POSSIBLY QUANTUMLY EXPLAINED NEGATIVE INTEREST RATES

Aretina David-Pearson

Politehnica University of Bucharest, Romania, e-mail: aretina.magdalena.david@google.com

Abstract.*Negative interest rates have similarities with quantum mechanics. Feynman diagrams can be employed top explain intertemporal liquidity exchange, due to speed of money reaching the maximum:c.*

Keywords:*Feynmann diagram, quantum mechanics, intertemporal liquidity.*

1. INTRODUCTION

Presently, negative interest rates started to become more and more present in the international landscape. The negative interest rates have shown on for the first time in Japan, as inverse forward curves. Negative interest rates are not being forward (virtual) any more, but they became real and show off not only in the Swiss deposit rates, but also in the Swiss bonds market, both of the Swiss National Bank (SNB) and also for corporations highly rated on the Swiss Exchange market.

2. POSSIBLY QUANTUMLY EXPLAINED NEGATIVE INTEREST RATES

In Switzerland, where the real negative interest rates headed on among the firsts in the world, in 2011. the Swiss Franc, the Euro, the American Dollar and almost the Great Britain Pound are practically at parity, at least on the exchange tables. But the interest rates plunge differently. Equally to SNB, the Danish NordeaKredit [1] started paying mortgage holders to borrow money by charging a negative interest rate. When doing short-selling of shares in the stock market, you promise to sell somebody shares for a price lower than they are selling for, because when the time comes to deliver the shares you are expecting to pick them up cheap. From financial point of view, the negative interest rates mortgages could be represented as a short sale of currency, in the context of a deflationary economy.

But what about the negative yield corporate bonds, which start to emerge? Technically again, the risk free interest rate is considered to be the rate offered by the central bank. If this rate is negative, investors loose less by investing into a negative yield bond. And why would somebody want to lose money, by exchanging more money now for less money in the future? It looks like the premium you willingly pay for your own future liquidity or, otherwise, against your own probability of default (debt valuation adjustment).

Example [2]: When a house builder takes/validates a credit from a bank, a hole is created, representing the money he owns to the bank. The builder's hole versus the bank is filled in by the money he/she receives from a new houseowner, who has built his house by borrowing money from the same bank. The bank, via the money, transfers the hole from the house builder to the house owner. Further assuming that everybody has debts, money operates as the visualisation mechanism of the hole, which travels in the opposite direction (when money enters, the hole leaves). When money does not fill in any hole (the money owner had no debt), it is only useful as it represents the fill in for future holes or future debts that the owner will encounter. In Feynman's terms, [3] who gives a second interpretation to negative energies, money represents a hole/debt in the future that travelled back in time, to the present, and future liquidity can be seen as a reflection on own credit risk, like when paying for pension/retirement.

What could be the difference between all these deposited money, in whatever form (in the bank, directly in corporate borrowings showing on as bonds) and their returned interest rates? The speed of money, instantly transported with the most performant electrical systems, that the classical approach to finance might not work anymore. The exponential limit with which interest rates used to be approximated, exp(rt) has been reached. In such a fast environment, a new, quantified approach might be necessary.

In the classical impulse conservation low, where p=impulse, one has p=mv conserves. The same holds for its square: $p^2 = m^2 v^2$ is constant. The measure unit for impulse is [p]=[m][v]=kg*m/s. In the quantum limit, when the mass of the particle is very light (photon), in its mass limit to zero, the mass unit (kg) is useless and we can write it directly in units of speed, which is the speed of light [c]:

$$[p]=1*[v]=[c] \quad (1)$$

As, on the relativistic limit of the photon $E^2 \rightarrow p^2$ $[c^2]=m^2v^2[c^2]=m^2c^2[c^2]$. Dividing by the size of c, we will obtain:

$$E^2 \rightarrow = m^2c^4 (2)$$

Leading to

$$E^2 = \pm \text{sqrt}(m^2c^4) = \pm mc^2 \quad (3)$$

Mathematically, the credit risk spread can be mapped, through averaging, to the probability of default. A negative spread would then translate to negative probabilities. For the very moment, the thing that jumps to my mind is what Paul Dirac used to write more than 70 years ago: « Negative energies and probabilities should not be considered as nonsense. They are well-defined concepts mathematically, like a negative of money. » Negative energies do get employed in particle physics. Dirac associated them to antiparticles/holes, which do conceptually resemble to short selling. Anyway,

there is a more terre-à-terre immediate explanation. For the negative interest mortgages, technically the negativity is covered by the negative yield of the mortgage-backed bonds that then the bank emits. In the very end, it is supported by the final investor, as a plus profit is taken by the bank from the spread between the two.

If we consider ***v*** to be the velocity of money, which now reaches ***c*** due to liquidities transmission via optical fiberglass cables, and ***m*** to be the transmitted monetary mass, which has no inertia and represents a number, the negative and positive energies ***E*** above could be mapped to a model to base on both positive and negative interest rates.To note above the use of ***c*** some times as speed of light and sometimes as measure of unit.

3. CONCLUSION

There is a lot of debate in particle physics on what antiparticles do represent and how negative energies can be made concordant with positive mass. And this is why maybe one could at least use the available mathematical recipes to deal with current financial events. As in order to produce an item one needs to start from primary ingredients, standardly valuated in money, a functioning, producing economy can be naturally assimilated to a Dirac sea of holes. And one can also seem to be naturally happier to pay for being able to invest the money and eventually be taxed on the gain (which is none under negative investments), than for keeping the cash at zero rates and being taxed on the whole fortune. This does make the mathematics really less difficult understanding.

4. REFERENCES

[1] Ministry of Business and Growth of Denmark (Soren Moller Nielsen, smn@evm.dk): “Negative mortgage rates can be handled”

[2] Aretina David’s blog: skyfinance.wordpress.com:

[3] Feynman, Richard P.; Leighton, Robert B.; Sands, Matthew (2005). The Feynman lectures on physics, Volume III: Quantum Mechanics (Definitive ed.). New York: BasicBooks. ISBN 978-0805390490.