Economic Modelling 49 (2015) 11–18

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

Gurus and belief manipulation☆

Elyès Jouini [a,*], Clotilde Napp [b,c,1]

[a] CEREMADE, Université Paris Dauphine, France
[b] DRM-Université Paris Dauphine, France
[c] CNRS, France

ARTICLE INFO

Article history:
Accepted 20 March 2015
Available online xxxx

JEL classification:
G12
D53
D81

Keywords:
Heterogeneous beliefs
Belief manipulation
Gurus
Optimism
Pessimism
Equity premium puzzle

ABSTRACT

We analyze a model with two types of agents: standard agents and gurus, i.e. agents who have the ability to influence the other investors. Gurus announce their beliefs and act accordingly. Gurus are strategic: they take into account the impact of their announced beliefs on the other agents, hence on prices. Standard agents observe gurus' performances, choose a guru and follow her/his recommendations. Prices are determined through a classical Walras mechanism. The competition among gurus for attracting followers among standard agents is governed by the level of accuracy of their predictions. The strategic behavior leads to belief subjectivity and heterogeneity among the gurus even when gurus' initial beliefs coincide with the objective belief. Optimism as well as pessimism can both emerge. We find a positive correlation across the agents between pessimism and risk tolerance. The representative agent belief, or the consensus belief is pessimistic. As a consequence of the pessimistic bias at the aggregate level, the risk premium is greater than in the standard rational expectations equilibrium. We show on an example that this impact is significative. In a multi-asset framework, the impact is stronger on the riskier assets.

1. Introduction

It suffices to observe “”the heterogeneity of analysts or professional forecasters forecasts or more generally of experts opinions to realize that the homogeneous and rational expectation assumption is not realistic. Behavioral asset pricing theory gradually starts to form as a complement to the traditional asset pricing theory and many authors analyzed the impact of the introduction of noise traders (e.g. De Long et al., 1990), of cognitive biases (e.g. Barberis et al., 1998), of investor sentiment (Dumas et al., 2009; Yang and Zhang, 2013a, 2013b) or, more generally, of heterogeneous beliefs (e.g. Jouini and Napp, 2007).

In this paper, our aim is to analyze to what extent this heterogeneity may be generated by the presence of gurus that act strategically. We consider a model with two types of agents: uninformed investors and gurus. Both of them trade on the markets but gurus may also influence prices through their announcements. Like in Benabou and Laroque (1992),

> We have in mind three kinds of informed agents whose announcements influence prices. First, there is the journalist who writes a financial column, and can trade directly or through namesakes; the Winans-Wall Street Journal is an obvious example. Second, there is the "guru" who issues forecasts or newsletters, but is also in the business of trading, for his own account or some investment firm (…)
>
> Finally, probably the most widespread case is that of a corporate executive who owns or trades stock in his company, and by the very nature of his job periodically makes prospective reports to stockholders and financial analysts.

Because ordinary participants to financial markets face frictions associated to information transmission and processing, they are assumed to follow guru announcements instead of developing their own analysis of the markets based on their own data processing. Therefore, we consider the situation where gurus announce a belief and each uninformed investor adopts the announced belief of one guru. Aware of their market power resulting from their followers, the

☆ The authors want to thank the Editor as well as two anonymous referees for their thoughtful comments that permitted to highly improve the manuscript. The financial support of the GIP-ANR (2010 BLANC 1803 01) (RISK project) and of the Risk Foundation (Groupama Chair) is gratefully acknowledged by the authors. We have benefitted from comments from two anonymous referees as well as from participants at the Parisian Seminar of Game Theory (Paris), Bachelier Seminar (Paris) and at the Adam Smith Asset Pricing Conference (LBS) and in particular from Françoise Forges, Denis Gromb, Marco Ottaviani, Sylvain Sorin, Dimitri Vayanos.
* Corresponding author at: IFD, Université Paris-Dauphine, Place du Maréchal de Lattre de Tassigny, 75 775 Paris cedex 16, France. Tel.: +33 1 44 05 42 26.
E-mail addresses: jouini@ceremade.dauphine.fr (E. Jouini), clotilde.napp@dauphine.fr (C. Napp).
[1] Tel.: +33 1 44 05 46 42.

http://dx.doi.org/10.1016/j.econmod.2015.03.013
0264-9993/

gurus choose their announcements strategically taking into account the impact of their announced beliefs on other agents hence on prices. Guru actions and announcements are fully observable and any discrepancy between these two characteristics would disqualify the concerned guru. Therefore, gurus act according to their announced beliefs.

We tackle the following issues. Do gurus have incentives to announce beliefs other than their true beliefs? How are investors' beliefs affected by the strategic interaction between gurus? Do the resulting beliefs overestimate/underestimate assets' returns? How are the possible biases related to the agents preferences? What is the impact of these beliefs on individual decisions? What is the impact of these beliefs on equilibrium characteristics such as prices and risk premium?

Our findings are the following. When gurus are not identical (i.e. have different preferences), a strategic behavior leads to belief subjectivity and heterogeneity among the gurus. Overestimation of assets' returns (optimism) as underestimation of assets' returns (pessimism) can both emerge. The intuition is the following. For the more risk tolerant guru, her/his demand in the risky asset is positive, so that her/his expected utility from trade is decreasing in the price of the risky asset. The choice of a pessimistic belief is associated with a lower demand, hence to a lower price, and the optimal belief balances this ""benefit of pessimism against the costs of worse decision making. The converse reasoning applies to the more risk averse guru, who, at the equilibrium, has a negative demand in the risky asset and benefits from optimism. This mechanism is similar to the one in a monopolist/monopsonist market. However, in our model, "relative market weights/power" are not only determined by gurus' characteristics but also by the choice of a specific guru made by each uninformed investor. We show that the more (less) risk tolerant investors follow the most pessimistic (optimistic) guru.

Second, the consensus belief, which is given by the average of the individual beliefs weighted by the risk tolerance, is pessimistic. Since we have just seen that the more risk tolerant are pessimistic, it is consistent to obtain a pessimistic consensus belief. As a consequence[3] of the pessimistic bias at the aggregate level, the risk premium is greater than in the standard rational equilibrium with full information and no gurus. We show on an illustrative example that this impact on the risk premium is significative.

Our model then provides an explanation to the pessimistic bias that is observed in empirical studies in a purely behavioral setting (Ben Mansour et al., 2006), in a decision theory framework (Wakker, 2001) or in a market framework (Giordani and Söderlind, 2006).[4] The resulting increase of the risk premium is interesting in light of the equity premium puzzle on financial markets.

The paper is organized as follows. Section 2 presents the main model and the results. Section 3 provides three main extensions (considering private information, more than 2 assets, more than 2 gurus). Section 4 concludes. All proofs are provided in the Appendix A.

2. The model and the results

We consider a model with a continuum of infinitesimal agents indexed by $i \in [0, 1]$. Among these agents, there are 2 influential investors who have a wide audience. We do not assume that they have the capacity to move the markets by their own trades but only that they have, through their wide audience, the ability to largely influence the other investors. We will call them gurus and denote them by Guru j, $j = 1, 2$. The other agents will be called standard agents.

We assume that standard agents have CARA utility functions for consumption,

- agent i utility function is given by $u_i(c) = -exp\left(-\frac{c}{\theta_i}\right)$ where $\theta_i > 0$ denotes agent i degree of risk tolerance,
- the function $i \to \theta_i$ is measurable on [0, 1].

We focus on a single period and consumption takes place at the end of the period. There is a single risky asset in the economy, whose payoff at the end of the period is denoted by $\widetilde{x}$. There is one unit of this risky asset in the economy equally distributed among our continuum of agents.[5] The agents have the possibility to negotiate futures contracts on this asset. We let p denote the unit futures price of the risky asset, which means that agents can sell their property rights on the risky asset against the delivery of the sure quantity p at the end of the period. Since we deal with CARA utility functions, negative levels of wealth are allowed.

We assume that $\widetilde{x}$ is normally distributed, with mean μ and variance σ^2.

Standard agents in the economy believe that gurus are well informed or have specific ability to predict market movements. At a given date each agent has a preferred guru. There are then 2 groups of agents: the agents in Group j (G_j) follow Guru j, $j = 1, 2$ and believe that the distribution of $\widetilde{x}$ has a mean μ_j that corresponds to Guru j announced belief. We denote by $\Theta_1 = \int_{G_1} \theta_i di$ and by $\Theta_2 = \int_{G_2} \theta_i di$ the aggregate risk tolerance in G_1 and G_2. We have $\Theta_1 + \Theta_2 = \int_0^1 \theta_i di = \Theta$ where Θ is the aggregate degree of risk tolerance in the economy.[6]

For given announced beliefs (μ_1, μ_2), the demand $\alpha_i(p)$ of the risky asset that agent i will retain given price p maximizes the expected utility from trade

$$\alpha_i(p) = arg\max_{\alpha\in\mathbb{R}} E^i\left[-exp\left(-\frac{p+\alpha(\widetilde{x}-p)}{\theta_i}\right)\right]$$

where E^i corresponds to the expectation operator associated to agent i belief P^i. This problem corresponds to the standard portfolio allocation problem, where the agents choose the share of risky asset in their portfolios given their beliefs. If agent i adopts the belief of Guru j then the distribution of x with respect to P^i is normal with mean μ_j and variance σ^2 and $exp(\widetilde{x}) \sim ln\, N\left(\mu_j, \sigma^2\right)$ which leads to

$$\alpha_i(p) = arg\min_{\alpha\in\mathbb{R}} exp\left[-\frac{p+\alpha\left(\mu_j - p\right)}{\theta_i} + \frac{1}{2}\alpha^2\frac{\sigma^2}{\theta_i^2}\right]$$

and gives $\alpha_i(p) = \theta_i \frac{\mu_j - p}{\sigma^2}$. The total demand of Group j is then given by

$$\alpha_{G_j}(p) = \Theta_j \frac{\mu_j - p}{\sigma^2},$$

and corresponds to the demand of an hypothetical agent with belief μ_j and risk tolerance Θ_j.

2.1. The gurus' game

The gurus take into account their impact as well as the impact of their followers on prices and can manipulate their announcements to take advantage of this impact. For example, a guru, who is risk tolerant, hence willing to buy risky assets, could announce a more pessimistic

[3] The fact that a pessimistic bias and a positive correlation between risk tolerance and pessimism lead to an increase of the market price of risk has been underlined by Abel (1989), Calvet et al. (2002), Detemple and Murthy (1994), Gollier (2007) and Jouini and Napp (2006); in their models, beliefs are exogenously given.

[4] In particular, as underlined by Shefrin (2005) based on Wall $treet Week data " between 1983 and 2002, professional investors were unduly pessimistic, underestimating market returns".

[5] Each agent has an infinitesimal absolute risk tolerance level $\theta_i di$ and an infinitesimal share di, the total number of shares being normalized to 1.

[6] A model with a continuum of agents permits to approximate models with a large number of agents. Furthermore, all pairs (Θ_1, Θ_2) with $\Theta_1 + \Theta_2 = \Theta$ are possible in such a model. The analysis would be essentially the same in a model with a finite number of agents except that we should choose the Θs on a grid.