

Does Gold under your bed helps you sleep better? Reading the market sentiment of crisis in Gold Future curve.

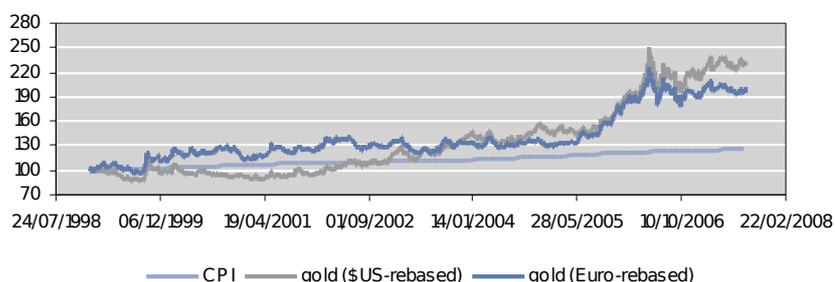
Vincent Guffens

August 24, 2007

Amongst all other base and precious metals, gold has with no doubt played a very particular historical role. Across time and geographical regions, the intrinsic value of gold has always been recognized and as such, it has often been used as valid specie currency. Today, gold is still regarded as a particular metal for having specific characteristics: gold return is believed to be independent of other asset and even independent of business cycles. It can therefore be used for diversification purpose in portfolio management. Furthermore, large gold inventories exist, particularly in central bank for historical reasons, which makes the price of gold less susceptible to rapid changes. What's more is that gold is also believed to be an effective hedge against inflation. All these characteristics, probably combined with the highly symbolic nature of gold, have designated gold has a last resort asset to physically possess when everything goes wrong. In other terms, gold should act as a crisis hedge, keeping value when everything else has gone pop.

If the validity of this statements should really only be judged after a total meltdown of the global-economy, it is still worth investigating the available market data in order to understand gold price behavior with respect to crisis sentiment.

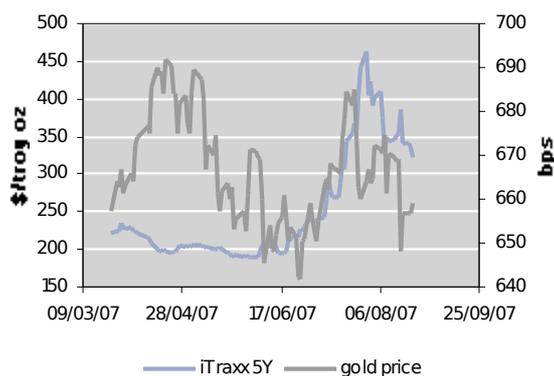
Gold as an inflation hedge



Compared to the CPI index over the last ten years, gold has not performed badly and the inflation has been followed up quite closely until 2005 when speculative pressures due

to the renewed interest in commodities as an asset class took place and pushed the prices higher. However, one cannot really see any correlation between this price evolution and the market history. After 2004 when we can locate the beginning of the last bullish market, gold prices did indeed go up but the economic slow down that lasted from 2000 to 2003 cannot be seen on the curve. Furthermore, if it could, this would contradict the idea that gold value is independent of economical cycle.

Gold and iTraxx during the subprime crisis



What happened to gold during the subprime crisis? The iTraxx crossover is a credit derivative (Credit Default Swap) index and can therefore be used as a proxy toward default risk. Hence, we can use it to read through the crisis. At the end of June, the iTraxx started soaring which happened amid a strong increase in the front month gold contract apparently showing a strong correlation between the two. However, between the 24 to 27 July, gold lost 3.65% while the

iTraxx gained 20% indicating a very large increase in default risk. In fact, in between 23 March and August 20, the price of gold did not change while the market sentiment clearly remains highly uncertain after that date. While the increase in gold price could be explained by the hedging value of gold (and therefore the rush of investor toward it), the decrease in gold price can also be explained by investors trying to recover some cash to pay off large margin losses.

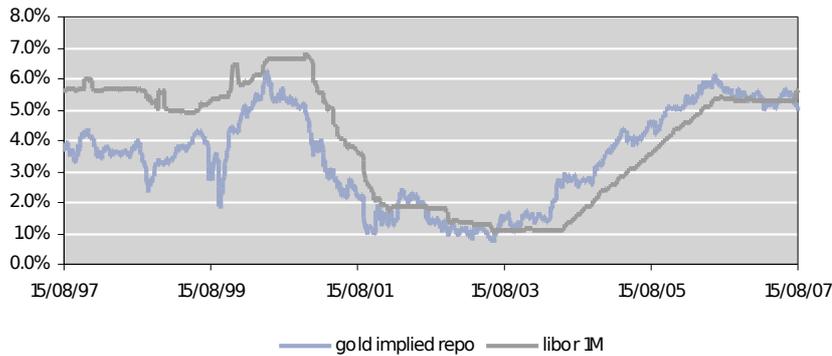
Therefore, both in the ten-year period case and during the short-term subprime crisis period, it is not clear how to interpret gold price movements in term of crisis sentiment. Is it possible to find in gold price a better reading of global market conditions?

Understanding the gold future curve movement

A common way, inspired by fixed income works, to analyze commodity future curve is to perform a Principal Component Analysis (PCA) on the future curve term structure to extract various components that explain the curve movement. The first component explains the vertical parallel movement of the curve while the slope explains the rotation of the curve. Rotations of commodity forward curve are of particular importance as they characterize their backwardation or their contango. It is well known that the gold term structure is in contango meaning that short-term maturity contracts are cheaper than long-term contracts. This is largely explained by large gold stocks, market liquidity and gold indestructibility.

Performing a PCA on a ten-year data set of gold price including the eleven first gold contracts traded on COMEX gives quite surprising results. The first component explains 99.96% of the curve movement and the second component, the slope, explains the remaining 0.04%. It means that most curve movements are mainly level-based which is very common for metals. It also shows that two components suffice to explain the entire curve history. Looking at the correlation between the slope component and the LIBOR 1 month gives a remarkably high correlation of 91%! This can be understood by considering the following argument: suppose that you want to buy a quantity of gold in a six-month time at a price known today. You can either buy the gold on the spot market and store it during the 6 months or buy it on the future market. Remember that entering in a future contract is free and only necessitates a margin maintenance. Therefore, choosing to enter in the future contract leaves you with a capital that can earn the risk free rate.

One can then expect that the price of a future contract is equal to the spot price with interest accrued at a rate that we call the repo (as one can typically buy spot and sell forward which acts as a repurchase agreement. Note that this is different from the gold forward lease) rate and which cannot substantially differ from the risk free rate as it would violate a no arbitrage relationship. It is easy to directly measure the repo rate from the gold future curve as, if the relationship described above holds, the logarithm of the curve should be a straight line. The angular coefficient of this line is simply the continuously compounded gold repo rate and can be extracted with a linear regression.



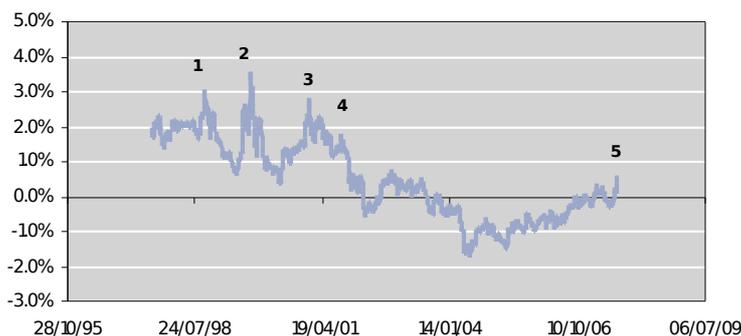
The repo rate so extracted has a correlation of 90% with the slope component computed with a PCA which confirms our intuition that they hold the

same information and they are essentially the same thing. The comparison with the LIBOR rate leaves little doubts that the level of contango of the gold curve is governed by the risk free rate. We know turn to a tentative explanation of the difference that remains between the two curves.

The convenience of holding physical gold

As mentioned earlier, a no-arbitrage argument suggests that the repo rate should be equal to the risk free rate. What other phenomena may be invoked to explain the difference? The first factor is obviously the storage cost that must be paid by someone buying gold on the spot and storing it until the settlement date of a future contract. As this cost should remain more or less constant with time, we do not consider it further in the discussion. What remains is precisely the reason why some investors want to hold gold physically in the first place : this is referred to as convenience yield and is defined as the value that accrue to the holder of a physical asset but not to the holder of derived contract written on the same asset. The convenience yield is responsible for the backwarded shape of most base metals for which holding physical stocks help prevent production disruption.

Gold convenience yield

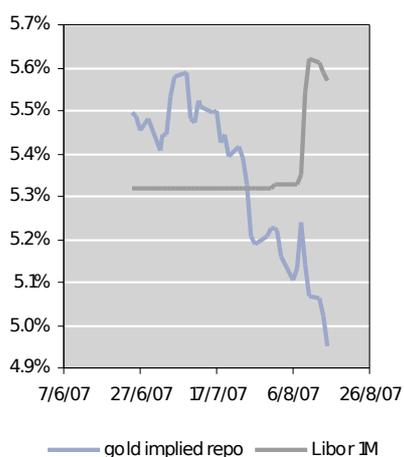


If we suppose that the rate investors agree to pay to hold gold is proportional to their perception of major crisis risk we can then read in the gold convenience yield the evolution of the market crisis sentiment. Indeed, before 2002, the convenience yield remains positive. This corresponds to a period where interest

rates were constantly reduced in an effort to boost the economy. This therefore also corresponds with a time of high market risk. The convenience stabilize and oscillate around zero until frankly departing in the negative region in the beginning of 2004 at which time market outlooks were improving. A more detailed look at the convenience allows us to locate five peaks reported on the figure. Peak 1 happened in October 98 which corresponds to the Long Term Capital Management crisis. Peak 2 is in

October 99, that is say just before the year 2000 and the uncertainty around the famous Y2K bug and its potential dramatic economical consequences. Peak 3 almost neatly corresponds with a sharp move in the interest rate and seems not to be related with a crisis event. Peak 4 happened on the 17 September 2001 that is to say just after the 9/11 terrorist attack in New York. Finally, peak 5 corresponds to the subprime crisis. Therefore, gold convenience yield seems to offer a much better reading of the market sentiment then gold price itself.

What gold tells us about crisis sentiment now?



The spread between the one-month Libor rate and the implied gold repo rate is clearly widening meaning that the convenience yield is increasing. This can be observed on this figure (on the left) which is a zoom on the two last months of the gold implied repo figure shown above. This looks like the perfect start of a decreasing interest rate period with positive convenience yield just like what happened in the period between 2000 and 2002. One can also observe what happened in June 2004 when the interest rate start increasing. The gold repo started increasing with anticipation which suggests that gold repo rate is a good indicator.

Unfortunately, there is no such thing as a perfect oracle and, as happened in 2003, the repo and the Libor rate crosses each other many times before marking a decisive direction.

As of now however, the outlook according to the gold future curve is quite bearish.

Conclusion

It is widely believed that gold can act as a crisis hedge. However looking at the gold price evolution gives little evidences that support this statement. A more in-depth analysis of the future curve dynamics reveals that the amount of security that gold provides is not necessarily to be read in gold price but rather in the so-called convenience yield. Measuring the historical convenience yield then shows that this measurement is correlated with the past economical-cycles and that it exhibits peaks at time that can be identified as crisis. During the past few months, there have been ongoing discussions about the direction that interest rates would follow. Either up so as to control inflation, or, more recently, down to cover for a possible economical slow down following the subprime crisis. The widening of the convenience yield in the last few weeks suggests that the gold future curve is pricing a decreasing rate which represents a bearish macro-economical factor.