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Regional spillovers across transitioning emerging and frontier equity markets: A multi-time scale wavelet analysis☆

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ABSTRACT

The episodic wave of crises experienced across the global financial markets over the past two decades has raised questions surrounding the vulnerability of transitioning emerging and frontier equity markets to exogenous shocks. These markets, by design, have lacked the institutional or financial architecture supporting their capital base compared to more established markets. We make the initial attempt to examine four such stock markets (Saudi Arabia, UAE, South Africa and Israel). We perform multi-timescale analysis using wavelet-based time and frequency decompositions in order to investigate (i) whether the shocks transmitted were pure contagion or fundamental-based and (ii) also whether the dynamic evolution of stock market integration was mainly short-term or long-term. We find that prior to the 2008/09 US subprime crisis, the shocks generated pure contagion in contrast to the subprime crisis that reveals evidence supportive of fundamental-based contagion. Further, when exploring the dynamics of market integration, we find that integration strengthens over time as opposed to any immediate short-term outcome. This supports policies engendered to promote stock market resiliency and stability.

1. Introduction

The shock transmission across countries during financial crises has been an issue of great interest and recently generated a heated policy debate among market participants, central bankers, and governments, as to whether financial shocks in one country can have rapid and large impacts on other countries. Recently, the remarkable US born sub-prime crisis of 2008-09 that considerably hit the markets all over the world has raised a critical question on the capacity of the global financial system to maintain its financial stability in a meaningful way. The major interest has been its amplification which started out in the floating-rate segment of the US sub-prime mortgage market. Even emerging markets were not spared, with an example of the global crisis impact on the Asian region,[1] which implies that the Asian region still absorbed indirect effects due to the deepening global financial integration (Zhang et al., 2010). The findings on this particular issue may indicate the impact on the policy makers as to whether they are better off in liberalizing their financial markets (Furman and Stiglitz, 1998; Radelet and Sachs, 1998), which is recognized as a source of financial sector development.

When we look at studies focusing on the Middle East region, Neaime (2012) has empirically highlighted the impact of the recent subprime crisis on the emerging MENA equity markets. He argues that the transmission of external shocks into MENA countries can be attributed to their higher overall trade openness and their mismanagement in terms of domestic financial and macroeconomic policies. In addition, Beirne et al. (2010) also argue that regional spillovers have dominated in Latin America and Middle East, while Asia is more exposed to global spillovers. Middle East as a region also represents some markets that represent frontier equity markets. In this study, frontier market refers to the emerging countries that over the last decade experienced a rapid growth with respect to financial market development within the region. The increasing volume, turnover, and market capitalization signal the growth in stock market development, which attract the interest of foreign investors. The significant growth in Middle East such as, Saudi Arabia and UAE has been strongly driven by

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[1] The credit spreads in Asia, with lower exposures to US sub-prime mortgages, noticeably increased along with those in the United States and Europe (Brana and Lahet, 2010). Valuation losses on CDS in Asia had soared mainly due to global and region-specific risk pricing factors as well as revisions to expected losses from defaults (Kim et al. (2010). The Asian interbank markets were also affected by the distress in the US dollar market (Yu and Fung, 2009)

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the rapid increase in oil price over the last ten years, altogether with the prominent accumulation of their respective sovereign wealth funds. On the other hand, African region has recently attracted foreign capital inflows due to its strong economic fundamentals, where South Africa has been considered as the leading emerging economy in this region.

These periods of financial volatility have sparked questions on both the nature of the transmission mechanism across markets, as well as whether the sources of such linkages were due to contagion effects or more fundamental underpinnings. Many prior studies attempted to explain the nature of transmission mechanism across borders during several major financial crises. Dornbusch et al. (2002) and Kaminsky and Reinhart (2000) mentioned the two distinctive characteristics between pure and fundamentals-based contagion. While the former is defined as an excessive transmission of shocks beyond any idiosyncratic disturbances and fundamental linkages (Forbes and Rigobon, 2002; Bae et al., 2003; Eichengreen et al., 1996), the latter is transmitted by way of financial market integration and trade linkages or interdependence (Calvo and Reinhart, 1996; N'Diaye et al., 2010; Zhang, 2008). The strong debate of empirical findings centres on the evidence of these two channels.

Given the presence of contagion effects in emerging countries, along with the different nature of their transmission channels, our study makes the initial attempt to address this issue in the context of equity markets in the Middle East and Africa, namely: Saudi Arabia, UAE, South Africa and Israel. There are three primary issues that this empirical study focuses on: (i) the first is to detect the evidence of contagion not only during the period of the recent subprime crisis but also during the earlier major crises. The finding may demonstrate how the impact of one crisis differs from that of the other crises. (ii) the second is to identify whether each crisis reveals the evidence of fundamental-based or pure contagion. We further examine the lead-lag relationship in order to capture the dynamics of transmission. (iii) the third is to investigate the evolution of short-run and long-run integration since well-integrated equity markets tend to have a higher exposure to external shocks. The length of daily observations extend over eighteen years starting from the year 1994 to 2010.

As to the methodology, we examine co-movement and lead-lag relationship amongst the equity indices. There are two main reasons of using co-movement to address our research objectives. Firstly, many prior studies identified the evidence of contagion by observing the changing correlations across different markets during crises periods (Candelon et al., 2008; Chakrabarti and Roll, 2002; and so on). Secondly, the phases of financial integration also can be reflected through the increased cross-country correlations (Goetzmann et al., 2002; Bekaert et al., 2005; Bekaert and Harvey, 1995; Baele, 2005; and so on).

While there is a variety of established literature on discovering the contagion and market integration evidence in both developed and emerging markets, our study is different from most of the prior studies in that we emphasize the use of multi-scale analysis with frequency decomposition on asset co-movement among the selected frontier markets. Firstly, Forbes and Rigobon (2002) pointed out that previous studies did not correct the correlation measure for heteroscedasticity so that the testing of contagion would become biased. The standard time-domain instruments, using econometric techniques, have major difficulty in distinguishing fundamentals-based contagion from other shock transmissions (Corsetti et al., 2005; Bartram and Wang, 2005; Pesaran and Pick, 2007). This is due in part to the problematic task of obtaining good proxies of the influence that comes from macroeconomic fundamentals. The alternative solution to overcome the above issue regarding distinguishing between pure contagion and fundamental-based contagion is through associating the two with the nature of short-run and long-run co-movement. In that case, we follow Bodart and Candelon (2009) and Orlov (2009) who have proposed an alternative method to examine contagion by associating high and low frequencies with contagion and interdependence, respectively. In our study, we perform multi-timescale analysis using wavelet decompositions as one of the latest techniques in finance to decompose any observed variable on scale-by-scale basis. The decomposition may capture both time series and frequency domain simultaneously. This may provide an ability to distinguish between higher frequencies and lower frequencies. The concept is similar to the prior studies by Bodart and Candelon (2009) and Orlov (2009) that examined contagion by associating high and low frequencies with contagion and interdependence respectively. In addition, to observe the phases of stock market integration, our study uses wavelet coherence with a rolling-window in the multi-horizon nature to evaluate the changing co-movement across the different equity markets.

Regarding the findings, our study discovers that prior to the 2008/09 subprime crisis, contagion effects generated short-term shocks. This finding has been substantiated by another empirical result that shows short-term volatility shocks temporarily amongst different stock markets, signalling a short-run high volatility regime due to extreme price swings during turmoil. In terms of the degree of vulnerabilities to volatility shocks, we find that stock markets in Middle East are mostly exposed to the US-born subprime crisis, whereas South Africa is mostly affected by the crises before 2007. The US subprime crisis, however, reveals evidence supportive of fundamental-based contagion. Results also highlight the vulnerabilities of fundamental contagion to long-term integration. Specifically, we examine the dynamics of weak short-term market integration amongst the equity markets considered, in conjunction with a stronger long-term integration recently.

The paper is organized as follows. Section 2 presents some literature reviews associated with the issue of financial contagion and integration. Section 3 introduces wavelet decomposition analysis of continuous wavelet transform. Section 4 presents and discusses the empirical results. Section 5 provides some overarching interpretations, conclusions and policy implications.

2. Literature review

Our literature review is structured as follows. The first is to present the theoretical underpinnings on financial contagion and interdependence. The second is to show some empirical findings of contagion effects in emerging equity markets. The third is to present some established methods of measuring contagion.

2.1. Pure contagion

Dornbusch et al. (2002) and Kaminsky and Reinhart (2000) have mentioned the two distinctive characteristics between "fundamental-based" and "pure" contagion.

The pure contagion is defined as an excessive transmission of shocks from the crash in origin country into others beyond any idiosyncratic disturbances and fundamental linkages. The implication is that during the crisis, the correlation between the two markets significantly increase in the short run without the support of changes in correlation in the long-term (Forbes and Rigobon, 2002; Bae et al., 2003; Eichengreen et al., 1996). In this case, the trend component of the two markets are not affected. This is explained by the sentiment shift of investors, unrelated to economic fundamentals (Kumar and Persaud, 2002), may lead to a general reversal of funds and eventually trigger financial crises (Forbes and Rigobon, 2002; Kleimeier and Sander, 2003). The role of herd behaviour may burst asset bubbles created by self-fulfilling expectations, moral hazard, either implied or explicit (Krugman, 1998). There are mainly three mechanisms of shocks transmission. The first is the transmission of information from markets with more rapid price discovery, where the effect of news may spread investors' sentiment across borders (Kaminsky and Schmukler, 1999). Secondly, negative returns in one market may increase the risk premium in other markets, resulting in simultaneous drop of assets prices (Vayanos, 2004; Longstaff, 2010). Thirdly, liquidity shock across