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"The Corporate Social Responsibility Is just a Twist in a Möbius Strip" by Nazaria Solferino and Viviana Solferino.

Referee Report

The insight from this work is to make an analogy between the topology of interactions between fermions on a Moebius strip and the interactions occurring between stakeholders and sectors of companies engaged in so-called corporate social responsibility. The authors argue, "corporate social responsibility is just a twist in a Moebius strip."

In the economics literature, considering corporate social responsibility demands treating companies and stakeholders as a unique interacting system where the companies fully identify themselves with the stakeholders' interests and vice-versa, as if there were no agent-principal problem. To make the physics analogy, the authors adopt the model of Yacubo et al (2003), where electrons travelling on a Moebius strip generate energy of higher intensity (lower energy dissipation) due to the less resistance accruing from the twist of the bend. The economics analogy the authors make: "Ethical capital" creates higher benefits and then lower dissipation of costs because of improved cooperation.

The authors take for granted that ethical capital improves cooperation and go on to implement the analogy. In my opinion, rather than assuming this proposition is true, a physical model would be more useful if applied to reinforce the proposition is true. Only assuming it is true and then automatically considering the link between Moebius strip and corporate social responsibility sounds artificial and perhaps not much useful. Of course, the exercise the authors make still yields the result that investing in corporate social responsibility depends on some identified factors ("worker sensitivity," "alienation," and number of sectors) and it is implied these factors should be boosted were the aim to improve corporate social responsibility. But the entire enterprise would be more satisfying if it helped one to make the case that ethical capital improves cooperation in the context of corporate social responsibility.

As for the physics, given both the fact that electrons, protons and neutrons interact and also the existence of basic laws (positive attracts negative, etc.) how can one explain so much difference in the behavior of solids? What makes one solid, say, heat insulating or a heat conductor? The problem is tackled, for example, by Hubbard model (there are other, more sophisticated models), which considers a crystal where the Hamiltonian (roughly the total energy of a system) presents a kinetic term for the tunneling of electrons (fermions) across sites and a term for potential energy in on-site interaction. Particles are created or destructed in a site, and operators of creation and destruction describe the hopping from one site to another. The role the Moebius strip plays is to model this well.

What the authors do throughout the paper is to take this result from the theory of solids and electronic transport and to apply it to economics. They repeat the finished physical model's calculations by simply finding analogies with the economic model.

This exercise is obviously valid. However, how legitimate it is? Quantum mechanics is behind the theory of solids. The analogy is pushing too far because it implies an application of quantum mechanics to economics. The postulates of quantum mechanics only refer to general properties that nature's fundamental particles should follow. Physical states are described by normalized wave functions, observed physical variables are described Hermitian operators, the evolution of wave functions follows Schroedinger equation, etc. And as far as I understand it, complexity is tackled by non-equilibrium statistical mechanics, which is classical mechanics.

Nevertheless, I recommend acceptance after the authors consider the comments above. Though the work sounds a bit artificial to me, I am not sure another reader would consider it uninspiring.