The Predictive Power of Commodity Futures Prices on South American Equity Markets

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Abstract:

The purpose of this paper is to examine the relationship between the futures United States futures market the returns on the South American stock market. In particular the paper focuses on three key commodities—industrial sugar, copper, and coffee. The study looks into methods to isolate the effect of the United States commodity market from the returns of the equity exchanges in both the United States and South America. Once isolated, the relationship between the selected commodities and South American stock market returns can be estimated through quantitative analysis.

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1.0 INTRODUCTION

Figuring out what determines the returns in equity markets has been a pursuit that has consumed the lives of many academics and industry professionals. Even today there isn't much that can be said in terms of models that can completely predict returns in individual securities or markets in general. At their core, exchanges such as the NYSE act as a centralized location for financial information to be exposed and calculated into the price of their related securities. The efficiency of these markets has increased substantially as communication and technology have progressed over the years, with arbitrage opportunities being limited or even impossible to find.

Commodity futures prices have often served as barometers of the global economy. This is because they incorporate much of the present and historical data into their prices. Many financial gurus believe they serve an important informational role in the broader equity markets. Addressing whether this statement is true or not will help evaluate how useful commodity futures markets are at disseminating information. Spot prices may also have some predicative capabilities, but due to a lack of centralized trading locations they do not have the same effect that futures markets possess.

This paper aims to analyse whether historical prices of three different commodities that are traded on the Intercontinental Exchange (ICE) have a statistically significant relationship to returns in the equity markets of South America. Specifically the commodities that this paper will look at are sugar, copper, and coffee. Those three commodities were chosen based on the amounts that were exported out of South American countries. Within these commodities, the countries that are represented include Brazil, Colombia, Chile, and Peru. By proving that a relationship exists between futures prices and

the returns in South American equity markets, it implies that the commodity futures prices do reveal useful information about global economic strength.

Another important factor that needs to be considered is that a lot of countries in South America currently do not have a balanced dispersion of capital within their individual exchanges. This means that a small amount of companies can account for a large portion of the market capitalization of national stock markets. Studies have found that part of the reason could be attributed to the lack of established local pension and mutual funds (Johnson and Soenen, 2009). However, the concentration of capital has been somewhat equalized with the introduction of American Depositary Receipts (ADR's), which have accounted for a significant portion of capital flows into these markets over the past two decades. Having an exchange that isn't heavily concentrated in a few securities is important for the dissemination of information efficiently within the market.

Keeping that factor in mind, the choice of which exchange to use as a benchmark for the broader South American equity markets is extremely important. Although there isn't a market that singlehandedly encompasses all nations that are included within this study, the Mercado Integrado Latinoamericano (MILA) exchange does manage to capture three, specifically Colombia, Chile, and Peru. The issue with choosing the MILA exchange is twofold in that it doesn't include Brazil and furthermore it does not possess the highest market cap or volume within the exchanges of South America. Both are important factors to consider.

This paper was guided by two main research objectives that differ from other studies: First it specifically analyzes the South American equity markets; second, it looks at three commodities, which are sugar, coffee, and copper, as opposed to broader indexes.

There is very little other empirical work that looks at both specific commodities and the South American region. This paper successfully fills this void.

The rest of the paper is organized as follows: Section 2 looks at the trends of factors that are examined in this paper. Section 3 gives a literature review of significant papers related to the subject. Data and estimation methodology are discussed in section 4. Finally, section 5 presents and discusses the empirical results. This is followed by a conclusion in section 6.

2.0 TREND

Figure 1 shows the GDP growth of the countries that are included in this study from the period of 2005-2012. As expected, all the countries suffered from the financial crisis in late 2008, but for the most part have pulled away from their troughs in 2009. The only exception to this is Brazil, as their GDP growth in 2012 was still dismal compared to their historical rate. As a result, for the purpose of this study the regressions have been taken after the financial crisis, starting from 2008 onwards.

Figure 1: GDP Growth YoY in %
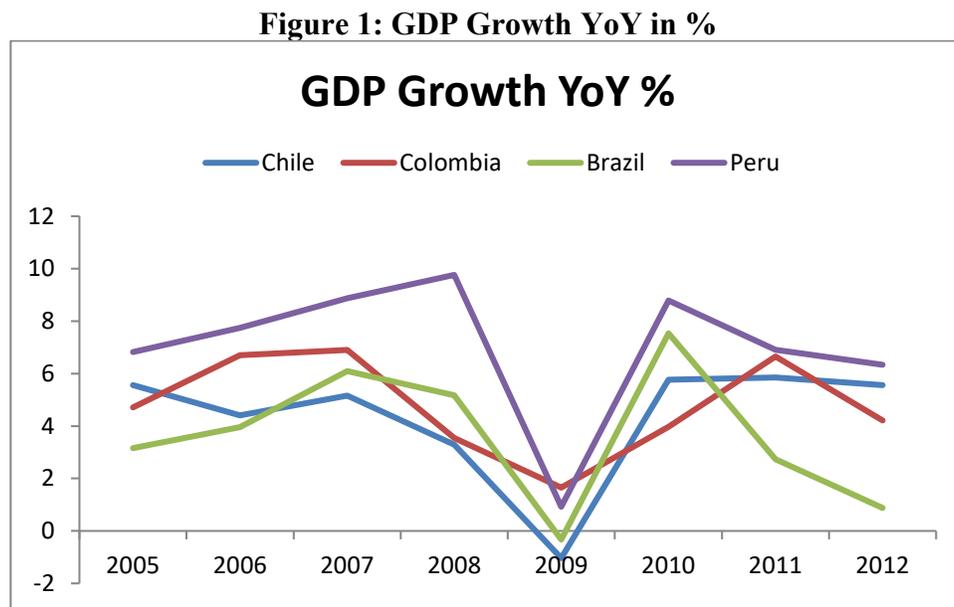
Source: World Bank Database

Figure 2 illustrates the total market capitalization of the markets of each country included in this study in millions of dollars. While Chile, Colombia, and Peru have been steady over 2005-2012, Brazil has seen significant jumps in market capitalization. Since market capitalization is directly tied to the stock prices of all relevant companies within the exchanges of the listed countries, it makes sense that there is a significant dip in 2008 due to the financial crisis. It seems that the markets have recovered to pre financial crisis levels despite lacking GDP growth in Brazil.

Figure 2: Market Capitalization in Millions of Dollars
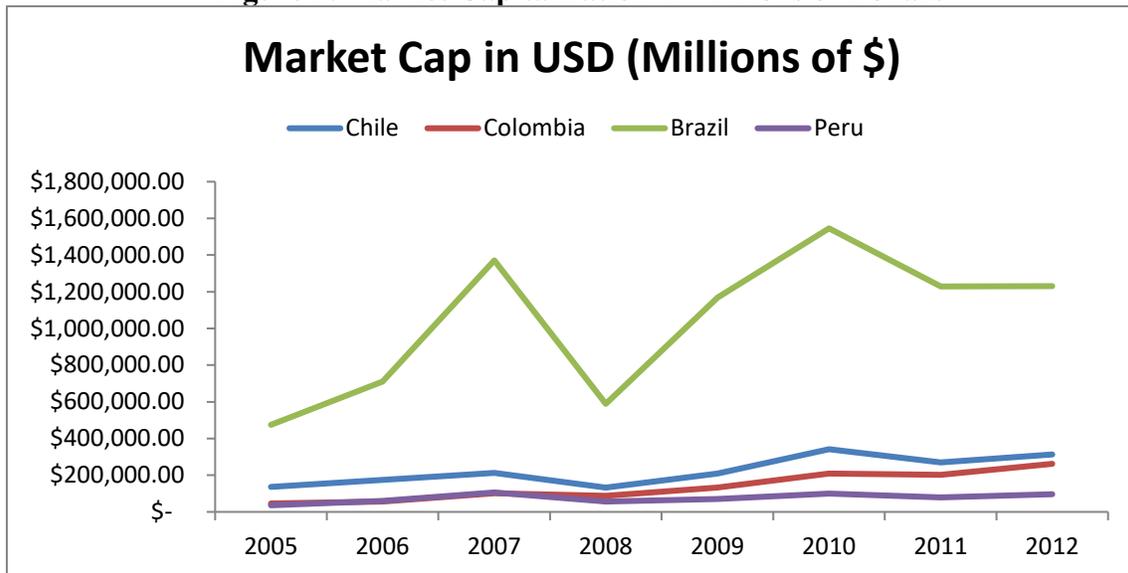
Source: World Bank Database

Figure 3 investigates the domestic exchanges of the selected countries a bit further by looking at the total amount of listed companies within the countries. This information is important to get an idea of exactly how diverse the exchanges within these countries are. For the most part there isn't an alarmingly low amount of companies within these countries. It is also important to note that in this study the MILA exchange is used. This exchange is a combination of all the companies listed within the individual exchanges of Chile, Colombia, and Peru which should circumvent some of the problems associated with having a limited offering within these markets.

Figure 3: Total Amount of Listed Domestic Companies
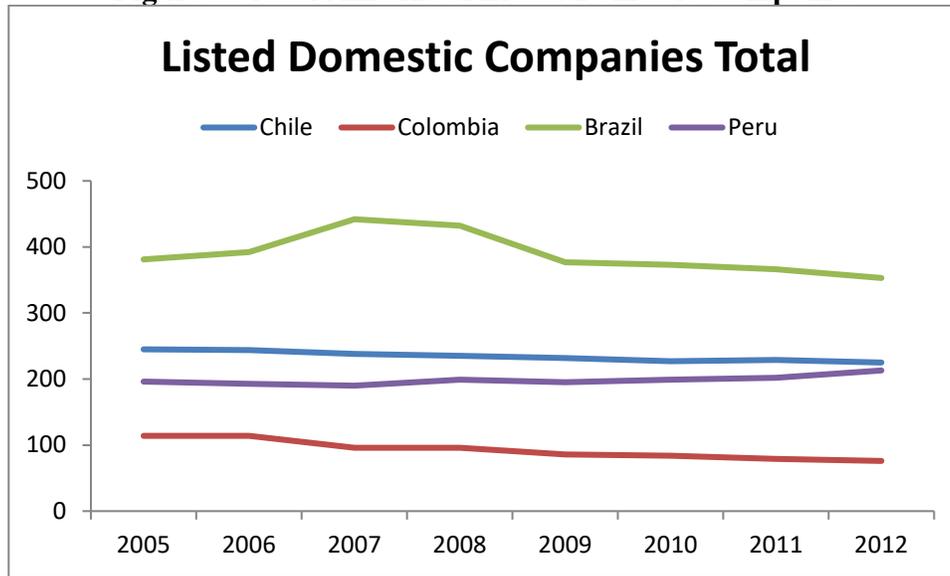
Source: World Bank Database

Figure 4 shows total exports from the listed countries as a percentage of their GDP. This graph helps to give an idea of exactly how export oriented all these countries are. Since the commodities were chosen based on amount exported in relation to other countries, it is important that they display a stable rate in relation to their GDP so that the data can be relied on over the time period the study is conducted in. As the graph shows, all the countries show a pretty steady trend, which is positive for the data used in this study.

Figure 4: Total Exports of Goods as a % of GDP
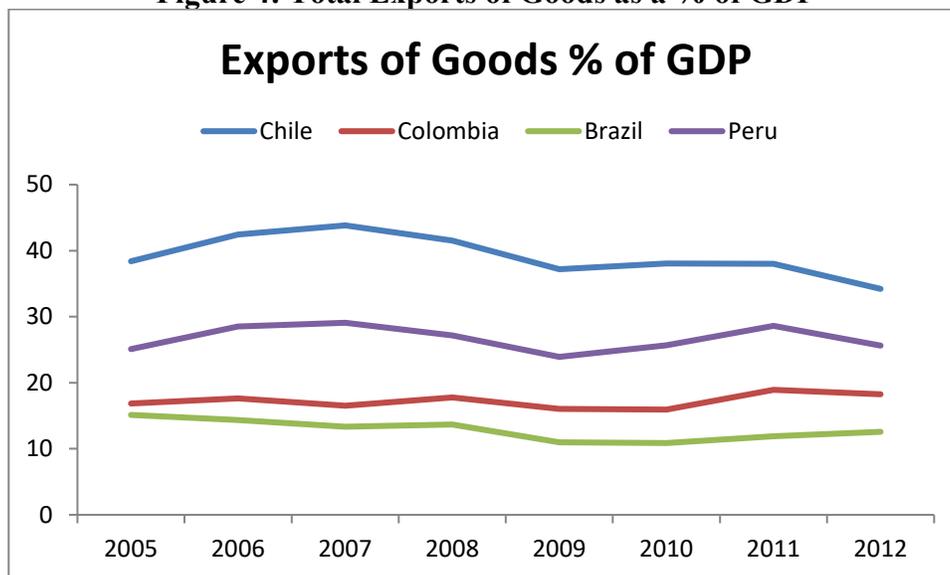
Source: World Bank Database

3.0 LITERATURE REVIEW

Commodity futures prices have been proven to incorporate information both historical and present into their prices when the information is relevant to the commodity. For example, Roll (1984) discusses how orange juice futures prices were directly affected by the weather outlook for the Florida region. Roll saw that nearly 98% of orange juice production was centered in Central Florida and that the cold weather was adverse for the continued healthy growth of oranges. After compiling the data and running a regression using both weather data and the futures prices of orange juice, Roll found that there was a statistically significant relationship between the two. The more important takeaway in this study, outside of the fact that the weather in Central Florida was a way to predict changes in futures prices of orange juice, is that the futures exchanges in general take into account speculations when calculating a price.

Although Roll (1984) does not specifically comment on the second conclusion, Bhar and Hamori (2008) have found that this is the case. Their research centered on commodity prices being indicators for monetary policy, but they comment on the viability of futures prices as leading indicators. They find that since commodity prices are determined in auction markets, they reflect the demand and supply shocks more rapidly than prices of manufactured goods. Moreover, their research also shows that speculative purchases or sales of commodities also add to the viability of futures prices as leading indicators to the general markets. Research on the livestock commodities market has found that the predictive power of these prices extends to about eight months before there is a drastic decline (Dwight and Manfredo 2008). Finally, preliminary research done by Osterholm and Zettelmeyer (2008) has found that Latin American GDP growth is linked

to external shocks, such as commodity prices. This study helps back up the basic premise of this study and provides important insight into how external shocks can affect the broader economy of Latin American countries.

Furthermore, there has been previous research that has found that there is a statistically significant relationship between commodities and the returns in equity markets of related countries (Hu and Xiong 2013). Much of the research and methodology used in this paper has been adapted from Hu and Xiong's study. In their research they looked at futures prices of copper, soybeans, and crude oil, in relation to the equity returns from China, Japan, and Hong Kong, South Korea. From their results they were able to establish that the futures prices of copper and soybeans were statistically significant in predicting the equity returns on the aforementioned economies. However some factors are fundamentally different since their study focused in on Asian stock market returns. For example, they only looked at the imported commodities of those selected Asian economies due to the low level of contribution to total income that commodity exports provide in these economies. South American countries on the other hand rely heavily on commodity exports, with countries such as Brazil even being number one in the world when it comes to coffee exports.

Johnson and Soenen (2009), has a similar premise to Hu and Xiong (2013), but focuses in on South American economies. Unlike this paper, they used a commodity index as a proxy for specific commodities. Despite the difference in model setup, they were able to find that there was evidence to support the idea stock markets of South American countries are highly affected by changes in commodity prices. To build on this

research, this paper will focus in on certain commodities that the selected South

American economies are known for exporting.

4.0 DATA AND EMPIRICAL METHODOLOGY

4.1 Data

The study uses daily data from 2009 to 2014. The data was obtained from Quandl, which

is a free database for a variety of different variables. Weekend data points and holidays

on the relevant stock exchanges are not included in the data set. Summary statistics for

the data are provided in Table 1.

Table 1 Summary Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Rmila	786	-.0003279	.102087	-.0680111	.0394372
LRmila	785	-.0003139	.0102076	-.0680111	.0394372
LRsp500	785	.0005601	.0103698	-.0666344	.0474068
LRsugarS	785	.0001425	.0131245	-.0593428	.106861
LRsugarF	785	.0005154	.0350776	-.385623	.5991735
LRcopperS	785	-.000031	.0152557	-.0727321	.0708295
LRcopperF	785	.0001386	.0164387	-.2047781	.070475
LRcoffeeS	785	.0003355	.0197846	-.0568182	.1251228
LRcoffeeF	785	.0002179	.0194495	-.0540221	.1225735

4.2 Empirical Model

Following Hu and Xiong (2013) this study adapted and modified the model for isolating the effect of commodities futures returns on equity markets by changing both the geographic location of concentration as well as the commodities that are looked at. In Hu and Xiong (2013) they looked at the effect of futures prices on Asian equity markets, whereas this study prefers to focus on South American markets. The commodities that are used to measure the relationship are also different, since the goods that are traded in the Asian markets are not the same as those prominently traded in markets such as Brazil, Colombia, Peru, etc.

The model could be written as follows:

$$RMILA_t = B_0 + B_1 RMILA_{t-1} + B_2 RSP500_{t-1} + B_3 RCOMDTYS_{t-1} + B_4 RCOMDTYF_{t-1}$$

$RMILA_t$ is the day to day returns experienced by the Mercado Integrado Latino Americano. It is used as an endogenous variable in this study as a way to represent the South American equity markets. The BM&F Bovespa can also be used as a proxy as it is one of the most highly developed South American equity markets; however, it is biased towards representing Brazilian companies.

The independent variables consist of 4 variables obtained from the Quandl database. Table 3 provides acronyms, descriptions, expected signs, and data source for the variables. $RMILA_{t-1}$ represents the lagged day to day returns of the Mercado Integrado Latino Americano. In case there is some explanatory power of previous returns of the exchange on future returns, then this variable would be able to account for that effect. The expected sign on this variable is positive. $RSP500_{t-1}$ takes into account the returns of the SP500 stock exchange benchmark that is followed worldwide and reflects general

sentiments of the global economy. The expected sign on this variable is also positive. Since the SP500 is a leading indicator for global economies, it should be positively correlated with the MILA index. $RCOMDTYS_{t-1}$ reflects the return of the commodities spot price. This final variable will help isolate the effect of futures prices of commodities on the return of equity markets in South America. Data on actual spot prices was limited so for the sake of the study, front end commodity contracts are used as a proxy. The expected sign on this variable is unknown. Depending on the commodity, it could be both. $RCOMDTYF_{t-1}$ represents the returns of the futures prices of commodities and is the variable of interest in the study. Since front end contracts are used for the spot price, back end contracts are used to calculate the returns of futures prices. Once again, depending on the commodity the expected sign on the variable could be either negative or positive.

5.0 EMPIRICAL RESULTS

The empirical estimation results are presented in Table 2. The regression analysis shows that there is no significant relationship between the futures prices of sugar and coffee on the returns of South American equity markets; however, copper does hold a statistically significant relationship. The empirical estimation shows that there is a negative relationship between the returns of copper futures to the returns of South American equity markets. In essence this means that as the returns of copper increase, there will be a negative effect on South American equity returns. This result is supported by a study that was done on the relationship between commodity and stock market investment (Wang et. al. 2013). The study found that investors move towards commodities as returns in stock markets become more volatile or negative thereby increasing the return of commodity prices.

As mentioned before, there was no significant relationship between the commodity prices of sugar and coffee to South American Equity markets; however, this phenomenon is explainable. Johnson and Soenen (2009) found interesting results on a variety of different industries of commodities. Most importantly they found that in order to establish a significant relationship between commodity prices and the equity markets, the commodity needs to contribute to a large share of the relevant country's GDP. Keeping this in mind, this study does not look at individual countries, but rather uses MILA, which is a stock exchange that represents stocks for Chile, Colombia, and Peru. Although agriculture in general is extremely important in South American countries, it should be noted that not all three of the countries rely heavily on either coffee or sugar. Specifically, only in Colombia do both of those commodities contribute a significant portion of GDP output. On the other hand, copper extraction plays a role in all three economies and therefore is very statistically significant.

On another note, the lagged returns for the SP500 were not statistically significant at all to the returns experienced by MILA. Although the SP500 is often viewed as the leading benchmark for the economic status of the world it seems that there isn't a strong correlation with the MILA stock exchange. This can be explained as a lack of development in South American countries until recently. The establishment of the MILA exchange only took place in 2008 and the availability of a large stock exchange in South America before this time was limited only to the BM&F Bovespa in Brazil. Since the data only reaches back till 2008 it is quite hard to establish a long run relationship between the two. A study done by Kotkatvuori-Ornberg et al. (2013) backs up this conclusion. The study looked at the effect of the financial crisis, the specified period is

2008-2009, and how correlated different markets around the world were. The main finding concluded that in a two asset allocation framework there are consistently low portfolio variances. This in turn implies that there is low correlation between the world markets during this period, which is also consistent with the period of 2008-2010 that the MILA data was taken from.

The final variable, which is the returns of the MILA exchange lagged, presents an interesting finding. It is statistically significant at the 1% level for all three models. According to the efficient market hypothesis there should be no statistical significance for the lagged returns of MILA; however, the results show that it is significant at the 1% level for all three models that were run. This finding is consistent with studies that have been done on the topic that seem to point to the fact that efficient market hypothesis may not be practical in the real world. Specifically Urquhart and Hudson (2013) found that when looking at the long run data of the US, UK, and Japanese markets, there was little to no evidence that support the efficient market hypothesis. Therefore, the results obtained from this variable seem to support the findings in the field.

6.0 CONCLUSION

This paper examines the effects of specific commodity futures prices on returns experienced by South American equity markets. In summary, copper was found to be statistically significant but coffee and sugar were not. This is due to the importance of these commodities to the nations that were selected for this study (Chile, Colombia, and Peru). Copper is a significant export of all three countries, whereas sugar and coffee were isolated to either one or two countries in terms of importance. Despite the lack of results in the other two commodities, the establishment of a relationship with copper still

indicates the importance of this research. Also interesting was the significance of the lagged returns of the MILA index, which seems to imply that the efficient market hypothesis does not hold for South America. The adaptive market hypothesis on the other hand seems to explain the significance.

One of the biggest issues with this study is that the data available was limited due to a lack of resources. Future studies with the appropriate resources should explore different commodities as well as the significance of the lagged returns of the MILA index. Another issue was that the exchange that was used in the regressions was the MILA index. This study used three different commodities that attempted to blanket the three different countries that are included within the index. However, in order to get statistically significant results, the commodities that are chosen need to account for a significant portion of the country's GDP. Future studies should attempt to isolate the exchanges of the countries and pick commodities based on the country as opposed to a representative sample of all South American countries.

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Table 2: Regression Results

	RMILA		
	I	II	III
Constant	-0.0002163	-0.0002443	-0.0002381
$RMILA_{t-1}$	0.1975679***	0.1970158***	0.0350664***
$RSP500_{t-1}$	-0.0221136	-0.0246698	-0.0232714
$RCopperS_{t-1}$	.0684304**	-	-
$RCopperF_{t-1}$	-0.1225661***	-	-
$RCoffeeS_{t-1}$	-	0.0525268	-
$RCoffeeF_{t-1}$	-	-0.034194	-
$RSugarS_{t-1}$	-	-	0.0238703
$RSugarF_{t-1}$	-	-	-0.0001125
R^2			
F-Statistics			
Number of Obs.	785	785	785

Table 3: Variable Explanations and Expected Signs

Variable Name	Variable Explanation	Expected Sign	Data Source
$RMILA_{t-1}$	Lagged returns of the MILA (Mercado Integrado Latino Americano) Index	+	Quandl
$RSP500_{t-1}$	Lagged returns of the S&P 500 Index	+	Yahoo Fianance
$RCOMDTYS_{t-1}$	Lagged returns of the spot price of the selected commodity (sugar, coffee, or copper)	+/-	Quandl
$RCOMDTYF_{t-1}$	Lagged returns of the futures price of the selected commodity (sugar, coffee, or copper)	+/-	Quandl

THE FIRST GLOBAL FINANCIAL CRISIS OF THE 21ST CENTURY

BUT THERE IS ONE ENDURING LESSON OF THE HISTORY OF FINANCIAL CRISES: **THEY ALL END** – LAWRENCE SUMMERS

AGENDA

- Review of Sub-Prime Crisis

- Monetary Policy

- Fiscal Policy

- Protectionism

- Other Proposals

SUB-PRIME CRISIS

- Causes:

  - Relaxed Lending Standards

    - NINJA loans, 100% mortgages, teaser rates, etc.

  - Low interest rates increases demand for real estate

  - Mortgages securitized to hide risk

  - Current account imbalances

    - International capital inflows
    - Led to intertwining of international markets

"I THOUGHT WE WERE JUST BUYING A HOUSE!"

Cagle Cartoons
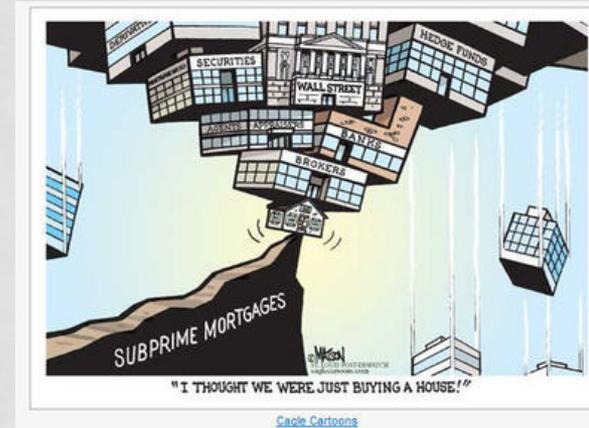
THE ASSET BACKED SECURITY (ABS)

Asset Backed Security (Simplified)

Asset 1
Asset 2
Asset 3

⋮

Asset n

Principal: $100 million

→ SPV →

Senior Tranche
Principal: $80 million
Return = LIBOR + 60bp

Mezzanine Tranche
Principal: $15 million
Return = LIBOR+ 250bp

Equity Tranche
Principal: $5 million
Return = LIBOR+2,000bp

The Waterfall

Asset Cash Flows

Senior Tranche

Mezzanine Tranche

Equity Tranche

7
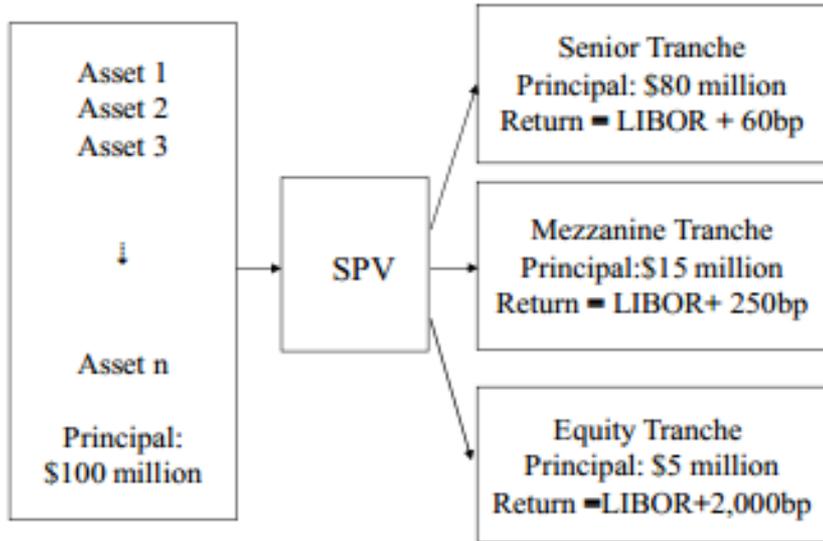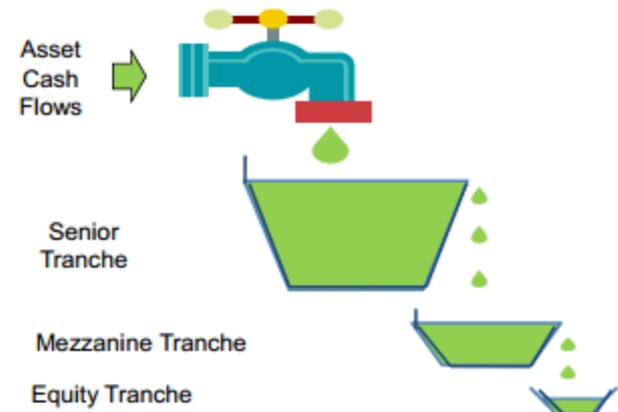
MONETARY POLICY

- Common first action was to reduce interest rates

- The Federal Reserve moved aggressively

- European Central Bank (ECB) was reluctant

  - Statement by ECB President Jean-Claude Trichet

- Japanese Central Bank already at low interest rates

FEDERAL RESERVE INTEREST RATES
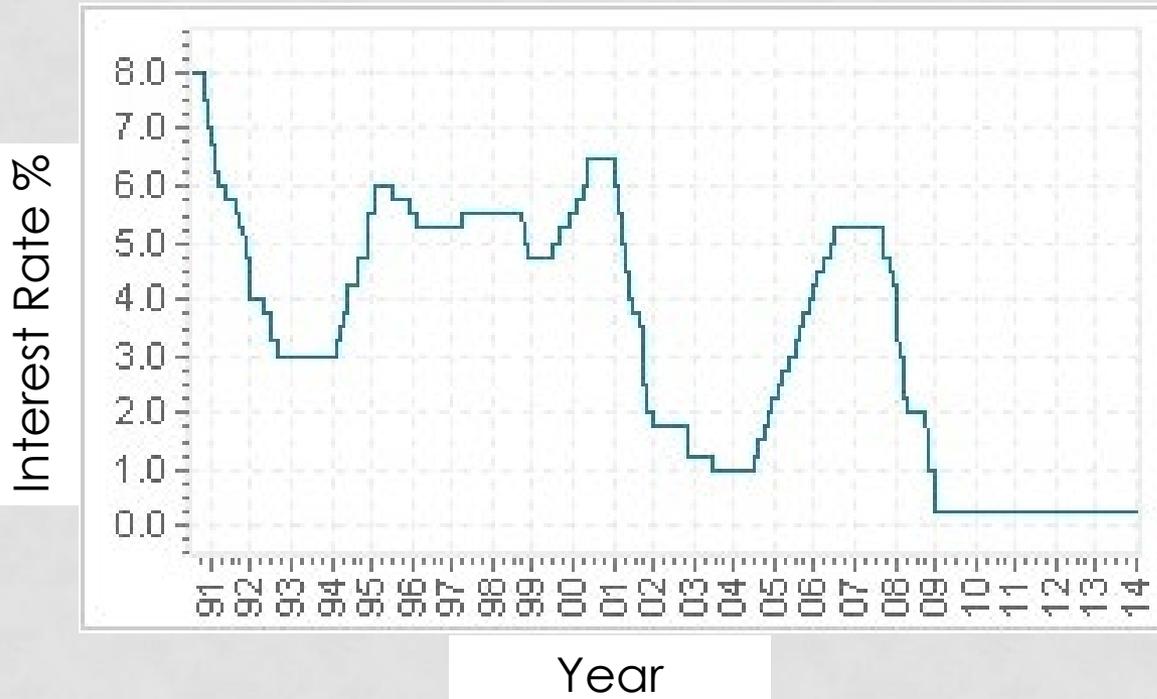
EUROPEAN CENTRAL BANK INTEREST RATES
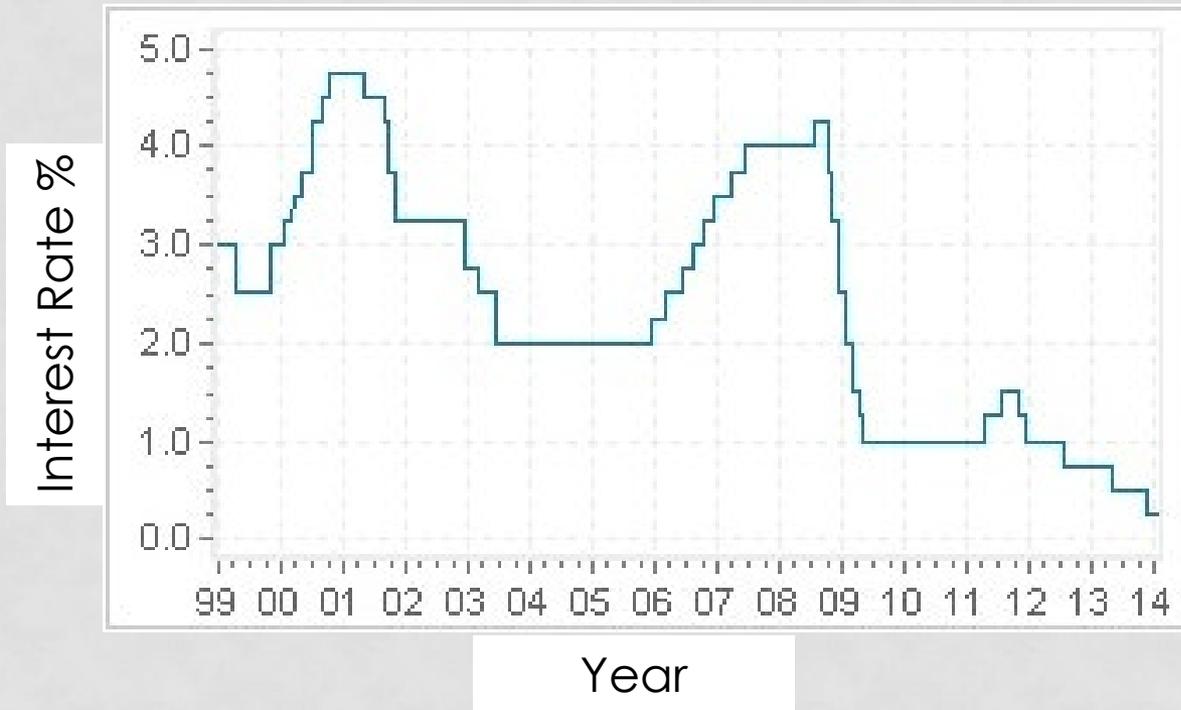
CHINESE CENTRAL BANK INTEREST RATES
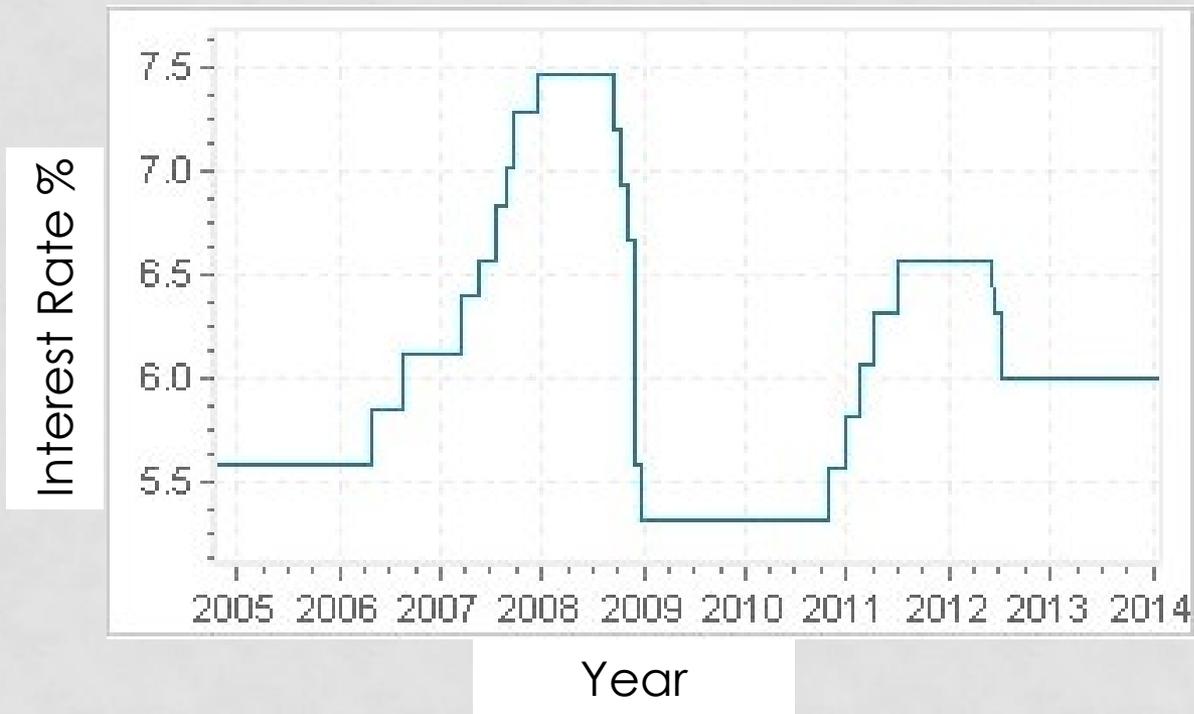
FISCAL POLICY

- IMF recommended a stimulus of 2% of GDP

  - United States pushed a $787 billion package

  - China passed a 4 trillion yuan package ($586 billion)

- Many in the EU opposed to such high stimulus

- Only the U.S., China, Australia, Spain, and Saudi Arabia reached the 2% of GDP goal

PROTECTIONISM
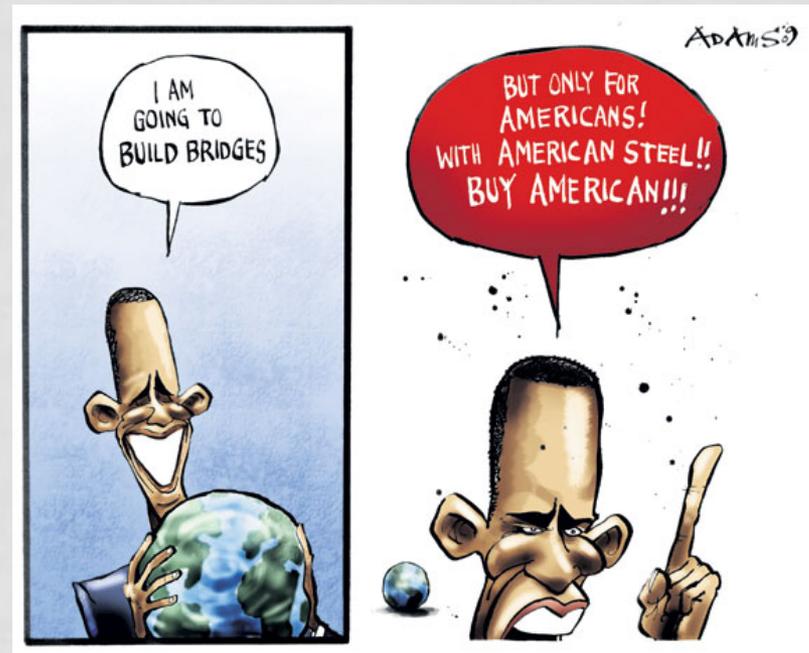
PROTECTIONISM

- Protectionism growing trend
  - 9% decline in exports
  - Anti-dumping claims up 20% in 2008
- Governments adopting new measures to protect industries
  - United States "Buy American" provision
  - India banned Chinese toys
  - Argentina stricter regulations on textiles and leather goods
- Does protectionism help or hurt?

OTHER PROPOSALS

- IMF strived to play larger role with increased lending capabilities

  – Countries were reluctant to borrow from the IMF

- New world currency proposal from China

  – Quickly shot down by the U.S.

GDP

GDP Growth %
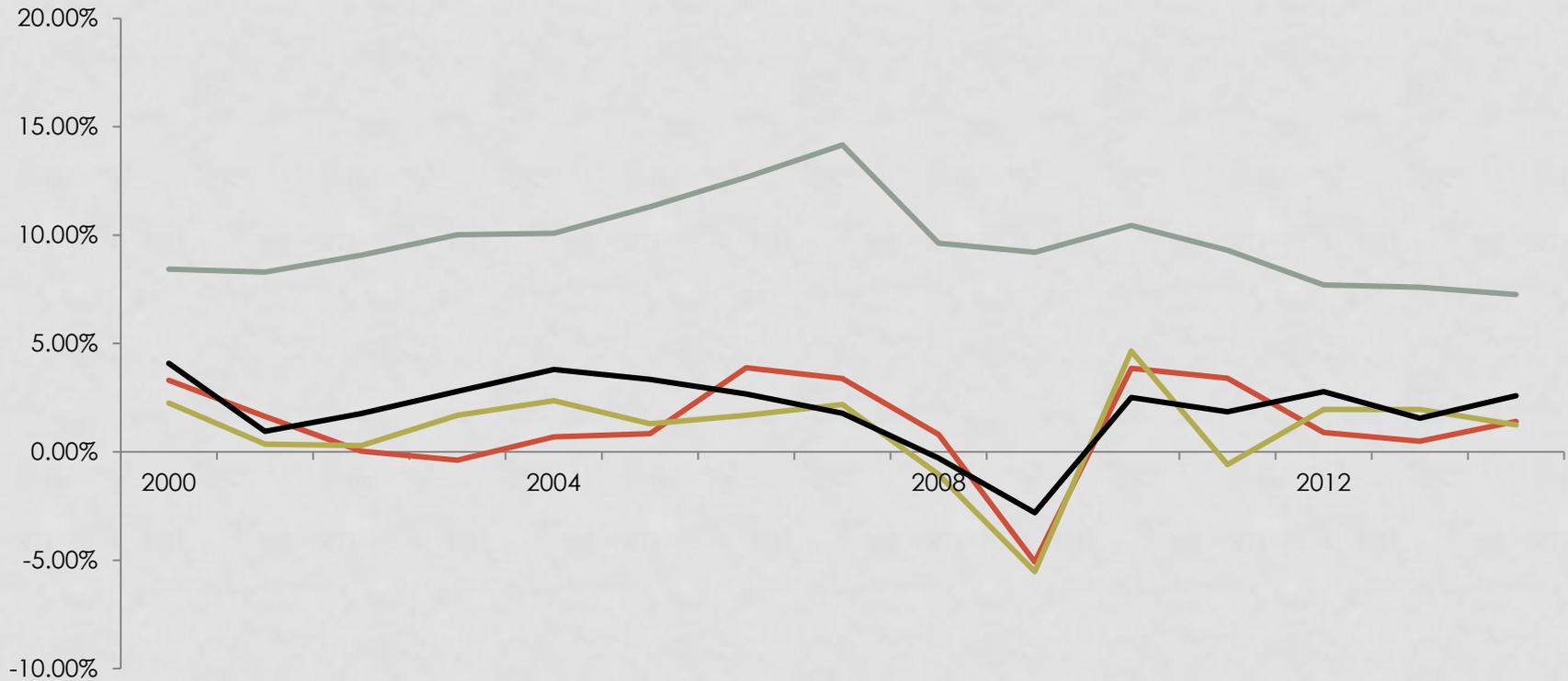
INFLATION RATE

Inflation Rate %
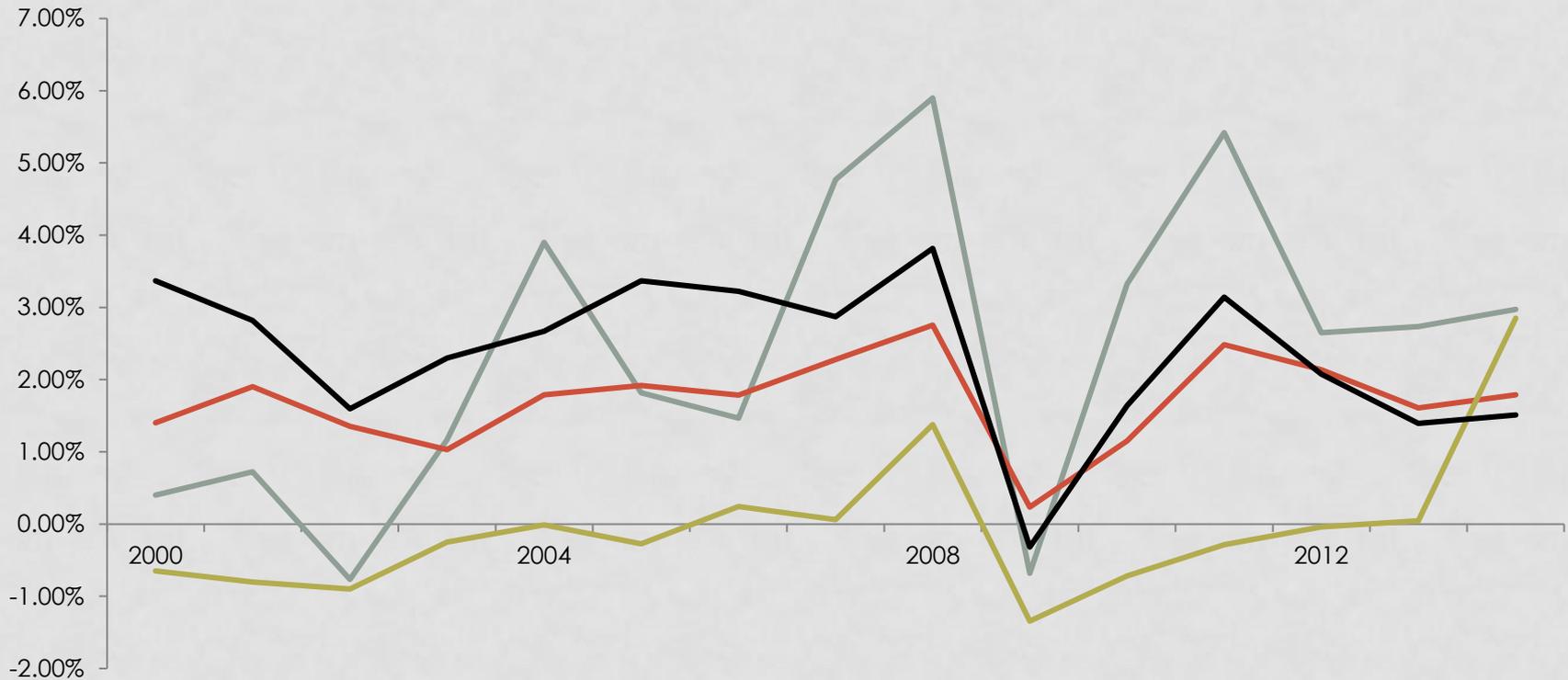
UNEMPLOYMENT RATE

Unemployment Rate %
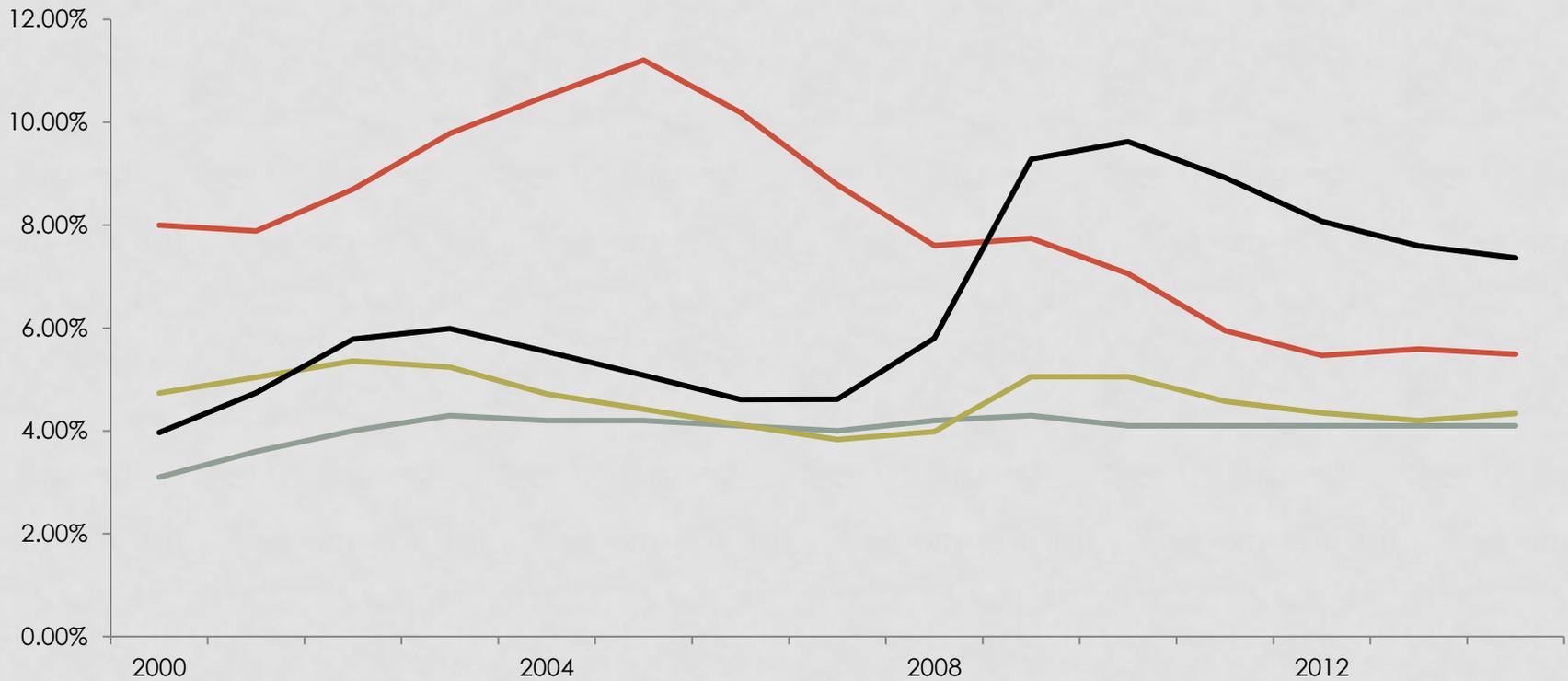
INVESTMENT

Total Investment % of GDP

— China — Germany — Japan — United States
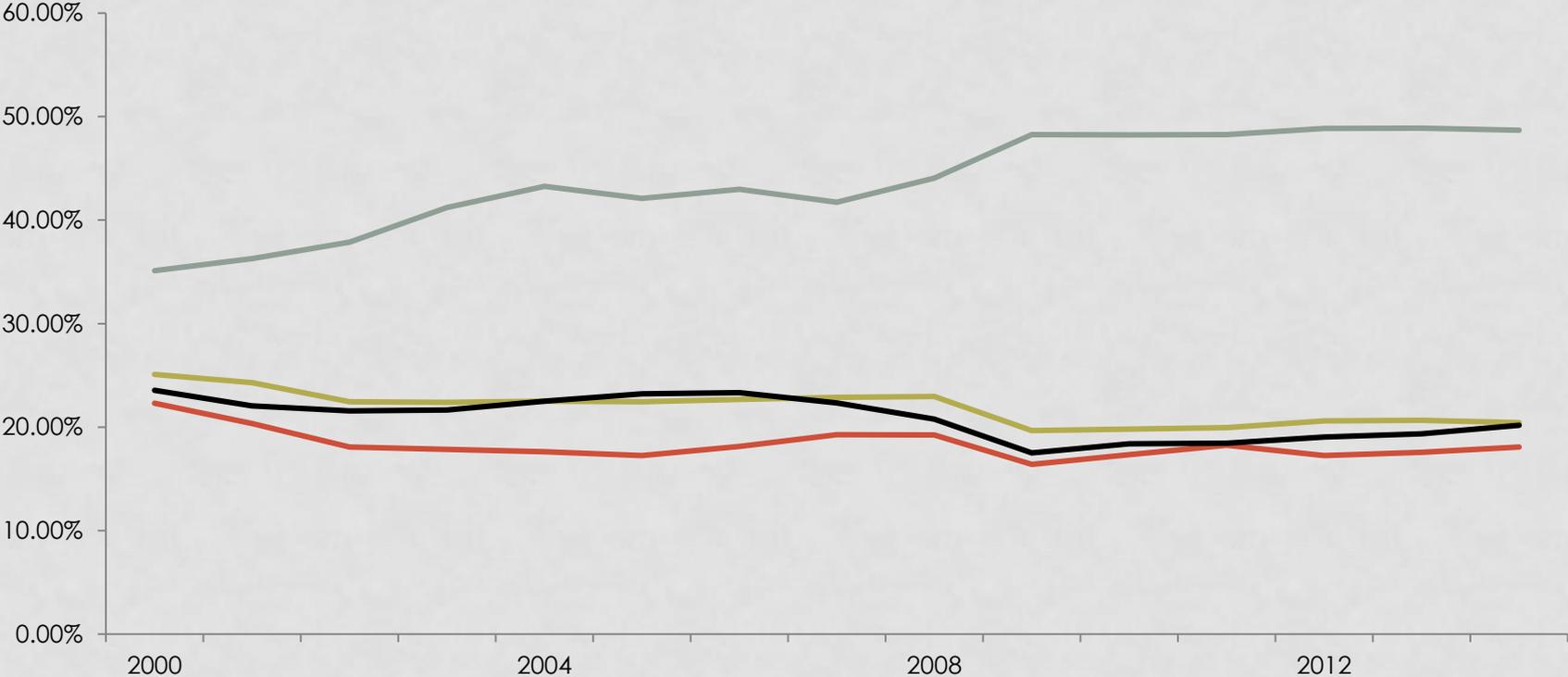
GOVERNMENT DEBT

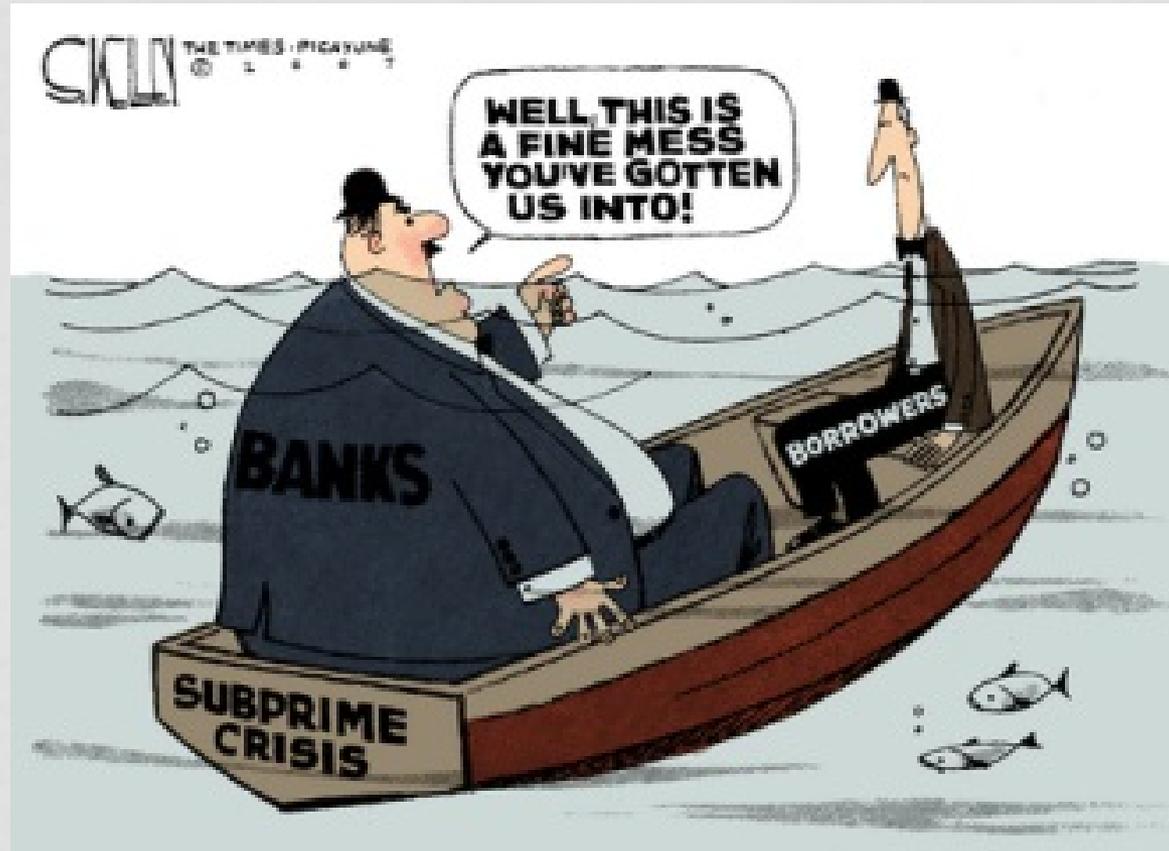**Government Debt % of GDP**
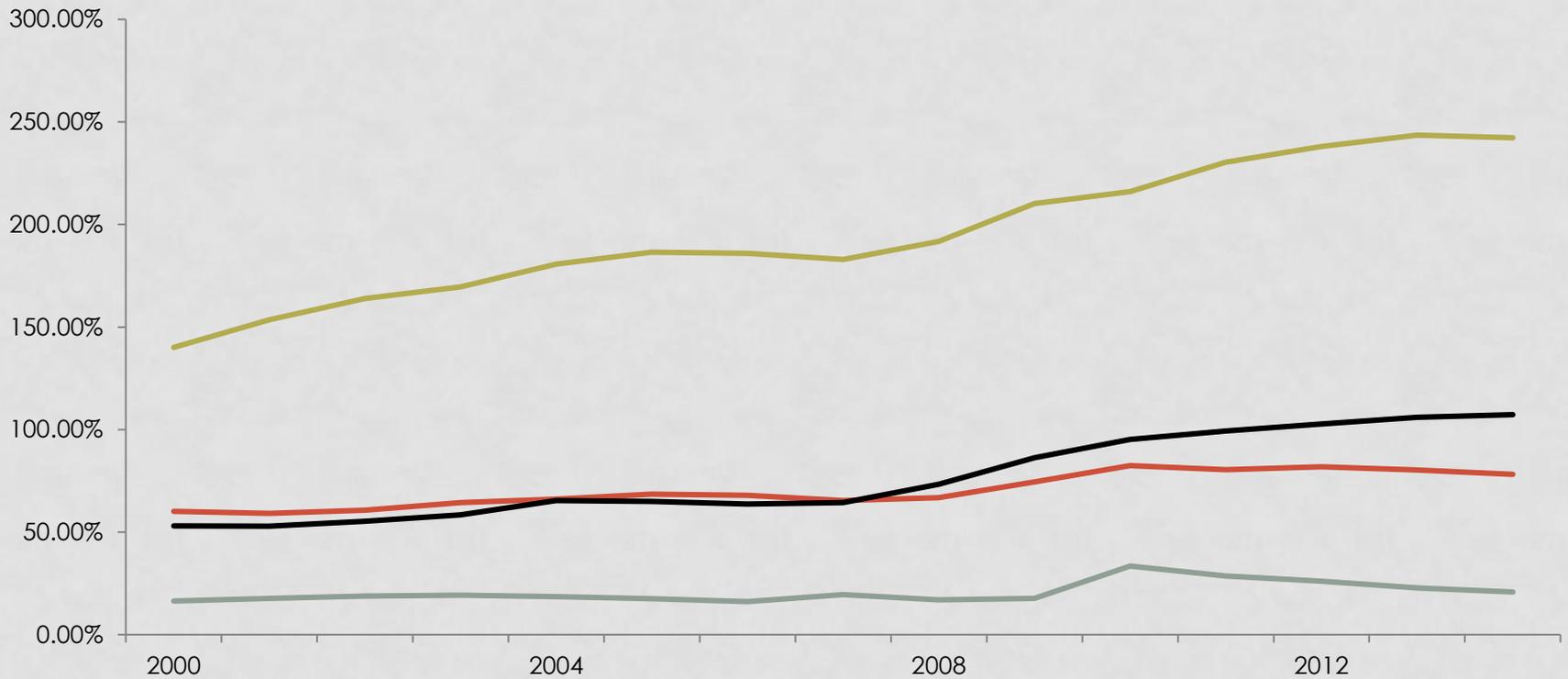
CURRENT ACCOUNT BALANCE

Current Account Balance % of GDP

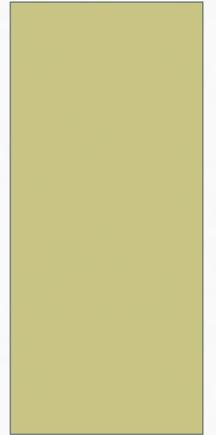China — Germany — Japan — United States
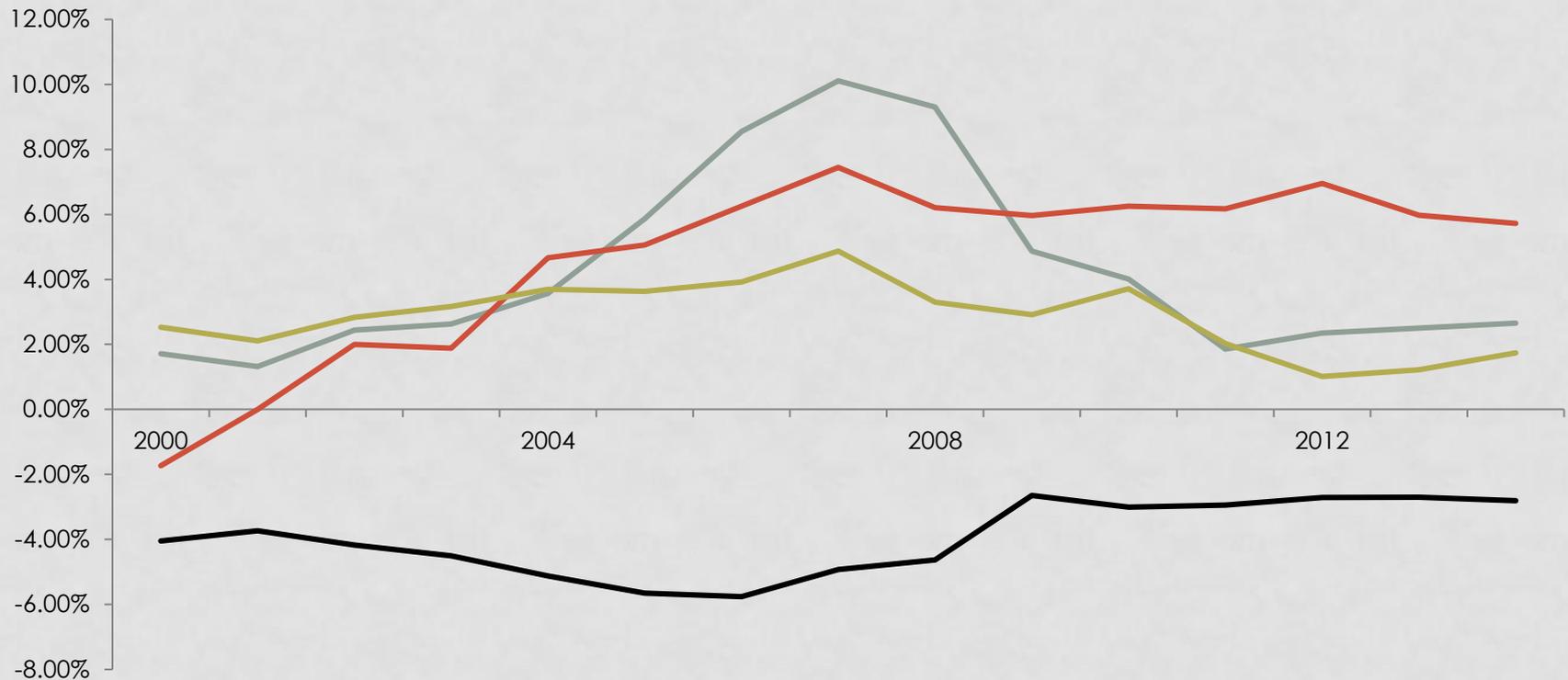
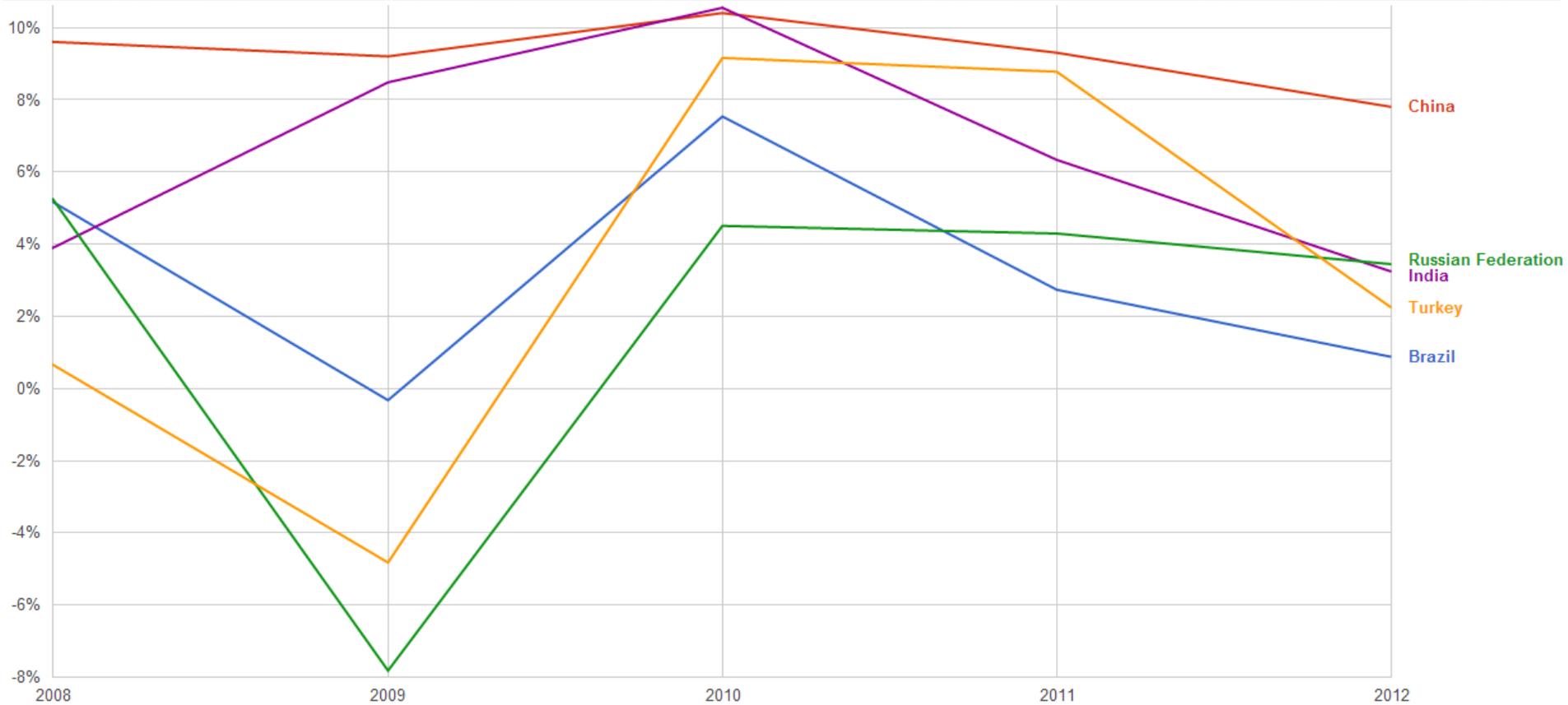# CONCLUSION

TURKEY

AADITHYAN MANIVANNAN

GEOGRAPHIC POSITION

ECONOMIC OVERVIEW

- One of the founding members of the OECD and G20

- 15th largest GDP based on PPP

- Key Industries:

  - Banking

  - Oil Refining

  - Textiles

  - Electronics

GDP GROWTH

FUTURE PERSPECTIVE

- Next 11, MINT, BRIC?

- Current account deficit

  - 6.5% of GDP

  - $25 Billion tourism industry

- Position of Istanbul as financial center

- Inflation rate of 7.1%

QUESTIONS?