



# Returns and volatility spillover in the European banking industry during global financial crisis: Flight to perceived quality or contagion?<sup>☆</sup>



Taufiq Choudhry<sup>\*</sup>, Ranadeva Jayasekera

School of Management, University of Southampton, UK

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## ABSTRACT

This paper empirically investigates return, volatility and leverage spillover effects between banking industrial stock markets of the major economies (ME) (Germany, UK and US) and the smaller stressed European Union countries (SE), (Italy, Ireland, Greece, Spain and Portugal) from 2002 to 2014 which includes the global financial crisis period (2007–2014). Thus the paper investigates the influence of the global crisis on the spillover between the banking industrial stock markets of Europe and the US. We apply a multivariate GARCH–GJR framework to investigate the effects of the financial crisis with respect to spillover. Our results indicate an increase in both means and volatility spillover between the major economies and the stressed EU economies from the pre-crisis to the crisis period. During the pre-crisis period there is ample evidence of spillover from Germany, UK and the US to the smaller EU economies. Little evidence of a significant spillover from the smaller economies to the major economies is found during this period. We find that return and volatility transmission mechanisms between the major economies and the smaller EU countries are asymmetric during the crisis period. During the crisis, the level and amount of spillover from the major economies increase. But now there is also clear evidence of spillover from smaller EU economies to the major economies, this is especially true for Germany and the UK. Evidence of spillover effects suggests the existence of exploitable trading strategies and has important implications to investors in the areas of option pricing, portfolio optimization and risk management.

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## 1. Introduction

The 1997 “Asian flu,” the 1998 “Russian virus,” the 1994 Mexican “Tequila crisis,” and the 1987 US stock market crash are cases that substantiate the widely held view that dramatic price changes in one country can have a devastating impact on markets of very different sizes and structures across the world (Forbes, 2004; Masson, 1999). Most financial markets both in developing and developed countries have now liberalized capital movements, facilitated by advances in computer technology and information processing. Thus the isolation of domestic markets is reduced and made them more vulnerable to react promptly to news and shocks originating from the rest of the world causing the linkages between stock markets around the world to have grown stronger. Strong linkage reduces the insulation of domestic market from any global shock whereas weak market linkage offers potential gains from international diversifications. Increasing integration between different markets has led to information and sentiment spillover from one

market to another. Information transmission across markets might be through returns as well as through volatility. Lin, Engle, and Ito (1994) claim that volatility and returns of two equity markets may be related due to close trade and investment links, growing financial market integration, international asset-pricing models and market contagion. According to Hamao, Masulis, and Ng (1991), strong interdependence among financial markets could fundamentally alter investor perceptions concerning the importance of foreign financial news, thereby permanently increasing the correlation in stock returns and volatility across markets.

We investigate return, volatility and leverage spillover effects between banking industries of the major economies (ME) (Germany, UK and US) and the smaller stressed European Union countries (SE), (Italy, Ireland, Greece, Spain and Portugal) from 2002 to 2014 which includes the global financial crisis period (2007–2014). Thus, we investigate the effects of the crisis on the spillover effect between the European banking industries. We conduct a subperiod analysis of pre-crisis (2002–2007) and crisis period 2007–2014 in order to examine the particular patterns and changes in the returns and volatility spillover effects during the crisis period. We use banking industry stock indices and apply a multivariate GARCH–GJR framework to investigate the effects financial crisis with respect to volatility spillover in the banking industry. To our knowledge, no other paper investigates the effects

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<sup>\*</sup> Corresponding author at: School of Management, University of Southampton, Southampton SO17 1BJ, UK. Tel.: +44 2380599286.

E-mail address: t.choudhry@soton.ac.uk (T. Choudhry).

of the current financial crisis on the spillover effect among the European banking industry.

Transmission mechanisms between the returns and volatilities of the banking industry stocks are important for a number of reasons. Firstly, transmission mechanism yields insight about market efficiency. In an efficient market, and in the absence of time-varying risk premia, it should not be possible to forecast the returns of one stock using the lagged returns of another stock (Harris & Pisedtasalai, 2006). A spillover effect in returns implies the existence of an exploitable trading strategy and, if trading strategy profits exceed transaction costs, potentially represents evidence against market efficiency (Choudhry & Jayasekera, 2012). Secondly, transmission mechanisms may be useful for portfolio asset allocation due to its inherent implications of risk. Furthermore information about volatility spillover effects are useful for applications in finance, such as option pricing, portfolio optimization, value at risk and hedging as they rely on estimates of conditional volatility. Spillover analysis is also important for the identification of the factors underlying the transfer of national financial disturbances to other markets. Furthermore, the dynamics of international price movements is of interest to those who invest in securities, which can be traded across national exchanges. Electronic exchange systems have enabled investors to trade in assets from one exchange, outside of normal trading time, by trading on another exchange located in a different time zone (Abhyankar, 1995).

Pownall and Koedijk (1999) highlight the limitations of the traditional Value-at-Risk (VaR) methodology mandated by the world's banking regulatory authorities for use by banks and other financial institutions when the extent of downside risk is underestimated. They argue that today's VaR measures understate the true amount of economic capital required by banks to support their market risks since they generally do not recognize the severe departures from normality observed during periods of market turmoil and evidenced by recent global financial crises. Another implication of the presence of any spillover effects in the banking industry during the global financial crisis may imply frictions in policy coordination among the countries studied.

We investigate three specific effects associated with returns and volatility spillover in the banking sector during the crisis period. Firstly we investigate the presence of spillover effects of returns and volatilities during the crisis period between the banking industries of ME and SE. Secondly we investigate the nature of these spillover effects; in particular we study the direction of these effects and whether they exhibit asymmetry (i.e., leverage spillover<sup>1</sup>). Finally we study the dynamic correlation structure of the returns between ME and SE, and investigate whether we detect evidence of contagion or flight to/from perceived quality during the crisis period using the framework detailed below.

Much of the current debate on reforming the international financial architecture is aimed at reducing the risks of contagion—best defined as a significant increase in cross-market linkages after a shock to an individual country (or group of countries). Dornbusch, Park, and Claessens (2001) define market contagion as “the spread of market disturbances mostly on the downside—from one country to the other, a process observed through co-movements in exchange rates, stock prices, sovereign spreads and capital flows.”<sup>2</sup>

Our paper analyzes the existence of flight-to/from-perceived quality from the banking sector of the stressed EU economies to the major economies and contagion between the two economies/classes. Following the literature (Baur & Lucey, 2009), we define contagion as an

increase of the correlation coefficient in a crisis period compared to a benchmark period. Conceptually similar to Baur and Lucey (2009)<sup>3</sup> we conclude that flight-to-quality is present if correlations between ME and SE strongly decrease in falling stock markets since this constitutes a movement of the economies in opposite directions. A movement in the same direction characterized by strongly increasing correlations in falling stock markets implies contagion across the economies. Flight-to-quality from banking sectors of stressed EU economies to major economies is defined as a decrease in the correlation coefficient and simultaneously falling stock markets. Flight-from-quality from banking sectors of major economies to stressed EU economies is defined as a decrease in the correlation coefficient and simultaneously rising stock markets. This is where investors would move from ME to SE in pursuit of better gains in a rising market and thus constitute to a movement of economies in opposite directions, hence a weakening of correlations. Contagion and flight-to-quality are not exclusive effects with regard to these two economies. Following Baur and Fry (2005), we classify that positive contagion is an increase of the correlation caused by positive shocks and negative contagion is an increase of the correlation caused by negative shocks. We define the following framework and use it to analyze our findings (Table 1).

In a sense our approach is analogous to viewing the spillover effects between large stocks and small stocks,<sup>4</sup> but in this case the effects studied are between banking sectors of the major economies and the stressed European economies. Harris and Pisedtasalai (2006) state that the asymmetry in volatility spillovers between large and small stocks is consistent with a market in which the prices of large stocks respond to new information immediately, but the prices of small stocks respond with a lag. McQueen, Pinegar, and Thorley (1996), also confirm this view and show that small stocks display a delayed reaction compared to large stocks when news reaches the market. Analogously we test whether this effect is prevalent in ME and SE. In other words we test whether the banking stocks in SE exhibit a delayed reaction to shocks evidenced in the banking industry in ME.

## 2. Related literature

The volatility-spillover analysis was initiated by Engle, Ito, et al. (1990), and Engle, Ng, et al. (1990). Lin et al. (1994) investigate the volatility spillover between the US and Japanese stock markets. Bekaert and Harvey (1997), Ng (2000), Bekaert, Harvey, and Ng (2005) and Baele (2005a,b) investigate volatility-spillover effects on various equity markets using similar volatility-spillover models. They all find evidence of volatility-spillover effects. Bekaert and Harvey (1997) investigate the volatility of the emerging stock markets. They distinguish between global and local shocks. Ng (2000) finds evidence of volatility-spillover effects to various Pacific Basin stock markets from Japan (regional effects) and the US (global effects). Baele (2005a,b) investigates the volatility-spillover effects from the US (global effects) and aggregate European (regional effects) stock markets into various individual European stock markets. According to Bekiros (2014) there are only limited numbers of papers studying the spillover effect of the financial crisis. Angkinand, Sawanggoenyuang, and Wihlborg (2010) show increased interdependence between the US and many developed economies when the crisis emerged. Further Dufrenot, Mignon, and Péguin-Feissolle (2011) show increased volatility spillover from the US to the Latin American markets, especially to Mexico. Bekiros (2014) also show increased interdependence between the stock markets of the US, Europe and the Brazil, Russia, China and India. Dufrenot and

<sup>1</sup> The leverage effect is where positive or negative shocks induce an asymmetric change in the volatility. The negative shocks (bad news) cause a higher degree of volatility (Campbell & Hentschel, 1992; Engle, Ito, & Lin, 1990; Engle, Ng, & Rothschild, 1990). We investigate the spillover characteristics of the asymmetric nature of volatility under 'leverage spillover'.

<sup>2</sup> There is no generally agreed upon definition for contagion. For a discussion of alternative definitions as well as their strengths and weaknesses, see Forbes and Rigobon (2001) or the web site <http://worldbank.org/economicpolicy/managing%20volatility/contagion/DefinitionsOfContagion/definitionsOfContagion.html>.

<sup>3</sup> Although we follow the conceptual framework presented by Baur and Lucey (2009) in defining flight to/from quality and contagion, we do not follow their exact methodology in estimating the directional market movements and return correlations.

<sup>4</sup> See Lo and MacKinlay (1990), Boudoukh, Richardson, and Whitelaw (1994), Badrinath, Kale, and Noe (1995), McQueen et al. (1996) and Campbell, Lo, and MacKinlay (1997). Grinblatt, Titman, and Wermers (1995), Keim and Madhavan (1995).

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