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Optimism, pessimism and financial bubbles

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ABSTRACT

This paper shows that it is possible to extend the scope of the existence of rational bubbles when uncertainty is introduced associated with rank-dependent expected utility. This RDU assumption can be viewed as a transformation of probabilities depending on the pessimism/optimism of the agent. The results show that pessimism favors the existence of deterministic bubbles, when optimism may promote the existence of stochastic bubbles. Moreover, under pessimism, the RDU assumption may generate multiple bubbly equilibria. The RDU assumption also leads to new conditions ensuring the (absence of) Pareto-optimality of the competitive equilibrium without bubbles. These conditions still govern the existence of bubbles.

1. Introduction

This paper shows that the scope for the existence of rational bubbles can be extended when uncertainty and rank-dependent expected utility are introduced. In the framework of an overlapping generations model *à la* Diamond (1965), the seminal article by Tirole (1985) proves that bubbles can arise in economies for which the return on capital at a steady state is below the growth rate of output. The bubbleless economy must be in a state of overaccumulation that corresponds to dynamic inefficiency. Weil (1987) proposes a model of stochastic bubbles using the same framework as Tirole, and finds existence conditions that are even stronger. Different authors have introduced rational bubbles in richer frameworks with endogenous growth (e.g. Grossman and Yanagawa, 1993; Olivier, 2000). But the existence of bubbles remains linked to the same condition between the growth rate and the interest rate. As empirical observations suggest that this condition is not fulfilled in general (see Abel et al., 1989), rational bubbles seem unlikely to arise. They may perhaps not be the pertinent explanation to understand bubble phenomena that actually are observed.

In recent contributions, Caballero and Hammour (2002) and Caballero et al. (2006) obtain the existence of bubbles under less stringent conditions at the price of a transformation of the notion of bubble. They build an overlapping generations model with an adjustment cost to capital leading to two long-run equilibria. They interpret the equilibrium corresponding to a higher valuation of the capital stock as a bubbly[1] equilibrium.

This paper intends to show that it is possible to extend the scope for the existence of rational bubbles when uncertainty is introduced associated with a rank-dependent expected utility. A simple overlapping generations model is studied in

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[1] This paper uses the terminology introduced by Tirole (1985) and employs the expressions of "bubbly equilibrium" and "bubbleless equilibrium".

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which the production technology depends on a technological shock: capital return is random. In order to have a very tractable model, there are only two possible states of the nature and the capital return may oscillate between a high and a low value. In an economy in which capital is the only asset, financial markets are incomplete as two states of the nature exist. The existence of a bubbly asset can make financial markets complete. Two types of bubbles are considered in this context. The first type, called a deterministic bubble, is an asset that has the same price in both states of the nature. The second type, called a stochastic bubble, is an asset whose existence is conditional to the occurrence of a particular state of the nature. As in Weil (1987), agents form their expectations according to a self-fulfilling prophecy which assumes that the bubble will burst if the other state arises.

Moreover, it is assumed that agents are endowed with a rank-dependent expected utility (RDU) function. This model has been introduced by Quiggin (1982) and developed by Chateauneuf (1999). A general presentation can be found in Cohen and Tallon (2000). The RDU model can be viewed as a generalization of the standard EU (Expected Utility) model, based on the Von Neumann Morgenstern's axioms. In a famous paper, Allais (1953) has showed through experiments that a majority of people do not behave according to the expected utility model, as their actions violate the independence axiom. The RDU model is based on a weaker form of this independence axiom that can reconcile the theory with some actual behaviors.

According to the RDU model, the distribution of probabilities is transformed by a probability weighting function (pwf). The utility is no longer linear with respect to the probabilities of the states of nature. This assumption can be viewed as a transformation of probabilities depending on the pessimism/optimism of the agent. A pessimistic agent will give more weight to the bad state of the nature, whereas an optimistic agent will give more weight to the good state. This assumption has two implications. First, the deformation of probabilities may lead to quantitative changes with respect to the ones obtained with the standard EU (Expected Utility) model. More precisely, our results show that pessimism favors the existence of deterministic bubbles and of small stochastic bubbles, while optimism may promote the existence of big stochastic bubbles. Second, the deformation of probabilities depends on the *rank* of the consumptions in the different states of the nature. It will be shown that this property may lead to a multiplicity of bubbly equilibria.

Considering pessimistic agents in the case of a deterministic bubble, the transformation of probabilities weakens the existence conditions of a bubble. The interpretation is simple. By assumption, the gross capital return is greater than 1 in the good state of the nature, while it is smaller than 1 in the bad state. Investing in the bubble provides a gross return equal to 1. Agents invest in the bubble in order to be protected against the occurrence of the bad state. In the case of pessimism, they put more weight on this state and invest more in the bubble. Therefore, pessimism may support the bubble.

In the case of a stochastic bubble, it is assumed that the existence of the bubble is conditional to the state with a low capital return, the bubble bursting in the state with a high capital return.[2] This assumption may reverse the rank of the states of the nature. With a deterministic bubble, as this asset provides the same gain in the two states of the nature, the state with a high capital return is always the best state of the nature. With a stochastic bubble, the state with a low capital return also corresponds to the continuation of the bubble. Therefore, if the bubble has a high value, it is possible that the state with a low capital return becomes the best state of the nature. But if the bubble has a low value, the state with a high capital return remains the best state of the nature. As the transformation of probabilities in the RDU model depends on the rank, two types of bubbly equilibria may exist, associated with a low value or a high value of the bubbly asset.

Optimism promotes the existence of an equilibrium with a high value of the bubble. As the good state for the consumer corresponds to the existence of the bubble, optimistic agents assign more weight to the bubbly state and invest more in the bubble. In the end, optimism favors stochastic bubbles. In contrast, pessimism plays in favor of the existence of an equilibrium with a low value of the bubble. In this case, the bubbly state is the bad state of nature for the consumer. A pessimistic agent assigns more weight to this state, which favors the existence of a bubbly equilibrium.

The case of a stochastic bubble is particularly interesting under the RDU assumption, as it leads to two types of bubbly equilibria associated with either a low price or a high price for the bubble. Increasing the degree of pessimism can have both a positive or a negative effect on the existence of a bubbly equilibrium. Pessimism promotes the existence of a bubble with a low price, whereas optimism plays in favor of a bubble with a high price. These results come from the property that the weights put on the different states of the nature depend on the rank within the RDU framework. A stochastic bubble with a low value does not change the ranking of the two states of the nature whereas a bubble with a high value does. Therefore, the same parameter – the degree of optimism – can have opposite effects depending on the type of bubbly equilibrium.

Finally, in the case of pessimism and stochastic bubbles, an equilibrium may exist associated with a value of the bubble such that the two states of nature lead to equal levels of consumption. Moreover, this bubbly steady state may be stable and there is convergence with oscillations. There exists an infinity of initial conditions for the value of the bubble and the bubbly equilibrium is indeterminate. The existence of such an equilibrium is due to the "kink" in the indifference curves which appears for equal levels of consumption, in the two states of nature in the RDU framework.

This result can be related to previous ones obtained in finance literature with rank dependent utility or Choquet utility: Tallon (1997) and Epstein and Wang (1994) also obtain the existence of multiple equilibria. The originality of this work is to obtain the result in a production economy with capital and a bubbly asset. In an exchange economy, the dynamics of asset prices is completely governed by the history of exogenous shocks. In a production economy with capital, the dynamics of

[2] A stochastic bubble conditional to the state with a high capital return could not exist.