonds, there are various models. If all countries use only Eurozone bonds then Germany would see a rise of its rate from 2% to say the 2.75% average. The liquidity premium of 0.25% would disappear, but the extra risk factor has to be included that there no longer is a safe haven in Germany since it has taken along the load of other nations. Though one might argue that it already has taken on that load anyway. Countries may also only partly use Eurozone bonds, e.g. the first 60% of debt, or alternatively only the current surplus above 60% as a single once-only measure as the German Five Wise propose (Bofinger et al. (2011)). Eurozone bonds destroy the information about individual performance and thus you would think only about partial application. Setting up a temporary and/or partial system for Eurozone bonds has the risk that the mechanism gets known and becomes permanent.

It is a curious system that private banks can borrow from the ECB at 1%, use a multiplier, and loan to governments at 18%. In normal situations we would like to see governments benefitting from seigniorage, see Colignatus (2005), and banks having to

compete for funds in the market place, rather than the other way around. The target rate of interest would be about the same as the nominal GDP growth, thus $r \approx g$, since then income and wealth would be balanced. With the long term rate anchored in that manner, the weight for inflation policy falls on the short term rate of interest, hence the term structure, and bank profits based upon their channelling of short term deposits into long term loans.

The approach suggested here can already be started. Again, this discussion can best be seen in the context of Colignatus (2011ab). Stress tests would enhance our information about the system performance.

Conclusion

It is useful to see the issue at the level of the EU and not just the Eurozone. The proposed scheme has these features:

(1) In the "normal" situation around the Debt / GDP norm of 60% countries pursue their own debt policies.

(2) If a country comes from the normal situation of Debt / GDP around 60% into another situation higher than another norm, say 90%, it can be declared under threat of default. It then restructures its debt into annuity forms where the rate of interest is establised by the regulator.

(3) In the current situation where various EU member states are under threat of default already (2) applies, though with a more agreeable interest rate cap to allow recovery from the rather severe crisis we are in. Healthy people can have brisk measures but the recoverating need careful treatment. The EU-costless scheme does not put a burden on safe countries. It only regulates the interaction of markets and problem countries, by reducing irrational and counterproductive feedback loops.

(4) The identification of the stigma effect and counterproductive market process however requires reevaluation of the Treaty on the euro. Regulation with EU-costs may actually be desirable to block such counterproductive processes rather than merely reduce them. This view supports the earlier conclusion in Colignatus (2011ab) that it would be better that the EU as a whole gets a proper central bank.

References

Colignatus is the name of Thomas Cool in science.

Bofinger (Peter), Lars P. Feld, Wolfgang Franz, Christoph M. Schmidt, Beatrice Weder di Mauro (2011), "A European Redemption Pact", http://www.voxeu.org/index.php?q=node/7253

Cabral, R. (2011), "Greece's 2nd bailout: Debt restructuring with no debt reduction?", http://www.voxeu.org/index.php?q=node/6818

Cool (1999), "The Economics Pack. Applications of Mathematica", Thomas Cool Consultancy & Econometrics (software update 2011), http://www.dataweb.nl/~cool/TheEconomicsPack/index.html

Colignatus (2005), "A better way to account for fiat money at the Central Bank", http://econpapers.repec.org/paper/wpawuwpgt/0512014.htm

Colignatus (2011a), "High Noon at the EU corral. An economic plan for Europe, September 2011", http://mpra.ub.uni-muenchen.de/33476/

Colignatus (2011b), "An economic plan for Europe", http://ekathimerini.com/4dcgi/_w_articles_wsite3_1_23/10/2011_411466

ECB (2011a), "Long-term interest rate statistics for EU Member States", http://www.ecb.int/stats/money/long/html/index.en.html

ECB (2011b), "Euro yield curve", http://www.ecb.de/stats/money/yc/html/index.en.html

Eurostat (2011), "Interest rates", http://epp.eurostat.ec.europa.eu/tgm/table.do?tab=table&plugin=1&language=en&pcode=teimf060

Hau, H. (2011), "Europe's €200 billion reverse wealth tax explained", http://www.voxeu.org/index.php?q=node/6804