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Distinguishing between 'Normal' and 'Extreme' Price Volatility in Food Security Assessment

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Volatile food prices are held to threaten food security worldwide, but controversy over how to distinguish between 'normal' and 'extreme' volatility compromises threat assessment and identification of countermeasures. Whether food-market dynamics normally stabilize or destabilize prices is the source of controversy. The conventional view is that market dynamics are inherently stable so that price volatility—arising from exogenous shocks—normally stabilizes due to forces of supply and demand. Extended food panics are improbable, reducing need for interventionist public policy. An emergent alternative view is that market dynamics are inherently unstable so that volatility persists endogenously. Interventionist public policy is needed to deal with chronic food panics.

Since neither view of 'normal' price volatility is a theoretical imperative, we propose an empirical scheme for diagnosing real-world market dynamics from observed price series data (Fig. 1). The scheme distinguishes between 'normal' and 'extreme' price volatility, tests whether normal volatility is generated by endogenous market dynamics, simulates these dynamics with a phenomenological (data-driven) market model, and models extreme volatility probabilistically. Armed with this information, policymakers can make an empirical determination of whether *laissez-faire* or interventionist policies are most promising in reducing price volatility in particular cases.

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We illustrate the proposed NLTS scheme to diagnose the market dynamics of volatile organic apple, pear and orange prices (Euros per kilogram, €/kg) recorded weekly at the Milano *Ipercoop*—an Italian retail grocery chain—over an eight-year interval (from 2003 to 2010, 421 weeks). The Italian organic fruit market is at a critical stage as it attempts to evolve from a niche market serving a limited group of consumers concerned with ethical, environmental and food safety issues to retail grocery chains offering the possibility of more widespread and secure distribution. We find compelling evidence of endogenous price volatility generated by low-dimensional nonlinear market dynamics.

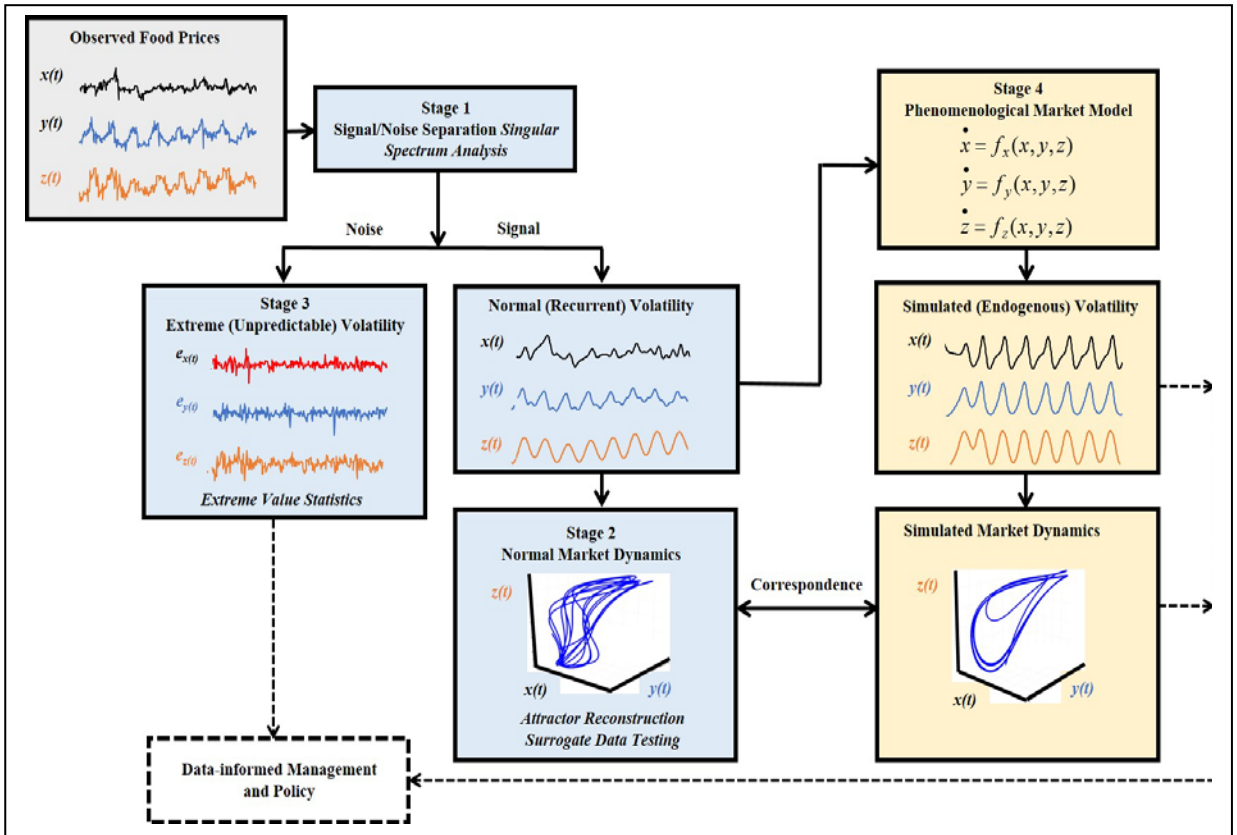

Fig. 1. Empirical scheme for distinguishing between 'normal' and 'extreme' price volatility. In Stage 1, signal processing separates observed price series into signal (normal volatility) and noise (extreme volatility). In Stage 2, normal volatility is tested for low-dimensional, nonlinear endogenous market dynamics. In Stage 3, detected endogenous volatility is simulated with a phenomenological market model to understand price interactions driving endogenous volatility. In Stage 4, extreme (unpredictable) volatility is analyzed with Extreme Value Statistics. Policymakers can use diagnosed information to make a data-informed choice of whether *laissez-faire* or interventionist policies will be most effective in reducing price volatility.

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