

THE IMPACT OF CRISES ON THE RELATIONSHIP BETWEEN STOCK MARKET DEVELOPMENT AND MACROECONOMIC VARIABLES: EVIDENCE FROM HONG KONG AND SINGAPORE

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ABSTRACT

Dynamic linkages between macroeconomic factors and stock market developments in the economies of Hong Kong and Singapore are the subject of investigation in this paper. These city-states belong to the world's most globalised economies and are two of the world's four largest financial centres. In the crisis years, both these countries experienced a decline in GDP, faced the threat of deflation, and their foreign trade turnover decreased. The crisis also affected the financial sector. This paper aims to ascertain the impact of structural economic changes, namely the financial crisis, on the prosperity of these advanced economies. The basic characteristics of determinants of economic development and the analysis of the mutual relationships of selected macroeconomic indicators with the financial markets serve to meet the aim of this paper. The macroeconomic variables used in most research are GDP, the interest rate, the inflation rate, money supply and the unemployment rate. To test the dependence of these indicators, a regression model was constructed, and the period from 2005 to 2016 was chosen for observation. From the linear regression equation, it is obvious that the unemployment rate, the exchange rate and the interest rate have a prevailing negative effect on equity returns, in contrast to money supply, which has a prevailing positive effect. The Chow test confirms that the global financial crisis at the end of 2008 had a negative impact on the predictive ability of the chosen linear regression analysis in the long-term time horizon in both countries.

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KEY WORDS

Hong Kong, macroeconomic variables, regression model, Singapore, stock market.

Introduction

This paper investigates dynamic linkages between macroeconomic factors and stock market development in the economies of Hong Kong and Singapore. The city-states Hong Kong and Singapore are advanced

and powerful countries, and their economies are intertwined and based on similar principles. The export-oriented policy, introduced in the 1960s, transformed the former British colonies from developing

countries into Newly Industrialised Economies (Asian Tigers) and into high-income and advanced economies (IMF, 2017). Both of them belong to the world's most globalised economies and they are among the world's four largest financial centres, together with New York and London.

The financial crisis of 2007-2008 brought the global economic system to the brink of collapse. Whilst previous crises had always hit only specific regions or economic segments (such as the monetary crisis in Japan in 1990 or the Asian financial crisis in 1997), the most recent crisis affected the entire global economy. Although these countries ended their fixation on the US dollar, the US economy continued to have an impact on their economic prosperity, especially on the financial markets, which was reflected in the financial crisis in 2007-2008. Currently, it is widely recognised that a well-functioning financial system is crucial to economic growth. An efficient financial system increases financial savings and the investment allocation range and reduces asymmetric information or transaction costs (Khan et al., 2020). The financial markets develop because of the overall macroeconomic development. According to Garcia and Liu (1999), a continual monetary expansion that stimulates economic growth requires more financial services; consequently, the financial system adapts to the financing needs of the all sectors and aligns with its autonomous development.

The aim of this paper, which is closely related to the motivation for writing it, is to discern the impact of the financial crisis on the prosperity of the advanced economies of Singapore and Hong Kong. Prosperity is understood in this paper in terms of GDP growth, low unemployment and inflation rates. The basic characteristics of determinants of economic development and the analysis of the mutual relationships of selected macroeconomic indicators with the

financial markets serve to meet the aim of this paper. The macroeconomic variables used in most research are GDP, the interest rate, the inflation rate, money supply and the unemployment rate. Our paper analyses the impact of the abovementioned indicators including the financial indicators, namely the exchange rate and fixed deposits.

The motivation for writing this paper is that the financial sector in these city-states deserves additional study. Recent years have been marked by the recovery of the global economy from the impact of the financial crises and the subsequent debt crises. In this context, it is important to determine the impact of these crises on financial companies in Hong Kong and Singapore and other economic impacts they had on the national economies. To that end, we would like to draw your attention to an interesting statement by Musa et al. (2020) that Islamic financial institutions are more resistant to the crisis than other banks.

The remainder of this paper is organised as follows. The relevant literature is reviewed in the second section. The data and methodology used in this paper are introduced in the third section. The results of the empirical estimation and discussion are reported in the fourth section. Finally, the conclusion and summary of the main findings are in the last section.

1. Literature review

The impact of macroeconomic indicators on the movement of share yields has been and continues to be analysed by many authors. Firstly, the work of certain researchers has been aimed at a larger group of countries; secondly, there are many pieces of research focusing on this topic in individual advanced countries; thirdly, even among developing countries, many types of research can be found. Additionally, such research is very often done

in emerging economies; and last but not least, the studies are focused on the examined countries, namely Hong Kong and

Singapore. An overview of the analysed groups and research findings is given in Table 1.

Table 1. Macroeconomic variables and stock market (prices) in research

Group of (Mixed) Countries		
Author/s	Countries	Findings
Garcia and Liu, 1999	Argentina, Brazil, Chile, Colombia, Mexico, Peru, Venezuela, Indonesia, Korea, Malaysia, the Philippines, Taiwan, Thailand, Japan, US	Real income, savings rate, financial intermediary development and stock market liquidity influence stock market development
Anari and Kolari, 2001	Canada, France, Germany, Japan, UK, US	The initial negative response of stock prices to a shock in goods prices turns positive over longer horizons
Altay, 2003	Germany and Turkey	The interest and inflation rates had significant results in Germany but insignificant results in Turkey
Diebold and Yilmaz, 2008	43 American, African, Asian and EU countries	A positive link between macroeconomic fundamentals (except GDP per capita) and stock market volatilities
Gay, 2008	Brazil, India, Russia, China	No relationship among stock indexes, exchange rates and oil prices
Su et al., 2012	Malaysia, Thailand, Hong Kong and Singapore	The unemployment rate, CPI and interest rates had a significant impact on movements of stock prices
I. Advanced Countries		
Author/s	Country	Findings
Hondroyannis and Papapetrou, 2001	Greece	Macroeconomic variables could (partially) explain the volatility of the stock market, but not vice versa
Morelli, 2002	UK	Macroeconomic variables did not explain the stock market volatility
Czaja and Scholz (2006)	Germany	The results showed that interest rates explain the sensitivity of stock return
Beltratti and Morana, 2006	USA	The causality direction of the stock market to macroeconomic variables was stronger than vice versa
Büyüksalvarcı, 2010	Turkey	The interest rate, production index, oil price, and the exchange rate had negative influences on returns, but a positive effect on money supply, and no influence on the stock exchange
Beetsma and Giuliodori, 2012	USA	The influence of macroeconomic variables on the stock market became smaller over time
II. Developing Countries		
Author/s	Country	Findings
Adam and George, 2008	Ghana	A long-run relationship between variables and the stock index existed
Fedorova and Pankratov, 2010	Russia	The stock market was strongly influenced by the oil price and the US Dollar exchange rate
Sabetfar et al., 2011	Iran	The macro variables affected the stock returns, but the significance of factors did not exist over time
Okoli, 2012	Nigeria	The results showed that only exchange rate variables have an influence on stock market volatility
Momani and Alsharari, 2012	Pakistan	The gross domestic product and exchange rate positively affect stock prices, but money supply, oil prices and FDI do not affect them
Özlen and Ergun, 2012	Bosnia and Herzegovina	The interest rate and the exchange rate were significant factors in stock price fluctuations and stock returns were sensitive to changes in stock prices
Chang and Rajput, 2018	Pakistan	Positive and negative shocks in macroeconomic variables do not affect stock prices in the same way

Amassoma and Ogbuagu, 2018	Nigeria	Very little correlation between crude oil price and stock indices; causality relation running from crude oil price and real rate of exchange to stock indices
Mesagan et al., 2019	Ghana	The existence of a long-term relationship between both short- and long-term financial market indicators and economic growth
III. Emerging Countries		
Author/s	Country	Findings
Adrangi et al., 1999	Korea	A negative relationship between real stock return and inflation
Puah and Jayaraman, 2007	Malaysia	All variables have a relationship and stock prices are co-integrated with macroeconomic variables
Liu and Shrestha, 2008	China	Long-term relations among stock prices and macro-factors
Singh et al., 2011	Taiwan	The exchange rate, GDP and inflation were the significant factors, whereas employment rate and money supply were insignificant
Kumari and Mahakud, 2014	India	Relationships among output, exchange rate, short- and long-term interest rates, money supply, inflation and stock market indices
IV. Hong Kong and Singapore		
Author/s	Countries	Findings
Maysami and Koh, 2000	Singapore	The stock market was sensitive to inflation, money supply growth, the interest rate and the exchange rate
Maysami and Sim, 2002	Hong Kong and Singapore	Relationship between macroeconomic variables and stock returns
Maysami et al., 2004	Singapore	The stock market had a relationship with changes in the short and long-term interest rates, industrial production, price levels, the exchange rate and money supply
Wong et al., 2005	Singapore and US	Long- and short-term equilibrium relationships between the stock indices and money supply and interest rate

Source: Own elaboration.

As no study related to this issue in the monitored countries in the last five years has been found, this paper fills the gap using the linear regression model and investigates the relationship among macroeconomic variables and the stock market. Our assumptions do not differ from the assumptions made by the abovementioned authors - we believe that the relationship between macroeconomic indicators and the stock market was very close in the monitored countries, especially in times of financial crises.

2. Methodology

Both economies are highly export-oriented; the average growth rate of high-tech exports was 17% for Hong Kong and 16% for Singapore before the monitored period (from 1980 to 2005) (Ocampo and

Parra, 2006). Despite the ongoing Asian financial crisis in the late 1990s, Singapore showed an average annual GDP growth rate of 6.7% over the period, while Hong Kong recorded a smaller growth rate of 5.6%. The slowdown was caused not only by the aforementioned financial crisis but also by the negative expectations of economic subjects associated with the transition under the Chinese administration. This led to a decline in GDP growth rates (on average to 4%) as well as to a decrease in investment capital, a fall in the Hong Kong dollar and the mass emigration of wealthy and educated people (Krieger, 2001).

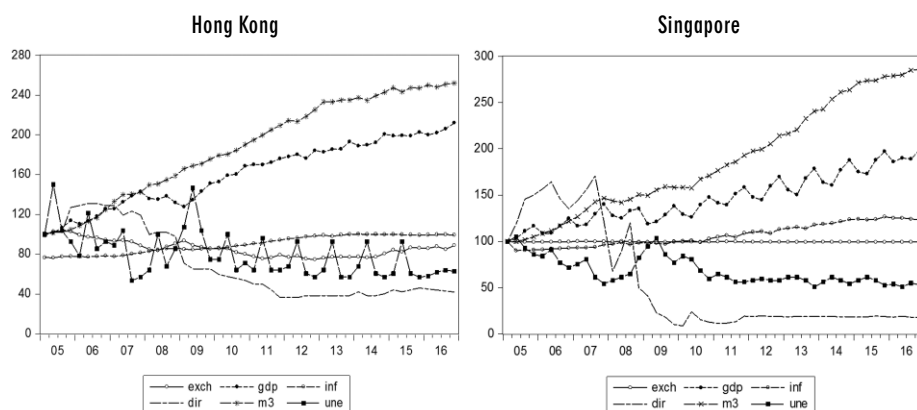
2.1. Data and samples

Due to historical development, previous studies and a lack of research in recent years, we focus our research on mutual

relationships between the development of the stock market and macroeconomic variables. Macroeconomic variables, namely gross domestic product expressed in current market prices, in millions of national currencies (gdp); inflation measured by year-on-year change in consumer prices (inf); percentage of total unemployment,

unemployment rate (une), and stock market variables, namely money supply expressed in M3 in millions of national currencies (m3); the exchange rate of the national currency against the USD (exch) and fixed deposit 6-month interest rate, expressed as a percentage (dir), were used for our paper.

Figure 1. Development of macroeconomic variables in Hong Kong and Singapore (percentage change)



Source: Own elaboration.

All macroeconomic indicators, as well as stock prices, are explored on a quarterly basis with the values at the end of this period, and they come from the national statistical offices of Hong Kong and Singapore respectively. The observed period was chosen from the end of the first quarter of 2005 to the last quarter of 2016 (see Figure 1). The number of observations is 48 within one relationship or one variable. The statistical and econometric program Eviews was used for a global fundamental analysis of selected indicators.

The development of the individual macroeconomic indicators of the two observed countries is different and does not provide a universal conclusion. The financial crisis was mostly affected by changes in unemployment and interest rates in the second and third quarters of 2008. The sustained weakness in inbound tourism

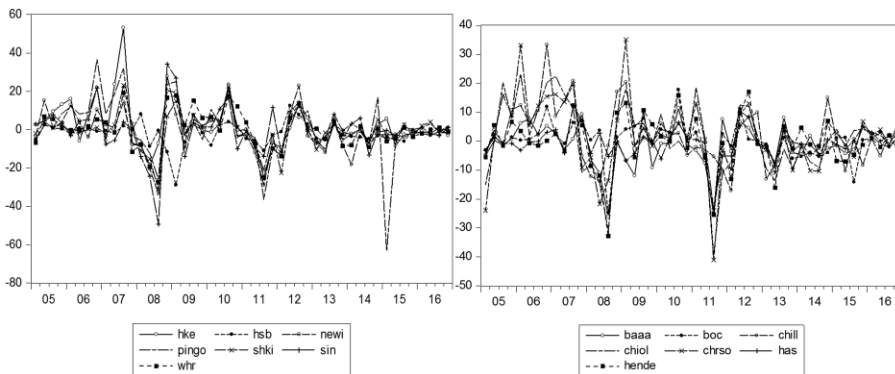
and the slackened growth momentum of local consumption had an increasingly apparent impact on the labour market (ADB, 2017). Inflation rate and exchange rate experienced almost constant development over the monitored period, without major fluctuations. The gross domestic product indicator and the money supply indicator have had a tendency to grow in the after-crisis period.

Hang Seng's main index of Hong Kong stock exchanges includes a total of 50 joint-stock companies, 14 of which meet the conditions for financial market activity and availability of data since 2005. The development of equity returns is captured in Figure 2:

- Banking and financial services companies: The Bank of East Asia (BAA), BOC Hong Kong Holdings (BOOC), and Hang Seng Bank (HASE), HS-

- BC's international banking institution (HSBC)
- Life insurance companies: China Life Insurance Company (CHL) and Ping AN Insurance Company of China (PING)
 - Investment enterprises: China Overseas Land and Investment (CHO),
- China Resources Land (CHRS) and The Wharf Holdings (WHRF), Henderson Land Development Company (HEND), Hong Kong Exchanges and Clearing (HKEX), New World Development Company (NEW), Sun Hung Kai Properties (SHK) and SIN Land Company (SIN).

Figure 2. Development of equity returns of stock companies in the Hang Seng index



Source: Own elaboration.

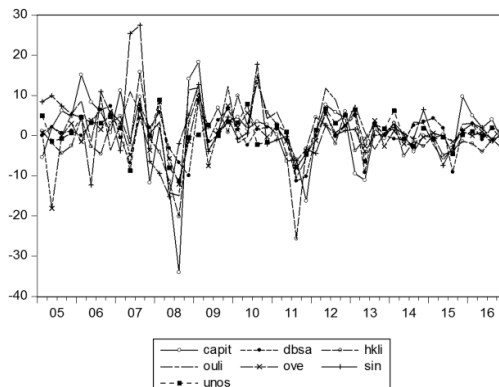
The main index of the Straits Times, the Singapore Stock Exchange, includes a total of 30 stock titles by companies, seven of which meet the conditions of the financial sector and the availability of data since the beginning of 2005:

- Companies providing banking and financial services: DBS Group Holdings (DBS), United Overseas Bank

(UNO) and Singapore Exchange (SINE)

- Investment enterprises: CapitaLand (CAP), Hong Kong Land Holdings (HKL) and UOL Group (UOL)
- International banking institution: Oversea-Chinese Banking Corporation (OVE).

Figure 3. Development of equity returns of stock companies in the Straits Times index



Source: Own elaboration.

2.2. Methods

An important element of the basic characteristics of selected shares is the Capital Asset Pricing Model (CAPM), a special case of the Markowitz Portfolio Model, in which just one asset in the portfolio has zero risk and a positive return. Modern portfolio theory presents the concept of risk diversification. For instance, Karkowska and Kravchuk (2019) claimed that the problem of systemic risk on global stock exchanges is growing despite numerous prudential regulations. In line with studies by Markowitz (1952) and Sharpe (1964), we will use the following equation (1) for calculating the security market line (hereinafter SML) for Hong Kong and Singapore shares:

$$E(r_i) = r_f + [E(r_m) - r_f] * \beta_i \quad (1)$$

where $E(r_i)$ means the expected rate of return of stock, r_f is the risk-free rate of return, $E(r_m)$ is the expected market return and β_i represents the systematic risk of the asset.

According to Brooks (2002), the regression model attempts to find the ideal mathematical function to best express the character of dependence and to show the course of changes of conditioned averages of the dependent variable as closely as possible. General tendencies in changes in the explained variables regarding the changes in explanatory variables are studied. When the regression model is constructed, the smallest squares method is used to minimise the sum of the deviations of the actual data values from the theoretical ones, as seen in equation (2):

$$Y_t = \beta_0 + \beta_1 X_{t1} + \beta_2 X_{t2} + \dots + \beta_k X_{tk} + \varepsilon_t \quad (2)$$

where the values of the character Y_t are dependent variables (equity returns) at time t , X_i is the designation for individual independent variables from 1 to k (macroeconomic indicators) at time i , coefficients β_0 to β_k are parameters of the regres-

sion function, and ε is the residual part of the model.

The linear regression model must meet four basic conditions. Firstly, modelling works with stationary rows. Secondly, there must be no strong correlation dependence among the regressors (multi-collinearity), with correlation coefficients lower than 0.80. The third condition deals with the exclusion of autocorrelation of residues, thus eliminating their correlation. The Durbin-Watson statistic in the regression model output is used for testing, the values of which must be close to 2.0. The detected autocorrelation may be due to the presence of delayed variables in the model. For this reason, the Breusch-Godfrey autocorrelation test, which already takes the delayed values of the variables into consideration, is used. The aim of this test is not to reject a zero hypotheses based on the absence of autocorrelation of residues, but to exclude autocorrelation of residues. The fourth basic condition is the absence of heteroscedasticity of the residual component of the model, or confirmation of the zero hypothesis of the existence of homoscedasticity. For the robustness of the model, the residue must have a constant and ultimate scattering, for which White's heteroscedasticity test is used. As a complementary condition, the normal distribution of the residual component is used. In the output of the normality test, the most important indicators are the Skewness values, which should reach 0, and the Kurtosis, which should be 3. Furthermore, the hypothesis of the normal distribution of residues is accepted or rejected based on the Jarque-Berra test.

Financial crises can also affect the robustness of regression models. The Chow test examines the possible existence of financial crises. The test aims to accept or reject the zero hypotheses pertaining to the lack of financial crises among the in-

dicators studied (Elton, 1995). If one of the regression models meets all the conditions described above, then the dependence between the variables can be described by a linear regression equation.

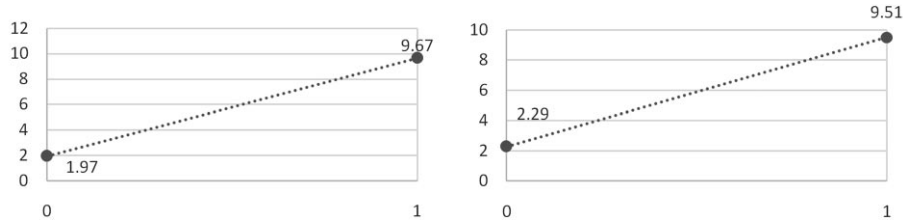
To determine the relationship between the development of individual stock markets and macroeconomic variables, panel regression will be used. The methodology for using least squares panel regression is strictly defined. Data must first be properly separated into individual panels, so as to confirm stationarity and examine long-term causality. Only then is it possible to select

a sample of countries suitable for panel regression based on long-term relationships. Without these steps, the output could not be considered objective.

3. Research results

The risk-free rate determines the position of the SML line (Figure 4). Its height is independent of market movements; therefore, its beta value is zero ($\beta = 0$). The risk-free rate of return is approximated by government bond treasury bills and government bonds.

Figure 4. Security Market Lines (SML) of Hong Kong and Singapore
SML (Hongkong) SML (Singapore)



Source: Own elaboration.

To calculate the position of SML, the current risk-free rate of interest in Hong Kong is 1.97 and in Singapore 2.29, and the expected capital market interest rate in Hong Kong is 9.7 and in Singapore 9.5. The current level of systematic risk (x-axis) is important for calculating the expected interest rate of shares (y-axis).

The role of the median expected earnings rates on the capital market fulfils the expected return on the stock market index. The return of the market index expresses

the average rate of systematic risk. Beta is a measure of the shared risk associated with stock market movements. The stock market is affected by several factors whose impact cannot be eliminated within the national economy. In the CAPM model, return on equity is a function of the beta factor, which expresses the degree of this risk. This risk is referred to as systematic risk. The beta factor is the SML line equation – the only factor that relates to a particular share (Table 2).

Table 2. Results of systematic risk of stocks in Hong Kong (HKG) and Singapore (SIN)

Stock (HKG)	BOOC	HASE	HSBC	CHL	PING	CHO	
Beta	1.00	0.97	0.58	0.87	1.25	1.45	1.44
Stock (HKG)	CHRS	WHRF	HEND	HKEX	NEW	SHK	SIN
Beta	1.61	1.37	0.86	1.72	1.34	0.97	0.77
Stock (SIN)	DBS	UNO	SINE	CAP	HKL	UOL	OVES
Beta	1.53	1.09	0.8	1.23	1.07	1.1	1.01

Source: Own elaboration.

To interpret the results of the linear regression model correctly, the analysed variables have to meet the conditions of stationarity, multicollinearity, autocorrelation, heteroscedasticity and normality gradually. If certain stock yields in Hong Kong or Singapore meet all these conditions, their relationship with macroeconomic indicators can be characterised by a linear regression equation. The Chow test will deter-

mine whether the financial crisis affected the structural robustness of the model.

Evaluating the results of Hong Kong's stock-exchange regression models, according to the abovementioned results, all terms of the least square regression method meet the equity returns of the BAA and SIN titles, so their relationship to selected macroeconomic indicators can be described by the following equations (3) and (4).

$$BAA = -5,34 + 0,00 GDP + 0,35 INF + 0,02 M3 - 5,37 UNE + 58,86 EXCH - 3,54 DIR + \varepsilon \quad (3)$$

$$SIN = -2,68 + 0,00 GDP + 0,58 INF + 0,01 M3 - 1,71 UNE - 108,70 EXCH - 8,15 DIR + \varepsilon \quad (4)$$

The output of regression models is also an important factor in the statistical significance of individual macroeconomic indicators. The BAA title is statistically significant for indicators of M3 money supply and unemployment. Consequently, it can be concluded that if the cash supply increases by one unit, the stock yield will increase by 0.02 units. If the unit of unemployment rises, BAA's stock yield will decrease by 5.37 units. The only statistically significant variable for SIN is the exchange rate. Therefore, if the exchange rate per unit increases, the SIN stock will grow. The results of these regression models could be affected by macroeconomic financial crises. In Hong Kong's basic statistical description of stock yields and macroeconomic indicators, it was possible to see development therein over the projection horizon. A possible structural change came in the third and the fourth quarter of 2008, when Hong Kong suffered as a result of the global financial crisis. Using the Chow test (see Table 3), it was found that the results of certain stock returns were affected by financial crises in the third or the fourth quarter of 2008. This table demonstrates how the (financial) cri-

ses could affect the relationship between stock price development and macroeconomic fundamentals. In this case, the global financial crisis influenced nine cases of financial companies in Hong Kong. The financial market in Hong Kong suffered capital losses during the financial crisis, which was reflected in equity returns. For the BAA and SIN stock returns, the regression models of which met all the conditions of the smallest square regression method, the impact of the financial crisis was only confirmed by SIN in the fourth quarter of 2008. The results also reflect that companies from the banking sector (BAA, BOOC, HASE or HSBC) have the strongest capital resources, and the structural change at the end of 2008 did not have a statistically significant impact.

When evaluating the results of Singapore's stock-exchange regression models, we see that the analysed conditions for the linear regression method of the smallest squares were fulfilled by the equity proceeds of OVE, UNO and UOL. Their relationship to macroeconomic indicators can be expressed by the following equations (5) to (7):

$$OVE = -0,39 - 0,59 GDP - 0,00 INF + 0,00 M3 - 0,50 UNE - 20,36 EXCH - 7,07 DIR + \varepsilon \quad (5)$$

$$\text{UNO} = 0.29 - 0.55 \text{ GDP} - 0.00 \text{ INF} + 0.00 \text{ M3} - 0.00 \text{ UNE} - 50.10 \text{ EXCH} + 10.44 \text{ DIR} + \varepsilon \quad (6)$$

$$\text{UOL} = 0.65 - 1.54 \text{ GDP} - 0.00 \text{ INF} + 0.00 \text{ M3} - 2.26 \text{ UNE} - 39.56 \text{ EXCH} - 13.66 \text{ DIR} + \varepsilon \quad (7)$$

Looking at the statistical significance of individual regressions, it is clear that only the exchange rate statistically influences the yields of all the shares significantly. Therefore, if the unit exchange rate increases, the stock yield will fall by 20.36 units for OVE, 50.10 units for UNO and 39.56 units for UOL. These results of regression mod-

els could be affected by macroeconomic financial crises. The statistical summary of stock earnings and the macroeconomic indicators of Singapore show possible joint financial crises in the third and fourth quarters of 2008. The resulting Chow test values shown in Table 3 confirm the impact of the financial crisis on most of the models.

Table 3. The Chow test for financial crises in Hong Kong and Singapore

Hong Kong			Singapore		
Company	F-stat. Q3 2008	F-stat. Q4 2008	Company	F-stat. Q3 2008	F-stat. Q4 2008
BAA	0.58861	1.9279	CAP	1.6905	4.8154 *
BOOC	0.65568	1.167125	DBS	0.6236	0.646638
CHIL	3.4635 *	3.3682 *	HKL	0.7810	1.446339
CHIO	3.4197 *	2.5611 **	OVE	0.6273	1.932072
CHRS	2.4917 **	2.157 ***	SINE	3.3758 *	3.4709 *
HASE	0.5312	0.441412	UNO	2.4093 **	3.2241 **
HEND	1.3080	1.830435	UOL	3.8826 *	2.2512 ***
HKEX	5.3560 *	4.4974 *			
HSBC	1.3320	1.301143			
NEW	2.2402 ***	2.343 ***			
PING	1.9974 ***	1.820411			
SHK	1.8102	2.201 ***			
SIN	1.3934	2.4412 **			
WHRF	2.8792 **	2.227 ***			

*, **, *** statistical significance at the 10 %, 5 % and 1% levels

Source: Own elaboration.

The Chow test for the Straits Times index implicates the global financial crisis in four cases of financial companies. For the OVE, UNO and UOL stock returns, the regression models of which met all the conditions of the smallest square regression method, the impact of the financial crisis was confirmed by UNO and UOL in the third and fourth quarter of 2008. Even though the financial crisis had a statistically significant impact mostly on the relationship between equity returns and the exchange rate of Singapore's currency, it can be concluded that it is not possible to predict the relationship between the observed variables in the long term.

4. Discussion

The stationarity of the observed variables was analysed using the Adjusted Dickey-Fuller test, and after subsequent differentiation of the variables, it was possible to claim that the selected data are statistically significant and stationary. Table 4 shows that the correlation values between the variables do not reach values that are higher than 0.80. Therefore, the regressions are not strong interrelationships and are suitable for constructing a regression equation.

Table 4. Correlation matrix of macroeconomic variables in Hong Kong and Singapore – Multicollinearity

Hong Kong	INF	M3	UNE	EXCH	DIR	
GDP	1.000000	0.015110	0.306248	-0.318043	-0.178367	0.205777
INF	0.015110	1.000000	0.114754	-0.154810	-0.076688	-0.160470
M3	0.306248	0.114754	1.000000	-0.158854	-0.288505	0.055594
UNE	-0.318043	-0.154810	-0.158854	1.000000	0.034492	-0.221607
EXCH	-0.178367	-0.076688	-0.288505	0.034492	1.000000	0.228910
DIR	0.205777	-0.160470	0.055594	-0.221607	0.228910	1.000000
Singapore	GDP	INF	M3	UNE	EXCH	DIR
GDP	1.000000	0.038749	0.074514	-0.478299	-0.145277	-0.087280
INF	0.038749	1.000000	-0.143837	-0.171379	-0.107640	0.302771
M3	0.074514	-0.143837	1.000000	-0.113213	0.039943	-0.327706
UNE	-0.478299	-0.171379	-0.113213	1.000000	-0.079419	-0.221607
EXCH	-0.145277	-0.107640	0.039943	-0.079419	1.000000	-0.010705
DIR	-0.087280	0.302771	-0.327706	-0.221607	-0.010705	1.000000

Source: Own elaboration.

One of the other satisfactory conditions is the absence of autocorrelation of residuals detected in the outputs of the regression models. To exclude autocorrelation, the values of the Durbin Watson coefficient should be within the range of $<1.80; 2.20>$. This condition is fulfilled only by the regression models of the shares of BAA, BOOC, HASE, HEND and SINO. The residual autocorrelation of the rest of the stocks has been demonstrated for the remaining share yields. The incidence of autocorrelation in most stock yields shows a possible presence of a certain length of delay between variables. According to the Akaike information criterion, the optimal delay of one quarter has already been verified. For this reason, the Breusch-Godfrey test was needed to verify the autocorrelation of residues. After the Breusch-Godfrey autocorrelation test, the presence of statistically significant autocorrelation was determined only by the CHIL, CHIO, CHRS, HKEX, NEW and WHRF shares in Hong Kong, which does not meet one of the least square regression conditions. The fourth condition of the regression analysis is not to reject the zero hypotheses of homoscedasticity, the final and constant scattering of residues determined by the White's

heteroscedasticity test. The condition of the absence of heteroscedasticity does not meet the HEND, HKEX, NEW, SHK and WHRF stock titles in Hong Kong, and DBS and SINE in Singapore. For the rest of the stocks, they have a final and constant scatter. The final condition to show the correctness of the chosen model is to meet the normal residual distribution. The normality test involves a slope coefficient with the ideal value of approximately 0, the kurtosis coefficient with the ideal value of 3, and the Jarque-Bera normality test in which it is important not to reject a zero hypothesis for normal residual distribution. The test of normality in Hong Kong does not meet the BOOC, HASE, HSBC, and PING stock. As regards Singapore, normality was not confirmed for CAP, HKL and SINE.

The observed financial crises affected the statistical significance of each stock model. However, after the addition of a fixed effect at the time of financial crises, panel regression was used to determine the impact of macroeconomic factors on the development of stock markets. Based on the results in Table 5, we can see the resulting relationship between the monitored variables. The rising inflation rate has a negative impact on Hong Kong stock

market developments, with an increasing inflation rate lowering the return on financial and investment instruments. On the contrary, a positive effect was reflected in the M3 and interest rates indicators, where the increasing amount of money in the economy positively affects corporate shares. While interest rates would appear to be perceived negatively by investors as well as stable economic growth, inter-

est rate growth does not have a negative impact on the stock market. In the case of Singapore, a statistically significant relationship was confirmed in four variables, where inflation and interest rates showed the same weight as Hong Kong. Furthermore, the negative impact of the exchange rate and unemployment was confirmed, as the growth of these factors led to a declining trend in the stock market.

Table 5. Resulting impact of macroeconomic variables on stock market developments

_GDP	INF	M3	UNE	EXCH	DIR	
Hong Kong	+/-	- **	+ **	-	-	+ **
Singapore	+/-	- *	-	- *	- **	+ **

*, **, *** statistical significance at the 1%, 5 % and 10% levels

Source: Own elaboration.

Our results differ from previous research done at the turn of the millennium. In contrast to the results obtained by Maysami and Sim (2002), our research indicates that not all macroeconomic indicators can influence the stock market in monitored countries. The money supply was insignificant; furthermore, although we can see the influence of unemployment in Singapore, the unemployment and exchange rates in Hong Kong were insignificant. On the contrary, Wong, Khan and Du (2005) describe the relations among only stock indices, money supply and interest rates in Singapore, which is fewer than our total number of indicators.

Conclusions

Economic and financial crises have always attracted a great deal of attention from the professional and lay public, and their effects have been analysed in many papers. Such a premise is also valid for the last crisis which began with the mortgage crisis in the United States of America, spreading to other continents throughout the globalised world economy; it affected other generally stable economies and financial powers such as Singapore and Hong Kong.

This paper aimed to investigate the impact of the financial crisis on the prosperity of Singapore and Hong Kong. According to the results of basic economic determinants, it was found that the crisis influenced the economies at the end of 2008 and continued in 2009. In the crisis years, both countries experienced a decline in GDP, were faced with the threat of deflation, and their foreign trade turnover decreased. The financial crisis also affected the financial sectors of Hong Kong and Singapore, even though both countries are among the most advanced financial and business centres. This structural change results in the low predictability of models. The Chow test confirms that the global financial crisis at the end of 2008 had a negative impact on the predictive ability of the chosen linear regression analysis over a long-term time horizon in both countries.

According to the previously mentioned methods, we found that the inflation rate and unemployment rate (statistical significance 1%) have a greater influence on stock prices in Singapore than the exchange rate and interest rates (significance 5%), so four of six macroeconomic indicators. In the case of Hong Kong, there are only three

indicators with significance at the 5% level – the inflation rate, money supply and interest rates. In both economies, GDP did not influence the stock market in any way. Our assumption was not confirmed as a whole.

Our findings do not provide any universal conclusion as regards this relationship, as they have limitations due to the time series and methods used – it is possible that extending the time period and using other methods, such as non-linear ones, could bring different results. From the linear regression equation, it is obvious that the unemployment rate, exchange rate and interest rate have a prevailing negative effect on equity returns, in contrast to money supply which has a prevailing positive effect.

Despite the abovementioned limits of research, it is possible to discern a certain contribution to the research area – both theoretical and practical. As already mentioned in the text, research on this issue in relation to both economies has been lacking in recent years, and this article can be seen as a supplement to this missing research and as inspiration for authors who want to address this issue in the future.

From our point of view, we would like to expand our future research in this area in three directions. Firstly, in terms of time – using longer time series; secondly, in terms of indicators, in which we want to include selected microeconomic indicators; and thirdly, in terms of geography, whereby we will expand the number of economies examined, namely those belonging to the group of so-called Asian tigers.

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