New way of financing firms based on the fat-tailed distribution of growth rate

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In this paper I firstly point out a kind of systemic fragility of general financial system based on the interest rate using analogy of material science, and then introduce a new type of financing system which is quite different from ordinary financing based on interest rates.

When a bank lends some amount of money to a firm, the interest rate is usually fixed at the time of contract. The interest rate is determined by the market rule that the firm can choose the bank which proposes the lowest interest rate among competitive banks. A positive interest rate is not a burden for a firm if the firm grows with a rate larger than the interest rate. However, this occurs only in a lucky case, as it is confirmed from real data of firm statistics that the probability of a firm's growth rate to be larger than 1 is always about 50% for any category of firms. In the case that the growth rate is smaller than the interest rate this positive interest rate works as a kind of pressure for the firm.

As for material under non-uniform pressure there are two types of response, plastic and fragile. Plastic material deforms freely proportional to the external pressure and no strain remains in it like clay. Fragile material like glass behaves elastically until the pressure is not big enough. However, when the external non-uniform pressure exceeds a certain threshold, the strain accumulated inside the material suddenly tends to localize at the weakest point and a brittle fracture occurs at the maximal strain point. Then, the shear pressure which is supported by the broken part is distributed to its neighbors, and some parts of neighbors can not hold the increased pressure resulting successive development of fracture. I will show that similar failure development can occur in financial systems based on interest rate as those firms having larger pressure tend to be forced to have higher interest rate until they become bankrupt.

To avoid such fragility of financial systems I propose a new financing system that takes advantage of the universal properties of the fat-tailed distribution of firm's growth rate. The fat-tailed distribution means that there exists non-negligible number of firms whose growth rate is very large such as 10. In the proposing new financing system the interest rate is not fixed at the time of contract, instead the amount of pay back is determined at the end of financing period as a result depending on the actual growth rate of the firm. For example, for a firm whose growth rate is less than 1 the amount of pay back is about the same as the borrowed amount, namely, the practical interest is zero or very low. For a firm that has grown very well the amount of pay back is large. I will show examples of assignment of practical interest rate that is a function of growth rate. In this financing system there is no possibility of strain concentration and no failure development is expected. Namely, this financing system is more like plastic material as for the response to the external financial pressure.

Keywords
growth rate distribution of firms, interest rate, bankrupt