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行政院國家科學委員會專題研究計畫成果報告

亞洲金融危機對金融市場波動性之傳染效果

The Contagious Effect of Asian Financial Crisis on Financial Market Volatility

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一、中文摘要

本研究分析亞洲金融風暴期間亞洲及美國金融市場之波動度傳染性效果。所採用之分析主要以整合國際貿易及外匯及金融市場活動之架構來探討其相關影響。本研究分析東亞國家及美國之外貿關係並評估其外貿對經濟成長與進出口之回饋效果；藉由國際貿易之基本面因素來探討這些國家金融市場之風險與報酬，及外匯匯率變動性的關係。此研究架構可允許吾人來檢驗匯率、外貿及股市績效之間的動態關係。此模型亦可用來預測一經濟體的金融風暴對其他在亞太各國及美國市場的外溢效果。本研究實證分析發現顯著的貿易關聯程度為波動度之外溢效果之重要因素。以台灣為例，波動度之外溢效果受香港、日本及美國股市波動度影響較大。本研究亦發現亞太金融風暴期間，亞洲股市的不穩定對美國股市波動度具傳染性效果。而重要之亞太股市與美國之相關性與市場波動度成正比，即股市波動度愈大，二國股市之相關性愈大，股市報酬跌幅愈大時，股市波動度愈大。

Abstract

In this study we examine the contagious effect of Asian financial crisis on the financial markets in the East Asian region and the U.S. The analysis is pursued from a broad perspective of an international trade environment integrated with foreign exchange and financial market activities. We first analyze the trade relationships between the East Asian region and the U.S., and assess the feedback effect of foreign

trades on economic growth and export-import of each individual economy. We then link the financial market performance of these countries to the international trade fundamental and the foreign exchange rate movement. This integrated framework enables us to detect the dynamic relationship between international trades, foreign exchange and stock market performance. The model is also used to estimate the spillover effect of the financial crisis in one economy on the rest of the countries in the East Asian region and the U.S. More specifically, we can estimate the spillover effect of the problems in other Asian economies on Taiwan's economy and financial markets. The findings demonstrate that contagious effect in volatility occurs due to significant international trade relationship. For example, volatility in Taiwan stock market is more related to the stock markets of Taiwan's trade counterpart countries, i.e., US, HK, and Japan. Besides, the results show that volatility and correlation of stock markets tend to increase as market become bearish. This result is useful for international diversification. Because correlations in stock markets are not stable over time and correlations are higher during market recession period, diversification benefits tend to decrease as market crash happens.

二、緣由與目的

The issue of international market integration has recently received considerable attention from economic researchers (see for example, Hamao,

Masulis and Ng, 1990; Lin, Engle and Ito, 1994; Bae and Karolyi, 1994; Susmel and Engle, 1994; Koutmos and Booth, 1995; Tse, 1998; Wu and Su, 1998). Most of the previous studies have shown that information in one market can be transmitted to another rapidly. The more integrated and deregulated the markets are, the higher speed is the information transmission between financial markets. The effect of an economic or financial event can be transmitted to other countries in a rather short period of time. Recent financial crisis in Pacific Rim Asia has witnessed how fast economic problems in one region can spread to others.

Several factors may have contributed to the speed of Asian contagious effects. First, the worldwide economy has experienced a boom in international trade and investment. As these relations improve, domestic markets should be more closely linked to foreign markets. Second, there is a trend toward deregulation and liberalization in all of the world's economies, particularly prevalent in recent years in transition and less developed countries. Deregulation and liberalization seem to enlarge the magnitude of international capital flows and enhance the investment relations between countries. Advanced telecommunication technology has made information in one market almost instantaneously available to other markets. This has directly increased the extent of information integration between the world's financial markets and indirectly helped spread the economic effect on one economy to another.

This research examines contagious effects on the financial markets in East Asia and the U.S. Unlike previous studies, this study focuses on the trade relation as a plausible explanation for the widespread financial crisis in this region. We first look into trade relations between the East Asian region and the U.S. and assess the chain effect of foreign trade on economic growth of Taiwan and her neighbor economies. We then link the performance of each major financial market to international trade fundamental and foreign exchange rate movement. This approach traces the interrelation between product and financial

markets to detect the sources of return and volatility spillovers in financial markets. The model will also permit an interaction between stock and foreign exchange markets to ascertain whether stock market performance is affected by foreign exchange rate movement.

This chain effect will persistent and income continues to shrink for all trading partners until a new equilibrium is achieved. How much the regional income will decline depends on three major factors: (a) the size of the negative shock; (b) the import-export relation between countries; and (c) the size of the originating country's economy. In general, the net effect on the income of the entire region will be larger, the larger the size of external shocks and the economy that was hit, and the more reliance of that region on foreign trades.

We next examine the interaction between international financial markets. Financial markets reflect the outlook for the future economic performance. When a country is perceived to have a recession or income drop, its stock price will go down and currency will depreciate. How much the stock price and currency value will fall depends on the impact of negative external shocks on its economy, which in turn depends on the three factors indicated above. However, to translate the impacts of external shocks on foreign trades and then national income directly into stock returns is not a simple task. Not only must we specify a complete reduced-form model of income determination including all interdependent countries but also need to establish a clear linkage between stock market valuation and national income. Nevertheless, the analysis above suggests that in general the stock market performance of a country will be affected more strongly by those countries that have a closer trade relationship with it. Since the stock market reflects all past and future economic conditions, whatever happens to foreign trades and the economy will be impounded into stock price. Thus, we can examine the performance of financial markets to draw implications for foreign trade repercussions.

Relations among international stock markets can be cast in either return or volatility regressions:

$$R_{it} = a_0 + a_1 R_{it-1} + a_2 FX_{it} + \sum_{\substack{j=1 \\ j \neq i}}^N a_{ij} R_{jt} + \varepsilon_{it}$$

$$R_{it}^2 = b_0 + b_1 R_{it}^2 + b_2 FX_{it}^2 + \sum_{\substack{j=1 \\ j \neq i}}^N b_{ij} R_{jt}^2 + v_{it}$$

In the return regression domestic stock returns are regressed against own lagged returns, foreign exchange returns (FX) and foreign stock market returns. Foreign exchange returns are positive (negative) when the home currency is depreciated (appreciated) as the exchange rate is expressed in terms of domestic currency per unit of U.S. dollar. Foreign stock return variables include only market returns of those countries that have close trade relation with the home country. The only difference is that squared returns are used instead of raw returns.

Both return and volatility regressions can be extended to test the difference in coefficients before and after the blowout of Asian financial crisis. More specifically, we can estimate the following return and volatility regressions including time dummies. Significance of the dummy variable coefficient will indicate a structure shift in the empirical relationship.

The volatility spillover effect can be estimated by including lagged foreign exchange and stock returns instead of concurrent returns. We can also examine the return and volatility spillovers simultaneously using the GARCH model (Bollerslev, 1986). Based on GARCH estimation, we can assess the speed of information transmission and the magnitude of external shock effects.

We also examine the contagious effects in volatility using the integrated volatility approach of Andersen, Bollerslev, Diebold, and Labys (1999). The NYSE TAQ database is applied to examine the contagious effects in volatility. Following Andersen, Bollerslev, Diebold and Labys (1999), we use high-frequency intraday returns to construct daily volatility measures that are subject to

little error and allowing us to treat volatility as observed instead of latent.

$$y_t = m + A_1 y_{t-1} + \dots + A_p y_{t-p} + \varepsilon_t,$$

where y_t corresponds to the vector $[\sigma_{1t} \dots \sigma_{kt}, r_{1t} \dots r_{kt}]'$, volatility and returns in k stock markets and $A_1 \dots A_p$ are the matrix of coefficients. We use the TAQ database as the empirical database to examine the effects of return, correlation and market volatility. Using country fund data of Taiwan, Korea and U.S., we examine the hypothesis that volatility and correlation of stock markets tend to increase as market become bearish.

三、結果與討論

We test the empirical hypotheses implied by the proposed model using stock and foreign exchange market data. The results find that trade interdependence is the driving force for contagious effects of Asian financial crisis. The more dependence of an economy on foreign trades, the contagious effect is stronger and its spread is much faster. Empirical tests are conducted using daily and intraday data to capture dynamic relations between markets. The empirical results suggest that in general the stock market performance of a country will be affected more strongly by those countries that have a closer trade relationship with it.

The results provide useful information for designing optimal economic and financial policies. First, the analysis of chain effects of Asian crisis will allow us to assess the impact of other economies on Taiwan's economy through the international trade relationship. Based on this assessment, we can design suitable economic policies and strategies to estimate potential effects of foreign crisis and to mitigate its effects. Second, the finding of the interaction between stock and foreign exchange markets will enhance our understanding about the interrelationship between these two markets. This in turn will help us design appropriate foreign exchange rate policies to improve performance and reduce excessive volatility in Taiwan's financial markets. Third, the empirical result of return and volatility spillovers will offer crucial information about the speed of information transmission and the efficiency of financial markets in Taiwan and

her neighboring countries. This result will not only reveal the dynamic relation between Taiwan and other markets but also allow us to predict the short-term impacts of events in the domestic as well as foreign markets. To the extent that these short-term impacts are likely resulting from foreign trade repercussion, proper macroeconomic policies can be developed to reduce foreign impacts on economic growth of Taiwan, and to maintain stability and prosperity in her financial markets.

Using the data of country fund of Taiwan, Korea and SPDR provided in the TAQ, our empirical results show that there are significant relationship in of return, correlation and market volatility. The results demonstrate that volatility and correlation of stock markets tend to increase as stock market returns decrease. This effects are particular significant if the returns in emerging markets decrease a lot. Hence, these results are useful for international diversification, because the results show that the diversification benefit of international stock markets tend to decrease during the financial crisis period.

四. 成果自評

The findings in this research have contributed to the evidence that contagious effect in volatility occurs due to significant international trade relationship. We find that trade interdependence is the driving force for contagious effects of Asian financial crisis. The empirical analysis in this research suggests that in general the stock market performance of a country will be affected more strongly by those countries that have a closer trade relationship with it.

Besides, the results show that volatility and correlation of stock markets tend to increase as market become bearish. This result is useful for international diversification. Because correlations in stock markets are not stable over time and correlations are higher during market recession period, diversification benefits tend to decrease as market crash happens. The research results are currently writing as an academic paper and planning to submit it to academic journal. Research assistant's

programming ability in MATLAB and GAUSS are enhanced. The application ability of the research group in using the NYSE-TAQ database has improved.

五. 參考文獻

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