

Australian Centre for Financial Studies — Academic Research Grant Program 2017

Project title: Volatility connectedness between equity index sectors: Dynamics within the ASX

What are we doing in this project?

Our project will analyse ‘spillover’ effects between Australian Stock Exchange (ASX) industry sectors. The focus of our project will be on the extent of volatility spillover effects (also known as volatility connectedness) between ASX sub-sector indices. These ASX sub-sector indices are comprised of constituents of the S&P/ASX 200 index. In addition, while our focus will be on volatility spillovers, we will also examine the related issue of spillover effects between the returns of these ASX sub-sectors.

In our study we will be considering a number of dimensions of volatility connectedness. The first is directional network connectedness, which we will identify by separating the components of total spillover effects into those coming from (to) each ASX sub-sector to (from) all other sectors (including contagion effects). The second is net volatility spillovers from each market to all other markets, enabling us to determine whether an ASX sub-sector is a net receiver or transmitter of spillovers. Finally, we will create a visual analysis of the directional connectedness between the ASX sub-sectors by graphing its network topology.

Our project’s analysis will allow us to address a number of related research questions. What are the magnitude and direction of volatility spillovers between the ASX sub-sectors? Which ASX sub-sectors are the main transmitters of volatility? Which ASX sub-sectors are, on average, net transmitters of volatility to other sub-sectors? Which ASX sub-sectors are, on average, net receivers of volatility from other sub-sectors? How has volatility connectedness between the ASX sub-sectors evolved over time, especially before, during and after recent financial crises (i.e., over the pre-GFC, GFC through European Sovereign Debt Crisis, and ‘post-crisis’ periods)?

Why is this project relevant?

To the best of our knowledge, our study will be the first to examine directional network connectedness across equity sub-sectors within a single market, Australia, while accounting for recent financial crises. The results of our project will be of interest to academics, policy makers, and specific groups within the investment services industry (e.g., quant funds, asset consultants, and equity funds). This reflects a renewed academic, industry and policy maker interest in the issue of financial connectedness between different countries, markets, and assets, and its implications, including financial contagion. The renewed interest in this area is, in part, a result of the impact and ongoing effects of the most recent financial crises. Given our focus on ASX sub-sectors, our results will also be of interest to equity investment professionals with a focus on the Australian equities market.

From policy maker and academic perspectives, the measurement of connectedness provides important inputs and information for a range of activities. This includes deriving inputs for construction of “early warning” systems of upcoming crises, and providing evidence through which to track the progress of current crises (Diebold & Yilmaz, 2012). Understanding connectedness is essential for observing the transmission paths of volatility shocks across financial markets, and, therefore, also in visualising the network topology of market connectedness (Cimini, 2015; Liu et al., 2017).

From an investment perspective, connectedness is a crucial component in risk measurement and management, particularly for portfolio concentration risk (Diebold & Yilmaz, 2014). A better understanding of the sources of volatility at the sector level and volatility connectedness could, potentially, enhance quant funds' equity portfolio construction processes. This reflects that quant fund equity products typically have a focus on risk control, with these funds devoting significant resources and time to their portfolio construction process, notably constructing their variance-covariance matrix. For asset consultants, there are implications for the size of active bets that actively managed funds require to boost tracking error and support their active management fees. In recent years asset consultants have been challenged by a significant decline in tracking errors from their active funds, associated with a decline in market wide volatility. At the index level, this reflects a drop in single stock volatility and higher pairwise correlations. Our research will shed light on whether these effects are also present at the sector level. Finally, valuation theory suggests that low volatility can contribute to higher valuations, as it represents a proxy for the confidence intervals investors assign to expected cash flows. A better understanding of the transmission mechanisms of volatility across sectors may provide equity funds with insight into the sustainability of current valuations and so assist in market timing decisions.

How will we analyse connectedness?

Our primary methodology for this project is the spillover index framework of Diebold and Yilmaz (2012, 2014), which is based on the decomposition of the H -step-ahead forecast error variance derived from the moving average representation of a generalized vector autoregression (GVAR) model. The spillover index enables examination of total, directional and net-pairwise spillovers, and so will capture the path through which volatility is transmitted from each ASX sub-sector to all other sub-sectors (i.e., the pattern of volatility connectedness propagation). Its empirical validity has been widely accepted, as demonstrated through its recent application to the analysis of a diverse set of financial asset networks. This includes: commodity futures (Kang et al., 2017), currencies (Greenwood-Nimmo et al., 2016), equity indices (Kang & McIver, 2016), financial institution stocks (Diebold & Yilmaz, 2014, 2016), and sovereign bonds (Fernández-Rodríguez et al., 2016).

To better understand the dynamics of connectedness between ASX sub-sectors we will implement a number of strategies. The first will be to examine for robustness over the sample period, using the multivariate structural model of Qu and Perron (2007) to detect structural break points. Second will be to identify changes in the relative importance of ASX sub-sectors over time, including changes in net transmitter/receiver roles, by using a 200-day rolling window approach. Finally, following Diebold and Yilmaz (2014, 2016), the variance decomposition matrix based on estimated H -step-ahead forecast error variances will be interpreted as the adjacency matrix of a weighted directed network. This will then be used to develop a network topology of all market connectedness. The open-source Gephi software (<https://gephi.org>) will be used to visualize network graphs, allowing for a summary presentation of results in an easy to interpret graphical format.

Project data

We propose to use standard range-based volatility measures based on open, close, high and low data (Garman & Klass, 1980). This estimator has a number of useful properties, including unbiasedness in the continuous limit, being independent of non-zero drift, and incorporation of the impact of opening price jumps (Yang and Zhang, 2000). For this project, the spillover index framework will be applied across 11 major S&P/ASX 200 sub-sector indices. These are: A-REITs (XPJ),

Consumer Discretionary (XDJ), Consumer Staples (XSJ), Energy (XEJ), Financials (XFJ), Health Care (XHJ), Industrials (XNJ), Information Technology (XIJ), Materials (XMJ), Telecommunications Services (XTJ), and Utilities (XUJ). Daily index data will be derived from Thomson Reuters Datastream.

The project team

Our project team is comprised of Mr Salvatore (Sam) Ferraro (Evidente/RMIT University), Associate Professor Sang Hoon Kang (Pusan National University, Korea), Mr Ron McIver (University of South Australia—Project Leader), and Dr Lei Xu (University of South Australia). We bring a diverse set of academic, consulting and industry experience to the project, which we believe will enhance the relevance of our research to investment practitioners with an interest in, or focus on, Australian equity investments.

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