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**An equation of state for the financial markets: connecting order flow to price formation.** AUSTIN GERIG, University of Illinois at Urbana-Champaign, SZABOLCS MIKE, Budapest University of Technology and Economics, J. DOYNE FARMER, Santa Fe Institute — Many of the peculiarities of price formation in the financial marketplace can be understood as the result of a few regularities in the placement and removal of trading orders. Based on a large data set from the London Stock Exchange we show that the distribution of prices where people place orders to buy or sell follows a surprisingly simple functional form that depends on the current best prices. In addition, whether or not an order is to buy or sell is described by a long-memory process, and the cancellation of orders can be described by a few simple rules. When these results are combined, simply by following the rules of the continuous double auction, the resulting simulation model produces good predictions for the distribution of price changes and transaction costs without any adjustment of parameters. We use the model to empirically derive equations of state relating order flow and the statistical properties of prices. In contrast to previous conjectures, our results demonstrate that these distributions are not universal, but rather depend on parameters of individual markets. They also show that factors other than supply and demand play an important role in price formation.

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