Bubble, Bubble, Toil and Trouble:
A Study of Market Bubbles and Their Impact on the Macro Economy

by

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Abstract

In the aftermath of the financial crisis of 2008, much attention has been paid to the phenomenon of speculative bubbles in the stock market, and the adverse impact they have on all aspects of the economy. The purpose of this paper is to shed some light on the empirical relationship between the bursting of a market bubble and the ripple effect it has across the macro economy. In particular, I place the most emphasis on real GDP growth. Based on my research, with data spanning across crises in thirty different countries from time periods spanning from the 1800s to the present, this paper suggests that the decline in stock returns during a market bubble crisis is correlated with a decline in GDP growth mostly in the short run, while long term recessions are correlated with secondary factors including decline in investment and employment in the economy. The data also suggests that, on average, bubbles are correlated with a lower GDP growth rate in the year following the crisis, but that the absolute level of per capita GDP does not always decline relative to pre-crisis times. Finally, the data shows that, while bubbles are usually preceded by abnormally high stock returns in the market, high stock returns are not sufficient to predict whether the market is about to experience a crisis.

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1. Introduction

With the aftereffects of the most recent financial crisis still being felt today, there has been an astounding amount of public attention surrounding the subprime mortgage crisis and how the economy and policy makers should respond. The idea of speculative bubbles and what happens when they burst is interesting because it challenges the idea of market efficiency. In fact, these bubbles point to the power of investor psychology or other behavioral factors that impact the market in a significant way.

An appropriate starting point would be to define what a speculative bubble is. Charles P. Kindleberger defines it as "a loss of touch with rationality, something close to mass hysteria."[1] Speculative bubbles have been defined as a trend in which the price of a class of assets is driven up compared to its fundamental value, by the herding of investor optimism into that particular sector.

While some have accused the term "bubble" as being overused by the media and academics alike, it well-characterizes the phenomenon in which hyped investors in the market flood into specific classes of assets, thereby driving prices away from fundamental values. From the tulip mania in the 17th century, to the subprime mortgage bubble, such crises have been an ever-present phenomenon in global economies. While scholars and policy makers have strived to improve the financial system and mitigate the occurrence of future bubbles, they have continued to present significant challenges to the world time and again.

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[1] Kindleberger, Charles. Manias, Panics, and Crashes: A History of Financial Crises. pp 38

Current research of bubbles has focused mainly on the anatomy of a bubble: in other words, the process of bubble formulation and the dynamics of a burst. On the other hand, the aftereffects of the bursting of a bubble have mostly been preserved to the arena of fiscal discussions and public policy: in other words, how to clean up the mess. There are exceptions, however, including Barro and Ursua's paper "Macroeconomic Crises since 1870" in which the authors focus on the phenomenon of decreasing consumption (real per capita personal consumer expenditure) after economic crises, and the "low average of real bill returns observed during crises."[2]

I found that it would be interesting to quantify the impact that bubbles and other financial crises have on the economy at large after a crisis, and separate the myths from realities. In addition, while Barro and Ursua focused on consumption instead of GDP, I chose to measure GDP growth during crises, as a proxy for economic productivity. Finally, I wanted to test whether the popular view that stock market bubbles cause long-term contractions in the macro economy were true, and if so, how one could quantify this relationship.

To summarize, the increasing media attention for speculative bubbles, as well as insufficient analysis of the actual quantitative impacts of bubbles on the economy motivated me to take on this project to make the relationship more empirical and robust.

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[2] Barro, R., Ursua, J. "Macroeconomic Crises since 1870."

2. Research Questions and Hypotheses

2.1 Research Questions

By gathering data from thirty countries around the world, this paper empirically explores the dynamics between a stock market crash and the macro economy. While a wide range of macro economic variables could be used for this analysis, I chose to focus on real GDP growth as a proxy for economic productivity. Throughout the paper, I explore three broad concepts:

- Does the return on stock market indexes predict GDP growth when a bubble bursts?
- By how much do bubbles hurt GDP growth?
- Can we look at stock returns to predict the bursting of bubbles?

2.2 Initial Hypotheses

Before conducting the data analysis, my initial hypotheses were that:

- The correlation between stock market index returns and GDP growth will increase dramatically during and after a bubble.
- Bubbles hurt GDP growth directly in the long run over more than 1-2 years.
- Stock returns will not be sufficient for the prediction of bubbles.

3. Methodology and Data

Instead of looking at specific bubbles and doing a case-by-case analysis, my approach is to take on a macro view, and establish trends for the phenomenon of bubbles in general. In order to make the results robust, I collected data from 30 countries and accumulated as much data on per capita GDP and stock index returns as possible, using Global Financial Data for the stock returns and Angus Maddison's "Historical Statistics of the World Economy" for the GDP data.[3] Appendix 1 shows the countries and time periods covered in this paper.

In order to measure changes in the stock market, I used stock index data because it reflects a wide range of stocks in each market, and would be a suitable indicator for the general state of the stock market at any given point in time. In order to use real returns on stock indexes, inflation data was taken from the Reinhart-Rogoff dataset[4] and real returns were calculated as: $r_{real} = \frac{1 + r_{nom}}{1 + \text{inflation}} - 1$

All stock index data was downloaded from Global Financial Data in yearly frequencies, and all indexes were reported in U.S. dollars. As Angus Maddison's data on per capita GDP had already been converted into 1990 International Geary-Khamis dollars, these did not need to be further adjusted for inflation. Unemployment rates were also taken from Global Financial Data.

In order to identify when financial crises and bubbles occurred, I used Appendix A.4 of Reinhart and Rogoff's "This Time is Different."[5] However, since this table listed

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[3] http://www.ggdc.net/MADDISON/oriindex.htm
[4] http://terpconnect.umd.edu/~creinhar/Courses.html
[5] Reinhart, C., Rogoff, K. *This time is different : Eight centuries of financial folly*.

all varieties of financial crises ranging from national debt crises and currency crises to bubbles, I had to narrow down the list for my analysis of bubbles only. To do so, I looked at Appendix B from Charles P. Kindleberger's classic "Manias, Panics, and Crashes"[6] as well as Table 10.8 from "This Time is Different." The table in Kindelberger's book provided each of the items upon which the market speculated following a particular time period, while the Reinhart-Rogoff data mainly focused on bubbles that arose from real estate speculation. The list of bubbles is shown in Appendix 2 of this paper.

For the analysis of the relationship between stock returns and GDP growth, data was used from financial crises in general and bubbles only, as financial crises in general differed somewhat from bubbles only, while for the remaining hypotheses, only bubbles were analyzed.

Shortcomings

Ideally, having access to monthly per capita GDP data would have made the analysis more refined. However, data constraints limited my focus to only yearly GDP growth. In addition, in the process of isolating bubbles from general financial crises, I noticed much subjectivity and judgment in deciphering which crisis involved speculative bubbles. For instance, some of the cases that Reinhart and Rogoff identified did not match with those that Kindleberger's list. Even when the basic ideas of the crisis were the same, the timeline often did not match. This underlines the difficulty in defining market bubbles even ex post, and a clear consensus on the occurrence of bubbles would have made my research more accurate. I believe that this is a challenge for research of financial crises in general.

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[6] Kindleberger, C.*Manias, panics, and crashes : A history of financial crises*

In the following sections of this paper, I will discuss each of the initial hypotheses that I had established, the statistical tests, and the implications of the results.

4. Stock Index Returns and GDP Growth

4.1 Are GDP growth and stock returns correlated?

In 2004, the United States Congress put forth a report which stated that, "[i]n every major developed country, the bursting of the bubble slowed economic growth"[7] in the late 1990s. This made me wonder whether there was in fact a systematic relationship between stock returns and GDP growth during financial crises and stock market bubbles. Having heard a plethora of discussions on this topic in the media, and particularly in political discussions, I wondered whether there was, in fact, a direct correlation between bubbles and a slowdown in economic growth. In order to make a meaningful comparison, the relationship between stock returns and per capita GDP growth were tested for 1) a control group, which included non-crisis and crisis states, as well as 2) a sample of financial crises in general, and one with 3) only market bubbles.

In normal states of the world in which the financial markets work efficiently, the stock market is an essential part of fostering GDP growth by providing liquidity to firms. It does so by being an instrument that both raises capital for firms and channels capital toward those sectors in the economy that seem to be the most promising to the investing community at large. For example, Cole, Moshirian and Wu (2008) have reiterated that

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[7] Joint Economic Committee, United States Congress, "*International Economic Performance Since the Stock Market Bubble"* (2004)

"stock market index returns affect future economic growth."[8] In contrast to normal states of the world, however, stock market bubbles occur when investors concentrate optimism into certain classes of assets, thereby driving the value of stocks away from their fundamental values.

The expectation, therefore, was that the breakdown of the financial markets during a financial crisis of any kind would hurt the economy even more than a normal drop in stock returns would; in other words, that the correlation between stock returns and GDP growth would increase during a crisis.

To test this hypothesis, the following regressions were run for each sample:

(1) 0-year lag: $g_{GDP(t\to t+1)} = a\cdot r_{t\to t+1} + c_1$
(2) 1-year lag: $g_{GDP(t+1\to t+2)} = b\cdot r_{t\to t+1} + c_2$
(3) 2-year lag: $g_{GDP(t+2\to t+3)} = d\cdot r_{t\to t+1} + c_3$

Where:

$g_{GDP(t\to t+1)}$ = real per capita GDP growth from time t to t+1
r = real return on stock index from time period indicated

The results of the regressions are summarized in Tables 1,2, and 3 on the next page. In addition, regressions (1), (2), and (3) were also executed with country dummy variables to test the robustness of the results.

[8] Cole, R., Moshirian, F., Wu, Q. (2008). Bank stock returns and economic growth. *Journal of Banking Finance, 32*(6), 995.

Table 1. *Results from the regression* $g_{GDP(t\to t+1)} = a\cdot r_{t\to t+1} + c_1$

	Control Group	Financial Crises	Bubbles Only
a	0.022	0.023	0.012
	(6.87)*	(2.82)	(0.81)
c_1 (intercept)	0.025	0.012	0.013
	(24.06)	(4.07)	(1.93)
a: With Country Dummies	0.019	0.018	0.011
	(5.96)	(2.08)	(0.53)
N	2490	252	98
Adj- R^2	0.018	0.03	0.00
Adj- R^2 with country dummies	0.057	0.08	-0.10

*t-statistic

Table 2. *Results from the regression* $g_{GDP(t+1\to t+2)} = b\cdot r_{t\to t+1} + c_2$ *(1-year lag)*

	Control Group	Financial Crises	Bubbles Only
b	0.025	0.053	0.090
	(7.72)	(6.29)	(8.11)
c_2 (intercept)	0.025	0.01	0.01
	(23.60)	(4.39)	(2.13)
b: With Country Dummies	0.022	0.052	0.091
	(6.66)	(5.78)	(7.63)
N	2476	239	98
Adj- R^2	0.023	0.14	0.46
Adj- R^2 with country dummies	0.048	0.19	0.51

Table 3. *Results from the regression* $g_{GDP(t+2\to t+3)} = d\cdot r_{t\to t+1} + c_3$ *(2-year lag)*

	Control Group	Financial Crises	Bubbles Only
d	0.007	0.032	0.026
	(2.19)	(1.05)	(1.14)
c_3 (intercept)	0.025	0.011	0.014
	(23.57)	(3.92)	(1.94)
d: With Country Dummies	0.003	0.017	0.012
	(0.96)	(0.97)	(0.62)
N	2446	198	98
Adj- R^2	0.010	0.01	0.02
Adj- R^2 with country dummies	0.031	0.08	-0.10

The results of the regression were actually somewhat different from what I had hypothesized. Appendix 3 of this paper shows the regression plots for the results reported in each of the tables. In normal states of the world, which I have labeled as the control group, there was a statistically significant and positive correlation between stock returns and GDP growth in the 0-year lag, 1-year lag, and 2-year lag, with all three regressions having roughly equal amounts of statistical significance and explanatory power. In the case of financial crises in general and stock market bubbles only, however, the results were different.

For financial crises in general, while the 0-year and 1-year lag regression yielded positive and statistically significant correlation coefficients, this relationship went away in the 2-year lag. This indicates that the abnormal movements in the stock market during financial crises are in fact correlated with the GDP growth both in the current period and the year after, but that these effects become less significant after about a year, on average. This also suggests that, on average, stock returns during a financial crisis are correlated with the GDP growth in the economy over a shorter time horizon than when the financial market is functioning normally.

The most striking result, however, came from the group of bubbles only. I had initially hypothesized that the correlation between stock returns and GDP growth would increase dramatically during the bursting of bubbles, and that this could be a possible reason that the economy often falls into a recession after a market crash. To the contrary, however, there was no statistically significant relationship between the stock market returns in a year during a market bubble crash and the GDP growth in that same period. In the case of a one-year lag, however, I did observe a statistically significant and

positive correlation. In fact, across all variables in all three regressions, this was the most significant result, with the highest R-squared value of 46%, as shown in Table 2.

These results indicated that the crash in stock returns during the bursting of a bubble do have a significant association with GDP growth in the upcoming year, but that there is no significant correlation in the concurrent period of the bubble or two years after the crash. A comparison between financial crises in general and bubbles also suggests that the impact of financial crises in general is felt more immediately than that of bubbles and lasts longer while the impact of bubbles peaks a year after the crash and is only significant in this one case. Most of the findings were robust even when I included country variables, but the 2-year lag correlation coefficient for the Control group was insignificant when country dummies were included. This could indicate that there is much country-specific variation that determines the length of time for which stock returns and GDP growth display a correlation.

To summarize, while in a steady economic state, stock returns from time t to t+1 are strongly associated with the direction of future GDP growth with statistical significance, this is not true during financial crises. During crises in general, including those of currency and national debt, the correlation between GDP growth and a drop in stock returns is felt immediately and lasts about a year, while in the case of speculative bubbles, the association peaks a year after the crash, and then goes away.

Therefore, the dramatic drop in stock returns during bubbles or financial crises is not sufficient to explain all of the prolonged slumps in economic growth and recessions in the long run. This is particularly true because the impact of the drop in stock returns during a crisis is more significant in the short term, while recessions often linger for

longer periods of time. Rather, the slowdown in GDP growth may be more directly caused by a host of secondary factors that are triggered by the crash of the financial markets, including the level of investment in the economy and unemployment. These will be explored in the following section.

4.2 What causes the slowdown in the macro economy after a market crash?

4.2.1 Investment

Since a drop in stock returns does not fully explain the decline in GDP growth, particularly in the longer run, I started to probe possible other reasons for the decline. While the degree of causation among each contributing factor is beyond the scope of this analysis, I speculate that a decrease in liquidity and investment in the economy caused by the dishevelment of financial markets could be a significant force that prolongs the effect of market bubbles.

For instance, the following quote from Kalemli-Ozcan, et al. explains "the importance of a troubled banking sector that cannot provide credit to domestic firms"[9] and the corresponding slowdown in the economic productivity during a crisis:

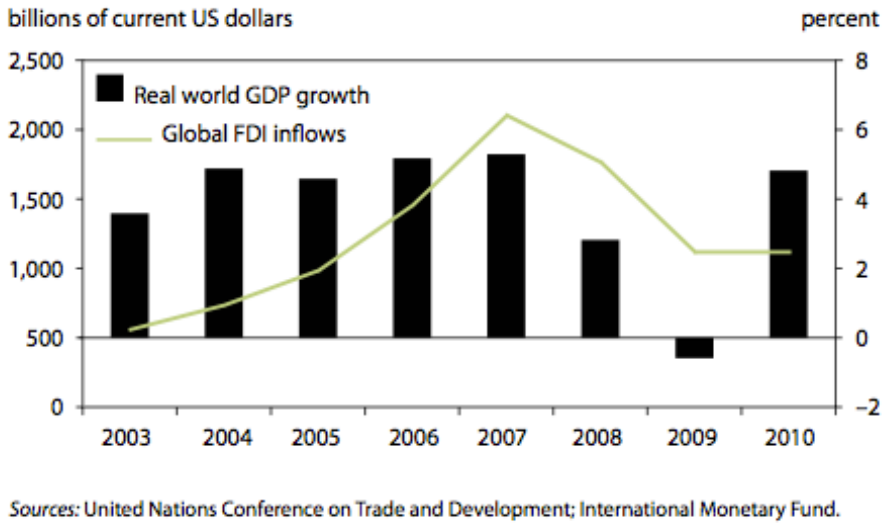
"Liquidity decreases because domestic banks cannot provide credit. At the same time capital flows come to a halt and foreigners exit from the crisis economy, so-called 'sudden stops,' leading to a decline in foreign credit. As a result, the liquidity-constrained firms cannot undertake new investment and hence contract production."[10] *(Kalemli-Ozcan, et. al, 2010)*

[9] Kalemli-Ozcan et al. "What Hinders Investment in the Aftermath of Financial Crises: Insolvent Firms or Illiquid Banks?" (2010)
[10] Kalemli-Ozcan et al. "What Hinders Investment in the Aftermath of Financial Crises: Insolvent Firms or Illiquid Banks?" (2010)

In other words, a crash in the stock market could lead to a deterioration of investors' availability of funds and confidence in the market, which would then lead to decreased investment. This decreased investment would then cause a shortage of funds for banks and other lenders, which would immediately mean a decline in liquidity for firms. The firms, then, would cut down on their capital expenditures, thus causing a slowdown in production.

In fact, Poulsen and Hufbauer have shown that the level of foreign direct investment (FDI) decreases quite dramatically during a crisis, and that an important cause of recessions after crises may be the "traditional strong link between economic growth and FDI flows."[11] Figure 1 demonstrates the correlation between FDI levels and GDP growth in the most recent crisis. The figure suggests that the level of FDI and GDP growth becomes strongly correlated during a crisis while the relationship is not as clear for non-crisis periods.

Figure 1. *FDI and Real GDP growth*



(Source: Poulsen, L. (2011). Foreign direct investment in times of crisis)

[11] Poulsen, L., Hufbauer, G. (2011). Foreign direct investment in times of crisis.

4.2.2 Unemployment

In addition to the level of investment in the economy, data also shows that there is a significant correlation between the bursting of a bubble and the rise in unemployment rate with a 1-year lag and that this correlation persists for at least three years. The lags were calculated as the effect of the occurrence of a bubble, measured by a dummy variable (1 if bubble, 0 if not) and the unemployment rate 1) in the concurrent period, 2) a year afterwards, 3) 2 years afterwards, and 4) 3 years afterwards. Table 4 shows that the impact of a bubble on the unemployment rate lasts longer than the impact of a bubble on GDP growth; While the impact of a bubble on the GDP growth peaks at a year after the crisis and fades away, the relationship between the occurrence of a bubble and unemployment rate is affected even three years after a crash. The results were robust when country dummies were included. In the following regression, the dummy variable was 1 if there was a bubble in the time period observed minus the 0, 1, 2, or 3-year lag. The dummy variable was 0 when there was no bubble during the previously mentioned time frame.

Table 4. *Results of the regression:* $unemployment\%_{t \to t+1} = \alpha \cdot dummy + c$

	0-year lag	1-year lag	2-year lag	3-year lag
N	2434	2401	2369	2315
Adj- R^2	0.09	0.02	0.01	0.01
α	0.021	0.030	0.023	0.016
	(2.50)	(3.52)	(2.69)	(2.05)
c (intercept)	0.08	0.07	0.07	0.08
	(32.95)	(32.79)	(32.83)	(33.02)
α: With Country Dummies	0.019	0.024	0.023	0.015
	(2.06)	(3.17)	(2.53)	(2.01)
Adj- R^2: With Country Dummies	0.09	0.03	0.02	0.00

4.3 Summary

In conclusion, while there is a correlation between stock returns and GDP growth in the case of financial crises in general, the central cause for the decline in economic productivity in the long run is not the drop in stock market performance, per se. More specifically, stock returns during crises were most significantly associated with the GDP growth year after the crisis, but this correlation did not last longer than a year.

Therefore, what adversely impacts the macro economy after the bursting of a market bubble may not be just the drop in stock returns, but rather the disruption of the financial system in general and the impact that this disruption has on other macro economic variables. In other words, a drop in stock returns may be the trigger for the domino effect that takes place after the crash of the stock market, including decreased investment, liquidity, and rising unemployment, and all these changes, combined, are what prolong the downturn in the economy and lead to recessions.

5. By How Much do Bubbles Hurt GDP Growth?

In the previous section, I speculated that the decrease in GDP growth after the bursting of a bubble was much more associated with the dishevelment of the financial markets and the decline in their effectiveness in raising liquidity for banks and firms than the actual drop in stock returns. In this section, I explore exactly how much of a correlation there is between the occurrence of a bubble and the fall in GDP growth afterwards. First, an event study was carried out to visualize the effect of bubbles on GDP growth. Next, I conducted a regression analysis covers the relationship between the

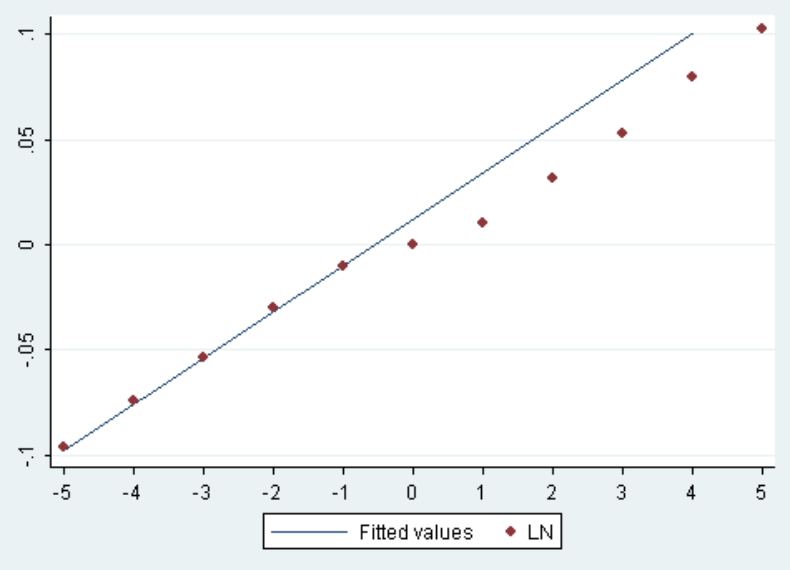
occurrence of bubbles and GDP growth in the same period, a year later, and two years later.

The results suggest that the adverse impact of the bursting of a stock market bubble was most influential in the same period as the market crash and a year after. Starting two years after the peak of a market bubble crash, GDP resumes its growth, all other things being equal. It is also interesting to note that, ignoring other changes in the economy after the bursting of a bubble, even dramatic drop in stock returns has less of an impact on economic growth, on average, than I had originally predicted.

5.1 Event Study

In order to conduct the impact of a bubble on the per capita GDP of countries, I first accumulated per capita GDP data across all thirty countries from 5 years prior to the beginning of a crisis to 5 years after the end. Then, I took the average of the per capita GDP in each period, and took the ratio of the average per capita GDP in time period t and the average per capita GDP in t=0. The x-axis was defined as the number of years to the crisis, with t=0 being the time of the crisis. A full list of variables and explanations is presented below:

Figure 2. *Event Study of Per Capita GDP Surrounding Market Bubbles*



Y-axis: GDP_Ratio, X-axis: t (time relative to crisis)

$$GDP\_Ratio = \log_e(\mu PerCapitaGDP_t / \mu PerCapitaGDP_{t=0})$$

t = time relative to crisis

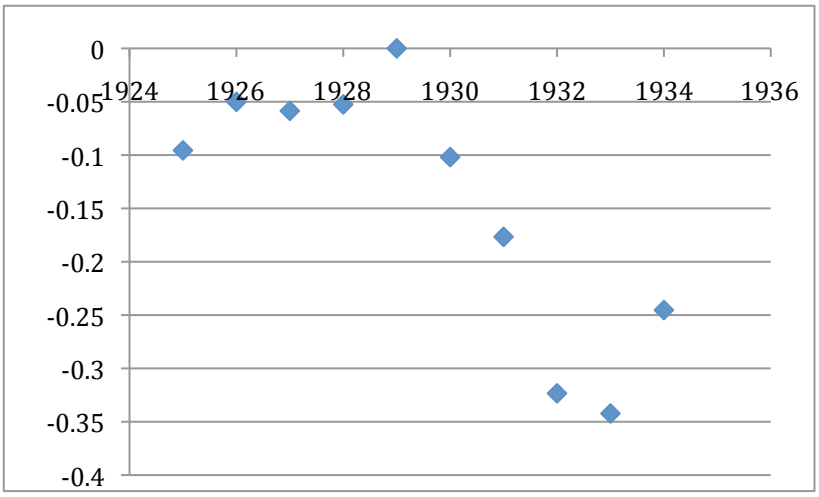
$\mu PerCapitaGDP_t$ = Average per capita GDP in 30 countries

From Figure 2, we can see that the growth in the average per capita GDP across the thirty nations in the sample starts slowing down about a year before the bubble bursts. In other words, the rate of increase in average per capita GDP starts to slow down from t=-1 to t=1. After t=1, however, per capita GDP growth resumes its pre-crisis trend. This result was a bit unexpected. However, the trend line does show that, while the GDP growth (the slope of the line) is almost identical from pre-crisis to post-crisis, the GDP ratio declines relative to what it would have been had the pre-crisis trend continued into the future.

I had initially expected the ratio of per capita GDP to peak at t=0, and then decrease sharply until t=5. Indeed, there actually were a number of cases, including that

of the Great Depression in 1929, that produced this expected result, but this turned out not to be the typical pattern. (See Figure 3.)

Figure 3. *Event Study of The Great Depression*



The y-axis shows the log of the ratio between the per capita in a given year and the per capita GDP in 1929. In this case, we can clearly see that the GDP peaks in 1929, and declines until 1933, before starting to recover. On average, however, while the per capita GDP growth rate slowed during the 1-year bracket surrounding a crash, GDP growth started to recover after about a year.

5.2 Regression Analysis

To quantify the magnitude of the impact on per capita GDP growth, I conducted regression analysis in various time periods. The regression equations are laid out below:

$$(1)\ g_{GDP(t\to t+1)} = k_1 \cdot dummy + c_5$$
$$(2)\ g_{GDP(t+1\to t+2)} = k_2 \cdot dummy + c_6$$
$$(3)\ g_{GDP(t+2\to t+3)} = k_3 \cdot dummy + c_7$$
$$(4)\ g_{GDP(t+3\to t+4)} = k_4 \cdot dummy + c_8$$

Where:

$dummy = 1$ if there was a crash at time t, 0 otherwise

I conducted the analysis for GDP growth concurrently as the crisis, 1 year after a crisis, and 2 and 3 years after a crisis in order to determine the length of time that bubbles are associated with lower GDP and the magnitude of the correlation. Similar to the trend that the event study showed, the presence of a bubble was associated with lower GDP growth in time t to t+1, as well as the following year, but this effect reversed in the 2-year and 3-year lag. Table 4 shows the results of the regressions.

Table 5. *Regressions of Bubble Dummy versus Real Per Capita GDP Growth*

	(1)	(2)	(3)	(4)
k	-0.014	-0.013	-0.00	-0.01
	(-3.73)	(-3.43)	(-0.12)	(-0.44)
c (intercept)	0.026	0.025	0.025	0.025
	(24.73)	(24.65)	(23.53)	(23.51)
k: With Country	-0.016	-0.015	-0.00	-0.01
Dummies	(-4.05)	(-3.78)	(-0.51)	(-0.50)
N	2530	2530	2530	2530
Adj- R^2 with	0.038	0.044	0.033	0.033
Country Dummies				
Adj- R^2	0.01	0.07	0.00	0.00

The table suggests that GDP growth is lower by 2% on average during a crisis, compared to normal states of the world. A year after the bubble, the GDP growth is also an average of 2% lower per year than normal states of the economy. In regressions (1) and (2), the coefficients of -0.02 are statistically significant. Interestingly, when we look at columns 3 and 4, the correlation coefficients are still negative, but are no longer statistically significant. This suggests that the immediate effect of a crisis on GDP growth becomes insignificant after a year. The findings were consistent and robust with the inclusion of country dummy variables. In other words, the results were robust even when I tested for the possibility of country-specific phenomena. In fact, the coefficients in the 2- and 3-year lags became almost zero, indicating a stronger recovery, on average, after accounting for country-specific phenomena.

The results also suggested that the impact of a stock market crash on GDP growth is on average a short-term phenomenon, rather than one that carries on for multiple years after the fact. In order to probe this issue further, I also carried out a multiple regression with dummy variables for the 0-year, 1-year, 2-year, and 3-year lag. I expected to find that economic growth would be hurt concurrently as the bursting of a bubble and the year after, but that the economy would start to recover after that.

Regression Equation:

$$g_{GDP(t \to t+1)} = i \cdot 0yrdummy + j \cdot 1yrdummy + m \cdot 2yrdummy + n \cdot 3yrdummy + c_6$$

Where:

$0yrdummy$ = 1 if there was a crisis at time t
$1yrdummy$ = 1 if there was a crisis at time t - 1
$2yrdummy$ = 1 if there was a crisis at time t - 2
$3yrdummy$ = 1 if there was a crisis at time t - 3

Table 6. *Results from Multiple Regression*

	Regression	With Country Dummies
i	-0.011	-0.012
	(-3.01)	(-2.72)
j	-0.013	-0.013
	(-3.02)	(-2.68)
m	0.012	0.012
	(2.43)	(2.30)
n	-0.00	-0.01
	(-0.86)	(-1.08)
c_6 (intercept)	0.03	0.05
	(23.51)	(5.73)
N	2493	2493
Adj - R^2	0.01	0.04

As previously inferred, whether the crisis was in the current period time t or a year before (t-1) was significantly correlated with the GDP growth from time t to t+1, with the coefficients suggesting that GDP growth in the same period as a stock market crash or a year after would be lower by around 1.3 to 1.4%. On the other hand, two or three years after the crisis, GDP started to recover, with positive coefficients. In fact, the coefficient m was positive and statistically significant, indicating a recovery. The regression suggests that the impact of a market bubble starts to weaken about a year after the beginning of the crisis and the economy starts to recover.

The results were interesting because they go against the popular opinion that the bursting of market bubbles hurt the economy so much that it usually falls into a recession or prolonged slump shortly after the crash. However, focusing on per capita GDP growth, my research suggests that the sole presence of a market bubble crash does not stunt the economic growth for more than a year, after which the economy usually starts to bounce back. Once again, the results were consistent with the inclusion of country dummies.

6. Does the Stock Market Predict Bubbles?

As Reinhart and Rogoff elaborate in *This Time is Different*[12], one of the interesting things about stock market bubbles and financial crises is the fact that they occur again and again despite regulatory efforts to reform the financial system in order to prevent future crises. Therefore, one may question whether there is some way to predict bubbles on their onset and set into place precautionary measures. In order to probe this issue, I ran a test in which I tested whether a high cumulative stock return in the 5-year period prior to the bursting of a bubble could predict the crisis. As in the previous section, I tested the predictive power of stock returns for crises with both an event study and regression analysis.

6.1 Event Study

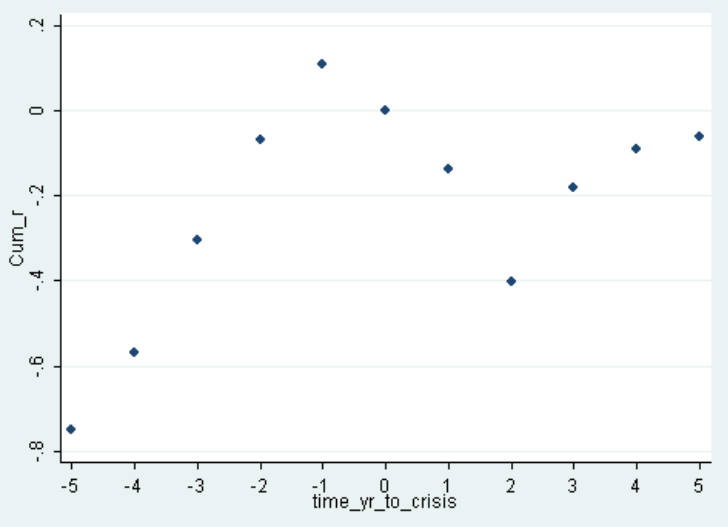
First, I was interested to see whether the bursting of stock market bubbles was preceded by periods of abnormally high returns. In order to see this, I calculated cumulative stock returns in the 5-year period immediately preceding the bursting of a stock market bubble. As shown in Figure 4 below, on average, during the 5-year period leading up to a stock market crash, the cumulative stock returns continue to increase up until a year before the onset of a crisis. It is interesting to note that the peak of the cumulative returns actually occurs a year before the onset of the crisis, instead of time 0. From t=-1 to t=2, the cumulative stock returns decrease at an increasing rate. Two years after a crisis, the cumulative stock returns reach a trough, and then start recovery.

Interestingly, while rates had decreased at an increasing marginal rate from t=-1 to t=2, the recovery happens at a progressively decreasing marginal rate, as Figure 4

[12] Reinhart, C., Rogoff, K. *This time is different : Eight centuries of financial folly*.

illustrates. In other words, stock returns start to recover, but at progressively slower rates. At t=5, cumulative stock returns have increased relative to the lowest point at t=2 but are still not back to the peak reached a year before the crisis.

Figure 4. *Event Study of Cumulative Stock Returns in a Market Bubble*



Variables:

$$\log\_cum\_r = \log_e(1 + avg.R_{cum(t)})$$
$$R_{cum(t)} = (Index_t / Index_{t=0}) - 1$$

Even though the event study showed a trend in which stock returns increased over time leading up to a financial crisis, this does not answer the question of whether higher stock returns actually predict crises. In order to probe this issue, I carried out a regression analysis as explained in the following section.

6.2 Regression Analysis

The dummy variable was 1 for the 5-year period immediately following a market bubble crash, and 0 otherwise. The regression equation was: $dummy_{bubble} = d \cdot r_{t-5 \to t} + c_4$. The results suggested that there is indeed a positive and statistically significant

correlation between cumulative stock returns and the popping of a bubble, but that the cumulative returns cannot be the sole measure used to predict market crashes. In other words, while the t-statistic of 4.67 indicates that there is a statistically significant correlation between higher stock returns and an increased likelihood for a crisis, the R-squared value is a mere 1%, and therefore, we cannot just rely on cumulative stock returns of a 5-year period to say with confidence that the market is about to experience the bursting of a bubble.

In fact, when we took a regression with both $r_{t-5\to t}$ and $r_{t-6\to t-1}$, the cumulative 5-year return one year before the bursting of a bubble was statistically significant, while the marginal return in the year immediately preceding the crisis was not. This is consistent with the event study, which shows that the peak of cumulative stock returns occurs about a year before the bubble bursts.

Table 7. *Results from Regression*

	Regression	With Country Dummy
d	0.042	0.034
	(4.67)	(4.21)
c (intercept)	0.05	0.08
	(9.68)	(1.68)
N	2493	2493
Adj. R^2	0.01	0.03

Variables:

$dummy_{bubble} = d \cdot r_{t-5\to t} + c_4$

Where:

t = beginning of stock market bubble crash

$dummy_{bubble}$ =1 in time t-5 to t and 0 otherwise

$r_{t-5\to t}$ = cumulative real stock return from t-5 to t

These results point to the difficulty of developing a systematic way of predicting the formation and bursting of stock market bubbles and could at least partially explain why economies around the world seem to be affected by such bubbles time and again. In other words, while the definition of bubbles incorporates the unreasonable build-up of asset prices and a subsequent crash, simply observing the rise in stock prices may not be enough to forecast whether the market is due for a crash.

In addition to the low explanatory power of stock returns, Blanchard and Watson (1982) have elaborated on the idea that not all speculative bubbles end up crashing, with the probability of a crash corresponding to "how long the bubble has lasted, or by how far the price is from market fundamentals."[13] In concluding, the fact that cumulative stock returns actually peak a year before the bursting of a bubble, the low explanatory power of stock returns in predicting bubbles, and the fact that not all bubbles burst, make it difficult to predict when the market will crash.

7. Are There Any Country-Specific Phenomena?

Since the sample in this study contains 30 different countries with different levels of economic and financial development, it seemed fitting to inject country dummy variables into the analysis to identify if there were any interesting trends and subgroups within the sample. For this analysis, the same regression analysis that I previously carried out were re-run with country dummies for each of the thirty countries in the sample.

[13] Blanchard, O., Watson, M., *"Bubbles, Rational Expectations and Financial Markets"* (1983)

7.1 Revisiting: Stock Index Returns and GDP Growth

The following regressions were re-run with country dummy variables to isolate whether certain countries were systematically outperforming or underperforming the average across the thirty nations in the sample:

(1) 0-year lag: $g_{GDP(t\rightarrow t+1)} = a \cdot r_{t\rightarrow t+1} + c_1$
(2) 1-year lag: $g_{GDP(t+1\rightarrow t+2)} = b \cdot r_{t\rightarrow t+1} + c_2$
(3) 2-year lag: $g_{GDP(t+2\rightarrow t+3)} = d \cdot r_{t\rightarrow t+1} + c_3$

In normal states of the economy, the same group of countries, all of which are in East Asia and Southeast Asia, systematically outperformed the average growth in GDP in the economy. These countries were: China, Hong Kong, Japan, South Korea, Malaysia, Singapore, Taiwan, and Thailand. On average, these countries outperformed the market by about 3.2% higher than what regressions (1), (2), and (3) suggest. China had the highest correlation coefficient of around 5.2%. The results show that Asian countries have been outperforming the projected growth in GDP based on stock market returns.

This could be either because some of these markets have experienced unprecedented growth in the economy, while others may not fit the model because the prospective stock markets are relatively underdeveloped and are not acting as efficiently to promote GDP growth as in other countries with older, more mature stock markets. There could also be a combination of both factors that is contributing to the results. This question is left to possible further research, but is currently beyond the scope of this analysis.

During financial crises, on the other hand, no country was shown to have significant dummy variables. This suggests that a bubble equally impacts even those countries whose GDP growth has been poorer or better relative to stock market

performance. Besides the additional insights from these country dummies, the same results held as did in the regressions without country dummies.

7.2 Revisiting: By How Much Do Bubbles Hurt GDP Growth?

In this analysis, I tested once more whether the occurrence of a bubble hurts GDP growth and by how much, along with added country variables. In this case, there was a significant amount of variation from country to country, with 18 out of 30 countries having statistically significant dummy variables. Out of the 18 countries, only China had a positive correlation coefficient, and the rest had negative dummies, meaning that a bubble would hurt them more on average.

Interestingly, the countries that were hurt more by bubbles were not the same countries that systematically outperformed the market in section 4.1. In other words, the countries who had exceptional GDP growth, or whose stock markets were too immature to have wide-spread impacts on the macro-economy, were not the ones that were hurt by more than average.

As elaborated in previous sections of this paper, I speculate that one reason for such results could be that the immature stock markets would be less correlated to other aspects of the economy, including investment and liquidity, and therefore the chain effect that occurs from the bursting of a bubble would not be as pronounced. However, I leave this question to be explored in further research.

7.3 Revisiting: Does the Stock Market Predict Bubbles?

The inclusion of country variables did not significantly alter the findings in this analysis; While stock market crashes caused by speculative bubbles were indeed

associated with higher returns in the preceding 5 years, the explanatory power of the model was too low to conclude that one can forecast the bursting of a bubble simply by observing cumulative stock returns.

8. Further Research

For further research, I would like to probe the difference between speculative bubble crises and other types of financial crises in more detail, and specifically figure out which crises have the most dire impacts on the macro economy. For instance, it would be interesting to see whether currency crises have more or less of an impact on GDP growth compared to national debt crises. In addition, to make my analysis on investment more comprehensive, it would be helpful to find more quantitative data. Though the actual relationship between investment in the economy and bubbles was beyond the scope of my research, I think it would be an important question to be probed in the future.

Additionally, in order to make the research more comprehensive, the country sample that I used in this study would need to be expanded to include more data. Ideally, I would also like to test the relationship between unemployment, investment, and GDP growth separately in order to quantify the correlation between various other macro economic variables and GDP growth. To refine the analysis of stock returns, I would like to collect industry-level data. For instance, for the dot-com bubble, I would try to find data on technology stocks and the prices of these stocks, and compare it to the index. Finally, formulating my own definition of what constitutes a speculative bubble would help make the list more thorough and precise.

9. Conclusion

In the aftermath of the financial crisis of 2008, the public has been paying increasing attention to the idea of speculative bubbles, and their impacts on the macro economy. The issue of said bubbles is intriguing because it provides an anomaly to the efficient markets hypothesis, and the analysis of its causes is still relatively undeveloped. This paper was written with the hope that my analysis could shed some light on the facts and myths of such market bubbles, and to empirically quantify just how much of an impact bubbles have on the macro economy.

By analyzing an array of data over 30 different countries in time periods ranging from the 1800s to the present day, I have discovered that the popular opinion that contributes prolonged recessions and depressions to the bursting of bubbles should be taken with a grain of salt. In other words, while it is true that the bursting of bubbles is often followed by recessions and decreased productivity in the macro economy, the sharp decline in stock market performance is not the sole cause, particularly in the long run.

This paper suggests that the sharp decline in stock returns during the burst of a bubble acts more as a catalyst for a host of events in several sectors of the macro economy that turn the stock market crash into a prolonged recession, rather than directly cause all of the decline in GDP growth during the recession by itself. More specifically, the fall in liquidity and investment in the economy, coupled with decreased investor confidence that leads to decreased flows into the stock market, amplify the effects of a stock market crash and hence cause the macro economy to deteriorate in the longer run.

I have also found that while speculative bubbles are indeed correlated with abnormally high stock returns in five to six years leading up to the crisis, these abnormal

returns by themselves are not enough to project with confidence that a bubble in the market is about to burst. Finally, I have discovered that countries in Asia have, on average, outperformed the GDP growth that was predicted by the performance of stock market indexes during normal states of the economy, but that this did not protect said countries from the decline in GDP during a crisis.

To summarize, this paper suggests that the bursting of speculative bubbles is more powerful as a trigger to other events in the macro economy that directly cause the decrease in the productivity of the economy, rather than as the sole cause. Data also suggests that predicting the burst of speculative bubbles is imperfect, at best, and that on average, per capita GDP growth resumes its normal course about a year after the crash of the market.

Appendix 1 – Countries and Time Periods Covered

Country	Time Period Covered
Australia	1875 - 2008
Austria	1922 - 2008
Belgium	1897 – 2008
Brazil	1995 – 2008
Canada	1914 – 2008
Chile	1960 – 2008
China	1990 – 2008
Colombia	1927 – 2008
Denmark	1914 – 2008
Finland	1912 – 2008
Germany	1850 – 2008
Greece	1952 – 2008
Hong Kong	1964 – 2008
India	1920 – 2008
Japan	1914 – 2008
Korea (South)	1962 – 2008
Malaysia	1973 – 2008
Mexico	1930 – 2008
Netherlands	1919 – 2008
Norway	1969 – 2008
Philippines	1952 – 2008
Portugal	1931 – 2008
Singapore	1965 – 2008
Spain	1850 – 2008
Sweden	1901 – 2008
Switzerland	1910 – 2008
Taiwan	1967 – 2008
Thailand	1975 – 2008
UK	1831 – 2008
USA	1801 – 2008

Appendix 2 – List of Bubbles

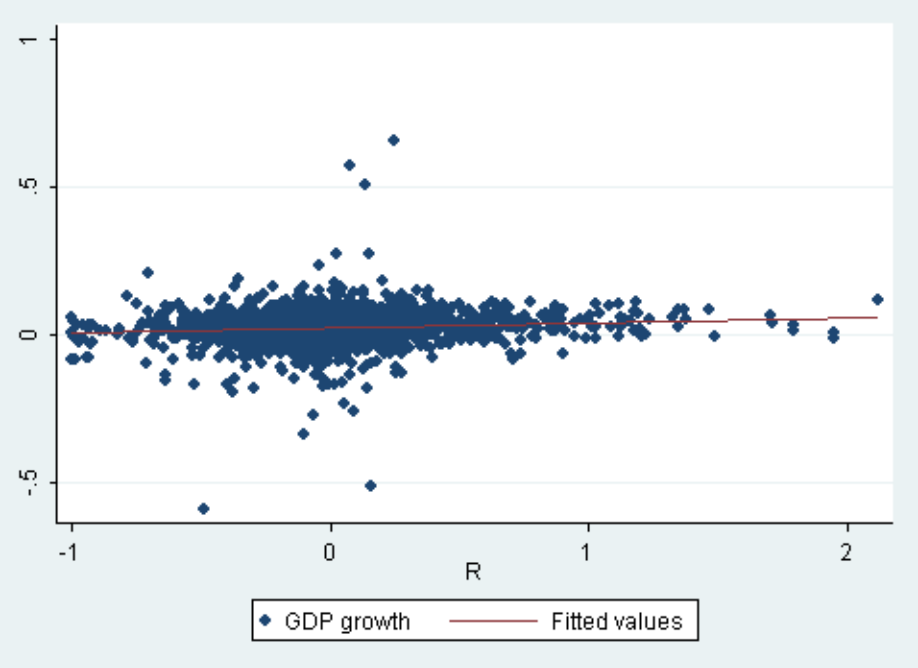
Country	Year of Crisis	Speculation On:
Japan	1990	Nikkei shares index; real estate
Mexico	1994-1995	Deregulation, domestic boom
Thailand, Malaysia, Korea, Brazil, Hong Kong, Philippines, Thailand	1997-1998	Deregulation, borrowing abroad, capital inflow and outflow
United States	1979	Oil prices, Third World syndicated bank loans
	1982-1987	stock market, luxury housing, office buildings
	1929	End of extended postwar boom
	1970-1971	OPEC, Collapse of Bretton Woods
	1890	Sherman Silver Act
	1995-2000	Dot-com bubble
	1907	?
	2007	subprime mortgage
	1837	Cotton, land
UK	1890	Argentine clearing of southern lands, etc.
	2007	housing prices
	1920-1921	End of Post-War boom
	1847	Railways, wheat
	1857	Bank mergers, clearinghouse
	1890	Argentine securities, private companies going public
Australia	1891	Growth of Cities
Colombia	1998	housing
Finland	1991	real estate
Norway	1987	real estate
Hungary	2008	real estate
Spain	2007	real estate
Mexico	1994-1995	capital inflow, bank lending, new domestic banks

(Source: “This Time is Different”, “Manias, Panics and Crashes: A History of Financial Crises)

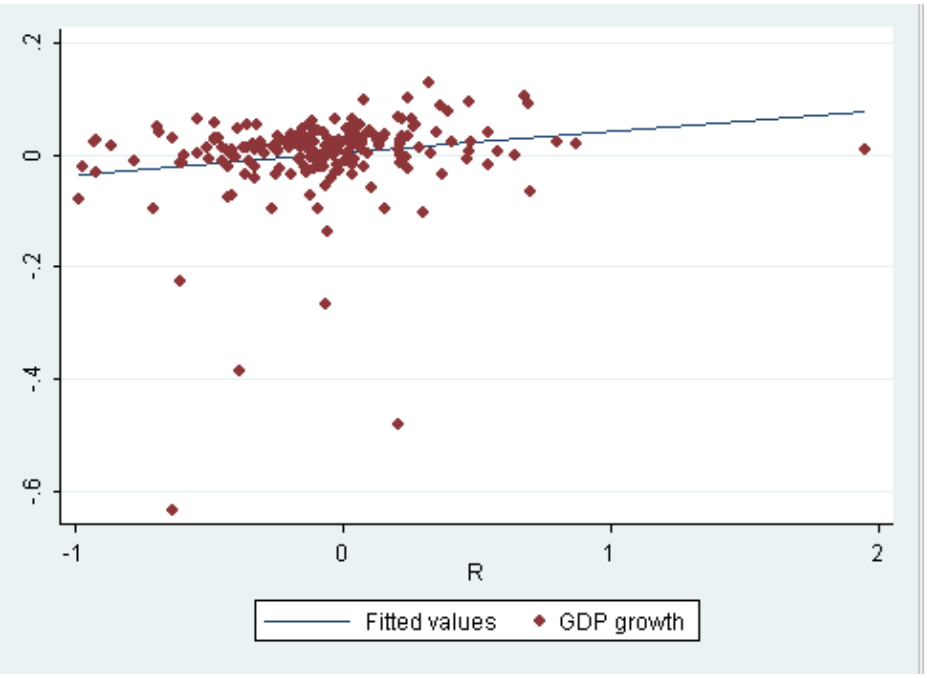
Appendix 3 – Regression Plots of Tables 1,2, and 3

1. Table 1

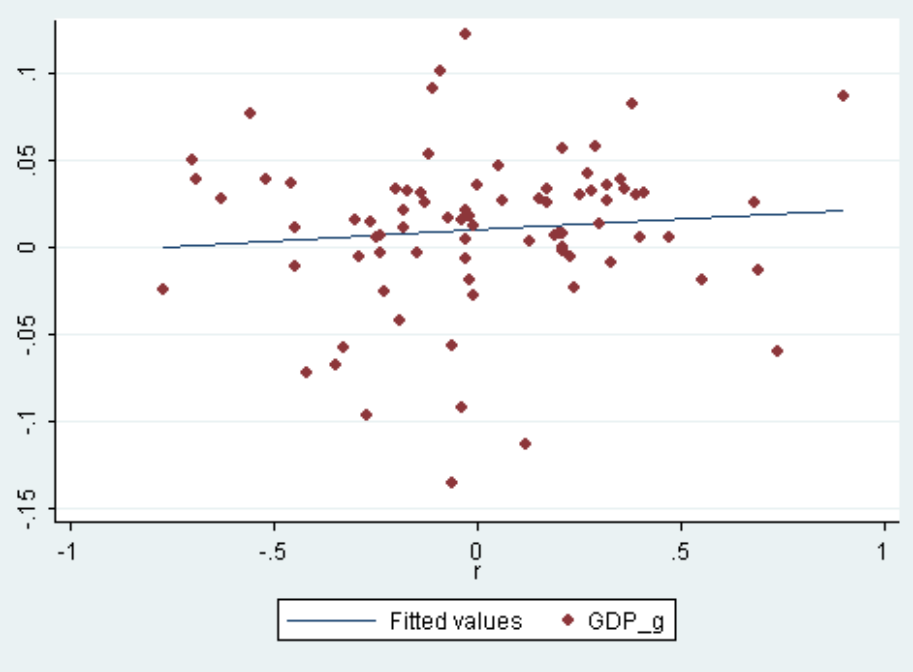
a) Control Group



b) All Financial Crises

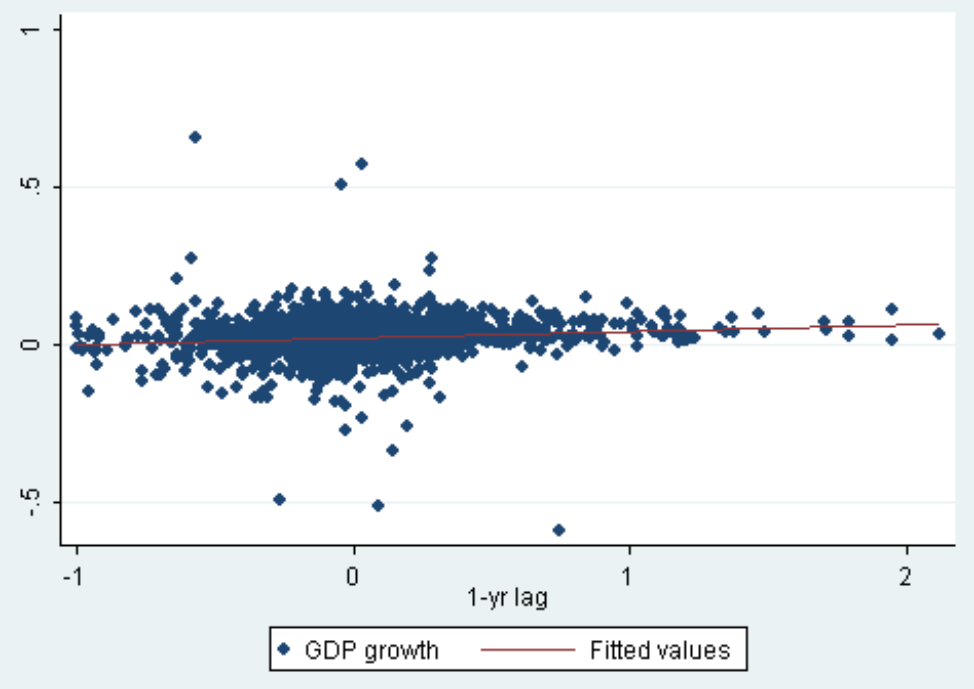


c) Bubbles Only

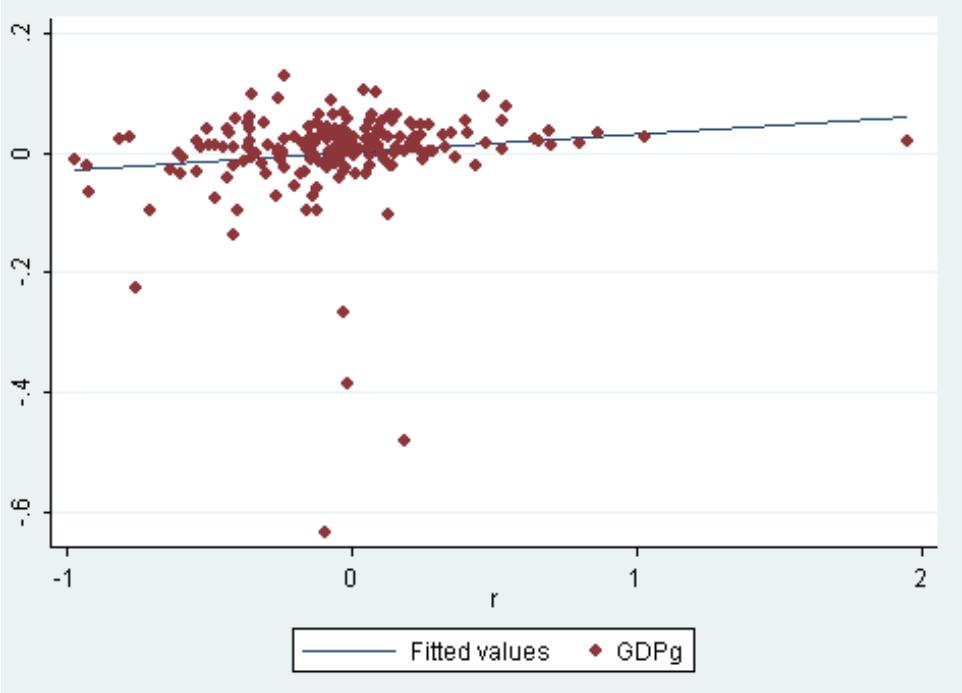


2. Table 2

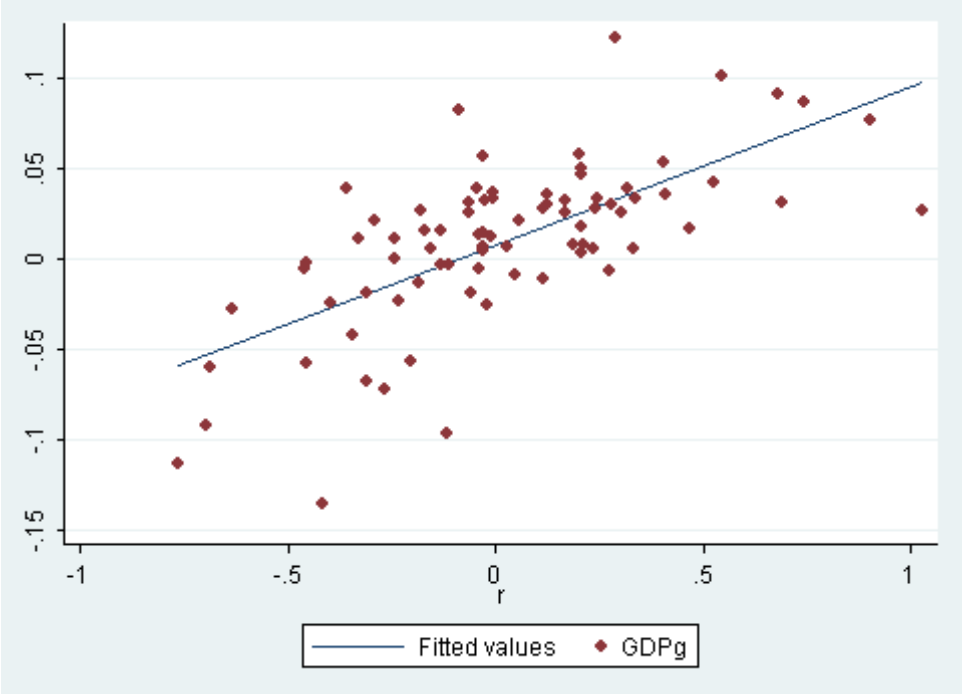
a) Control Group



b) All Financial Crises

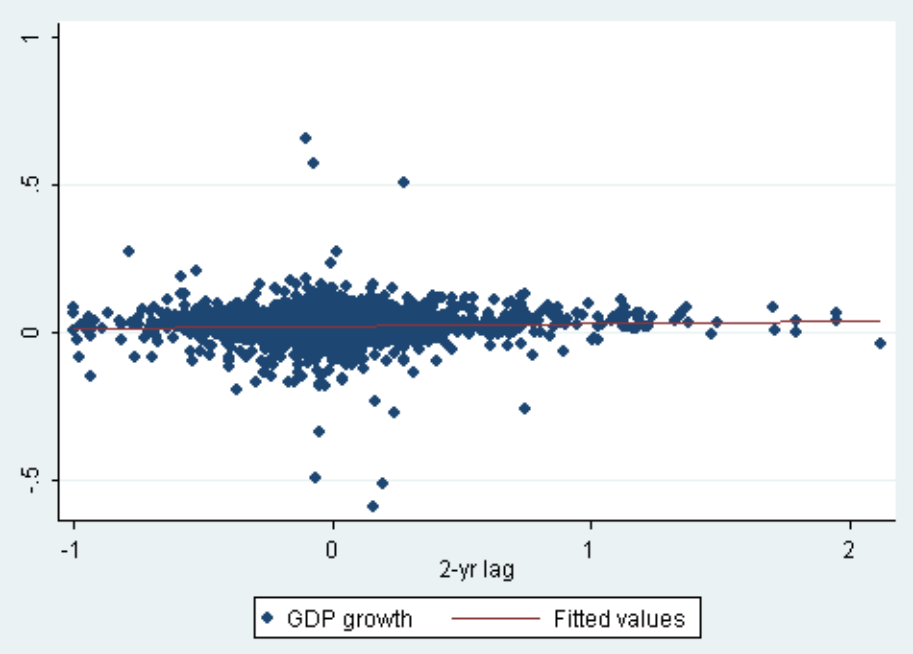


c) Bubbles Only

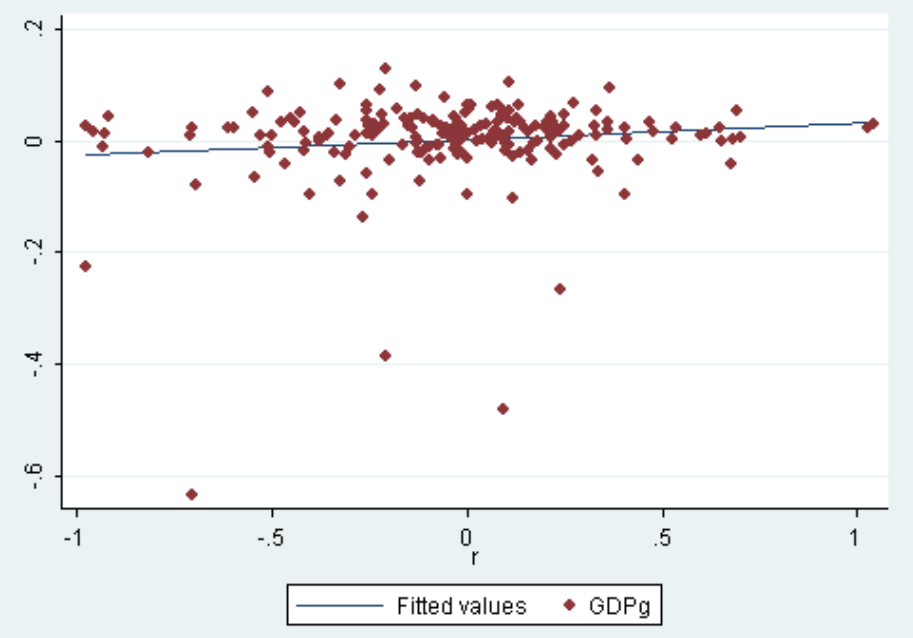


3. Table 3

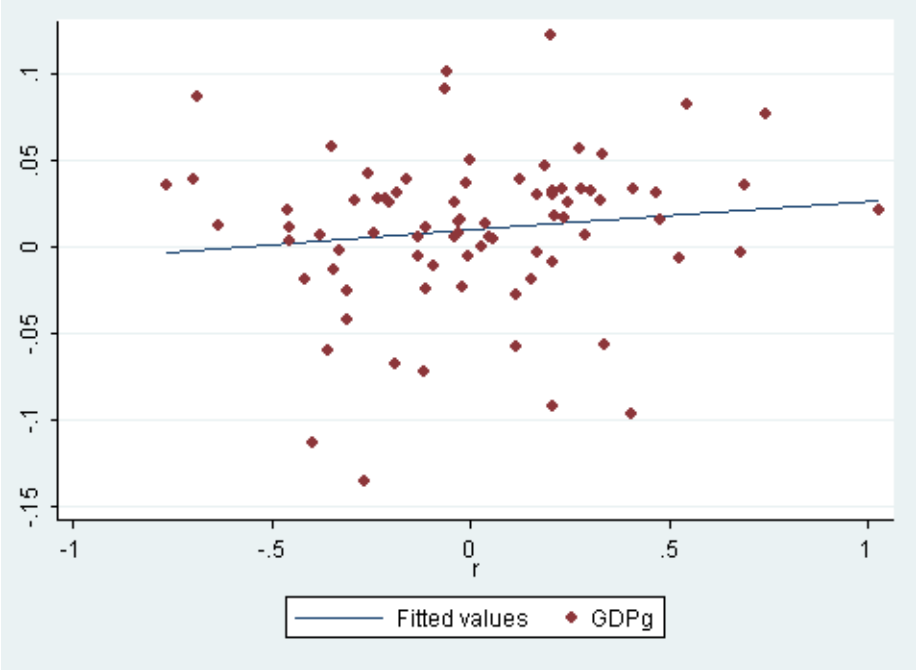
a) Control Group



b) All Financial Crises



c) Bubbles Only

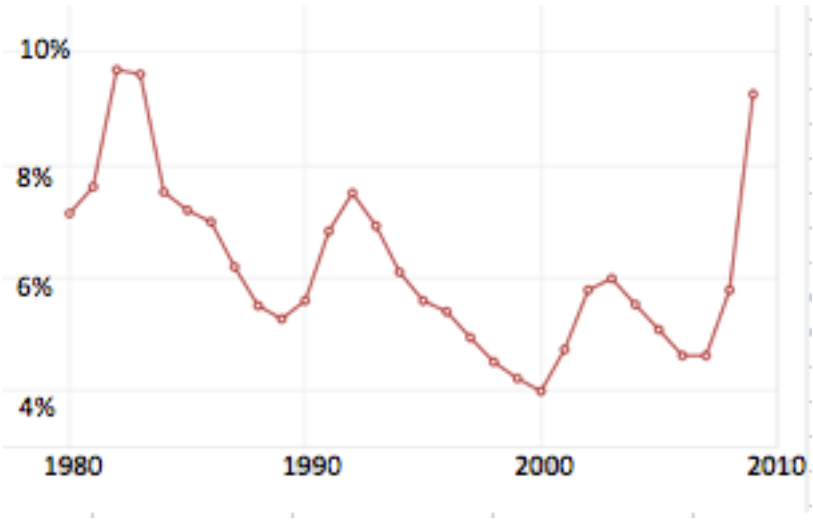


Appendix 4 – The Latest Crisis

Stock index returns:

(Source: Yahoo Finance)

Unemployment rate:



(Source: World Bank)

The graphs show that, even though the S&P 500 started to recover in the first quarter of 2009, unemployment was still rising until 2010. This trend is consistent with the findings from this paper. In addition, while per capita GDP decreased from 2008 to 2009, it had started to recover from 2009 to 2010.

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