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Financial System Development and Market Efficiency

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Abstract

This paper examines the relationship between debt yield responses to announcements of bailouts of Eurozone countries and the degree to which each countries' financial system is developed. We use high-frequency data to model the response of announcements of a bailout of Greece's financial system with other troubled Eurozone countries. We believe that the greater the countries' financial system is developed the faster the response to announcements of bailouts.

Introduction

The dynamics of investment strategies in fixed income assets are without a doubt temporally correlated with the probability and stability of expectations of future income growth. Diversification of assets into fixed income instruments, such as sovereign debt, serves to dampen the risk of other riskier assets such as equities, and provide stable growth prospects of future returns. Increasingly, investors have been disposed to invest into different countries as to divest any idiosyncratic risk that might exist in a single market; thereby, effectively systematically diverging single market risk into systemically global risk. Internationally dynamic capital allocations from investors endogenously serve as both risk stabilizers for portfolios, as well as a catalyst to economic growth, and therefore are important elements for policy makers to consider.

On the international front, given the increases in economic integration throughout the world, it has become more and more difficult for investors to price risk given the underlying international financial and economic threats. These threats stem from global economic imbalances that have resulted from stronger and stronger financial, capital, and trade linkages across countries. It is well documented that the growth and risk prospects of different countries are a direct result of past economic decisions made by policy makers. Since sovereign risk is a direct result of the policies that policy makers implement, it falls on the shoulders of the elected policy makers of each individual country to make progressive long-term decisions for their respective countries. However, the relationship between policy makers and their citizens sadly represent one that corresponds to the agency theory, thereby creating a principles/agents relationship wedge between the long-term prospects of the citizens, and the short term prospects of the policy makers.

The interdependence and endogeneity of both macro and micro government policies has been well documented throughout the literature and, the direction of which, have guided policy makers to refine, propose, and implement different policies on both the micro and macro levels. Moreover, current literatures blame current account imbalances as the genesis of currency/sovereign-debt crisis', the foundations of which have so far borne three generations of currency/sovereign-debt crisis debt models. These models make known that the burden and origins of these crises quintessentially fall squarely on the shoulders of the policy makers of their respective countries.

Investors are keen to monitor and foresee the effectiveness of governments to implement their policies, and are vigilant enough to take forceful action if they believe their investments are at risk. Therefore, it is important for policy makers, on a practical level, to see their policies through and to demonstrate, on a psychological level, that they have enough clout to be able to stand behind their decisions however difficult that may be. The question being asked here is that, does the degree of economic development increase the speed to which the implementation of government policies are priced into the market.

Literature Review

Currency Crisis

For the past three decades, there have been several emerging literature attempting to model currency crisis. There have emerged three different generations of models, these models have been based on observed crisis that have happened. The first generation of models have been modeled by Krugman (1979), Flood and Garber (1984), this generation has been called the "escape-clause model" by Jeanne (2000). Countries choose to maintain a fixed exchange rate in order to show credibility and to ward off inflation. The "escape-clause" model was based on the view that a country can only obey a fixed-exchange rate arrangement as long as it maintains an equivalent amount of reserves to do so. Maintenance of the local currency to a fixed peg is made through the central bank through currency sterilization. The action of sterilization involves a central bank offsetting a balance-of-payments surplus or deficit by performing any sorts of monetary controls such as open market operations, in which the central bank artificially intervenes in the depreciation of their currency by selling reserves and buying local currencies. The sterilization of local currency must be maintained at substantial par in order for the fixed exchange regime to maintain legitimacy. The escape clause term comes from the notion that if countries cannot maintain this fixed peg, because of ill ability of the central bank to sterilize local currency, they have the option to exercise an escape clause by devaluating, revaluating, or floating their currency. The first of two contributions of the “escape clause”, is that the escape clause defines defines fundamentals of country specific characteristics, and has these characteristics into two different categories of fundamentals, “hard” and “soft” fundamentals. Hard fundamentals have to do with quantitative fundamentals such as unemployment, balance of trade, and other macroeconomic variables. Soft fundamentals deal more with qualitative fundamentals such as the reputation, in the eyes of the citizens and investors, of central banks to control the value of the currency and to promote economic good.

The second role of the escape clause leads to the second generation of currency crisis models in which “self-fulfilling” speculations occur Obstfeld (1986). In contrast to the first generation, which is based on a fundamental view of macroeconomic influences that lead to currency crisis, the second generation contends that although there may exist a fundamental anomalies where exchange regimes can still maintain their regimes as long as “speculative attackers” do not think that they can pressure the regime to change. Self-fulfilling speculators have a perform speculative attacks on the regime whether or not they believe they can achieve a successful devaluation of the currency. Speculative attacks is in one way a win all or loose nothing attempt in forcing a regime to leave the peg and return to a floating exchange regime. The speculative attack involves a run on the reserves of the central bank in which the central bank's reserves are depleted up to the point in which they are forced to devalue, revalue or float their respective currency. A successful attack does requires either of two scenarios: the first is that a single entity have enough funds to deplete reserves thereby forcing the regime to change, or the second, there are enough different speculators involved the sum of which combined have enough funds to deplete reserves thereby also forcing the regime to change. Obstfeld (1996) interprets this by means of a game theory, where the attack should have a relative coordination to the point where speculators can gain enough acceleration to drive a momentum in the devaluation and force the regime into a floating exchange.

The third generation of currency crisis models deals with the financial and banking sectors and their roles in a currency crisis. McKinnon & Pill (1996), Krugman (1998), Corsetti, Pesenti, & Roubini (1998) present a model in which a "too big to fail" policy will lead to a hidden cost (in the form of debt) to governments when governments are forced to bail out companies; this is also known as the "Overborrowing Syndrome".

Currency Crisis and Contagion

Looking at the first generation of currency crisis we can apply contagion effects on the country. For example, if a country with a fixed exchange regime is forced to expand it's money supply, the escape clause will eventually take hold, and the country will be forced to devaluate. Once devaluation occurs structural imbalances occur in the balance-of-payments account, where if the country is dependent on foreign sources for capital, the withdrawal of capital from that country can lead to a trade imbalance and eventually the inability of a country to repay it's debt. The contagion occurs when trading partners who rely on a certain exchange rate cannot afford to continue trading Pesenti and Tille (2000).

The second generation of currency crisis and contagion occurs on a more qualitative level. If monetary authorizes are not seen as credible, and have a "history" of devaluating once they smell an economic downturn, this will make foreign investors in fear of devaluation once an economic downturn does occur. Further, this will reduce the value of their investments. Therefore, devaluation will require a higher rate of return for investors. When a higher rate of return is required by investors, the countries borrowing costs will rise, and when borrowing costs rise, this will reduce credit opportunities and diminish growth. In this cycle, regimes will eventually fail, and be forced to devaluate and abandon the peg Pesenti and Tille (2000).

The third generation of currency crisis and contagion can be exemplified by the Asian crisis. The Asian crisis gave us an example of how integrated banking and financial sectors become instruments of crisis diffusion in other countries. The foundations of the third generation model of currency crisis is if countries' liabilities are denominated in foreign currencies, a sudden appreciation in the foreign currency, will lead to a depreciation of the value as expressed in the foreign currency. Balance sheets of the country will change, and eventually lead to a currency crisis Pesenti and Tille (2000).

Currency Unions and Sovereign Debt Crisis

When countries have integrated trade and financial systems, according to the first-generation of currency crisis models, the ability of a country to cover its current account deficits by generating sufficient export earnings in the future is a major factor affecting the exchange rate regime. For example, if a country has a fixed exchange rate, and the reserves are not sterilized by the central banks, if a speculative attack occurs on the domestic currency of the country, the central bank will have no choice but to devaluate the domestic currency. If the central bank devaluates the domestic currency, then this will have an influence on the trading partners of that particular country, because it will be more expensive for it's trading partners to export to this country since the value of the currency has decreased. The contagion happens when investors in the foreign country see that the trading partners have devaluated their currency and that the companies that they are invested in the foreign country cannot sustain the profits, as a result, they sell the stocks of these companies. When investors sell the stocks of these companies, a decrease in the capital account of the country will occur, and this will lead to a balance-of-payments imbalance, and therefore lead to a monetization of the difference, and then an eventual depreciation. If countries have different currencies the trade between these countries changes, we would see a change in the exchange rates of these currencies. However, if countries do not have different currencies, and the debt of these countries are denominated in the same currency, then interest rate differentials between these countries will be purely representative of the risk of default of these countries.

European Union - Sovereign Debt – Stock Market Responses

Borgy, Laubach, Mesonnier and Renne (2011) develop a model to find macroeconomic variables to explain the evolution of euro area sovereign yield spreads at all maturities both before and after the crisis (the deviation was considered default risk). They use the German Yields as the benchmark risk-free rate of all euro area countries, they were encouraged to use this as the risk-free rate because they found that the yields on German debt was virtually unchanged before and after the crisis, therefore they concluded that German debt was "risk-free". Further assumptions were that the probability of a country leaving the EU was nil, expectations of future short-term interest rates were identical across the all EU countries, and since all countries were dealing with the Euro, exchange rate risk was not priced in. Therefore, they concluded that any deviation from the spreads of these bonds, pre and post crisis was the due to the risk of default. The sample of data they used was from January 1999 to March 2010. The stayed with this sample, because from the Spring of 2010 on, there was support from the EFSF and intervention in the debt market by the ECB to support debt of several EU countries.

Anderson, Hansen and Sebestyen (2006) look at the market response to German long-term bond futures, and examine the speed of adjustment to new news on major macroeconomic announcements and ECB monetary policy releases. They find that the volatility adjustment is more long-lasting than that in the conditional mean, and excess volatility can be seen post number announcement and slowly converge to the mean while the report is being read.

Conrad and Lamla (2007) analyze the effect of the ECB's monetary policy announcements on the level and volatility of the Euro-US dollar exchange rate. They use a AR-FIGARCH econometric model to model the exchange rate response to interest rate announcements by the ECB. They find that positive interest rate surprises induce a prolonged increase in the volatility of the exchange rate, in contrast, negative surprises have only weak effects. They also find that market participants react to expectations are substantially in line with ECB rate changes.

Hussain (2010) investigates return and volatility responses of Major European and U.S. Equity indices to monetary policy surprises by using 5-minute price quotes. He finds that the use of high frequency data separates the effect of monetary policy actions from those of macroeconomic news announcements on the stock index returns and volatility and also reduces problems associated with endogeneity and omitted variable bias in econometric estimation.

Harju and Hussain (2011) finds that there is a strong integration between the European and U.S. stock markets, where U.S. macroeconomic surprises, have an immediate and major impact on both the European stock markets' intraday volatility and returns. They further find that high-frequency data is critical in identifying news that impact markets. The research used a data set of 5-minute quotes of four major stock market indices for a period of 5 years and seven months. The researchers excluded the first two 5 minute openings from the data due to scaling problems caused by high opening levels of volatility. To analyze the impact that U.S. surprises have on European market volatilities, "two separate tests were conducted for the null hypothesis of equal average absolute returns on U.S. news release days verses days with no U.S. news release. Since the distribution average absolute return was not evident, an independent sample T-test was conducted along with a nonparametric Mann-Whitney U-Test." The results of the test indicates that in days of no new news, volatiles were significantly lower, and therefore leads to reason that U.S. macro news releases have a significant impact on the volatilities of the four European markets.

Bonfim (2003) measures the pre-announcement and news effect on stock markets in context of public disclosure of monetary policies by the Fed, from June 1989 to December 1998. The researchers finds that post February 1994, when the Federal Open Market Committee decided to issue formal press releases on the same day decisions to change the target interest rates were made, on days preceding regular scheduled federal reserve policy announcements, conditional volatility was found to be abnormally low, and surprise announcements boosted volatility significantly in the short-run. The key contribution of this paper is the ability to find a significant relationship in market volatility when new information has been released whether or not the news has been built into the market.

Andersson (2007) looks at how financial markets react to the release of monetary policy decisions by means of two distinct angles, “first, asset price volatility on monetary policy announcement days is compared to the volatility observed on non-announcement days. Second, the volatility pattern when the central bank changes policy rates as opposed to when the monetary policy rates are left unchanged is examined.” The paper is the first to compare U.S. and Euro area bond and equity market intraday volatility patters, and the first to examine the influence that monetary policy target and the surprises of the future path of monetary policy on intraday equity market volatility have conditional on alterations of monetary policy. The research also finds “higher volatility close to the end of the trading day is probably linked to some investors closing their trading books to avoid having open positions overnight.”

Brand, Buncic and Turunen (2006) note the differences in path expectations differ in ECB monetary policy between when a decision has been made, and the subsequent discussion (in the form of a press conference) of why that policy has been decided upon. The

ECB has a practice of announcing the path of monetary policy (rate changes), and subsequently holding a press conference where it provides information to the public for that particular change of policy. The researchers further find that when ECB monetary policy expectations are revised, a significant and substantial change in the yields of medium and long-term interest rates occur.

Ehrmann and Fratzscher (2004) examines the effect of U.S. monetary policy on stock market returns, and finds that on average a 50 basis point reduction, reduces returns by 3%, and no change in returns occur "when no change had been expected, when there is a directional change in the monetary policy stance and during periods of high market uncertainty."

Sovereign Debt and the Stock Market

Ferreira and Gama (2007) look at the cross-country stock market reaction to Standard & Poor's announcements of downgrade or change in sovereign credit ratings. They find that spillover effect of a ratings change exists both in the direction of the downgrade and in terms of economic impact. However no significant impact has been detected in rating upgrades. The also find that the negative effects of downgrades is more pronounced in traded-goods and small industry. They also find that the spillover impact is inversely related to geographic distance where countries that are further away from the downgraded country have a greater impact, this is consistent with the hypothesis that information asymmetry is moderated, in essence you know what how your neighbor is doing.

Brooks, Faff, Hillier, and Hillier (2004) find that in line with previous findings, upgrade of sovereign debt does not show significant behavior of abnormal returns. However, they find that in line with previous findings, rating downgrades do reveal a significant impact. One key finding of the research is that "downgrade impacts negatively on both the domestic stock market and the dollar value of the country's currency."

Kaminsky and Schmukler (2002) find that rating agencies' change in country ratings affects both bonds and stock markets, "with average yield spreads increasing 2 percentage points and average stock returns declining about 1 percentage point in response to a domestic downgrade." Rating changes have a spillover effect in stock returns and bond yields in emerging markets, where they are strongest at the regional level. Ratings changes are amplified for nontransparent countries. The researchers also find a strong correlation between upgrades/downgrades of countries, where "domestic-country rating upgrades do take place following market rallies, whereas downgrades occur after market downturns." The research also finds that interest rate hikes in the U.S. affect "fragile" economies more.

Rigobon and Sack (2001) apply a technique developed by Rigobon (1999) to identify the reaction of monetary policy to the stock market using hetroskedasticity based identification technique of stock market returns.

Currency Union and International Trade

Rose (2000, One money, one market: estimating the effect of common currencies on trade.) and Rose and Wincoop (2001) find that currency unions reduce the cost of international trade, and in effect increase international trade through different countries. They also propose a set of variables that determine the amount of trade between countries.

Sovereign Debt Risk

Remonlona, Scatigna and Wu (2008) contribute to the literature by introducing a framework to analyze the risk premia of sovereign debt. They argue that default risk of sovereign debt is not the same as sovereign risk pricing, where the pricing of sovereign risk premia is largely dependent on an investors risk aversion. They decompose sovereign debt risk into two categories, risk premia and default risk.

Grande and Parsley (2004) study the spillover effects of sovereign debt market upgrades and downgrades between categories of countries. They look at the effects between emerging and developed markets, and the look at variable such as trade and capital flows (solely vis-à-vis, the United States). They find a significant correlation in downgrades with capital flows.

Stock Market Integration/Contagion

Schotman and Zalewska (2006) find that foreign share ownership of countries have a significant and positive correlation of market co-movements in countries, a higher foreign ownership of a country results in higher sensitivity to crisis.Boyer, Kumagai and Yuan (2006) find evidence that stock market contagion is spread through assets that are owned by international investors. The researchers divide countries into two categories, countries that are open to outside investors, and countries that are not owned to outside investors.

Methodology:

We would basically be testing the return and volatility response of some of the European 10yr bond yields to see in high-frequency the risk of default of government debt before and after an announcement of a bailout. Again, since we have a currency union, and therefore the same exchange rate, then the potential for a default through debasement of the currency (by printing money) is non-existent, but a default in non-payment is purely the risk that is present.We would be testing the difference in conditional mean before and after the announcement of a bailout. To test this we can take the tick data that we pulled from Bloomberg for the European countries, and apply a 5-minute sampling for all these countries (because of the tick data that we pulled from Bloomberg, this would be the best interval to sample at). We will use the technique that was outlined by Andersen, bollerslev, Diebold, and Vega (2002) and by Hussain (2010):

Analysis of the data for detecting increases in volatility during days of no events, the same day of an event happening, and days after an event has happened is modeled in the following equations; Equation 1 through Equation 6 below (Bollerslev (1997), Hussain (2010)).

Equation 1: No Event with full 120 observations per trading day

$$|\Delta y| = \mathrm{c} + \beta_i \left(\sum_{j=0}^{J} \left[\begin{array}{c} \mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \mu_{3j}\frac{n^3}{N_3} + \mu_{4j}\frac{n^4}{N_4} + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6} + \\ \sum_{q=1}^{Q}\left(\delta_{qj}\cos\left(\frac{qn2\pi}{120}\right) + \varphi_{qj}\sin\left(\frac{qn2\pi}{120}\right)\right) \end{array} \right] \right) + u_t$$

Equation 2: Same day of Event with full 120 observations per trading day

$$\overline{|\Delta y|} = \bar{c} + \bar{\beta}_i \overline{\left(\sum_{j=0}^{J} \left[\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \mu_{3j}\frac{n^3}{N_3} + \mu_{4j}\frac{n^4}{N_4} + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6} + \sum_{q=1}^{Q} \left(\delta_{qj} \cos\left(\frac{qn2\pi}{120}\right) + \varphi_{qj} \sin\left(\frac{qn2\pi}{120}\right) \right) \right] \right)} + \bar{u}_t$$

Equation 3: Day after Event with full 120 observations per trading day

$$\overline{\overline{|\Delta y|}} = \bar{\bar{c}} + \bar{\bar{\beta}}_i \overline{\overline{\left(\sum_{j=0}^{J} \left[\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \mu_{3j}\frac{n^3}{N_3} + \mu_{4j}\frac{n^4}{N_4} + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6} + \sum_{q=1}^{Q} \left(\delta_{qj} \cos\left(\frac{qn2\pi}{120}\right) + \varphi_{qj} \sin\left(\frac{qn2\pi}{120}\right) \right) \right] \right)}} + \overline{\overline{u_t}}$$

Equation 4: No Event with first 5 of 120 observations removed per trading day

$$|\Delta y| = \mathrm{c} + \beta_i \left(\sum_{j=0}^{J} \left[\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \mu_{3j}\frac{n^3}{N_3} + \mu_{4j}\frac{n^4}{N_4} + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6} + \sum_{q=1}^{Q} \left(\delta_{qj} \cos\left(\frac{qn2\pi}{115}\right) + \varphi_{qj} \sin\left(\frac{qn2\pi}{115}\right) \right) \right] \right) + u_t$$

Equation 5: Same day of Event with first 5 of 120 observations removed per trading day

$$\overline{|\Delta y|} = \bar{\mathrm{c}} + \bar{\beta}_i \overline{\left(\sum_{j=0}^{J} \left[\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \mu_{3j}\frac{n^3}{N_3} + \mu_{4j}\frac{n^4}{N_4} + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6} + \sum_{q=1}^{Q} \left(\delta_{qj} \cos\left(\frac{qn2\pi}{115}\right) + \varphi_{qj} \sin\left(\frac{qn2\pi}{115}\right) \right) \right] \right)} + \overline{u_t}$$

Equation 6: Day after Event with first 5 of 120 observations removed per trading day

$$\overline{\overline{|\Delta y|}} = \bar{\bar{c}} + \bar{\bar{\beta_t}} \overline{\overline{\left(\sum_{j=0}^{J} \left[\begin{array}{c} \mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \mu_{3j}\frac{n^3}{N_3} + \mu_{4j}\frac{n^4}{N_4} + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6} + \\ \sum_{q=1}^{Q}\left(\delta_{qj}\cos\left(\frac{qn2\pi}{115}\right) + \varphi_{qj}\sin\left(\frac{qn2\pi}{115}\right)\right) \end{array} \right] \right)}} + \overline{\overline{u_t}}$$

The left hand side variables$|\Delta y|$, $\overline{|\Delta y|}$, and $\overline{\overline{|\Delta y|}}$ are the absolute value of the changes in yield from $(5 - Minute\ Spot\ Yield_{t)} - (5 - Minute\ Spot\ Yield_{t-1})$ and are the real volatility between the 5-minute intervals. The independent variables $\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \cdots + \mu_{6j}\frac{n^6}{N_6} + \sum_{q=1}^{Q}\left(\delta_{qj}\cos\left(\frac{qn2\pi}{120}\right) + \varphi_{qj}\sin\left(\frac{qn2\pi}{120}\right)\right)$, and $\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \cdots + \mu_{6j}\frac{n^6}{N_6} + \sum_{q=1}^{Q}\left(\delta_{qj}\cos\left(\frac{qn2\pi}{115}\right) + \varphi_{qj}\sin\left(\frac{qn2\pi}{115}\right)\right)$ is a Flexible Fourier Form of one day for both the full 120 observations per trading day and the first 5 of 120 observations removed per trading day as presented by Gallant (1981), and applied Bollerslev (1997) and Hussain (2010).

In addition to the method of analysis above, in order to offset any outlier bias in the regression estimation because of mismatching observation sizes, we took the mean of each observation with respect to each 5-minute time spot in the dataset for the three event highlighted subsets for both dependent and independent variables (the second methodology is cited below). The nature of the Flexible Fourier Form is a repeating integrated Sin/Cos cycle that repeats infinitely. The Flexible Fourier Form of my model was composed of a parameterized quadratic component fitted on the mean of each 5-minute spot of everyday of the entire data set for the respective countries. This methodology has been ‘customized’ for the purposes of this analysis, but incorporates, in essence, the method presented by Gallant (1981), and applied Bollerslev (1997) and Hussain (2010) [See ‘Lemma II’ for proof.].

Equation 7: Conditional Mean of No Event with full 120 observations per trading day

$$\frac{1}{d}\sum_{d=1}^{D}|y_t - y_{t-1}| = \sum_{d} \mathrm{c} + \beta_d\left(\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \cdots + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6}\right) + u_t$$

Equation 8: Conditional Mean of Same day of Event with full 120 observations per trading day

$$\overline{\frac{1}{d}\sum_{d=1}^{D}|y_t - y_{t-1}|} = \sum_{d} \bar{\mathrm{c}} + \overline{\beta_d}\left(\overline{\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \cdots + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6}}\right) + \overline{u_t}$$

Equation 9: Conditional Mean of Day after Event with full 120 observations per trading day

$$\overline{\overline{\frac{1}{d}\sum_{d=1}^{D}|y_t - y_{t-1}|}} = \sum_{d} \bar{\mathrm{c}} + \overline{\overline{\beta_d}}\left(\overline{\overline{\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \cdots + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6}}}\right) + u_t$$

Equation 10: Conditional Mean of No Event with first 5 of 120 observations removed per trading day

$$\frac{1}{d}\sum_{d=1}^{D}|y_t - y_{t-1}| = \sum_{d} \mathrm{c} + \beta_d\left(\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \cdots + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6}\right) + u_t$$

Equation 11: Conditional Mean of Same day of Event with first 5 of 120 observations removed per trading day

$$\overline{\frac{1}{d}\sum_{d=1}^{D}|y_t - y_{t-1}|} = \bar{\mathrm{c}} + \overline{\beta_d}\left(\overline{\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \cdots + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6}}\right) + \overline{u_t}$$

Equation 12: Conditional Mean of Day after Event with first 5 of 120 observations removed per trading day

$$\overline{\overline{\frac{1}{d}\sum_{d=1}^{D}|y_t - y_{t-1}|}} = \bar{\bar{c}} + \overline{\overline{\beta_d}}\left(\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \cdots + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6}\right) + \overline{\overline{u_t}}$$

The left hand side variables $\frac{1}{d}\sum_{d=1}^{D}|y_t - y_{t-1}|$, $\overline{\frac{1}{d}\sum_{d=1}^{D}|y_t - y_{t-1}|}$, and $\overline{\overline{\frac{1}{d}\sum_{d=1}^{D}|y_t - y_{t-1}|}}$ are the conditional means of the absolute value of the changes in yield from $(5 - Minute\ Spot\ Yield_t) - (5 - Minute\ Spot\ Yield_{t-1})$ and are the conditional volatility between the 5-minute intervals. The second part, $\mu_{0j} + \mu_{1j}\frac{n}{N_1} + \mu_{2j}\frac{n^2}{N_2} + \cdots + \mu_{5j}\frac{n^5}{N_5} + \mu_{6j}\frac{n^6}{N_6}$, is parameterized quadratic component of the Flexible Fourier Form of one day for both the full 120 observations per trading day and the first 5 of 120 observations removed per trading day without the infinity repeating functional forms, $\sum_{q=1}^{Q}\left(\delta_q \cos\left(\frac{q2\pi t}{120}\right) + \varphi_q \sin\left(\frac{q2\pi t}{120}\right)\right)$, and $\sum_{q=1}^{Q}\left(\delta_q \cos\left(\frac{q2\pi t}{115}\right) + \varphi_q \sin\left(\frac{q2\pi t}{115}\right)\right)$.

The analysis will be performed using Ordinary Least Squares regression, and proper regression diagnostics will be performed for the data set.

Taking a closer look at the regression, we use the Flexible Fourier Form as an independent variable to offset the seasonality of the intraday fluctuation in the conditional volatility of the data, the seasonality in my regression constitutes the “normal” volatility that we use as a benchmark against our event days – our days of interest. A significant FFF variable for each regression would signify that we have successfully adjusted the regression for the intraday conditional volatility per that given time series model. Regressing the real ($|\Delta y|, and\ |y_t - y_{t-1}|$) volatility on the seasonally adjusted intraday conditional volatility (FFF) would give us the degree to which the dispersion between the two is captured by the model. This dispersion constitutes increases and decreases in the volatility of the event days, by which we can measure uncertainty about bailout expectations. The results of the regression model will give us the following information: the Sum of Squared Residuals due to the regression ($SSR = \sum(\hat{y}_i - \bar{y})^2$), the Total Sum of Squares ($SST = SSR + SSE = \sum(y_i - \bar{y})^2 + \sum(y_i - \hat{y}_i)^2$), and the resultant Coefficient of Determination ($R^2 = \frac{SSR}{SST}$); the lower the dispersion between the volatility modeled by the FFF and the real volatility – the higher the SSE – the lower the R^2– the higher the volatility. Therefore, if we see a decrease in the R-squared from the trading day before the announcement, we can interpret this as ability for policy makers to increase uncertainty about a bailout.

We will rank each and every country based on it's financial development and perform a granger causality test, offsetting the daily intraday volatility with the Flexible Fourier Form.