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The mood of a firm

Li Way Lee

Wayne State University, Economics, 2131 FAB, Detroit, MI 48202, United States

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ABSTRACT

Mood is information. A good mood signals a desire to cooperate; a bad mood warns of a determination to oppose. Firms may communicate by mood. The paper makes three points about the mood of a firm. First, mood can change. A change in mood affects everyone in the market. Second, there exists a strong tendency for a firm frustrated by poor communication to have bad mood. Bad mood amplifies behavioral responses. Third, the attendant risks of bubbles and panics are a concern about policies that encourage firms to communicate by mood.

1. Introduction

Mood affects decisions. We buy more stocks on sunnier days (Saunders, 1993; Hirshleifer and Shumway, 2003). We also buy more stocks on days with lower temperature or longer daylight (Cao and Wei, 2005; Kamstra et al., 2003). Sunshine, temperature and daylight do not affect the fundamentals of most stocks; they affect stock prices because they affect our mood, and our mood affects the decisions we make.

Why do we pay attention to another person's mood? One reason is that it is informative. When we notice bad mood, we instinctively stay away from it. When we notice good mood, we feel drawn toward it. Mood tells us something about the potential consequences of social interaction.

As a way of communication, however, mood is not the most effective. Mood can be hard to express and difficult to read. Conversation and email are more effective. However, they may not be feasible, leaving mood to be the only means of communication. Casual observation suggests that people who are moody tend to have imperfect information about others' intentions. Moody people often are isolated, finding it difficult to communicate openly and directly with others.

Another characteristic of mood is that it can be infectious. When one member of a group is in a good mood, other members feel an improvement in their moods right away. A bad mood spreads quickly as well. As Shiller (1995, 2005) observes, information cascade is especially likely to occur when the message being transmitted is subtle, understanding is shallow, and communication is poor. That explains why "social mood" is particularly likely to emerge in financial decisions (Hong et al., 2004, 2005; Nofsinger, 2005; Lucey and Dowling, 2005).

There is every reason to believe that, in markets where direct contact is very costly, firms will communicate by mood. Yet classical theories of the firm almost never recognize mood. One significant reason is that classical theories do not pay much attention to how firms actually communicate with each other. Behavioral theories of the firm, in contrast, are sharply focused on that question (Simon, 1982).

I have three objectives in this paper. First, I call attention to a paper by Leontief (1936) which contains a proof that the mood of a firm exists. The proof is notable because it is to my knowledge the first and only one in the tradition of classical theories, and because it has managed to remain totally obscure. I use the model in that paper to show that, if we ignore mood, we will not be able to predict well. For example, the entry of a firm causes the moods of existing firms to change and if we do not recognize that, then we will seriously underestimate the total effect of entry. The second objective is to identify limitations of mood as a way of communication, in light of behavioral theories. Because mood encourages herd behaviors and speculative bubbles, a market dependent on mood for communication is inherently unstable. Lastly, I draw out the implication that antitrust policy is potentially destabilizing. By discouraging explicit cooperation, antitrust policy encourages mood as a means of tacit coordination. On that count, antitrust policy

E-mail address: aa1313@wayne.edu.

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must have been promoting merger waves, price fluctuations, and speculative bubbles.

2. Stackelberg and Leontief on mood: a short history of thought

A firm in classical theories of market is anything but a chameleon. Chameleons are best known for their ability to change colors. Herpetologists believe that chameleons change colors to camouflage, but also, when aroused, to signal their moods to fellow chameleons and predators. When a male chameleon's dominance is threatened, it changes to brighter colors. When a female tries to turn away a suitor, it produces red spots. We can tell that a chameleon is about to do something different when it changes its colors.

Though solitary and territorial like a chameleon, a firm in classical theories never changes mood. Once Cournot, always Cournot. Once a competitive price taker, always a competitive price taker. It is not aroused when the market becomes very crowded. It shows no fear when the demand plummets.

Stackelberg (1952) thought there is something odd about those theories of cool firms. He examined three popular theories at that time: the Cournot case, "the Bowley" case, and the "asymmetrical case". He thought that all three were implausible. The Cournot case, where both firms are followers, is unstable because each firm would find leadership more profitable and want to become a leader. The Bowley case, where each firm wants to be the leader, makes no sense because they do not seem to realize there are no followers.[1] The "asymmetrical case," where one firm leads and others actually follow – most ironically, known today as the "Stackelberg leader–follower equilibrium" – is improbable and unnatural (Stackelberg, 1952, p. 198). He pointed out that ". . .this equilibrium is unstable, for the passive seller can always take up the struggle again at any time" (Stackelberg, 1952, pp. 201–222). So unless there is a hereditary imperative to a firm's behaving subserviently, the leader–follower relationship is at best unstable and fragile.

Stackelberg argued that firms play roles that they find most profitable. Speaking of intentions in terms of reactions, he wrote (pp. 201–202): "Equilibrium will only obtain if the two chosen reaction curves are compatible with each other, i.e., if the reaction curve chosen by one duopolist is the more favourable one to him and that chosen by his rival is also his more favoured curve. . ."

In a book review published soon afterward, Leontief (1936) provided an algebraic example of the kind of behavior that Stackelberg envisioned. The firms in Leontief's model are interdependent, but they do not collude, nor do they see themselves as born leaders or followers. Instead of making arbitrary assumptions about each other's intention, a firm tries to figure out what another firm's attitude toward itself would be. Leontief showed that it can be done.

Here, then, is a workable definition of the mood of a firm: an expression of how it intends to relate to another firm. I hasten to add that, while this sounds like the classical notion of "conjectural variation," it is fundamentally different. The sine qua non of mood is the fact that it changes. Conjectural variation as it is employed in standard theories does not change. It is not mood in the same way that the photo on a driver's license does not tell much about the personality of the driver.

Leontief uses a simple numerical model to show how mood emerges on the basis of the desire for profit.[2] He considers two identical firms facing the following demand and marginal costs:

$$\begin{aligned} p &= 6 - (q_1 + q_2) \\ c_i &= 1 + 0.25q_i^2; \quad i = 1, 2 \end{aligned} \tag{1}$$

where p is price and q_i is output. From this model he shows that at the market equilibrium the mood of each firm (M) equals −0.5 and the market price equals \$2:

$$\begin{cases} M_1, M_2 = -0.5 \\ p = \$2 \end{cases} \tag{2}$$

Note that the prevailing mood in this market is bad.[3]

Table 1
Effect on mood.

	Δ in mood
The entry of the third firm	−0.22
A decline in demand	−0.11
A decline in marginal cost	−0.11

3. Mood amplifies reactions

The question remains: does mood matter to this market? The answer is yes, as we can see by comparing the price in the Leontief market with that in the Cournot market (wherein a firm has no mood), given the same demand and cost structures. We know the price in the Leontief market is \$2.00. We can easily show that the price in the Cournot market is \$2.58.[4] So the presence of mood makes a difference. This is a very robust result with respect to demand and cost structures.[5]

We may also look at another kind of evidence. Suppose that firms are being subjected to one of three structural shocks:

1. the entry of a new firm;
2. a decline in demand as reflected by a slope twice as negative: $p = 6 - 2(q_1 + q_2)$;
3. a decline in marginal cost as represented by a slope half as positive: $c_i = 1 + 0.125q_i^2$.

We may observe if mood changes in each case, and if it does, whether the change amplifies or dampens the effect of the shock. It is fairly easy to figure out mood change by using the formula in Appendix.

In all three cases, the mood of a firm will change for the worse. Table 1 shows how much worse, given that the mood before the shocks was negative 0.50.

To find the effect of the mood change on price, I use a two-step procedure: first, calculate the change in price holding the mood constant (in the Leontief example, that means holding the mood at −0.72), and then recalculate without holding the mood constant. The difference is attributable to the change in mood—the mood effect. Table 2 shows that the mood effect is substantial in all three cases.

1. When a new firm enters, the number of firms becomes three. The price declines from \$2.00 to \$1.24. That is a drop of 38%. We can break this down into the effect due to the structural change

[1] Stackelberg (1952, pp. 194, 197) attributes this case to Bowley (1924, p. 38). However, the Bowley case has become known as the Stackelberg disequilibrium.

[2] Leontief did not follow the behavioral procedure that Stackelberg described, instead taking a mathematical shortcut (known today as "consistent conjecture"), though ending up with the same results. That is a matter of little practical importance, because the shortcut leads to the necessarily condition of Stackelberg's optimal mood. The full proof is considerably more tedious. I will be pleased to share it with the interested reader.

[3] A positive M is a good mood, and zero M means the mood is neutral (i.e., neither good nor bad).

[4] Use the formulas in Appendix. For the Cournot market, set $M = 0$.

[5] In a separate paper I study the conditions for good mood to emerge. One such condition is rapidly declining marginal cost.