Thoughts on Financial Market Phase Transitions, Portfolio Risk Management, and Statistical Challenges

Blu Putnam, Chief Economist
Erik Norland, Senior Economist
Strategic Intelligence & Analytics, Strategy & Execution
October 2015
Investment advice is neither given nor intended

The research views expressed herein are those of the author and do not necessarily represent the views of CME Group or its affiliates.

All examples in this presentation are hypothetical interpretations of situations and are used for explanation purposes only.

This report and the information herein should not be considered investment advice or the results of actual market experience.
Futures trading is not suitable for all investors, and involves the risk of loss. Futures are a leveraged investment, and because only a percentage of a contract’s value is required to trade, it is possible to lose more than the amount of money deposited for a futures position. Therefore, traders should only use funds that they can afford to lose without affecting their lifestyles. And only a portion of those funds should be devoted to any one trade because they cannot expect to profit on every trade. All references to options refer to options on futures.

Swaps trading is not suitable for all investors, involves the risk of loss and should only be undertaken by investors who are ECPs within the meaning of section 1(a)12 of the Commodity Exchange Act. Swaps are a leveraged investment, and because only a percentage of a contract’s value is required to trade, it is possible to lose more than the amount of money deposited for a swaps position. Therefore, traders should only use funds that they can afford to lose without affecting their lifestyles. And only a portion of those funds should be devoted to any one trade because they cannot expect to profit on every trade.

Any research views expressed are those of the individual author and do not necessarily represent the views of the CME Group or its affiliates.

CME Group is a trademark of CME Group Inc. The Globe Logo, CME, Globex and Chicago Mercantile Exchange are trademarks of Chicago Mercantile Exchange Inc. CBOT and the Chicago Board of Trade are trademarks of the Board of Trade of the City of Chicago, Inc. NYMEX, New York Mercantile Exchange and ClearPort are registered trademarks of New York Mercantile Exchange, Inc. COMEX is a trademark of Commodity Exchange, Inc. KCBOT, KCBT and Kansas City Board of Trade are trademarks of The Board of Trade of Kansas City, Missouri, Inc. All other trademarks are the property of their respective owners.

The information within this presentation has been compiled by CME Group for general purposes only. CME Group assumes no responsibility for any errors or omissions. Additionally, all examples in this presentation are hypothetical situations, used for explanation purposes only, and should not be considered investment advice or the results of actual market experience. All matters pertaining to rules and specifications herein are made subject to and are superseded by official Exchange rules. Current rules should be consulted in all cases concerning contract specifications.

Copyright © 2015 CME Group. All rights reserved.
Challenges of Phase Transitions in Finance

When financial markets enter a phase transition both the volatility regime and the structure of correlations among security returns become decidedly less stable. Regardless of the fundamental cause of the phase transition, whether from a shift in government regulations or policy (i.e., Basel Accords on capital adequacy, Dodd–Frank Wall Street Reform and Consumer Protection Act, Federal Reserve’s Quantitative Easing), a change in technology (i.e., hydraulic fracturing, smart phones and social media), or demographic dynamics (i.e., retiring of the baby-boomer generation in the US, no labor force growth in Japan), the shift of an economic and financial system from one regime to another state exhibiting very different properties can make for very unusual effects, especially those that occur on the boundary between them.

In physics, a change from a solid to a liquid is a classic example, with seriously chaotic behavior at the boundary between two different states. We explore the statistical challenges faced by portfolio risk managers during phase transitions in economics and finance. Our approach is to use current real world examples as case studies to highlight the practical implications of using dynamic modeling and complex optimization approaches. Our case studies include the sharp diminution of the ability of major central banks to promote inflation and economic activity, and the economic growth challenges of major demographic trends.
Physics of Phase Transitions

In physics, a change from a solid to a liquid is a classic example of a phase transition. There is seriously chaotic behavior at the boundary between two different states.

Royalty Free Stock Images: Boiling water in an ovenproof dish
ID 32502199 © Roae | Dreamstime.com

Another example is the smooth or laminate flow of a liquid through a pipe, until at some point, due to pressure and/or velocity increases, the flow turns chaotic.
Five Major Phase Transitions Currently in Progress

- Slow labor force growth, baby-boomers retiring, millennials starting to dominate the work force.
- Limits on central bank influence over economy and inflation versus regulatory focus on diminishing systematic risks
- China decelerating, diminishing returns on infrastructure spending, rural-to-urban migration slowing, aging of population, continued export dependence
- Era of low commodity prices
- Weather: From El Nino to La Nina
US Personal Consumption (PCE) Inflation

Since 1994, Core PCE Inflation has been between 1.0% and 2.4%, averaging 1.7%, while general PCE Inflation has been between -1.0% and 4.0%, averaging 1.9%, using quarterly data.

Based on export and foreign reserve data, China's real GDP in 2016-2017 may decelerate into 5% - 6% range.
Source: National Oceanographic & Atmospheric Administration
www.ospo.noaa.gov/Products/ocean/sst/anomaly/
Statistical Challenges

- Volatility regimes and correlations are not stable at the boundaries of phase transitions.
- Classical constrained optimization often starts with a view (assumption) about the covariance matrix, which means it is uniquely incapable of analyzing phase transition problems.
- Quantum computing: Solving complex optimization problems by finding the lowest energy state (quantum annealing) does not require a view of the covariance.
- **Focus** should be as much on the **Path**, as on the future environmental state, and not on the past.
- **Phase transitions have no “normal”** and can last for a long length of time.
Thank you

www.CMEGroup.com/Putnam

CME Group