

When is aggregation enough?  
The Master Equation and Projection for  
Heterogeneous Agent models with Aggregate Risk

PRELIMINARY – WORK IN PROGRESS

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**Abstract**

I propose a global approach to study heterogeneous agents (HA) models with aggregate risk. I build on the Master Equation representation, studied in the Mean Field Games literature, where the value function takes the infinite-dimensional distribution as a state variable. In that context, the projection of the distribution on a finite set of moments, as in Krusell and Smith (1998), provides analytical insights and yields finite-dimensional HJB and KFE that can be solved using standard numerical methods. I show how to preserve rational expectations to ensure that agents' forecasts are consistent with equilibrium dynamics. This method bypasses the constraints of perturbation methods, which rely on certainty equivalence, and other approaches used in the literature. I demonstrate the method's potential for studying aggregate uncertainty by applying it to the Krusell-Smith model, with substantial speed gains. I show how to implement the method using higher-order moments, investigate why this class of models exhibits “approximate aggregation”, and test the robustness of the bounded-rationality assumptions used in other methods. I also illustrate how the analysis extends to richer environments, like price-setting models or portfolio choice problems.

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\*Thomas Bourany, [tb3219@columbia.edu](mailto:tb3219@columbia.edu). I thank Pierre Cardaliaguet and Yves Achdou, who introduced me to Mean Field Games and the Master equation many years ago. All errors are mine