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The Basic Ingredients vs. Chinese Equities

Impact of Global Commodity prices on the Chinese stock market

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Abstract

Title:	The Basic Ingredients vs. Chinese Equities: Impact of Global Commodity prices on the Chinese Stock Market.
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Key Words:	China, Commodities, Stock Market, Futures, commodity-stock price correlation
Purpose:	To determine the impact on and correlation of global commodity prices with China's stocks, given the country's recent GDP growth and closed domestic markets to outside investors and other outside influences.
Methodology:	Representative commodities are selected to be independent variables and regressed over composite and sector indexes to determine significance of relationships.
Theory:	Stock price is determined by EPS multiplied by the P/E ratio. Commodity prices will affect EPS as acquisition costs directly affect company profits. As commodity prices rise, profits fall and vice versa. Therefore an inverse relationship is expected between commodities and the Chinese stock market.
Results:	Copper and Gold are correlated with the main composite index between 2002 to 2009. Yet, the correlation disappears when examining sector indices with data only from 2009. Soybeans and Aluminum are highly correlated for the sector indices with data from 2009, yet insignificant versus the main composite over a longer period of time.
Conclusion:	Certain global commodities do influence the stock price of domestic Chinese securities. Gold, Copper, Aluminum, and Soybeans are statistically significant with regards to price movement on the exchange.

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1. Introduction

> "Commodities are an essential part of people's everyday life, whoever they are and wherever they are from. They are the food we eat. They help us heat our homes. They are a critical part of the economy. Their affordability therefore matters. At the extreme, their availability is a matter of life and death."
> -Alistar Darling, Chancellor of the Exchequer

Commodities and their markets are currently a topic of high interest due to their importance for global growth, as highlighted by this quote from Alistar Darling. Due to its sheer demand, the Chinese economy occupies a special place within the global commodity market. Between 2000 and 2005, Chinese share of global demand growth for commodities was more than 50% for aluminum, 84% for steel, and 95% for copper. (Albanese, 2006) This explosive growth in demand from China joins with increasing demand from the rest of the developing world to cause a tightening of market conditions. It is in this increasingly competitive global environment that Chinese companies must source the ingredients to bake the domestic economy. The focus of this paper will be to understand the relationship between Chinese companies and the global environment for commodities by exploring the relationship between commodity prices and company-share price performance on the Shanghai Stock Exchange.

Specifically, this paper will attempt to answer the following questions: Does Chinese demand create a price increase for commodities across the board? Is China ever at the mercy of global prices, i.e. a price-taker rather than price-setter? How are Chinese companies affected by the race for commodity consumption?

Neo-Classical Economic theory forms the basis of this paper. Rational Markets with the corresponding assumptions of full information being reflected in the stock price allow for the direct flow of information from globally-influenced commodity prices to Chinese companies bottom-lines as they purchase commodities on a non-closed global market. Fungibility represents the assumption and fact that copper is copper no matter where in the world it is mined and sold on the open market.

One mathematical definition of a stock price enables a direction correlation to take place. At its most basic level, a stock's price is determined by its earnings per share multiplied by its

P/E multiple. While the P/E multiple is influenced by political sentiment and sector valuations, amongst other things, earnings per share is a result of costs and revenues. Commodities are a cost and their fluctuation in price will directly impact a company's bottom line. It is via this mechanism, input costs and their affect on a firm's profit, that Chinese stocks are influenced by the larger world and global commodity concerns.

Investors and economic observers of all orientations will be interested in China's stock-market correlation to global commodity prices. China's dominance in commodity consumption and continued tightening of global commodity demand creates great uncertainty about commodity prices and geo-political posturing. By pinpointing which commodities and the extent to which China influences or is influenced by prices the most, appropriate policy and investments can be implemented.

Chapter 2 presents the theoretical background driving this inquiry. It will focus on stock-price composition and influence of commodity prices on the balance sheet of Chinese companies. Chapter 3 reviews the background behind all the actors involved in this paper. Chapter 4 introduces the methodology, model, and data selected with justification given for corresponding choices. Chapter 5 provides analysis and context of regression results. Finally, Chapter 6 concludes with relevant insights and suggests further research directions.

2. Main relationships between Commodities and Stocks

One mathematical definition of a stock price enables a direction correlation to take place. At its most basic level, a stock's price is determined by its earnings per share multiplied by its P/E multiple. While the P/E multiple is influenced by political sentiment and sector valuations, amongst other things, earnings per share is a result of costs and revenues. Commodities are a cost and their fluctuation in price will directly impact a company's bottom line. It is via this mechanism, input costs and their affect on a firm's profit, that Chinese stocks are influenced by the larger world and global commodity concerns.

From an investment perspective, the relationship between commodities and traditional asset markets, such as stocks, consist of three main rationales. These reasons contribute to the low correlation between historical commodity and equity performance. First there is a flight to quality in the event of turmoil and risk in the equity markets. Investors see precious metals as a refuge in uncertain times. Moreover, the selling pressure as retail and institutional investors exit equity markets contributes to downward pressure, while the sudden influx of funds into commodities increases buying pressure. Secondly, major external events have a negative effect on stocks, while positive for commodities. Agricultural commodities usually have positively skewed distributions as weather or wars cause demand to rise for fundamental supply and demand reasons. In a similar vein, a sudden inflation spike will have the same affects. Finally, as commodities are inputs for most firms, a rise in costs increases uncertainty and can adversely impact profits. Higher commodity prices can be seen as good news to longer investors of commodities and as bad news to stock holders. Together these three rationales lead to a demonstrable low correlation between stock and commodity performance. (Chong 2009)

As far as this author can find, there is no previous literature examining the direct impact of commodity futures' prices upon stock markets. Numerous articles document the correlation between asset classes to provide risk management profiles and identify appropriate risk management techniques. To summarize, these papers seek to confirm conventional sentiment that commodities and stocks are not highly correlated and that commodities can provide asset protection in highly volatile environments for other asset classes, such as short-term bonds, long-term bonds, and stocks.

Most recently, Chong and Miffre (2010) examined the "Conditional Correlation and Volatility in Commodity Futures and Traditional Asset Markets." Their paper provides evidence that conditional correlations with equity returns have fallen over time, providing better strategic asset allocation options. Moreover, the relationship between S&P500 and 11 commodities see an increasing negative correlation in periods of above average volatility in equity markets. This falling correlation extends to short-term interest rate investments, but does not hold for long-term interest rate investment tools. Chong and Miffre note the different performance between commodity futures and stress that commodities cannot be seen as perfect substitutes for one another. Gold, platinum, silver, cocoa, corn, orange juice, soybean meal, and metals are negatively correlated to the S&P 500, while energy futures seem to move hand in hand with the broader market.

Three economic rationales have been attributed to the observed results: 1) during periods of equity volatility, investors flee to the perceived quality (uncorrelated volatility) of commodities. The selling pressure on equities can trigger stop-loss orders, intensifying a sell-off and subsequently making the rise in commodity prices seem even larger. This assumes investors switch their assets only into commodities. 2) Major events, such as hurricanes, war, or an unexpected rise in inflation, cause uncertainty in equity markets and tighten demand for commodities. This combination suggests a lower correlation between commodities and equities, which the study's results support. 3) Commodities are inputs for most firms and thus a rise in price usually increase costs for firms. Higher commodity prices are good news to long investors in commodities, yet bad news to equity holders- possibly leading to equity volatility. This last rational forms part of the basis for this paper. There is an exact impactful link between commodity prices and stock performance.

Chong and Miffre's paper documents the investment community's interest in commodities from a correlation and risk-diversification perspective. Their analysis suggests and provides evidence for using an investment in commodities as a tool to hedge volatility risk in equities and short-term interest rate instruments. The offered economic rationales do not pursue exact causation or reverse causality of the influence of commodities upon stock market/bond instruments.

3. Background

3.1 China's Restricted Stock Markets

A well-known feature of Chinese equity markets is their restriction to local investors. Starting in 2003, a limited number of foreign institutional investors were granted access Chinese domestic markets with a limited dollar quota. By 2010, the overall investment quota has expanded to $30bn USD with lock-up periods of three months to one year for QFIIs. (QFII stands for Qualified Foreign Institutional Investor.) The official number of QFII increased to 94 by March 2010.

The affects of these restrictions on the stock market is profound. Lin et al. show that the Chinese stock market is much uncorrelated with world equity stock markets, despite China's growing importance to the world's economy. (Lin et al. 2009) This divergence with world stock markets is unique as most of the world's equity markets have generally strengthened correlation between themselves. (Cappiello et al. 2003) Interestingly, Lin et al. show that a downturn in the stock market does not equate to greater volatility. The implication is that selling pressure in non-Chinese markets leading to higher commodity prices does not necessarily have the same effect in China. This effect can be studied in a future paper with taking into account the domestic Chinese commodity markets.

Limiting foreign investment into the Chinese stock market hinders the expression of global views on Chinese companies. Chinese firms will not necessarily trade on the same earnings ratio as global competitors in their sector. This lack of foreign influence via direct investment means that indirect transmission of global views will only have influence upon listed Chinese company's stock performance.

3.2 Commodities & Futures

Commodities are produced goods, usually mined or farmed, and traded between interested actors. The exchange of the good takes place on a spot market, as the actual movement of the good takes place on-the-spot. Ideally, this mechanism works well for goods that can be produced with little lead time and do not face outside risk. In reality, most commodities require heavy investment up front and are subject to high exogenous shock risk, such as weather or conflict. To offset this risk, financial instruments developed to guarantee a fixed price in the future, i.e. futures. This certainty of future prices gave producers confidence to engage in commodity production.

3.2.1 Commodity Market Features

Several unique features of commodities trading prevent the market, both physical and futures markets, from easily responding to the forces of supply and demand. Demand for commodities does not diminish or increase much in the face of price fluctuations. Neither does supply change much in the short-term. With these constraints on market forces, shocks therefore can have a relatively large impact on the price of commodities. (HM Treasury)

In terms of daily life, consumption of a basket of commodities includes food and, in some form, energy for households. Typically, this consumption demand for food and energy does not vary greatly in the short-term and regardless of price. On a micro-level, short-term demand can be deemed inelastic to price change. From the supply-side, profitable opportunities offered by high prices face temporal obstacles. It takes at least one harvest season for producers to take advantage of price levels, yet uncertainty regarding the production process, e.g. weather, and other possible exogenous shocks limit the ability to fully take advantage of opportunities. In the case of non-agricultural commodities, such as oil, the lag time between producing supply and high prices is affected the level of spare capacity. This assumes spare capacity even exists. In total, the short-run commodity market can be inelastic on both the supply and demand side.

While the story for increasing demand is relatively stable, as it rests on the development of emerging economies, supply-side disruption is more frequent. Geographic concentration of production of individual commodities combined with exogenous factors such as weather and geo-political tension adds to the risk of disruption. Oil production in the temperamental middle-east, floods in the coffee basin of Brazil, political protests against mines in Indonesia or Peru all provide real world examples of supply-side risk. Any temporary turbulence in these concentrated areas can exacerbate price volatility in the short-run.

From a longer-term point of view, energy-efficient technologies develop in response to continuing demand which has lowered prices and raised productivity over the past 50 years. Demand surged as global real GDP growth averaged around 3.5 percent between the early 1960’s and 2002. This increase of over 350 percent in GDP was coupled with a population explosion, as the world’s population doubled from three to six billion people. Yet energy intensity of GDP fell by around 25% between 1980 and 2002, while real prices for commodities have not increased over the past 50 years. Supply adapted to long-term demand as technology improved and market structure/competition increased. (HM Treasury)

Historical and theoretical short/long term characteristics play a significant role in shaping commodity markets, yet new developments are having a dramatic impact on prices. It is in this most recent phase of commodity market evolution that Chinese companies are now operating. Governmental interference via regulations increases the thinness of traded markets by reducing market access. As seen in the rice market, the proportion of world rice production traded internationally is only four percent due to government regulations. That is compared to maize production (14 percent) and wheat (17 percent). (HM Treasury) In these thin markets, even relatively small supply shocks can produce a significant impact upon prices for all participants.

In addition to government interference, a recent slowing in cereal yields highlights the disparity in the quality of infrastructure for production and transport of commodities around the globe. Resistance to genetically-modified crops in many developed countries also sets a limit to increase in yields. Further, uncertainties about and limitations for new land devoted to production and poor water resource management create new possible shocks to the supply side of the commodity market. Combined, these five new developments increase complexity of the supply-side and create a highly uncertain market for Chinese and other companies to operate in. Especially as demand will only increase, as population is forecasted to be 40% higher in 2050. (HM Treasury)

3.2.2 Benchmark Futures Contracts

Futures markets can signal expectations about the future direction of prices and influence a producer's decision. Many futures have benchmark contracts that are followed globally as a signal. These benchmark futures contracts usually have the most volume of that category and are therefore thought to most fully reflect the opinions of market participants globally. As Chinese firms participate in the global commodity market, it is assumed that their thoughts on commodity prices will be reflected or taken into account by other actors in the benchmark futures pricing.

During the most recent commodity boom, concerns over speculative activities distorting future prices from the underlying spot value gained much attention. HM treasury examined the issue and determined there is "no consistent relationship between rising investment activity and prices across commodities." Nickel prices have fallen considerably while the investment activity has increased in the metal. The same phenomenon holds for the price of oil as well. (HM Treasury) Futures data can therefore be held to reflect the underlying spot price and all perceptions of the future price of a commodity.

3.2.3 Chinese Domestic Commodity Futures Exchanges

When China joined the WTO in 2001, no commitment was made to reform the futures industry. The futures markets are mostly closed to outsiders, unless a local company is established. Financial institutions are not allowed to participate in trading- the only exception being the four largest banks being able to trade in the gold contracts. Brokerages are not allowed to take positions. These regulations are designed to dispel speculation and allow producers and traders to set the price.

Three exchanges are located in various parts of China. The Dalian Commodity Exchange in northeast China trades soybean, soybean oil, corn, palm oil, soymeal. The Zhengzhou Commodity Exchange specializes in agricultural and chemical product futures, including hard white wheat, strong gluten wheat, sugar, cotton, rapeseed oil and PTA, a petroleum-based chemical product. The Shanghai Metal Exchange was created for trading in non-ferrous metals and currently contracts for several non-ferrous metals including copper, aluminum, lead, zinc, tin, and nickel.

Over the past nine years, the government has let the futures exchanges develop by themselves with the goal of providing benchmark prices comparable to the west. In providing its own prices, the Chinese are able to provide their own estimate of commodity prices that can reduce overcharging from foreign producers that base contracts on western benchmarks. Yet most of the volume belongs to state-owned groups, such as the commodity trader Cofco Corporation and the State Bureau of Material Reserve. (Areddy 2009) This makes the state both player and rule maker in the futures exchanges.

Western producers and Chinese companies engaged in commodity usage utilize these domestic exchanges to manage risk and execute domestic strategies. However, the exchanges do not mimic foreign benchmark contracts and only concern participants in the Chinese market. It is the global benchmark pricing that is relevant to the costs for Chinese companies, as they compete in the global market for goods.

3.3 Chinese Company Operating Environment

Over the past 60 years, three major commodity booms have taken place. The first commodity boom coincided with the Korean War, lasting from June 1950 to July 1953. Insecurity in industrial material supply in neighboring nations led to the establishment of strategic reserves in many countries. Shortages from World War II exacerbated price movements and the demand shock from resurgent GDP growth as countries rebuilt or developed, contributed to the boom. Notably, the MUV index only rose 2.6% percent over this four year period, indicating inflation and commodity price rise are not necessarily intertwined. (MUV Index represents the size of the basket of manufactured goods exported from the rich world that could be obtained for one US dollar at different times.) The second commodity boom lasted from 1972 to 1975. Again this four year rise was marked by GDP growth in OECD nations, yet two consecutive years of wide-spread crop failures and the advent of the oil cartel helped make this boom much stronger than the first. From a base of 100, the energy index peaked at 330 in 1974 versus a rise of only 20-30% during the first boom. Inflation also rapidly rose during this time with the MUV Index showing a 75% increase. (Radetzki 2006) China's political environment constrained domestic company involvement in the commodity market during these two booms to acquiring commodities as outlined by development plans. Importantly, government direction of commodity trading did not permit Chinese companies to operate and react to market forces.

During the third commodity boom of 2003 till the present day, Chinese companies are less controlled by the state and much more responsive to pull of demand and supply. Fast macro-economic expansion stimulated demand, leading to the highest recorded demand for oil and copper in the past 30 years in 2004. Economic growth rose substantially during this time period with a historical high of 3.3% for GDP and 4.1% for industrial output amongst OECD nations. A similar acceleration in developing Asia contributed greatly as well. China's impact is exemplified by its global share of oil demand growth from 2000 to 2005, which was 28%. (IEA) This 28% growth is almost double its contribution of global GDP over the same time period of

15.4% in PPP terms. (IMF 2006) Against this backdrop of immense and broad-based growth, producers were caught unaware. The contemporary habit of just-in-time inventories in many production chains, and little spare production capacity, led to prices in many markets to move up strongly. Chinese companies joined the fray amidst this price rise, yet were not confronted with the similar massive inflation of the second commodity boom. The MUV Index rise of 15.7% over 2003 and 2004 is attributed to the 30% decline in the US Dollar parity versus the Euro. In 2005, the MUV Index rose a further 4.3%. (Radetzki 2006) The financial crisis of 2008 and 2009 considerably altered the GDP growth of countries around the world, yet the demand story has not changed and the supply situation of little spare production capacity and limited new supply still shape the commodity market for Chinese companies.

In the current operating environment of the third boom, Chinese companies are faced with mild inflation, wildly fluctuating GDP, and the onset of new supply capacity. Once new capacity is in place, fundamental economic theory on long-term effects seems likely to overwhelm any short-term issues and punctuate the commodity boom. (Radetzki et al. 2008) However, commodity suppliers adapt to the new market and are adjusting their pricing accordingly. The three main iron ore produces of Vale, Rio Tinto, and BHP have switched to quarterly pricing for their contracts, instead of annual negotiations, in 2010. As of April, 2010, the new quarterly pricing system led to a 90% increase in iron ore, which is critical to steel production. The response by regulators across the world to the new standards set by the oligopoly remains to be seen. Regardless of government intervention, wildly fluctuating costs will affect the bottom-line of Chinese companies.

4. Methodology & Data

4.1 Methodological Approach

The purpose of this thesis is to find correlation, if any, between global commodity prices and the domestic Chinese stock market. A quantitative approach is utilized to examine if any correlation exists and to what degree.

4.2 Modeling Approach and Model

To identify significant relationships between widely followed and frequently utilized global commodities and the Chinese stock market, a simple OLS regression is utilized. After assessing that the data passes various robustness checks and allowing for not fully passing the Ramsey Reset or ARCH tests, the data is said to produce Best Linear Unbiased Estimators.

As stated before, the purpose of this paper is to examine the impact of prices upon the stock market. With OLS, the outliers of both the composite index and commodity prices are factored into results. For a business, these extreme prices can greatly impact profitability and if not properly planned for will affect business decisions in the future. Additionally, if the changes in the commodity prices are deemed to be structural or a pattern in extreme price swings is expected from a business perspective, the OLS regressions will show this impact in the price changes in detail.

Weekly data starting from Friday's close of the first week to next Friday's close was collected. The percent change between weekly closes is used in computation in order to avoid any issues of non-stationarity.

The model used is:

$$Y_t = \beta_1 + \beta_2 X_{1t} + \beta_3 X_{2t} + \beta_4 X_{3t} + \beta_5 X_{4t} + \beta_6 X_{5t} + \beta_7 X_{6t} + \beta_8 X_{7t} + \beta_9 X_{8t} + \beta_{10} X_{9t} + \beta_{11} X_{10t} + \varepsilon$$

Where Y is Shanghai Stock Exchange Index, $\beta_1$is Constant, X_{1t} is Aluminum, X_{2t} is Copper, X_{3t} is Corn, X_{4t} is Cotton, X_{5t} is Gold, X_{6t} is Live Cattle, X_{7t} is Natural Gas, X_{8t} is Soybeans, X_{9t} is Wheat, X_{10t} is WTI Crude, B_2 to B_{11} are corresponding parameters, and ε is the error term.

4.3 Data

All data has been collected from two databases. Datastream Advance 6.0 provided futures data for commodities on a weekly basis. Yahoo! Finance database provided weekly close data for the Chinese domestic securities market.

To select appropriate commodities for this examination, both major commodity indexes were reviewed. The S&P Goldman Sachs Commodity Index and the Reuters/CRB Commodity index components provide the most widely followed commodities and the specific futures contract that is most widely used as well. Each index contains five main categories of commodities- energy, agriculture, industrial metals, precious metals, and livestock. Individual categories contain more than one relevant commodity and in order to limit the number of independent variables and prevent multi-colinearity, representative commodities were selected.

To provide an example, the energy section of each index contains six different futures- Brent Crude Oil, Gas Oil, Gasoline Rbob, Heating Oil, Natural Gas, and WTI Crude. Since this paper only seeks to identify a relationship between commodities and Chinese companies in general, WTI Crude and Natural Gas were selected as both Crude and Natural Gas represent the most traded energy commodities and those which China would be most interested in. This selection process was repeated with agriculture, industrial metals, and livestock. Table 1 below presents the selected commodities and their specific future contract.

Table 1- List of Selected Commodities

Selected Commodities	Contract Symbol	Exchange
Energy		
WTI Crude	CL	NYMEX
Natural Gas	NG	NYMEX
Agriculture		
Corn	CC	CBOT
Soybeans	CS	CBOT
Cotton	CT	NYBOT
Wheat	CW	CBOT
Industrial Metals		
Aluminium	LAH	LME
Copper	HG	COMEX
Precious Metals		
Gold	GC	COMEX
Livestock		
Livecattle	CLC	CME

Chinese security market data is represented by the Shanghai Composite Index. The SCI represents all instruments listed on the Shanghai exchange, which has over time reached ~1400 in number in total. The SCI is a capitalization-weighted index. (Bloomberg) Of the two stock exchanges within China, the Shanghai is more widely followed than Shenzhen internationally. Due to various changes over time to Chinese stock markets, a base date of date of May 27th, 2002 was selected as no major regulation or composition changes took place after this date. This date also make sense as the full selection of commodity data can be gained, starting from this data as well.

Starting in late 2008 and early 2009, sector and thematic indexes began trading on the Shanghai Stock Exchange. To isolate the impact of commodities on Chinese companies, weekly data from January 12th, 2009 till the last trading week of 2009 is also compared against the selected commodities. Table 2 below presents the sector and thematic indexes, along with their start dates.

Table 2- List of Shanghai Indices Used

Chinese Index Name	Code	Exchange
Shanghai Composite Index	1	SSE
SSE Energy Sector Index	32	SSE
SSE Materials Sector Index	33	SSE
SSE Industrials Sector Index	34	SSE
SSE Consumer Discretionary Sector Index	35	SSE
SSE Consumer Staples Sector Index	36	SSE
SSE Health Care Sector Index	37	SSE
SSE Financials Sector Index	38	SSE
SSE Information Technology Sector Index	39	SSE
SSE Telecommunication Services Sector Index	40	SSE
SSE Utilities Sector Index	41	SSE
SSE 180 Growth Index	28	SSE
SSE 180 Value Index	29	SSE
SSE 180 Infrastructure Index	25	SSE
SSE 180 Natural Resource Index	26	SSE
SSE 180 Transportation Index	27	SSE

4.4 Robustness (BLUE) Tests

Ordinary Least Squares (OLS) Models require that basic assumptions must be checked before performing any analysis and inference of results. By meeting all criteria of the basic assumptions, the estimators created by the data are labeled BLUE for Best Linear Unbiased Estimators. The assumptions and appropriate tests for them are below: (Brooks 2008)

A. $E(u_t)$ = 0: The error term is expected to have a mean of zero.
B. Var(u_t) = $\sigma^2 < \infty$: The variance of the errors is finite and constant over time.
C. Cov (u_i, u_j) = 0: The errors are linearly independent of one another.
D. Cov (u_t, x_t) = 0: The errors are independent of the corresponding explanatory variable.
E. u_t ~ N(0, σ^2): To make reliable and valid inferences the errors are expected to be normally distributed

Per A: This assumption will never be violated as there is no theoretical reason for not including an intercept. Brooks (2008)
Per B: If this assumption is held to be not true, then estimates are deemed to have heteroscedastic tendencies and therefore not as efficient as theory dictates. To test for this, a White test and ARCH test are utilized with results and comments below.
Per C: If the assumption is not true, the errors are said to be auto-correlated. Auto-correlation leads to incorrect interpretation of the variables. Durbin-Watson and Breusch-Godfrey tests will show if autocorrelation exists. The results from these two tests are below.
Per D: This assumption requires the error terms to be uncorrelated with the corresponding explanatory variables. A cross-correlation matrix will easily show relationships between all variables.
Per E: A Jarque-Bera test checks for the normal distribution of the error terms.

4.4.1 Ramsey Reset Test

A Ramsey Reset Test looks for misspecification by examining whether non-linear combinations of the estimated values help explain the endogenous variable. The intuition behind the test is that, if non-linear combinations of the explanatory variables have any power in explaining the dependent variable, then the model is misspecified. If the Ramsey test is significant, often information is missing that allows for non-linear combinations to become relevant. Therefore, including more explanatory variables can yield a significant result, yet increases the probability of multicolinearity.

4.5 Methodological Problems

To ensure that the regressions and model are of proper rigor to produce meaningful results, the validity and reliability of the approach in this paper should be contrasted against other methods and sources of information.

4.5.1 Validity

An alternative to weekly close data is using the average of all closes in the five trading days during each week. By taking the averages, the idea is to smooth out extreme movements that may not be responding to purely economic forces. Political announcements, regulation exchanges, etc… can cause unexpected price distortion. Averages seek to focus only on fundamental forces. Chinese companies operate in an environment where commodity price is dictated by all forces. Their profit and loss, and theoretically their existence, depends on the current price regardless of cause.

An Error Correction Model also addresses similar issues as taking the averages of the daily closes for a trading week. By trying to smooth outliers and adjust for lagging information, an ECM hopes to focus more purely on fundamental economic forces. The same argument above against taking averages of closing prices applies. While OLS may seem a simplistic econometric approach, it explicitly captures all price movements and estimates the degree of impact of a specific commodity upon the stock index. Therefore an OLS model is preferred to an Error Correction Model.

4.5.2 Reliability

OLS methodology is a reliable method and has been utilized for decades. (Brooks 2008)

With ten explanatory variables in this formula, the risk of multicollinearity becomes relatively higher than if fewer variables are used. This paper acknowledges this risk, but reiterates that the model seeks to identify basic relationships between all commodities and Chinese companies. Low levels of cross correlation also give confidence that commodities are not impacting each other. To further test our reliability, the sub-indexes provide verification that this approach will work in multiple regressions.

Structurally, Datastream Advance provides reliable data. Eviews and Microsoft Excel are widely used programs for processing data. This paper follows many others in relying upon their computational soundness.

397 observations are used for the main regression of commodities upon the Shanghai Stock Exchange Index. This large number of observations gives great confidence that the findings will fully reflect the data and are not skewed by flaws in the data.

For the sub-indexes, 53 observations were used. The sub-indexes have been trading for about one year and as a result the number of observations is limited.

5. Results and Analysis

This section will first review the results of the robustness tests. Next, the OLS regression of the selected commodities upon Shanghai Stock Exchange Index will be examined. From this regression result, insight will be gained to which commodities actually affect the profit of Chinese firms. To focus on particular types of Chinese companies by sector and/or theme, the selected commodities was regressed on specific sub-indexes. Microsoft Excel 7.0 was used to calculate these OLS regressions.

5.1 Robustness Tests Results (Numeric Results in Appendix A)

White Test: In testing the variance of the errors, the results of the White Test are non-significant. Therefore, it can be stated that our errors are homoscedastic and no adjustment for this assumption is needed.

ARCH Test: Even though the White test is insignificant, the ARCH test is significant for heteroskedasticity. This is not necessarily surprising given the volatility and stock market performance over the sample period. From 2000 to April 2010, the Shanghai Stock Exchange Composite Index experienced a pronounced shift in value. (Graph Below) With such a highly volatile movement and uncertain investing environment, it is unsurprising that there is some information impacting decisions overtime.

Figure 1- 10yr Performance of Shanghai Composite Index

Breusch-Godfrey Test: This test of autocorrelation did not provide significant results. Therefore we cannot reject the null hypothesis of non-autocorrelation. No adjustment for this assumption is needed.

Cross Correlation Matrix: Amongst the commodities and composite index, the highest correlation is 0.58 between corn and wheat. The next highest is 0.55 between soybeans and corn. These relatively low correlations between the commodities and composite index give confidence that there is little multi-collinearity between our dependent and independent variables. For the sector and thematic indexes, there is much higher correlation. This is not surprising as there is cross over between sectors and themes. For the purposes of this examination, the sub-indexes will be the dependent variables in separate equations. Therefore this correlation will not impact the findings. As there are no significant cross correlations between our explanatory variables, no adjustment for this assumption.

Jarque-Bera Test: The errors are fairly normally distributed. Two main outliers affect the sample, but with the volatility inherent in both the stock market and commodities markets these outliers are not unexpected. Moreover, from a theoretical point of view these outliers can provide great impact upon the Chinese companies. A great swing in commodity prices may catch companies unprepared and unexpectedly impact their earnings.

Ramsey Reset Test: This test for misspecification shows that gold is significant at the 5% level and copper is significant at the 1% level. This indicates that significant variables explaining the relationship between the Shanghai Composite Index and the selected commodities are missing. Possibly more precious and industrial metals should be included into the equation. Yet the purpose of this examination is to identify relationships between commodities and representative commodities have subjectively been chosen. The commodities chosen do not fully represent all of the commodities that Chinese companies buy or sell, therefore some misspecification is expected. This misspecification will not be corrected by adding more explanatory variables otherwise the regression may be too large and lead to high multi-collinearity.

5.2 Regression of Commodities upon SSE Composite

The results of the main regression have a low R^2 of 0.048 indicating very little explanatory value can be attributed to the regression. This is not surprising given that only a few commodities are selected from amongst the entire range of traded commodities. Furthermore there are some commodities that are simply not traded, such as iron ore or coal.

This low R^2 also matches the low amount of significant variables. Only two variables demonstrate statistical significance. Copper at the 10% level and Gold at the 5% level. These two make intuitive sense as Copper is in huge demand for construction and China has very little domestic production of the mineral, whereas Gold is necessary for advanced electronics where China has a leading market share. Surprisingly, Soybeans is not significant even though China is the leading buyer of soybeans in the world. The same surprise for WTI Crude as China is the second largest importer of oil behind the United States.

Table 3- Composite Regression Results

Variable	Coefficient	Std. Error	Prob.
C	0.001536	0.002136	0.4727
ALUMINUM	-0.074688	0.089844	0.4063
COPPER	0.174757	0.067953	0.0105
CORN	0.027466	0.062953	0.6629
COTTON	-0.020441	0.050103	0.6835
GOLD	0.175382	0.086663	0.0437
LIVECATTLE	-0.009313	0.084135	0.9119
NATGAS	-0.020097	0.027353	0.463
SOYBEANS	0.069943	0.06438	0.278
WHEAT	-0.066166	0.056808	0.2448
WTICRUDE	-0.00591	0.046132	0.8981

The coefficients for gold and copper are both positive, which is interesting as the regression was run against the entire index. The Shanghai Composite Index includes both miners and manufacturers. Presumably the miners would like for the prices to rise, while the manufacturers would like copper and gold to fall. A positive effect indicates that an increase in prices lead to a rise in the value of the index. The assumption is that miners have had a good profit, which has outweighed losses by manufacturers.

From this main regression, it can be seen that China does not have a large impact on global commodity prices. On a very general level, China remains a price-taker for the commodities represented. A larger coefficient value for copper and gold would indicate that Chinese companies can be price setters in the market. The main takeaway is that China for its growing economic stature remains very much at the mercy of the market for key commodities.

5.3 Regression of Commodities upon Sector and Thematic Indices

The main regression against the Shanghai Composite Index indicated a significant positive relationship with only gold and copper. This section breaks down the composite by examining sector and thematic indexes that have been trading for roughly a year. Significant results outside the materials and industrials index would be considered surprising for the sectors. Thematic indexes are expected to show a mix of results for growth and value. Infrastructure is expected to be negative as companies need to buy commodities on the open market and natural resources should be positive as these companies participate in global commodity production via exporting or competing with imports. Table 4 gives a synopsis of the results.

The most surprising result is the significance of Soybeans in six out of the fourteen sub-indices. For example, the Industrials Sub-Index is comprised of shipping, railways, construction, heavy industry, and airlines. Intuitively matching soybeans with industrial costs is not easy. On the other hand, the basic building materials of copper, gold, aluminum, and oil are not significant. The same surprise arises in the Materials Sub-Index regression results- significance with soybeans and absence of a relationship with copper and gold as expected. Most of the companies are miners and chemical or synthetic material makers. Consumer Discretionary, 180 Growth, 180 Infrastructure all exhibit 10% significance, which continues the theme of unexpected soybean correlation. Meanwhile all of these sector and thematic indexes display no correlation to the other selected commodities.

Table 4- Regression Results of Commodities upon all Sub-Indices

	Constant	Natural Gas	Live Cattle	WTI Crude	Corn	Soybeans	Gold	Aluminum	Copper	Cotton	Wheat
Sector Indices											
Energy	.014*	-.062	.212	.037	-.19	-.253	-.346	-1.154	.117	.074	.245
Materials	.016	-.157	.402	.069	-.03	-.745*	-.380	-1.018	.165	.213	.129
Industrials	.011	-.125	.166	.103	-.09	-.611*	-.253	-.634	.132	.156	.210
Consumer Discretionary	.018	-.023	.116	.042	-.10	-.578*	-.257	-.699	.048	.094	.132
Consumer Staples	.014	-.074	.238	.045	.074	-.440	-.418	-.151	-.077	.105	-.038
Health Care	.014	-.05	.264	.053	.106	-.452	-.026	-.589	.237	.095	-.045
Financial	.012	-.094	.388	-.030	-.21	-.523	-.471	-.075	-.039	.122	.394
Telcos	.013	-.097	-.208	.045	-.28	-.226	.341	-1.439*	.327	.178	.124
Utilities	.009	-.132	.096	.138	-.28	-.356	-.284	-.566	.152	.162	.169
Thematic Indices											
180 Growth	.014	-.120	.333	.018	-.15	-.603*	-.398	-.373	.039	.144	.298
180 Value	.011	-.084	.319	-.014	-.15	-.53	-.424	-.335	.081	.137	.315
180 Infrastructure	.006	-.077	.141	.015	-.08	-.424*	-.212	-.510	.115	.123	.187
180 Natural Resources	.016	-.068	.411	.027	-.16	-.467	-.451	-1.328*	.167	.127	.255
180 Transport	.012	-.133	.283	.123	-.14	-.782**	-.411	-.556	.100	.167	.300

** = 5% Significance   * = 10% Significance

The discovery of soybean importance combined with a lack of correlation in copper and gold, which was significant against the composite index over a longer time period, in the sub-indices is unexpected. Possibly, the correlation between global commodity prices and the Chinese companies was more impactful between 2002 and 2008, with no impact in 2009. Alternatively, there are other companies that benefit from rising gold and copper prices in the past. All of the correlations coefficients for soybeans are negative, implying that even though China is one of the largest consumers of soybeans, they are price-takers on the global market.

Inline with expectations, aluminum is significant in the telecommunication and natural resource sub-indices at the 10% level. The conductive properties of aluminum cause it to be in high demand for the telecommunication companies. Moreover, China does not possess much Aluminum and must meet demand by procuring it on the global market. The negative coefficients demonstrate this relationship and indicate that China is price-taker. The Transport thematic index does display significance at the 5% level for soybeans. Logically, this relationship makes sense as China imports large amount of soybeans. Therefore, the price change in soybeans will affect the amount shipped and theoretically the lower the price of soybeans, more will be shipped- leading to higher profits for transportation companies. Assuming that soybeans are the only influential commodity, given coal and iron ore are not traded on a futures exchange, the negative correlation coefficient indicates that profits for transport companies have fallen and soybean prices have risen over the past year. However, the chart of soybean prices over 2009 shows that they peaked in June at over $1275 and then trended downwards to end the year around $1050. (See Figure 2 below) Basic economic theory fails to explain the real world context in this case of the 180 Transport Sub-Index. Yet the significance of Soybeans to many sectors/themes remains a surprise throughout the sub-indices examination.

Figure 2- Soybeans Performance Chart (January '09 to May '10)

Outside of Aluminum and Soybeans, the selected commodities did not show significance across the sub-indices. As mentioned earlier, both gold and copper did not replicate their significance on a more focused level in a narrower time-frame.

6. Conclusion

China occupies a special place as the world's second largest economy and one of the largest consumers of commodities. Chinese companies do not possess much domestic production of key materials and must look to the rest of the world for key ingredients. Interestingly, through the mechanism of input costs, Chinese company stock performance can be impacted by the global price level of input commodities. Foreigners are largely prohibited from investing in the Chinese stock market, the exception being the QFII licenses, and it is interesting to see if the domestic Chinese stock market is indirectly influenced by global commodity prices. Additionally, in the investigative process it could be determined if China is a price-taker or setter in the global market.

Data representing ten selected commodities was regressed upon the Shanghai Composite Index and upon individual sector or thematic indexes. These regressions sought to determine if any impactful relationship existed between global commodity prices and the profit/loss of Chinese companies. This profit or loss would then dictate stock performance as a stock price is determined by earnings per share multiplied by the price/earnings multiple. Data for the Composite Index spanned seven years, while the sub-indices have only traded roughly a year. The results differed between the composite and the sub-indices.

The regression upon the composite index indicated that Chinese companies had a positive significant relationship with copper and gold prices. Yet, these findings were not repeated in the examination of the sub-indices. The main explanation for this divergence is a time lag, where the impact of gold and copper was significant sometime before 2009, when the sub-indices started trading. Subsequently, an emergence of a soybean significance showed up in several instances within the sub-indices. This relationship was not anticipated by theory and indicates China's status as the world's largest importer of soybeans relates significantly to price. The negative coefficient in all significant cases points to Chinese companies being price-takers on the global market. Additionally, the fact that this soybean relationship did not manifest in the regression against the composite index over seven years indicates this significance is relatively new. Future research could be directed into the emergence of this soybean relationship.

The supply and demand for commodities function on inelastic curves in the short term, while eventually adjusting to long term forces as capacity and regulations adjust. The current commodity boom is the third of the past sixty years and with this latest boom capacity remains a key constraint. (Radetzki 2008) Once new capacity comes on-line, the boom in prices will be punctuated as predicted by economic theory. According to this paper, China is a price-taker in the soybean market and would welcome a fall in prices. Yet, Chinese companies are also intertwined with gold and copper prices, in reference to the regression on composite index. The positive sign indicates, the stock market would not welcome a fall in prices for these two commodities.

The pricing of each commodity and Chinese company is of course related to specific constraints and incentives outside of the examined relationships in this paper. Attempting to identify all influences in determining prices is a task larger than a master's thesis. Yet this paper has shown that global thoughts and ideas do influence the prices of the Chinese Stock Market, even though direct foreign participation is restricted.

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APPENDIX A (Robustness Tests)

Table 5- White Test Results

Heteroskedasticity Test: White

F-statistic	1.226860	Prob. F(65,330)	0.1291
Obs*R-squared	77.07063	Prob. Chi-Square(65)	0.1452
Scaled explained SS	126.1042	Prob. Chi-Square(65)	0.0000

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/22/10 Time: 20:46
Sample: 6/04/2002 12/29/2009
Included observations: 396

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001431	0.000325	4.404597	0.0000
ALUMINUM	-0.002195	0.007675	-0.286072	0.7750
ALUMINUM^2	0.336116	0.176104	1.908625	0.0572
ALUMINUM*COPPER	-0.293949	0.251155	-1.170392	0.2427
ALUMINUM*CORN	-0.459874	0.232832	-1.975135	0.0491
ALUMINUM*COTTON	0.046806	0.183479	0.255099	0.7988
ALUMINUM*GOLD	0.115082	0.287448	0.400359	0.6892
ALUMINUM*LIVECATTLE	-0.253226	0.330805	-0.765485	0.4445
ALUMINUM*NATGAS	-0.096867	0.106849	-0.906574	0.3653
ALUMINUM*SOYBEANS	-0.161637	0.214819	-0.752431	0.4523
ALUMINUM*WHEAT	0.328272	0.199115	1.648656	0.1002
ALUMINUM*WTICRUDE	0.291094	0.169946	1.712862	0.0877
COPPER	-0.004403	0.005670	-0.776645	0.4379
COPPER^2	-0.058414	0.118968	-0.491005	0.6237
COPPER*CORN	0.229003	0.179131	1.278412	0.2020
COPPER*COTTON	-0.090331	0.151547	-0.596054	0.5515
COPPER*GOLD	-0.197811	0.210992	-0.937533	0.3492
COPPER*LIVECATTLE	0.458408	0.271435	1.688827	0.0922
COPPER*NATGAS	0.115151	0.086150	1.336639	0.1823
COPPER*SOYBEANS	-0.117146	0.172495	-0.679129	0.4975
COPPER*WHEAT	-0.082790	0.183190	-0.451936	0.6516
COPPER*WTICRUDE	0.120523	0.114443	1.053124	0.2931
CORN	0.002094	0.005492	0.381266	0.7033
CORN^2	0.016234	0.088328	0.183794	0.8543
CORN*COTTON	0.145579	0.124094	1.173135	0.2416
CORN*GOLD	-0.249819	0.211833	-1.179321	0.2391
CORN*LIVECATTLE	0.237123	0.217710	1.089168	0.2769
CORN*NATGAS	0.014865	0.065008	0.228661	0.8193
CORN*SOYBEANS	0.031811	0.188645	0.168631	0.8662
CORN*WHEAT	0.007482	0.121020	0.061828	0.9507
CORN*WTICRUDE	0.027120	0.120926	0.224269	0.8227
COTTON	-0.005157	0.004344	-1.187075	0.2361
COTTON^2	0.071639	0.059913	1.195721	0.2327
COTTON*GOLD	0.135675	0.206336	0.657544	0.5113
COTTON*LIVECATTLE	0.096825	0.164191	0.589713	0.5558
COTTON*NATGAS	-0.052748	0.053702	-0.982252	0.3267
COTTON*SOYBEANS	0.138197	0.116928	1.181894	0.2381

COTTON*WHEAT	0.024591	0.106958	0.229916	0.8183
COTTON*WTICRUDE	0.120031	0.092775	1.293784	0.1966
GOLD	-0.001897	0.007841	-0.241983	0.8089
GOLD^2	0.204955	0.161415	1.269741	0.2051
GOLD*LIVECATTLE	-0.151768	0.318618	-0.476333	0.6342
GOLD*NATGAS	0.055533	0.103127	0.538495	0.5906
GOLD*SOYBEANS	0.325910	0.248160	1.313307	0.1900
GOLD*WHEAT	0.103570	0.218189	0.474681	0.6353
GOLD*WTICRUDE	-0.092206	0.151305	-0.609402	0.5427
LIVECATTLE	0.003674	0.007194	0.510743	0.6099
LIVECATTLE^2	0.018259	0.121750	0.149973	0.8809
LIVECATTLE*NATGAS	0.032364	0.094518	0.342407	0.7323
LIVECATTLE*SOYBEANS	0.137090	0.232250	0.590271	0.5554
LIVECATTLE*WHEAT	-0.170213	0.194167	-0.876633	0.3813
LIVECATTLE*WTICRUDE	-0.114524	0.158077	-0.724482	0.4693
NATGAS	-0.000150	0.002410	-0.062178	0.9505
NATGAS^2	-0.014698	0.017845	-0.823654	0.4107
NATGAS*SOYBEANS	-0.031611	0.071769	-0.440447	0.6599
NATGAS*WHEAT	-0.002628	0.068216	-0.038526	0.9693
NATGAS*WTICRUDE	-0.010364	0.052173	-0.198648	0.8427
SOYBEANS	-0.007985	0.005536	-1.442593	0.1501
SOYBEANS^2	0.058534	0.093020	0.629261	0.5296
SOYBEANS*WHEAT	-0.211543	0.148494	-1.424585	0.1552
SOYBEANS*WTICRUDE	0.076154	0.121662	0.625946	0.5318
WHEAT	0.009105	0.004965	1.833837	0.0676
WHEAT^2	0.029331	0.081354	0.360539	0.7187
WHEAT*WTICRUDE	-0.092518	0.118825	-0.778603	0.4368
WTICRUDE	-0.000478	0.003899	-0.122485	0.9026
WTICRUDE^2	-0.118030	0.056456	-2.090661	0.0373

R-squared	0.194623	Mean dependent var	0.001712
Adjusted R-squared	0.035988	S.D. dependent var	0.003190
S.E. of regression	0.003132	Akaike info criterion	-8.543253
Sum squared resid	0.003237	Schwarz criterion	-7.879684
Log likelihood	1757.564	Hannan-Quinn criter.	-8.280367
F-statistic	1.226860	Durbin-Watson stat	1.714977
Prob(F-statistic)	0.129065		

Table 6- Arch Test Results

F-statistic	8.975275	Prob. F(1,393)	0.0029
Obs*R-squared	8.819531	Prob. Chi-Square(1)	0.0030

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 03/22/10 Time: 20:46
Sample (adjusted): 6/11/2002 12/29/2009
Included observations: 395 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001452	0.000181	8.038096	0.0000
RESID^2(-1)	0.149436	0.049881	2.995876	0.0029

R-squared	0.022328	Mean dependent var	0.001709
Adjusted R-squared	0.019840	S.D. dependent var	0.003193
S.E. of regression	0.003161	Akaike info criterion	-8.670610
Sum squared resid	0.003928	Schwarz criterion	-8.650464
Log likelihood	1714.445	Hannan-Quinn criter.	-8.662628
F-statistic	8.975275	Durbin-Watson stat	2.033156
Prob(F-statistic)	0.002910		

Table 7- Cross Correlation Matrix (SSE Composite and Commodities)

	SSE Composite	*Natural Gas*	*Live Cattle*	*WTI Crude*	*Corn*	*Soybeans*	*Gold*	*Aluminum*	*Copper*	*Cotton*	*Wheat*
SSE Composite	1.000										
Natural Gas	-0.017	1.000									
Live Cattle	-0.009	0.071	1.000								
WTI Crude	0.072	0.265	0.055	1.000							
Corn	0.070	0.042	-0.007	0.234	1.000						
Soybeans	0.099	0.057	0.066	0.242	0.550	1.000					
Gold	0.152	0.080	-0.037	0.340	0.250	0.231	1.000				
Aluminum	0.084	0.153	0.068	0.296	0.192	0.188	0.290	1.000			
Copper	0.173	0.107	0.013	0.391	0.215	0.224	0.358	0.630	1.000		
Cotton	0.035	0.049	0.048	0.230	0.261	0.340	0.195	0.116	0.192	1.000	
Wheat	0.033	0.006	-0.023	0.269	0.587	0.382	0.304	0.174	0.265	0.261	1.000

Table 8 - Cross Correlation Matrix (Sector/Theme Indices on Shanghai Stock Exchange)

	Ener-gy	*Mater-ials*	*Indus-trials*	*Cons Disc*	*Cons Staples*	*Health Care*	*Finan-cials*	*Telco*	*Utilities*	*180 Growth*	*180 Value*	*180 Infrastructure*	*180 Natural Resources*	*180 Transport*
Energy	1.000													
Materials	0.821	1.000												
Industrials	0.772	0.895	1.000											
Cons Disc	0.633	0.806	0.913	1.000										
Cons Staples	0.629	0.812	0.868	0.913	1.000									
Health Care	0.424	0.595	0.732	0.835	0.819	1.000								
Financials	0.777	0.749	0.747	0.575	0.546	0.342	1.000							
Telco	0.447	0.509	0.611	0.605	0.507	0.459	0.313	1.000						
Utilities	0.767	0.877	0.932	0.877	0.840	0.682	0.713	0.525	1.000					
180 Growth	0.857	0.881	0.871	0.721	0.701	0.492	0.963	0.447	0.832	1.000				
180 Value	0.821	0.826	0.816	0.657	0.622	0.423	0.985	0.361	0.791	0.979	1.000			
180 Infrastructure	0.788	0.857	0.954	0.866	0.841	0.704	0.767	0.582	0.938	0.866	0.836	1.000		
180 Natural Resources	0.963	0.907	0.823	0.694	0.692	0.460	0.792	0.486	0.791	0.891	0.841	0.812	1.000	
180 Transport	0.723	0.860	0.981	0.881	0.844	0.707	0.727	0.590	0.904	0.842	0.796	0.954	0.779	1.000

Table 9- Ramsey Reset Results

	Value	df	Probability
t-statistic	0.491827	384	0.6231
F-statistic	0.241894	(1, 384)	0.6231
Likelihood ratio	0.249374	1	0.6175

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.000427	1	0.000427
Restricted SSR	0.678051	385	0.001761
Unrestricted SSR	0.677624	384	0.001765
Unrestricted SSR	0.677624	384	0.001765

LR test summary:

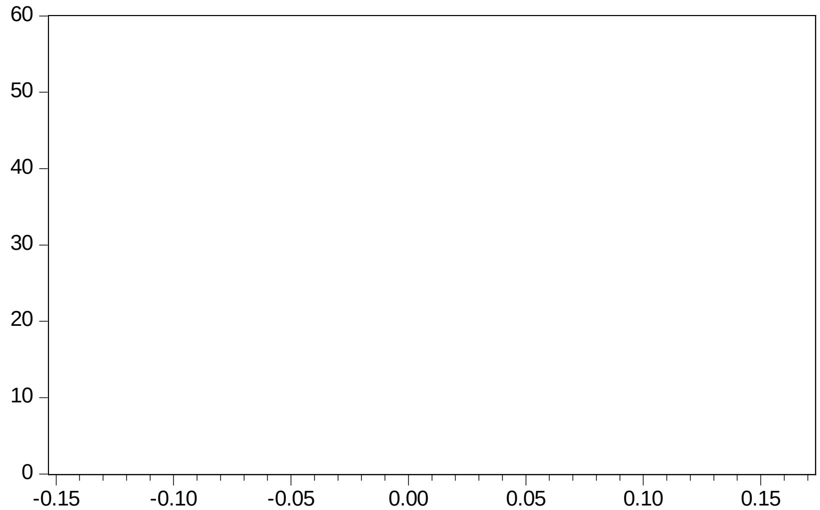
	Value	df
Restricted LogL	699.3498	385
Unrestricted LogL	699.4745	384

Unrestricted Test Equation:

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.002211	0.002541	0.870007	0.3848
ALUMINUM	-0.078896	0.090339	-0.873339	0.3830
COPPER	0.179191	0.068615	2.611554	0.0094
CORN	0.027656	0.063016	0.438880	0.6610
COTTON	-0.020605	0.050154	-0.410838	0.6814
GOLD	0.178318	0.086954	2.050719	0.0410
LIVECATTLE	-0.010650	0.084262	-0.126388	0.8995
NATGAS	-0.021475	0.027523	-0.780257	0.4357
SOYBEANS	0.073077	0.064757	1.128475	0.2598
WHEAT	-0.068226	0.057018	-1.196564	0.2322
WTICRUDE	-0.005770	0.046178	-0.124959	0.9006
FITTED^2	-7.268534	14.77864	-0.491827	0.6231

R-squared	0.049533	Mean dependent var	0.002719
Adjusted R-squared	0.022306	S.D. dependent var	0.042484
S.E. of regression	0.042008	Akaike info criterion	-3.472093
Sum squared resid	0.677624	Schwarz criterion	-3.351445
Log likelihood	699.4745	Hannan-Quinn criter.	-3.424296
F-statistic	1.819267	Durbin-Watson stat	1.953184
Prob(F-statistic)	0.049111		

Table 10- Jarque-Bera Results



Series: Residuals
Sample 6/04/2002 12/29/2009
Observations 396

Mean	2.64e-18
Median	0.000264
Maximum	0.160752
Minimum	-0.148893
Std. Dev.	0.041432
Skewness	0.001941
Kurtosis	4.462099
Jarque-Bera	35.27287
Probability	0.000000

APPENDIX B

<u>Table 11 - Composite Index Regression</u>

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.001536	0.002136	0.718825	0.4727
ALUMINUM	-0.074688	0.089844	-0.831305	0.4063
COPPER	0.174757	0.067953	2.571739	0.0105
CORN	0.027466	0.062953	0.436303	0.6629
COTTON	-0.020441	0.050103	-0.407969	0.6835
GOLD	0.175382	0.086663	2.023719	0.0437
LIVECATTLE	-0.009313	0.084135	-0.110689	0.9119
NATGAS	-0.020097	0.027353	-0.734730	0.4630
SOYBEANS	0.069943	0.064380	1.086415	0.2780
WHEAT	-0.066166	0.056808	-1.164738	0.2448
WTICRUDE	-0.005910	0.046132	-0.128115	0.8981

R-squared	0.048934	Mean dependent var	0.002719
Adjusted R-squared	0.024231	S.D. dependent var	0.042484
S.E. of regression	0.041966	Akaike info criterion	-3.476514
Sum squared resid	0.678051	Schwarz criterion	-3.365919
Log likelihood	699.3498	Hannan-Quinn criter.	-3.432700
F-statistic	1.980905	Durbin-Watson stat	1.951880
Prob(F-statistic)	0.034182		

Table 12 – Energy Sub-Index

Regression Statistics	
Multiple R	0.396
R Square	0.156
Adjusted R Square	-0.049
Standard Error	0.056
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.024	0.002	0.761	0.665
Residual	41	0.129	0.003		
Total	51	0.153			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.014	0.008	1.677	0.101	-0.003	0.031	-0.003	0.031
Natural Gas	-0.062	0.122	-0.510	0.613	-0.309	0.184	-0.309	0.184
Live Cattle	0.212	0.414	0.513	0.611	-0.624	1.048	-0.624	1.048
WTI Crude	0.037	0.183	0.203	0.840	-0.333	0.408	-0.333	0.408
Corn	-0.192	0.396	-0.485	0.630	-0.991	0.607	-0.991	0.607
Soybeans	-0.253	0.401	-0.630	0.532	-1.063	0.557	-1.063	0.557
Gold	-0.346	0.413	-0.836	0.408	-1.180	0.489	-1.180	0.489
Aluminum	-1.154	0.759	-1.520	0.136	-2.687	0.380	-2.687	0.380
Copper	0.117	0.432	0.271	0.788	-0.756	0.990	-0.756	0.990
Cotton	0.074	0.194	0.379	0.706	-0.319	0.466	-0.319	0.466
Wheat	0.245	0.288	0.853	0.399	-0.335	0.826	-0.335	0.826

Table 13 - Materials Sub-Index

Regression Statistics	
Multiple R	0.524
R Square	0.275
Adjusted R Square	0.098
Standard Error	0.054
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.046	0.005	1.555	0.155
Residual	41	0.120	0.003		
Total	51	0.166			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.016	0.008	2.043	0.048	0.000	0.033	0.000	0.033
Natural Gas	-0.157	0.118	-1.331	0.191	-0.395	0.081	-0.395	0.081
Live Cattle	0.402	0.399	1.008	0.319	-0.404	1.208	-0.404	1.208
WTI Crude	0.069	0.177	0.389	0.699	-0.288	0.426	-0.288	0.426
Corn	-0.032	0.381	-0.083	0.934	-0.802	0.738	-0.802	0.738
Soybeans	-0.745	0.387	-1.926	0.061	-1.527	0.036	-1.527	0.036
Gold	-0.380	0.398	-0.953	0.346	-1.184	0.425	-1.184	0.425
Aluminum	-1.018	0.732	-1.391	0.172	-2.497	0.460	-2.497	0.460
Copper	0.165	0.417	0.395	0.695	-0.677	1.006	-0.677	1.006
Cotton	0.213	0.188	1.138	0.262	-0.165	0.592	-0.165	0.592
Wheat	0.129	0.277	0.466	0.644	-0.431	0.689	-0.431	0.689

Table 14 – Industrial Sub-Index

Regression Statistics	
Multiple R	0.480
R Square	0.230
Adjusted R Square	0.043
Standard Error	0.043
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.022	0.002	1.227	0.303
Residual	41	0.075	0.002		
Total	51	0.097			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.011	0.006	1.758	0.086	-0.002	0.024	-0.002	0.024
Natural Gas	-0.125	0.093	-1.346	0.186	-0.313	0.063	-0.313	0.063
Live Cattle	0.166	0.315	0.527	0.601	-0.470	0.801	-0.470	0.801
WTI Crude	0.103	0.139	0.741	0.463	-0.178	0.385	-0.178	0.385
Corn	-0.091	0.301	-0.302	0.765	-0.698	0.517	-0.698	0.517
Soybeans	-0.611	0.305	-2.002	0.052	-1.227	0.005	-1.227	0.005
Gold	-0.253	0.314	-0.806	0.425	-0.888	0.381	-0.888	0.381
Aluminum	-0.634	0.577	-1.098	0.279	-1.799	0.532	-1.799	0.532
Copper	0.132	0.329	0.400	0.691	-0.532	0.795	-0.532	0.795
Cotton	0.156	0.148	1.052	0.299	-0.143	0.454	-0.143	0.454
Wheat	0.210	0.219	0.962	0.342	-0.231	0.652	-0.231	0.652

Table 15 – Consumer Discretionary Index

Regression Statistics	
Multiple R	0.443
R Square	0.197
Adjusted R Square	0.001
Standard Error	0.047
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.022	0.002	1.004	0.456
Residual	41	0.092	0.002		
Total	51	0.114			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.018	0.007	2.576	0.014	0.004	0.032	0.004	0.032
Natural Gas	-0.023	0.103	-0.227	0.822	-0.231	0.185	-0.231	0.185
Live Cattle	0.116	0.349	0.333	0.741	-0.588	0.821	-0.588	0.821
WTI Crude	0.042	0.155	0.269	0.789	-0.271	0.354	-0.271	0.354
Corn	-0.107	0.333	-0.321	0.750	-0.780	0.566	-0.780	0.566
Soybeans	-0.578	0.338	-1.709	0.095	-1.261	0.105	-1.261	0.105
Gold	-0.257	0.348	-0.737	0.465	-0.960	0.447	-0.960	0.447
Aluminum	-0.699	0.640	-1.093	0.281	-1.991	0.593	-1.991	0.593
Copper	0.048	0.364	0.132	0.896	-0.688	0.784	-0.688	0.784
Cotton	0.094	0.164	0.575	0.569	-0.237	0.425	-0.237	0.425
Wheat	0.132	0.242	0.545	0.589	-0.357	0.622	-0.357	0.622

Table 16 – Consumer Staples Index

Regression Statistics	
Multiple R	0.442
R Square	0.195
Adjusted R Square	-0.001
Standard Error	0.041
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.017	0.002	0.996	0.463
Residual	41	0.068	0.002		
Total	51	0.085			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.014	0.006	2.339	0.024	0.002	0.026	0.002	0.026
Natural Gas	-0.074	0.089	-0.834	0.409	-0.253	0.105	-0.253	0.105
Live Cattle	0.238	0.300	0.793	0.432	-0.368	0.844	-0.368	0.844
WTI Crude	0.045	0.133	0.336	0.739	-0.224	0.313	-0.224	0.313
Corn	0.074	0.287	0.256	0.799	-0.506	0.653	-0.506	0.653
Soybeans	-0.440	0.291	-1.511	0.138	-1.027	0.148	-1.027	0.148
Gold	-0.418	0.300	-1.393	0.171	-1.023	0.188	-1.023	0.188
Aluminum	-0.151	0.550	-0.274	0.785	-1.263	0.961	-1.263	0.961
Copper	-0.077	0.313	-0.246	0.807	-0.710	0.556	-0.710	0.556
Cotton	0.105	0.141	0.748	0.459	-0.179	0.390	-0.179	0.390
Wheat	-0.038	0.209	-0.180	0.858	-0.459	0.384	-0.459	0.384

Table 17 – Health Care Index

Regression Statistics	
Multiple R	0.400
R Square	0.160
Adjusted R Square	-0.045
Standard Error	0.039
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.012	0.001	0.782	0.646
Residual	41	0.064	0.002		
Total	51	0.076			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.014	0.006	2.319	0.025	0.002	0.025	0.002	0.025
Natural Gas	-0.050	0.086	-0.580	0.565	-0.223	0.123	-0.223	0.123
Live Cattle	0.264	0.290	0.908	0.369	-0.323	0.850	-0.323	0.850
WTI Crude	0.053	0.129	0.415	0.681	-0.206	0.313	-0.206	0.313
Corn	0.106	0.278	0.381	0.705	-0.455	0.666	-0.455	0.666
Soybeans	-0.452	0.282	-1.605	0.116	-1.020	0.117	-1.020	0.117
Gold	-0.026	0.290	-0.091	0.928	-0.612	0.559	-0.612	0.559
Aluminum	-0.589	0.533	-1.105	0.276	-1.664	0.487	-1.664	0.487
Copper	0.237	0.303	0.780	0.440	-0.376	0.849	-0.376	0.849
Cotton	0.095	0.136	0.694	0.492	-0.181	0.370	-0.181	0.370
Wheat	-0.045	0.202	-0.226	0.823	-0.453	0.362	-0.453	0.362

Table 18 – Financial Sub-Index

Regression Statistics	
Multiple R	0.370
R Square	0.137
Adjusted R Square	-0.073
Standard Error	0.054
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.019	0.002	0.652	0.761
Residual	41	0.118	0.003		
Total	51	0.137			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.012	0.008	1.531	0.133	-0.004	0.028	-0.004	0.028
Natural Gas	-0.094	0.117	-0.803	0.427	-0.329	0.142	-0.329	0.142
Live Cattle	0.388	0.395	0.981	0.332	-0.410	1.186	-0.410	1.186
WTI Crude	-0.030	0.175	-0.172	0.864	-0.384	0.323	-0.384	0.323
Corn	-0.209	0.378	-0.552	0.584	-0.971	0.554	-0.971	0.554
Soybeans	-0.523	0.383	-1.365	0.180	-1.296	0.251	-1.296	0.251
Gold	-0.471	0.395	-1.194	0.239	-1.268	0.326	-1.268	0.326
Aluminum	-0.075	0.725	-0.104	0.918	-1.539	1.388	-1.539	1.388
Copper	-0.039	0.413	-0.094	0.925	-0.872	0.795	-0.872	0.795
Cotton	0.122	0.186	0.658	0.514	-0.253	0.497	-0.253	0.497
Wheat	0.394	0.275	1.434	0.159	-0.161	0.948	-0.161	0.948

Table 19 – Telecommunications Sub-Index

Regression Statistics	
Multiple R	0.389
R Square	0.151
Adjusted R Square	-0.056
Standard Error	0.057
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.024	0.002	0.731	0.691
Residual	41	0.132	0.003		
Total	51	0.156			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.013	0.008	1.587	0.120	-0.004	0.030	-0.004	0.030
Natural Gas	-0.097	0.124	-0.785	0.437	-0.347	0.153	-0.347	0.153
Live Cattle	-0.208	0.419	-0.497	0.622	-1.053	0.637	-1.053	0.637
WTI Crude	0.045	0.185	0.240	0.811	-0.330	0.419	-0.330	0.419
Corn	-0.279	0.400	-0.697	0.490	-1.087	0.529	-1.087	0.529
Soybeans	-0.226	0.406	-0.557	0.580	-1.046	0.594	-1.046	0.594
Gold	0.341	0.418	0.817	0.419	-0.503	1.185	-0.503	1.185
Aluminum	-1.439	0.768	-1.874	0.068	-2.990	0.111	-2.990	0.111
Copper	0.327	0.437	0.748	0.459	-0.556	1.210	-0.556	1.210
Cotton	0.178	0.197	0.905	0.371	-0.219	0.575	-0.219	0.575
Wheat	0.124	0.291	0.426	0.672	-0.463	0.711	-0.463	0.711

Table 20 – Utilities Sub-Index

Regression Statistics	
Multiple R	0.428
R Square	0.183
Adjusted R Square	-0.016
Standard Error	0.043
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.017	0.002	0.917	0.527
Residual	41	0.077	0.002		
Total	51	0.094			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.009	0.006	1.434	0.159	-0.004	0.022	-0.004	0.022
Natural Gas	-0.132	0.094	-1.400	0.169	-0.322	0.058	-0.322	0.058
Live Cattle	0.096	0.319	0.301	0.765	-0.549	0.741	-0.549	0.741
WTI Crude	0.138	0.141	0.975	0.335	-0.148	0.424	-0.148	0.424
Corn	-0.281	0.305	-0.921	0.362	-0.897	0.335	-0.897	0.335
Soybeans	-0.356	0.310	-1.149	0.257	-0.981	0.270	-0.981	0.270
Gold	-0.284	0.319	-0.891	0.378	-0.928	0.360	-0.928	0.360
Aluminum	-0.566	0.586	-0.966	0.340	-1.749	0.617	-1.749	0.617
Copper	0.152	0.334	0.454	0.652	-0.522	0.825	-0.522	0.825
Cotton	0.162	0.150	1.083	0.285	-0.141	0.465	-0.141	0.465
Wheat	0.169	0.222	0.760	0.452	-0.279	0.617	-0.279	0.617

Table 21 – 180 Growth Index

Regression Statistics	
Multiple R	0.420
R Square	0.176
Adjusted R Square	-0.025
Standard Error	0.050
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.022	0.002	0.877	0.562
Residual	41	0.102	0.002		
Total	51	0.124			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.014	0.007	1.906	0.064	-0.001	0.029	-0.001	0.029
Natural Gas	-0.120	0.108	-1.103	0.277	-0.339	0.099	-0.339	0.099
Live Cattle	0.333	0.367	0.907	0.370	-0.409	1.075	-0.409	1.075
WTI Crude	0.018	0.163	0.111	0.912	-0.311	0.347	-0.311	0.347
Corn	-0.152	0.351	-0.432	0.668	-0.860	0.557	-0.860	0.557
Soybeans	-0.603	0.356	-1.693	0.098	-1.322	0.116	-1.322	0.116
Gold	-0.398	0.367	-1.086	0.284	-1.139	0.342	-1.139	0.342
Aluminum	-0.373	0.674	-0.553	0.583	-1.733	0.988	-1.733	0.988
Copper	0.039	0.384	0.102	0.919	-0.736	0.814	-0.736	0.814
Cotton	0.144	0.173	0.833	0.410	-0.205	0.492	-0.205	0.492
Wheat	0.298	0.255	1.167	0.250	-0.217	0.813	-0.217	0.813

Table 22 – 180 Value Index

Regression Statistics	
Multiple R	0.408
R Square	0.166
Adjusted R Square	-0.037
Standard Error	0.047
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.018	0.002	0.817	0.615
Residual	41	0.091	0.002		
Total	51	0.110			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.011	0.007	1.616	0.114	-0.003	0.025	-0.003	0.025
Natural Gas	-0.084	0.103	-0.816	0.419	-0.292	0.124	-0.292	0.124
Live Cattle	0.319	0.348	0.916	0.365	-0.384	1.022	-0.384	1.022
WTI Crude	-0.014	0.154	-0.092	0.927	-0.326	0.297	-0.326	0.297
Corn	-0.156	0.333	-0.469	0.642	-0.828	0.516	-0.828	0.516
Soybeans	-0.530	0.338	-1.571	0.124	-1.212	0.152	-1.212	0.152
Gold	-0.424	0.348	-1.219	0.230	-1.126	0.278	-1.126	0.278
Aluminum	-0.335	0.639	-0.525	0.602	-1.625	0.954	-1.625	0.954
Copper	0.081	0.364	0.222	0.826	-0.654	0.815	-0.654	0.815
Cotton	0.137	0.164	0.835	0.408	-0.194	0.467	-0.194	0.467
Wheat	0.315	0.242	1.304	0.199	-0.173	0.804	-0.173	0.804

Table 23 – 180 Infrastructure Index

Regression Statistics	
Multiple R	0.431
R Square	0.186
Adjusted R Square	-0.013
Standard Error	0.036
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.012	0.001	0.934	0.513
Residual	41	0.052	0.001		
Total	51	0.064			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.006	0.005	1.134	0.263	-0.005	0.017	-0.005	0.017
Natural Gas	-0.077	0.078	-0.993	0.327	-0.234	0.080	-0.234	0.080
Live Cattle	0.141	0.263	0.536	0.595	-0.390	0.671	-0.390	0.671
WTI Crude	0.015	0.116	0.128	0.899	-0.220	0.250	-0.220	0.250
Corn	-0.088	0.251	-0.350	0.728	-0.595	0.419	-0.595	0.419
Soybeans	-0.424	0.255	-1.667	0.103	-0.939	0.090	-0.939	0.090
Gold	-0.212	0.262	-0.808	0.424	-0.741	0.318	-0.741	0.318
Aluminum	-0.510	0.482	-1.058	0.296	-1.482	0.463	-1.482	0.463
Copper	0.115	0.274	0.420	0.677	-0.439	0.669	-0.439	0.669
Cotton	0.123	0.123	0.998	0.324	-0.126	0.372	-0.126	0.372
Wheat	0.187	0.182	1.026	0.311	-0.181	0.556	-0.181	0.556

Table 24 – 180 Natural Resources Index

Regression Statistics	
Multiple R	0.478
R Square	0.229
Adjusted R Square	0.041
Standard Error	0.057
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.039	0.004	1.217	0.309
Residual	41	0.132	0.003		
Total	51	0.171			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.016	0.008	1.915	0.062	-0.001	0.033	-0.001	0.033
Natural Gas	-0.068	0.123	-0.550	0.585	-0.317	0.181	-0.317	0.181
Live Cattle	0.411	0.418	0.983	0.331	-0.433	1.255	-0.433	1.255
WTI Crude	0.027	0.185	0.147	0.884	-0.347	0.401	-0.347	0.401
Corn	-0.164	0.399	-0.410	0.684	-0.970	0.643	-0.970	0.643
Soybeans	-0.467	0.405	-1.153	0.256	-1.285	0.351	-1.285	0.351
Gold	-0.451	0.417	-1.082	0.286	-1.294	0.391	-1.294	0.391
Aluminum	-1.328	0.766	-1.733	0.091	-2.876	0.220	-2.876	0.220
Copper	0.167	0.436	0.382	0.705	-0.715	1.048	-0.715	1.048
Cotton	0.127	0.196	0.648	0.521	-0.269	0.524	-0.269	0.524
Wheat	0.255	0.290	0.878	0.385	-0.331	0.841	-0.331	0.841

Table 25 – 180 Transport Index

Regression Statistics	
Multiple R	0.503
R Square	0.253
Adjusted R Square	0.071
Standard Error	0.048
Observations	52

ANOVA

	Df	*SS*	*MS*	*F*	*Significance F*
Regression	10	0.033	0.003	1.388	0.220
Residual	41	0.096	0.002		
Total	51	0.129			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	0.012	0.007	1.715	0.094	-0.002	0.027	-0.002	0.027
Natural Gas	-0.133	0.105	-1.267	0.212	-0.346	0.079	-0.346	0.079
Live Cattle	0.283	0.357	0.793	0.433	-0.438	1.003	-0.438	1.003
WTI Crude	0.123	0.158	0.779	0.440	-0.196	0.442	-0.196	0.442
Corn	-0.140	0.341	-0.411	0.683	-0.828	0.548	-0.828	0.548
Soybeans	-0.782	0.346	-2.261	0.029	-1.480	-0.083	-1.480	-0.083
Gold	-0.411	0.356	-1.155	0.255	-1.131	0.308	-1.131	0.308
Aluminum	-0.556	0.654	-0.850	0.400	-1.878	0.765	-1.878	0.765
Copper	0.100	0.373	0.268	0.790	-0.652	0.852	-0.652	0.852
Cotton	0.167	0.168	0.999	0.324	-0.171	0.506	-0.171	0.506
Wheat	0.300	0.248	1.209	0.233	-0.201	0.800	-0.201	0.800