2014

Can the Chinese Economy Affect the US Stock Market? The Case of the 2008 Chinese Stimulus Package

Jacqueline M. Lee
Claremont McKenna College

CLAREMONT McKENNA COLLEGE

CAN THE CHINESE ECONOMY AFFECT THE US STOCK MARKET? THE CASE OF THE 2008 CHINESE STIMULUS PACKAGE

SUBMITTED TO

PROFESSOR MITCH WARACHKA

AND

DEAN NICHOLAS WARNER

BY

JACQUELINE LEE

FOR

SENIOR THESIS

SPRING 2014

APRIL 28, 2014

Abstract

The Chinese stimulus package of 2008 was a response by the government to rebound the second largest economy from the effects of the Global Financial Crisis. The package was one of the largest, and arguably one of the most successful, in boosting demand and spurring growth through targeting infrastructure projects and consumer spending. This paper investigates whether the package had any spillover effects on the US industrial and consumption companies with large markets in China through the time series multiple regression technique. This paper found that Chinese net exports had some explanatory power over the consumption companies, and the US industrial companies were hurt by the stimulus package. The findings also suggest that there are more macroeconomic variables that have more explanatory power over the returns of the companies than the ones included in the regressions.

Table of Contents

I. Introduction

The Global Financial Crisis of 2007-2009 led to a dramatic drop in consumer wealth, rising and prolonged unemployment, failures of key businesses, and sluggish international trade that may have contributed to the European sovereign-debt crisis. The enormous rise in demand, and associated surge in asset prices, that characterized the financial crisis resulted from a period of low interest rates, over-leveraging, and incompetent regulations.

During the early 2000s, investors turned to investing in collateralized debt obligations (CDOs) backed by subprime mortgages, which offered high yields and "low" risk according to its Triple-A rating (Poole, 2010). In addition, the federal government pushed two Government-sponsored enterprises (GSEs), Fannie Mae and Freddie Mac to accept more subprime mortgages, thereby raising the number of families who owned their own homes in America. The steady rise in housing prices and the low interest rates encouraged more and more mortgages, eventually creating an unsustainable housing bubble. In 2006, as house prices leveled and rates began to rise for adjustable-rate mortgages, families began defaulting on their mortgages, creating enough pressure to burst the bubble. The housing securities plummeted, and due to the interconnectedness of financial institutions, spread the damage globally through an interbank credit crisis.

There were two major channels that indirectly spread the crisis to the emerging market economies. Financial institutions, which had invested heavily in the housing-related assets, suffered huge losses, caused a flight to safety in which large amounts of capital were withdrawn from many emerging economies (Zhang, Willet and Li, 2012). Ironically, these emerging economies had invested little in these toxic securities and had

few direct relationships to the real estate market. Thus, capital was much safer in these markets than back in the developed nations. The flight to safety happened on such a large-scale that in the last two months of 2008, there were many occasions when Treasury Bills were in such high demand, driving down yields to zero (Poole, 2010). Moreover, as the advanced nations—most notably the US—fell into recession, their demands for imports fell drastically, thereby dragging emerging economies into recessions as well. For the first time in six decades, global Gross Domestic Product (GDP) contracted; in 2009, the contraction was estimated to be approximately 1.1 percent of GDP. Growth in the emerging markets decelerated to 3.1 percent, whereas industrialized countries experienced a contraction in their economies of 3.3 percent (McKissack & Xu, 2011).

Impact of the Financial Crisis on China and the US

Prior to the crisis, China's growth rate was 12.7 percent in 2006 and 14.2 percent in 2007. Although China's economy did not contract and maintained relatively high growth through the crisis, with a record 9.6 percent in 2008 and 9.2 percent in 2009, China's economy was not insulated from the crisis, and suffered on levels comparable to the developed nations (Willet 2011). In absolute terms, China's growth rate fell drastically more than the US's relative to its trend in previous periods. In 2008, the value of China's deviation from the trend was approximately -3.4 percentage points, while the US's was -2.5 percentage points (Zhang, Willett and Li, 2012).

China was able to maintain relatively high growth for a variety of reasons. First, the nation was sheltered more than other nations from the crisis. China realized only half

the spillover effects from the channels that spread the crisis to the emerging economies. China was mostly immune to the effects of the foreign investors' flight to safety. The beginning of the financial crisis led to short term financial outflows of Foreign Direct Investment (FDI) that later recuperated to pre-crisis levels in 2010. However, given that 40 percent of China's GDP consisted of exports, its economy was hard hit by the decline in demand from the advanced economies.

During the month that the Chinese government implemented the stimulus program, China's export growth rate fell to -2.2 percent from 20 percent in the previous month, totaling a loss of 17 percent in growth in 2009 (Zhang, Willett and Li, 2012). Second, China was in a strong position to counteract the crisis effect through fiscal support. After the Asian Crisis of the late 1990's, China had accumulated massive amounts of foreign exchange reserves, reinforced their financial markets, and minimized their budget deficits. This allowed China to implement a large stabilization program without concerns over borrowing costs and whether their financial institutions could sustain such pressure.

China Stimulus Package

To counteract the effects of the crisis, most countries injected some form of stimulus into their markets. On November 10, 2008, the government of the People's Republic of China implemented one of the largest stimulus packages, resulting in an additional 2-3 percent to GDP in 2009 and 2010 (McKissack & Xu, 2011). China was in a powerful position to respond to the financial crisis—it had access to a lot of capital for

macroeconomic policies, control of the banking sector and exchange rates, and a substantial need for development and infrastructure.

The stimulus package allocated RMB 4 trillion ($586 B in 2008 dollars) or 13.3 percent of 2008 GDP on infrastructure and development projects, but also included projects that were slated to occur regardless of the state of the economy. The IMF estimated the figure to be around RMB 2 trillion, or approximately 3 percent of the GDP of 2009 and 2010 when adjusted for these projects (McKissack & Xu, 2011). Unlike the US stimulus package, which focused solely on tax-related policy to increase the disposable income of consumers and spur spending, China's stimulus package also targeted development and infrastructure. Approximately 72 percent of the stimulus package targeted infrastructure, with the bulk of it spent on re-construction after the Sichuan earthquake and on development of high-speed railways. In addition, the package also included government support policies for 10 Pillar Industries, industries deemed by the government to be vital to China's economic growth, including tax cuts and incentives, industry subsidies and consumer subsidies to encourage the purchase of certain products, as well as fiscal support (Morrison, 2009). These policies were aimed at encouraging consumer spending, and combined with the multiplier effect, rebound the economy.

In terms of monetary policy, the Chinese government focused on lending targets, the Reserve Requirement Ratio (RRR), and capital inflows. The banking sector is dominated by several large state-owned banks, meaning that the interest rates and lending quotas are essentially set by the central government. To control liquidity, the People's Bank of China (PBoC) increased lending targets from RMB 4.7 trillion in 2008 to RMB 10 trillion in 2009. In addition, the RRR was lowered by 17.5 percent for smaller banks

and by 15.5 percent for larger banks (McKissack & Xu, 2011). The difference in the changes in the RRR can be attributed to the structure of the large and small banks. Because larger banks tend to hold more reserves than is prescribed by the RRR, they are constrained by lending, whereas smaller banks have less capital, and are thus constrained by the RRR. The third monetary policy involves exchange rate management. To control fluctuations in its currency rates, the central government sterilized a majority of these foreign exchange reserves. The government was even able to realize large profits from its sterilization operations initially, but with the advent of the financial crisis, low interest rates on foreign assets made sterilization more expensive. China was forced to reduce their sterilization activity, thereby creating more liquidity in the banking system.

The stimulus package was subsidized in part by the central government, and the balance was funded by local governments. The central government paid for an estimated 30 percent of the package through the expansion of the budget. The budget was expanded from 0.75 percent in 2008 to 2.75 percent in 2009. Similarly, because local governments were barred from borrowing directly from banks, they were able to create Local Government Financing Vehicles (LGFVs) using public land as collateral to finance approximately two-thirds of the package (McKissack and Xu, 2011).

This paper studies the impact of the Chinese stimulus package on the stock returns of numerous construction and consumption companies in the US S&P 500. This paper's findings may have great implications for US investors—even to those who do not hold any Asian equities—because of the increasing integration between the two most dominant economies. If Chinese macroeconomic policies can affect the stock returns of US companies, investors should be attentive to and account for changes in Chinese policy

in their models to accurately and effectively forecast their portfolio returns. While the results of the study may not be completely definitive, it would not be prudent to disregard the findings of this study.

II. Related Literature

Burdekin and Weidenmier (2013) studied the effects of the Chinese stimulus package on Chinese companies. First, their study considered which of the sectors—which they computed manually by individually aggregating the Shanghai Composite companies into thirteen indices—benefitted from the stimulus package. Then they tested for any spillover effects in other markets by testing whether companies headquartered in Mainland China, and listed in the Hong Kong Hang Seng index or the US S&P 500 experienced any effects.

They found that of the thirteen sectors in the Shanghai equity market, only three of them experienced abnormal returns from the 2008 stimulus package in China: Building Materials, Heavy Construction, and Real Estate Investment and Services. The fact that these three sectors are related to real estate and infrastructure is not surprising, given that the majority of the stimulus package was funneled into building infrastructure and other construction projects. The absence of additional gains in the other sectors indicated that local investors did not expect the stimulus program to have any spillover effects or other positive effects on the other industries. Furthermore, they determined that the sectors that experienced short-term abnormal returns in Hong Kong were the Building Materials and Heavy Construction indices. After computing the event studies and time series, they determined that the statistically significant sectors led to a property bubble, rather than

repairing the economy, thereby suggesting that government stimulus programs, regardless of their magnitude, are rarely effective in mending the economy.

Goh et al. (2012) determined that US economic variables had immense predictive power in forecasting abnormal returns in the Chinese stock market only after—but not prior to—China's admission into the World Trade Organization (WTO) in 2001. They speculated that this was attributed to a transmission mechanism from the world market to China's economy, as its markets became freer and more open in 2001. The paper spotlighted China's admission as the event of interest, not only because of the lack of literature that studied the particular event from the perspective of China, but also because of the magnitude and significance of the event. After China's admission, the economy became increasingly integrated with other major markets (Johansson, 2009). Because the US is the largest economy in the world and China's largest trading partner, the country naturally increased their integration with the US. Goh et al. hypothesized that this would enable the US variables to better predict the stock returns in the Chinese stock market.

First the paper determined whether the financial and accounting variables could predict the behavior of the Chinese stock market using fourteen US variables that include the dividend-price ratio, earnings-price ratio, Sharpe Ratio, and term and default spreads. Then they determined whether those variables could supplement the nine Chinese economic variables in predicting the stock market. The study found that post-admission, US variables were able to effectively predict the Chinese stock market for twelve out of the thirteen industries; the variables could not predict the Agriculture, Forestry, and Fishing industry. The paper suggests that if investors and financial institutions consider

both US and Chinese variables in their conventional predictive regression models, they can more effectively and accurately estimate their future returns and act accordingly.

There are also a multitude of studies that have studied the linkages between the equity markets of China and the US using the cointegration and contagion technique. Kasa (1992) found a single, common stochastic trend in the US, Japanese, UK, and Canadian equity markets. Tian (2007) determined that a long-term equilibrium relationship between Chinese A-shares, but not B-shares, and US shares formed after the Asian Financial Crisis. Burdekin (2010) utilized the Chow contagion test to determine that the recent growth of the Shanghai market led to greater integration with other regional and world markets. Cheng and Glascock (2005) examined the relationship among the stock markets of the three Greater China Economic Area (GCEA) and the stock markets of two developed markets: Japan and the US. They determined that the markets of Mainland China, Hong Kong, and Taiwan have a weak nonlinear relationship with the developed markets, but are not cointegrated with either of them. They also concluded that the US has a larger effect on the GCEA economies than Japan does, but Hong Kong experiences great susceptibility than the other two GCEA markets. Wang and Firth (2004) studied the transmission of returns and volatilities across the four stock markets in the Greater China area and the three developed markets of Tokyo, London, and New York by employing the GARCH model. They concluded that the spillover effect is mostly unidirectional, from the developed economies to the Chinese stock markets, until after the Asian Financial Crisis, which caused the effects to become bi-directional.

This study will complement the existing literature by providing a fresh perspective on the link between the macroeconomic variables of China and the equity market in the US.

III. Data and Methodology

This paper will employ a time-series multiple regression technique to study the explanatory power of US and Chinese variables on the returns of S&P 500 companies. The sample period encompasses the years 1981 to 2012, and includes the levels of returns for the indices prior to the crisis to establish a baseline, during the crisis, and after the policy intervention, which allows for comparison to determine if there were any statistically significant shifts post-implementation.

This paper focuses on the industries that may experience the greatest effects from the implementation of the stabilization policy: Industrial and Consumer Goods & Services. Within these industries, thirteen companies were selected based on their relatively large and well-established market in China, as they would experience the greatest effects, if any.

Table 1 contains a chart of the companies and their respective industry category. The annual prices of the companies, gathered from the Bloomberg Terminal, were then aggregated to form revised indices weighted by their market capitalization. Their returns were then adjusted for the common market component by reducing the annual returns by the S&P returns of that year. These returns formed the dependent variables for the consumption (RETCONS) and infrastructure index (RETINFR).

Figure 1 contains a chart of the returns of both sectors, as well as the returns of the S&P. It is evident that both indices are affected by the same business cycle, as they have similar co-movements over time. However, a brief period after 2008, the indices diverge; the industrial index experiences a small spike in returns, while the consumption index continues to fall. One's first reaction would be to assume that the spike is indicative of the success of the stimulus package in boosting demand, and counteracting the downward trend. An alternative explanation for this phenomenon may be that the stimulus package may have pushed up the purchases of construction-related goods in 2008 from 2011, thereby causing the industry to experience artificial gains that eventually corrected itself in the future through relatively lower returns.

The returns of the indices will be regressed on the following variables: the second order condition of US consumption levels (UCONS), changes in Chinese consumption levels (CCONS), changes in US Net Exports (UNETEX), changes in Chinese Net Exports (CNETEX), changes in US Government Spending (UGOVTS), changes in Chinese Government Spending (CGOVTS), changes in US private investment (UINV), and changes in Chinese private investment (CINV). There will also be an indicator function for the Chinese stimulus package (CSTIM); years prior to the stimulus package receive a value of 0, and years after the package's implementation on November 2008 are assigned a value of 1. All observations are denoted in nominal values and US Dollars (CGOVTS and CCONS were converted to US$ from Chinese Renminbi using the World Bank's official exchange rate). Any additional notes on the independent variables are found in ***Table 2***.

Autocorrelation and Multicollinearity

A correlogram was used to determine whether autocorrelation existed for any of the independent variables at the 5% level. Because the variable for the US consumption (UCONS) and its previous values were determined to be correlated, the variable was adjusted by taking the second order condition to remove the correlative effects. ***Figure 2*** and ***Figure 3*** contains the results of the correlogram for the first order condition, and ***Figure 4*** and ***Figure 5*** contains the results for the second order condition. With the adjustment, none of the lags are correlated at the 5% level.

In addition, after computing a correlation matrix for all the independent and dependent variables, it was determined that both independent variables experienced multicollinearity. The correlation may have arisen due to the same underlying economic variables in the same market affecting the variables. To remedy the problem, the returns for the indices (RETCONS and RETINFR) were adjusted by the S&P returns of that year. The adjusted correlation matrix is found in ***Figure 6***.

Empirical Models

This paper will analyze four different regressions. The first two start small with two independent variables, and the third and fourth regressions build upon those with more complex models. The first time-series regression is expressed as

$$RETCONS_t = \beta_0 + \beta_1 UCONS_t + \beta_2 CCONS_t + u_t, t = 1981, \dots, 2012$$

where β_0 represents the height of the regression, $\beta_1, \dots, \beta_k$ represents the coefficients of the 1st independent variable to the k^{th} independent variable, *u* is known as the error term, and *t* denotes the year ranging from 1981 to 2012. Since the US and

Chinese consumption variables are most likely to be the biggest predictors on the consumption index returns, the regression will first start from these specifications.

Similarly, the second regression also begins with basic specifications for the infrastructure index, and uses investment rather than consumption. It is written as

$$RETINFR_t = \beta_0 + \beta_1 UINV_t + \beta_2 CINV_t + u_t, t = 1981, \dots, 2012$$

The third regression adds more independent variables to increase the explaining ability on the returns on the consumption index:

$$\begin{aligned} RETCONS_t = {} & \beta_0 + \beta_1 UCONS_t + \beta_2 CCONS_t + \beta_3 CSTIM_t + \beta_4 UNETEX_t \\ & + \beta_5 CNETEX_t + \beta_6 UGOVTS_t + \beta_7 CGOVTS_t + \beta_8 UINV_t + \beta_9 CINV_t \\ & + u_t, t = 1981, \dots, 2012 \end{aligned}$$

Similarly, the regression for the infrastructure index is as follows:

$$\begin{aligned} RETINFR_t = {} & \beta_0 + \beta_1 UCONS_t + \beta_2 CCONS_t + \beta_3 CSTIM_t + \beta_4 UNETEX_t \\ & + \beta_5 CNETEX_t + \beta_6 UGOVTS_t + \beta_7 CGOVTS_t + \beta_8 UINV_t + \beta_9 CINV_t \\ & + u_t, t = 1981, \dots, 2012 \end{aligned}$$

IV. Empirical Results

Summary Statistics

The results for the summary statistics are contained in ***Figure 7***. It is interesting to note that the standard deviation and range for the variable for the Chinese net exports (CNETEX) is extremely large, compared to the other variables. The minimum value of -380.5 was the change in net exports from 1981 to 1982. To satisfy food demands, the Chinese government has been importing large amounts of wheat, reaching a historical high during the early 1980's, and creating a large trade imbalance (Halbrendt &

Gempesaw, 1990). The outlier caused the standard deviation to be significantly higher with a value of 67.34, while the other variables had a tight distribution and a standard deviation of less than 1.

Results

The time-series multiple regressions allows the study to explore the determinants of the returns of the indices over time. The results for all four regressions are shown in ***Table 3***.

Analysis

The odd number regressions regress the independent variables on the returns of the consumption index (RETCONS), the even regressions regress the independent variables on the returns of the infrastructure index (RETINFR). By definition, adding more independent variables to the first and second regressions increased the R-squared in the third and fourth regressions, enhancing the explanatory power of the model. Overall, the intercept is positive and statistically significant for three of the four regressions, indicating that if all the other independent variables had coefficients of zero, the returns of the consumption and infrastructure indices would still have positive values. This suggests that there are other factors that have explanatory power that are not included in the regressions. Additionally, another interesting note is the statistical insignificance of any of the US macroeconomic variables in predicting the returns. This is highly unusual because there are a multitude of studies that have found a relationship between the

macroeconomic variables of a country and its stock market (Chen, 2009; Nai-Fu et al., 1986; Kwon, 1999).

For the first regression, both independent variables are not statistically significant at explaining the dependent variable, but the intercept is significant at the 5% level. However, looking at the low R-squared of less than 5% indicates that more variables are needed in order to more effectively explain the past trend of the returns on the consumption index. Analogously, none of the independent variables are significant in the second regression, and the R-squared is double that of the first regression but just as low to be inconsequential. Again the intercept is statistically significant at the 1% level.

In the third model, the Chinese net exports variable (CNETEX) is determined to be statistically significant at the 1% level. The coefficient is negative, indicating the returns of the consumption companies is positively correlated with imports and negatively correlated with exports. As mentioned earlier, exports constitutes a large portion of China's GDP, thus it is of no surprise that the variable is significant at explaining the returns of consumption companies. Once again, the changes of consumption for both countries are not statistically significant, but the sign for the variable for Chinese consumption has changed to reflect a positive relationship with the dependent variable. This would indicate that as Chinese consumers increase their spending, most of that spending is on the goods and services of the S&P 500 companies. In addition, the third regression is the only regression where the intercept is not statistically significant.

In the fourth regression, the investment-related variables are still statistically insignificant, and retain the same sign as the second regression. The indicator function for

the stimulus package (CSTIM) has become statistically significant at the 10% level. This suggests that when the variable had a value of 1, i.e. after the implementation of the stimulus package, the returns of the infrastructure index fell. This is evidence that the Chinese stimulus package had a negative effect on the S&P 500 industrial companies, which may have been caused by Chinese firms crowding out the US firms in China, or that the positive effects of the package may have been overshadowed by a variety of other factors that pulled down returns that were not included in the regression.

The results of the regression can only be so meaningful because of the considerable roadblocks in procuring data. The analysis is constrained by the lack of data available on Chinese variables for English-speaking users. All the large prominent international organizations that collect financial and economic data are very limited in their collection of data on China. This may be due to the tight control of information that the government chooses to release to these international organizations, or the reluctance of the organizations to provide unreliable data, that is given from a central government that is infamous for fabricating data. This study is forced to use annual data instead of higher frequency data, like quarterly or semi-annual data, which may have provided a more in depth analysis. To compensate with annual data, data had to be collected as far back as 1980 to achieve a larger number of observations, causing the majority of this range to be of the normal US business cycle, and diverting focus away from the financial crisis, the stimulus package, and the subsequent implications. In addition, with only thirty-two observations, this study faces the threat of small sample bias, which may affect the validity of the confidence intervals and hypothesis tests. Additionally, data on private investment for China is unavailable. Instead, total investment is used as a proxy, whereby

it is calculated as GDP less government expenditures, consumption expenditures, and net exports. These restrictions may detract from the effectiveness and reliability of this analysis.

V. Conclusion

This paper's empirical work applies time series regression technique to several companies of the US S&P 500 over the 1981 to 2012 period. The empirical analysis begins with basic regression with only two independent variables, and builds on those specifications with more complex models containing nine independent variables.

The results of the model indicate that Chinese net exports is the only variable that has explanatory power for the consumption index returns, and the Chinese stimulus package indicator function is the only variable that has explanatory power for the infrastructure index returns. In addition, because of the statistical significance of the intercepts for three out of four of the regressions, it is apparent that there are other macroeconomic variables that have more explaining ability than the ones included in the regressions.

However, there are many restraints that prevent a full, in-depth analysis, mainly lack of data that is available for non-Chinese users. Thus, it is advisable that investors do more research and analysis before making any drastic changes to their models.

VI. References

Burdekin, R. C., & Siklos, P. L. (2012). Enter the dragon: Interactions between Chinese, US andAsia-Pacific equity markets, 1995–2010. *Pacific-Basin Finance Journal*, *20*(3), 521-541.

Burdekin, R.C., & Weidenmier, M. (2013). Assessing the Impact of the Chinese Stimulus Package at Home and Abroad: A Damp Squib?, forthcoming

Chen, Shiu-Sheng (02/2009). "Predicting the bear stock market: Macroeconomic variables as leading indicators". *Journal of banking & finance (0378-4266)*, 33 (2), p. 211.

Cheng, H., & Glascock, J. L. (2005). Dynamic linkages between the greater China economic area stock markets—mainland China, Hong Kong, and Taiwan. *Review of Quantitative Finance and Accounting*, *24*(4), 343-357.

Goh, J.C., et al., Can US Economic Variables Predict the Chinese Stock Market. Pacific-Basin Finance Journal (2012), http://dx.doi.org/10.1016/j.pacfin.2012.10.002

Halbrendt, C., & Gempesaw, C. (1990). A policy analysis of China's wheat economy. *American Journal of Agricultural Economics*, *72*(2), 268-278.

Johansson, A. C., & Ljungwall, C. (2009). Spillover effects among the Greater China stock markets. *World Development*, *37*(4), 839-851.

Kasa, K. (1992). Common stochastic trends in international stock markets. *Journal of Monetary Economics*, *29*(1), 95-124.

Kwon, C. S., & Shin, T. S. (1999). Cointegration and causality between macroeconomic variables and stock market returns. *Global Finance Journal*, *10*(1), 71.

Linyue Li, Thomas D. Willett, and Nan Zhang, "The Effects of the Global Financial Crisis on China's Financial Market and Macroeconomy," Economics Research International, vol. 2012, Article ID 961694, 6 pages, 2012. doi:10.1155/2012/961694

McGraw Hill Financial. S&P Dow Jones Indices. S&P 500 2012: Global Sales. Available at http://www.spindices.com/documents/research/sp-500-2012-global-sales.pdf

McKissack, A., & Xu, J. Y. (2011). Chinese macroeconomic management through the crisis and beyond. *Asian-Pacific Economic Literature*, *25*(1), 43-55.

Nai-Fu, C., Roll, R., & Ross, S. A. (1986). Economic Forces and the Stock Market. *Journal Of Business*,*59*(3), 383-403

Poole, W. (2010). Causes and Consequences of the Financial Crisis of 2007-2009. *Harv. JL & Pub. Pol'y*, *33*, 421.

Prasad, E. S. (2009). Effects of the financial crisis on the US-China economic relationship. *Cato J.*, *29*, 223.

Tian, G., (2007). Are Chinese stock markets increasing integration with other markets in the greater China region and other major markets?, Australian Economics Papers, 46(3), 2007, 240-53. Available at http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1363&context=commpapers

Wang, S. S., & Firth, M. (2004). Do bears and bulls swim across oceans? Market information transmission between greater China and the rest of the world. *Journal of International Financial Markets, Institutions and Money*, *14*(3), 235-254.

Willett, T. D., Liang, P., & Zhang, N. (2011). Global contagion and the decoupling debate. *Frontiers of Economics and Globalization*, *9*, 215-234.

Zhang, Y. (2013). Multinational companies' dependence on China grows. *China Daily,* 07/23/2013.

VII. Appendices

Figure 1. Returns for the Revised Industrial and Consumption Indices

The blue line represents the returns for the consumption index, the red line represents the returns for the industrial index, and the green line represents the returns for the S&P index.

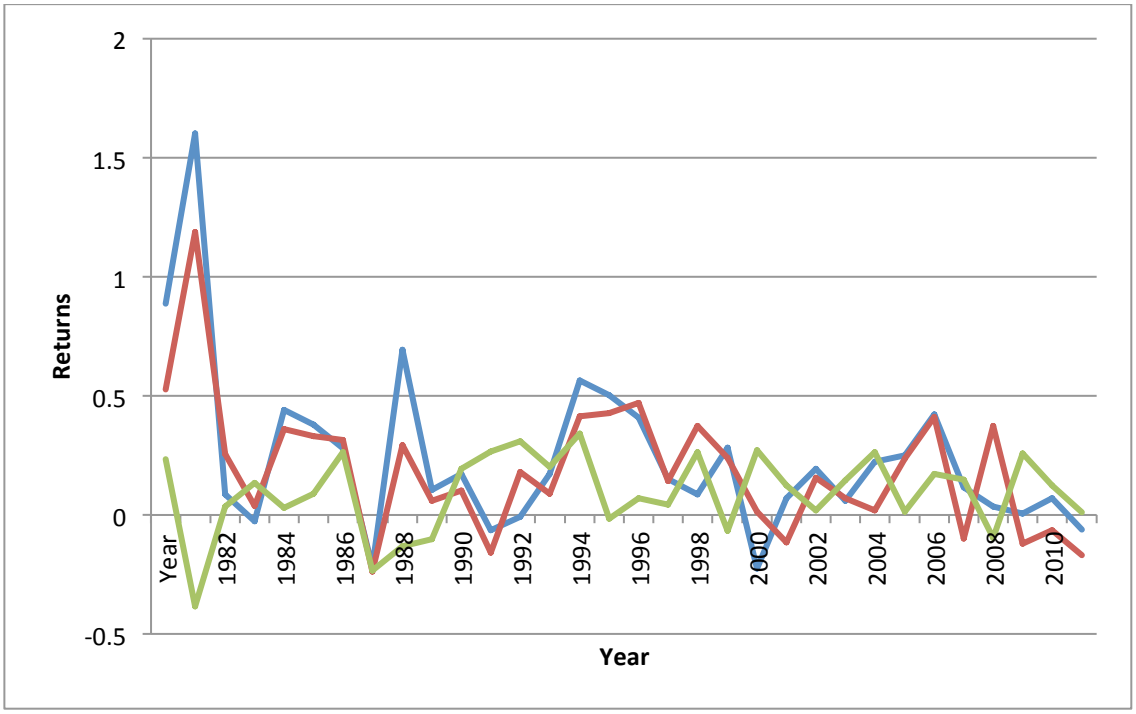
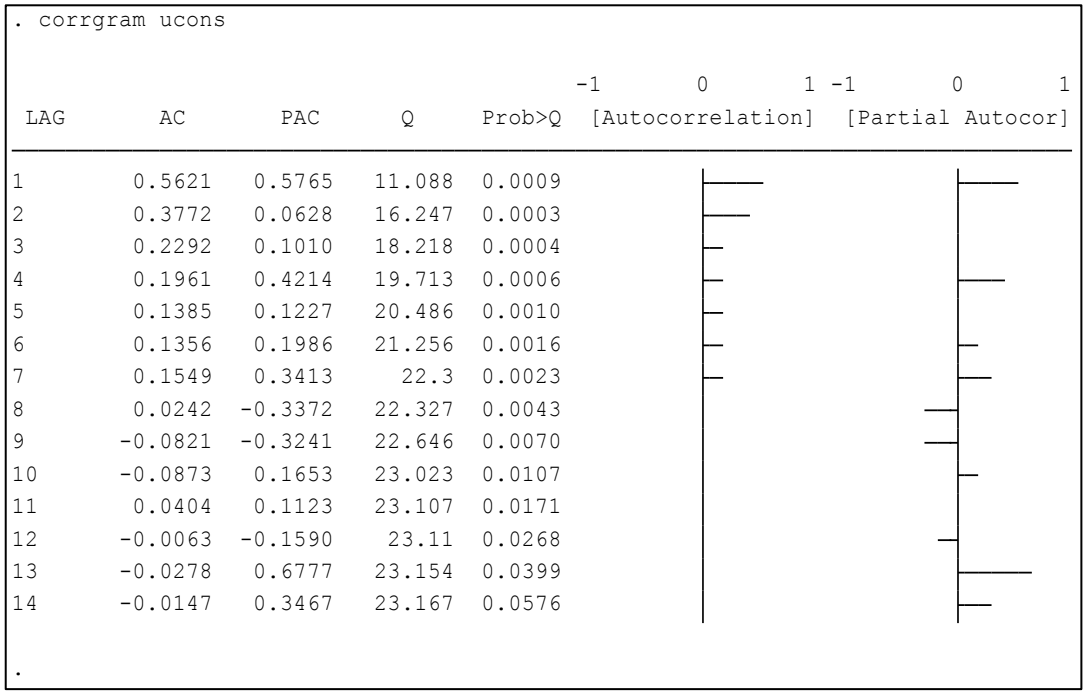


Figure 2. Correlogram of the First Order Condition for UCONS

The correlogram illustrates that the variable for the US consumption (UCONS) and its previous values were correlated.



```
. corrgram ucons

                                                -1       0       1 -1       0       1
 LAG       AC       PAC      Q      Prob>Q  [Autocorrelation]  [Partial Autocor]
-------------------------------------------------------------------------------------
1         0.5621   0.5765   11.088  0.0009           |----              |----
2         0.3772   0.0628   16.247  0.0003           |---               |
3         0.2292   0.1010   18.218  0.0004           |-                 |
4         0.1961   0.4214   19.713  0.0006           |-                 |----
5         0.1385   0.1227   20.486  0.0010           |-                 |
6         0.1356   0.1986   21.256  0.0016           |-                 |-
7         0.1549   0.3413     22.3  0.0023           |-                 |--
8         0.0242  -0.3372   22.327  0.0043                            -|
9        -0.0821  -0.3241   22.646  0.0070                            -|
10       -0.0873   0.1653   23.023  0.0107                             |-
11        0.0404   0.1123   23.107  0.0171                             |
12       -0.0063  -0.1590    23.11  0.0268                            -|
13       -0.0278   0.6777   23.154  0.0399                             |-----
14       -0.0147   0.3467   23.167  0.0576                             |--

.
```

Figure 3. Visual Representation of Correlogram of the First Order Condition for UCONS

The figure illustrates the correlogram for the first order condition. The blue lines show the autocorrelation for each lag, and the grey area shows the confidence bands at the 5% level. The first lag lies outside of the confidence bands, suggesting autocorrelation.

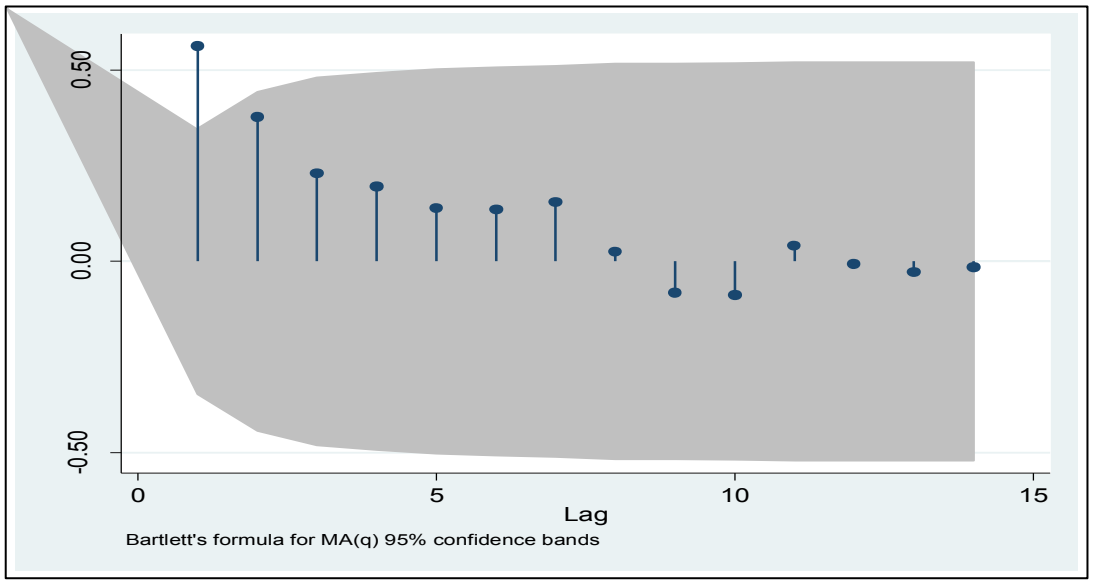


Figure 4. Correlogram of the Second Order Condition for UCONS

Below contains a numerical and visual representation of the removal of the correlative effect through the second order condition adjustment.

```
. corrgram ucons

                                                -1       0       1 -1       0       1
 LAG       AC       PAC      Q      Prob>Q  [Autocorrelation]  [Partial Autocor]
-------------------------------------------------------------------------------------
1         0.2374   0.2374   1.9773  0.1597
2         0.0443  -0.0138   2.0485  0.3591
3        -0.0137  -0.0615   2.0555  0.5610
4         0.0379   0.3817   2.1113  0.7153
5        -0.0285  -0.1689   2.1441  0.8289
6        -0.0938  -0.9120   2.5127  0.8670
7        -0.0380  -0.5848   2.5754  0.9213
8         0.0495   0.1675   2.6863  0.9525
9         0.0662   0.7554   2.8934  0.9684
10       -0.0838  -0.3996   3.2409  0.9752
11       -0.0178   0.6177   3.2573  0.9869
12       -0.0362  -0.1531   3.3285  0.9927
13       -0.0310  -0.9332   3.3836  0.9962
14       -0.0521  -1.1109   3.5479  0.9976
```

Figure 5. Visual Representation of Correlogram of the Second Order Condition for UCONS

The figure illustrates the correlogram for the second order condition; i.e. after the adjustment for the correlative effects. The blue lines show the autocorrelation for each lag, and the grey area shows the confidence bands at the 5% level. It is clear that all of the blue lines lie within the confidence bands.

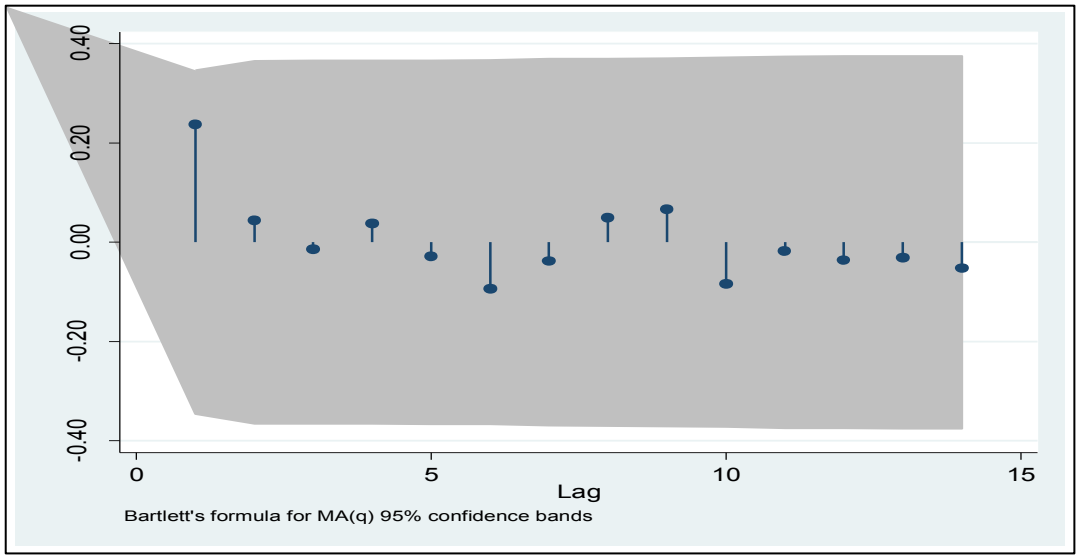


Figure 6. Correlation Matrix

The correlation matrix contains the correlation values for all the independent and dependent variables after the S&P adjustment.

```
. correlate
(obs=32)
```

	year	ucons	uinv	ugovts	unetex	cgovts	ccons
year	1.0000						
ucons	-0.3292	1.0000					
uinv	-0.2186	0.2577	1.0000				
ugovts	0.5125	-0.1133	0.0185	1.0000			
unetex	-0.2781	0.1975	0.4820	-0.1023	1.0000		
cgovts	0.5789	-0.0680	-0.0773	0.4518	-0.1355	1.0000	
ccons	0.4894	-0.0115	-0.1024	0.3358	-0.1689	0.8730	1.0000
cnetex	0.2818	0.0455	0.2609	0.1389	-0.1775	0.1999	0.1781
cinv	-0.0880	0.1192	0.2713	0.2780	0.4464	-0.1971	-0.1838
cstim	0.6292	-0.5522	-0.2739	0.3530	-0.2126	0.3493	0.3457
retcons	-0.4013	0.0540	-0.1877	-0.1065	-0.0441	-0.2966	-0.2136
retinfr	-0.4169	0.0334	-0.1887	-0.2396	0.1148	-0.3129	-0.2327

	cnetex	cinv	cstim	retcons	retinfr
cnetex	1.0000				
cinv	0.4857	1.0000			
cstim	0.0761	-0.0329	1.0000		
retcons	-0.7566	-0.4115	-0.1996	1.0000	
retinfr	-0.6485	-0.3248	-0.3261	0.8145	1.0000

Figure 7. Summary Statistics

The number of observations, means, standard deviations, minimum values, and maximum values are found below for all the independent and dependent variables.

```
. summarize

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        year |         32      1996.5    9.380832      1981       2012
       ucons |         32   -.1562119    .6848851  -3.244345      .8337
        uinv |         32   .0533249    .0909541  -.2254619   .2864314
      ugovts |         32   .1252963    .0824982  -.1456266    .273921
      unetex |         32   .1934016    .4242141  -.6315789      1.585
-------------+---------------------------------------------------------
      cgovts |         32   .1106622    .1023882  -.1164629   .2732755
       ccons |         32   .1026752    .1118369  -.1558645   .3403275
      cnetex |         32  -11.70386    67.33641     -380.5   10.72463
        cinv |         32   .2832057     .949309  -2.234235   3.877464
       cstim |         32     .15625     .368902          0          1
-------------+---------------------------------------------------------
     retcons |         32   .1454642    .4401452   -.497674    1.98626
     retinfr |         32   .1915754    .2786214  -.2377861   1.188986
```

Table 1. List of Companies, Symbols, and Sectors

The table contains an alphabetical list of US companies that have a relatively large market share in China, as well as their respective stock tickers and sectors. These companies were aggregated to form the dependent variables in the four regressions.

List of Companies, Symbols, and Sectors		
Company	**Symbol**	**Sector**
Boeing Company	BA	Industrial
Caterpillar Inc.	CAT	Industrial
Estee Lauder Cos.	EL	Consumer Goods & Services
General Electric	GE	Industrial
The Coca Cola Company	KO	Consumer Goods & Services
McDonald's Corp.	MCD	Consumer Goods & Services
3M Company	MMM	Industrial
Nike Inc.	NIKE	Consumer Goods & Services
Procter & Gamble	PG	Consumer Goods & Services
Starbucks Corp.	SBUX	Consumer Goods & Services
Tiffany & Co.	TIF	Consumer Goods & Services
United Technologies	UTX	Industrial
Yum! Brands Inc.	YUM	Consumer Goods & Services

Table 2. Additional Notes on the Variables

The table includes the database information and any calculation notes for the independent variables. Only credible sources were chosen for this paper; the databases used were limited to US government agencies and international groups.

Variable	Database	Title	Calculation Notes
CGOVTS	Organisation for Economic Co-operation and Development	Government Final Consumption Expenditure in China	
CCONS	Organisation for Economic Co-operation and Development	Private Final Consumption Expenditure in China	
CINV	World Bank	Gross Domestic Product (GDP), current USD	GDP less CGOVTS, CCONS, CNETEX
CNETEX	IMF International Finance Statistics	Goods, Value of Exports, USD; Goods, Value of Imports, USD	Value of Exports less Value of Imports.
Conversion for CGOVTS and CCONS	World Bank	Official exchange rate (Local currency units per US$)	
UGOVTS	World Bank	General Government Final Consumption Expenditure (current USD)	
UCONS	US Department of Commerce: Bureau of Economic Analysis	Personal Consumption Expenditures (PCE)	
UINV	Federal Reserve of St. Louis (FRED)	Gross Private Domestic Investment	
UNETEX	US Department of Commerce: Bureau of Economic Analysis	Net Exports of Goods & Services	

Table 3. Time Series Regression Results

The table contains the coefficients and standard errors for all four regressions. The dependent variable for regressions 1 and 3 are the returns for the consumption index (RETCONS), the dependent variable for regressions 2 and 4 are the returns for the infrastructure index (RETINFR). Individual coefficients are statistically significant at the *10%, **5%, or ***1% significance level. Standard errors are found in parenthesis.

Table 3. Time Series Regression Results				
Regressor	**1**	**2**	**3**	**4**
ccons	-0.8382		0.8045	0.7453
	(0.7130)		(1.0336)	(0.7720)
cinv		-0.0867	0.0062	-0.0705
		(0.0532)	(0.1308)	(0.0977)
cnetex			-0.0053***	-0.0016
			(0.0016)	(0.0012)
cgovts			-1.4505	-1.2821
			(1.3761)	(1.0277)
cstim			-0.1711	-0.2814*
			(0.1992)	(0.1488)
ucons	0.0331		0.0201	-0.052
	(0.1164)		(0.0979)	(0.0731)
uinv		-0.3325	0.4908	-0.5843
		(0.5556)	(0.8694)	(0.6493)
unetex			-0.2905	0.1255
			(0.2587)	(0.1932)
ugovts			0.5887	0.4531
			(1.0657)	(0.7959)
Intercept	0.2367**	0.2339***	0.1455	0.2439***
	(0.1087)	(0.0562)	(0.1126)	(0.0841)
R-squared	0.0483	0.1164	0.6788	0.5528
N	32	32	32	32