

**Creditor Moral Hazard in Equity Markets:  
A Theoretical Framework and Evidence from Indonesia and Korea**

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ABSTRACT

This paper expands on the work of Sarno and Taylor (1999) by developing IMF-induced creditor moral hazard models in equity markets under alternative assumptions of market bubbles and implicit guarantees. To do so, it incorporates IMF-related news associated program negotiations and program approval to the models. Using daily stock returns for Indonesia and Korea, we estimate the applicability of these models by estimating changes in stock returns in response to the IMF-related news during the Asian crisis period. The results regarding Korea and, to a lesser extent, Indonesia are consistent with the creditor moral hazard models that assume implicit guarantees and asset price bubbles. However, the results show that the duration of creditor moral hazard in equity markets could be measured only by days, suggesting that it is a short-term phenomenon.

## 1. Introduction <sup>1</sup>

The IMF's assistance to Mexico in 1995, which preceded financial crises in South East Asia (1997), Russia (1998), and Brazil (1998), has led to the contention that its support implies moral hazard in financial markets. For example, Friedman (1998) argued that the IMF's assistance to Mexico "... encouraged individuals and financial institutions to lend to and invest in the East Asian countries, drawn by high domestic interest rates and returns on investment, and reassured about currency risk by the belief that the IMF would bail them out if the unexpected happened and the exchange pegs broke." Therefore, creditor moral hazard is the hypothesis that an expected Fund-support to a country may provide an implicit guarantee to its creditors regarding their investment, which motivates them to take excessive risks (Edwards, 1998; Eichengreen, 2000; Feldstein, 1998; Friedman, 1998; Schultz *et al.*, 1998; Schwartz, 1998).

Initial empirical studies concerning creditor moral hazard emerged in the late 1990s, and since then the interest in quantifying this type of moral hazard has been increasing. This paper's motivation is based on the fact that the majority of studies have focused on creditor moral hazard associated with sovereign bonds.<sup>2</sup> So far, to our best knowledge, Sarno and Taylor (1999) is the only study that has tested the creditor moral hazard hypothesis in equity markets. Their paper represents the most comprehensive empirical study on creditor moral hazard.

In contrast to other papers that only examine bond markets, the Sarno and Taylor (1999) study includes portfolio (equity and bonds), commercial bank, official, and FDI

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<sup>1</sup> We thank Ales Bulir, Bernd Hayo, Gary Santoni, and Myles Wallace for their helpful comments on the previous version of this paper. All errors are ours.

<sup>2</sup> See Evrensel and Kutan (2004a) for a review of papers on creditor moral hazard regarding bond markets.

flows to emerging markets. Their approach to testing for creditor moral hazard is based on the question of whether various types of financial flows have a significant temporary (reversible) component. They find that official flows tend to have a large, permanent component. Among private flows, FDI flows are highly irreversible because they possess the largest permanent component. Commercial bank credits also seem to have a large permanent component. However, portfolio flows to most East Asian countries have a large temporary component, indicating a high degree of portfolio flow reversibility. They also find that stock prices and dividends are not cointegrated, which they interpret as evidence of stock market bubbles. Sarno and Taylor (1999) conclude that their finding of a high degree of portfolio flow reversibility combined with stock market bubbles is consistent with the moral hazard interpretation of the East Asian crisis.

Even though Sarno and Taylor (1999) provide a comprehensive coverage of different types of capital flows, they do not provide a formal model of creditor moral hazard. Our paper contributes to the literature in several directions. First, we develop an IMF-induced creditor moral hazard model under alternative assumptions of asset bubbles and implicit guarantees, incorporating Sarno and Taylor's findings regarding reversibility of equity flows and asset market bubbles. We test our model using data from Indonesia and Korea. Second, in addition to actual program periods, our estimations employ IMF-related news that is quite appropriate for moral hazard considerations, such as announcements of negotiations and approval of programs. Third, we account for sequential creditor moral hazard effects by also allowing IMF news from other countries to affect local equity markets. Fourth, we use daily data, while Sarno and Taylor (1999) employ monthly stock returns. This issue is important to capture the duration of creditor

moral hazard. Moral hazard effects may not last long, especially in equity markets, and therefore using monthly data may not capture the true dynamics of creditor moral hazard. Indeed, our results show that, if there is creditor moral hazard in equity markets, its duration could be measured only by days, which implies that creditor moral hazard can be best described as a short-term phenomenon.

The paper is organized as follows. Section 2 discusses the theoretical framework in which creditor moral hazard in equity markets is examined. Section 3 provides the results of the empirical analysis. Section 4 provides concluding remarks.

## **2. Theoretical Framework Regarding Creditor Moral Hazard in Equity Markets**

Sarno and Taylor (1999) point out two characteristics of equity markets. First, stock prices and dividends are not cointegrated, which they interpret as a sign of asset price bubbles. Second, equity flows have a large temporary component, which makes them highly reversible. The argument regarding the highly reversible nature of equity flows is intuitive, because one needs to have fast-acting investors, if they are supposed to enjoy higher returns as a result of IMF-related news. The argument regarding bubbles in equity markets, however, may be less clear. For example, it is not clear how asset price bubbles would secure excessive returns to the holders of equities in the event of an IMF program announcement.

In this paper, we develop a framework in which IMF-related news may create creditor moral hazard in emerging equity markets with and without bubbles. Our framework also includes assumptions regarding general investor behavior and their

response to IMF-related news in equity markets. The mechanics of creditor moral hazard and the role of IMF programs are explicitly examined.

As to the general investor behavior, there is a wide variety of assumptions: rational behavior, limited rational behavior, noise traders, contagion, etc.<sup>3</sup> We assume rational agents and relate rationality to agents' ability to use all available information at any point in time. This implies that investors revise their current information set and subsequently their decisions as more information becomes available. We rule out "mimetic contagion" discussed by Topol (1991) and assume that an investor's decision does not contain any information to another investor.<sup>4</sup> This enables us to explain the nature of creditor moral hazard based on a representative agent model. Asset price bubbles are assumed to be rational bubbles in the sense that the moments of the equity price are independently determined, as long as mimetic contagion does not occur (Topol, 1991).<sup>5</sup>

With respect to IMF-related news, we consider two types of news: announcement of IMF program negotiations and program approval. Additionally, investors expect that, once an IMF program starts, it would have particular effects on program countries' economic performance and hence asset markets. Investors may expect that, once the start

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<sup>3</sup> Noise traders who react in concert to non-fundamental signals are thought to influence equilibrium asset prices. Because price deviations from fundamentals created by changes in investor sentiment are unpredictable, noise traders introduce a systematic risk that is priced. See French, Schwert, and Stambaugh (1987), De Long, Shleifer, Summers, and Waldmann (1990), Brauer (1993), Brown (1999), and Lee et al. (2002) for theoretical and empirical treatment of noise traders.

<sup>4</sup> Topol's (1991) model assumes that an investor sets his bid or ask price according to an additive learning process. On the one hand, he adjusts his prices to his present value calculated from an incomplete information set. On the other hand, to capture some information held by the other investors, he also adjusts his prices to average prices of his nearest buyers and sellers, which implies "mimetic contagion."

<sup>5</sup> If agents have imperfect information and mimetic contagion exists, this creates a speculative bubble through correlations of the agents' behavior. In this case, mean and variance of asset prices are simultaneously determined, which implies that it is no longer possible to explain the asset price dynamics based on one agent's statistical properties. The representative agent hypothesis becomes invalid (Topol, 1991).

of program negotiations with a country is announced, the probability of an IMF program adoption in this country is close to unity, because it is fairly rare that the IMF decides not to provide a program to a country once negotiations start. However, it is assumed that investors do not know about the size of the program loan until its announcement. Hence, there is a period of uncertainty regarding the size of the loan. We therefore include a “window” variable in our estimations to capture such uncertainty. It covers the period from the initial announcement of negotiations until the day before the program approval. During this time period, the attitude of prospective country’s government towards IMF program and its degree of cooperation with the IMF may influence investors’ expectations regarding the future success of IMF programs and, therefore, equity market returns.

Investors’ expectations regarding a country’s economic performance during the IMF program are important as well. If they expect a credible program implementation in the future, this would lead to higher returns in asset markets today. However, investors’ expectations may also be affected by economic performance during previous programs. Knowing that GDP growth rates generally decline during program years (Evrensel, 2002; Prezeworski and Vreeland, 2000), investors may expect a slower economy in the program country during the implementation of an IMF program.

The sequential moral hazard argument was introduced in the late 1990s by economists who suspected creditor moral hazard in other countries when a country receives IMF support (Edwards, 1998; Eichengreen, 2000; Feldstein, 1998; Friedman, 1998; Schultz *et al.*, 1998; Schwartz, 1998). They implicitly argued that IMF programs provided to other emerging countries may represent an additional piece of information for

investors to recalculate the probability of an IMF program in another emerging country. Because previous studies do not offer an explicit discussion regarding the mechanism of sequential moral hazard, we address this issue here as well. To test for this hypothesis, we include IMF-related news in other countries in estimations, in addition to countries' own IMF-related news.

In the following, building on our general discussion of investor behavior and IMF-related news above, we develop two alternative creditor moral hazard models under various assumptions of asset market bubbles and implicit guarantees. Model 1 assumes the presence of asset market bubbles without any implicit guarantees, while Model 2 allows for implicit guarantees in the presence or absence of asset market bubbles.

***Model 1: Asset market bubbles without implicit guarantees***

In the absence of implicit guarantees provided by the IMF through emerging countries' governments to equity holders, one can describe the nature of creditor moral hazard in equity markets based on investors' expectations regarding the duration of the bubble in that country. Our hypothesis is that, if there are bubbles in emerging countries' asset markets, in the absence of implicit guarantees, IMF-related news may contain information regarding the timing of the bubble's burst.

In order to create an environment in which creditor moral hazard could take place, suppose that Country A's equity market experiences asset price bubbles. The duration of the current bubble may be determined based on the size and duration of previous bubbles. Investors are assumed to make some probabilistic statements regarding the end of the bubble and associated expected excess returns until the bubble would burst. If investors

believe that IMF-supported stabilization programs signal macroeconomic and financial problems in program countries, they would expect a downward trend in economic activity, including equity markets, during the implementation of the program. An expected IMF-program in Country A hence may start the countdown for the burst.

Investors' calculation of the present value of expected excess returns depends upon the duration of the bubble, which is based on the information set on previous bubbles,  $\Phi$ . Consider

$$R_t | \Phi = R_0 + \gamma_1 R_t (1 + \delta)^{-1} + \gamma_2 R_{t+1} (1 + \delta)^{-2} + \dots + \gamma_m R_m (1 + \delta)^{-m} \quad (1)$$

where  $R_t$  is expected excess return to Country A's equity market at time  $t$ , conditional on the information set  $\Phi$ . For simplicity, we assume that  $R$  implies the profit-maximizing excess returns, adjusted for the exchange rate risk. Time is index as  $t = 0, 1, 2, \dots, m$  where  $m$  marks the end of the bubble, and the return associated with this particular time period is negative. It is assumed that other returns in (1) are positive and  $R_t < R_{t+i}$  as long as  $0 \leq i < m$ .  $\gamma_i$  is the probability with which  $R_{t+i}$  will be observed and  $\sum_1^m \gamma_i = 1$ .  $(1 + \delta)$

is the discount factor.

Suppose that the information set  $\Phi$  associated with Country A's asset markets is revised to  $\Phi'$  because of IMF-related news in Country A. If, based on the revised information set  $\Phi'$ , investors expect an IMF-program in Country A, they may conclude that the bubble previously thought to last  $m$  periods with some probability will burst in period  $k$  with certainty, where  $k < m$ .

$$R_t | \Phi' = R_0 + \gamma_1 R_t (1 + \delta)^{-1} + \gamma_2 R_{t+1} (1 + \delta)^{-2} + \dots + \gamma_{k-1} R_{k-1} (1 + \delta)^{-(k-1)} + R_k (1 + \delta)^{-k} \quad (2)$$

Based on Equation (2), if investors sell their stocks in period  $k-1$ , which is the period before the bubble bursts in period  $k$  with certainty, the present value of their excess returns will be higher than that suggested in Equation (1).

We assume that two types of IMF-related news contain signals regarding the duration of asset market bubbles. News can be either a country's own IMF-related news or, based on the sequential moral hazard hypothesis, they can be another country's IMF-related news. Based on revised market views initiated by the IMF-related news in Country B (say, Thailand), investors may conclude that Country A (say, Indonesia) would be the next country to receive an IMF program. News that Country B would be receiving an IMF program may motivate investors to revise their stand on equity markets in general and on Country A's equity markets in particular.

Assuming that IMF-related news contains information regarding the duration of asset market bubbles, we expect the following changes in equity returns:

(i) *Country's own news*: Because IMF programs constitute a sign of external imbalances and may signal an expected burst in asset bubbles, we expect that the *announcement of program negotiations* in country B decreases equity returns in this market. During the *window period*, which covers the period between the announcement of negotiations and program approval, the change in returns may depend upon investors' interpretation of the relationship between the IMF and the prospective program country. A highly publicized negative relationship, which may signal, among other things, fewer funds from the IMF

and the government's lack of commitment toward the credible implementation of the prospective program, is expected to decrease returns. Cooperation between the IMF and the prospective program country, however, is expected to affect returns positively. Changes in returns due to the announcement of *program approval* depend upon whether a surprise is associated with program approval. In other words, we expect that the changes in returns during the window to continue on the day of the approval announcement, if there are no surprises as to the content or the size of the IMF program. While negative surprises are expected to decrease returns on the day of program approval, positive surprises are expected to increase them. In the absence of a surprise, we expect no changes in asset returns upon the announcement of program approval.

(ii) *Other country news*: If IMF-related news in Country B motivates investors to conclude that Country A will receive IMF support in the near future, investors would want to enjoy the bubble in Country A until it bursts following Country A's own IMF-related news. Therefore, *negotiations* in Country B may increase returns in Country A's equity markets due to increased buying activity of Country A's equities. Changes in returns in Country A during the *window* and on the day of *program approval* in Country B may depend upon several factors. Everything else constant, if investors interpret the relationship between the IMF and Country B as problematic, we expect higher returns in Country A, because investors would start buying Country A's equities. However, positive news regarding Country B may be associated with lower returns in Country A.

(iii) *Own program duration*: As mentioned before, empirical studies suggest that, on average, program countries' growth rates decline during an IMF program. Considering the fact that programs last more than a year and asset markets react to news and expected

changes in the overall economy immediately, the overall change in stock returns during an IMF programs may not be statistically significant.<sup>6</sup>

***Model 2: Implicit guarantees without asset market bubbles***

Even though there are no explicit guarantees provided by the IMF or program countries' governments to investors holding these countries' equities, implicit guarantees could be provided by the prospective program country's government due to domestic moral hazard in that country. The IMF's financial support is supposed to stop the temporary loss of international reserves in a country and therefore provide additional liquidity to the economy. The recipient government is expected to use the Fund's financial support to finance necessary fiscal and monetary policies so that macroeconomic inconsistencies that led to the reserve loss can be eliminated. However, money is fungible, and funds obtained from the IMF may be partly or overwhelmingly used to pay off lenders. As Lane and Phillips (2000) suggest, financial support provided by the IMF is not large enough to provide guarantees on every lender's return. Still, the government may decide which lender will receive his returns without any payment problems, if the government had to choose among them.

Even though the nature of the implicit guarantee with respect to some lenders, such as commercial banks, holders of sovereign bonds, etc., is considerably more straightforward, it is not obvious with respect to equity holders. Creditor moral hazard in equity markets would exist, if the government or its officials have ties to certain interest groups and therefore some funds are expected to be used for these business groups in the

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<sup>6</sup> Because we expect this to be true under all models, we do not report our expectations associated with program duration when discussion the remaining two models.

form of subsidies, government credits, etc.<sup>7</sup> In this case, we expect the following changes in equity returns associated with IMF-related news.

(i) *Country's own news*: We expect that the announcement of *program negotiations* will increase returns on equities, if the government is known to protect certain groups and it is likely to receive an IMF program. Again, during the *window*, the change in returns may depend upon investors' interpretation of the relationship between the IMF and the prospective program country. While a negative relationship with the IMF may signal fewer funds, a decline in support level for protected groups or a positive cooperation between the IMF and the prospective program country is expected to affect returns positively. The effect of *program approval* on returns depends upon whether there is a surprise associated with program approval. For example, if funds associated with the program are smaller than expected, this may decrease the returns.

(ii) *Other country news*: Negotiation news associated with Country B and investors' expectations that Country A will be the next country to receive an IMF program may motivate investors to buy Country A's equities. Therefore, *negotiations* in Country B are

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<sup>7</sup> In East Asian countries studied in this paper, there is a highly-publicized relationship between the government and business, which suggests the distribution of public funds by the government among certain business groups. Even though the nature of this distribution may be different in each country, it leads to an inefficient distribution of resources in all of them. In Thailand, the nature of the relationship seems to be more political in the sense that the government provides funds to the groups that are politically valuable to them. For example, considering the fact that peasants constitute the majority of the voters, following the 1997 crisis, the government approved a large sum of funds to all 70,000 peasant villages and a three-year moratorium on interest payments by indebted farmers. In Indonesia, the relationship-based distribution of public funds seems to be more prevalent. It is well known that sectors such as steel, petrochemicals, and real estate receive large funds from the government and enjoy various protective measures. Additionally, the members of the president's family had a monopoly on cloves, owned banks, and even started to develop a national car and aircraft business. In Korea, as a development strategy, the government has tried to pick winners in manufacturing and technology, and provided them subsidized credits, looser domestic and foreign borrowing restrictions, and protection from foreign competition. Generally speaking, the question of how investors who make decisions in an environment with adverse selection response to a prospective IMF program is an important issue and can be best addressed in a sector-specific setting. See Evrensel and Kutun (2004b) for the interaction between domestic adverse selection in the financial sector and prospective IMF programs in Thailand, Indonesia, and Korea.

expected to increase returns in Country A's equity markets. Changes in equity returns in Country A during the *window* and on the day of *program approval* in Country B depend upon several factors. Everything else constant, if investors interpret the relationship between the IMF and the prospective program country as problematic, we expect higher returns in Country A, because investors would buy Country A's equities. Positive surprises on the day of program approval in Country B may be associated with lower returns in Country A.

Model 2 can be modified to include asset market bubbles into the framework of implicit guarantees. In the presence of implicit guarantees and asset market bubbles, IMF related news would not signal the end of the bubble, but rather the continuation of the bubble due to expected IMF funding, which would produce the same changes in investor behavior described above.

At this point, it is important to point out the difficulty with which creditor moral hazard in equity markets can be distinguished from investors' response to any news, in this case, IMF-related news. Clearly news plays an important role in asset markets, and the fact that investors respond to news does not verify the existence of moral hazard. For example, one can question why Model 1 (asset price bubbles without implicit guarantees) implies creditor moral hazard, and not usual investor response to news. Even if there is an implicit guarantee, the reliability of this guarantee may be questionable. Additionally, foreign and domestic investors may think differently regarding the reliability of the implicit guarantee.

The above framework implies the following characteristics of creditor moral hazard in equity markets. First, portfolio flows imply fast movements of capital. If there

is creditor moral hazard in equity markets, it may therefore exist for a relatively short period. This is consistent with the evidence of highly reversible stock returns found in Sarno and Taylor (1999). However, because they use monthly data, higher frequency data are required to better capture the duration of creditor moral hazard behavior. Second, in the absence of explicit guarantees, which Sarno and Taylor (1999) do not assume in their analysis, only a subsection of investors who are willing to invest in high-risk and high-return equities in emerging markets and that interpret IMF-related news in the aforementioned fashion would enjoy excess returns. Therefore, we would not expect a systematic and statistically significant creditor moral hazard formation in equity markets.

In the next section, we provide empirical evidence to see which above model is better supported by the data, using Indonesia and Korean equity markets as a case study. Thailand is not included here as the dependent variable due to the (sequential) nature of our empirical framework, as it was the first country in the East Asian crisis. Of course, Thai news is included in daily stock return models for Indonesia and Korea.

### **3. Empirical analysis**

We employ daily stock indices of Indonesia and Korea, which are obtained from Thomson Financial database. The sample period runs from January 6, 1992 through December 27, 2002. Returns are computed using log-differenced data, multiplied by 100. We do not limit our sample period to the crisis period to better capture the data generating process for stock returns and also to account for the impact of Fund program durations on returns.

Table 1 reports the descriptive statistics associated with stock returns during the sample period. Average returns are higher for Korea. However, the range (minimum and

maximum) of returns is larger for Indonesian market. Korean returns have a larger standard deviation (risk), which is consistent with the higher average returns in Korea. The figures for the kurtosis indicate the non-normality of the returns, which is confirmed by the large values of the Jarque-Bera statistic.

Table 2 reports the dates of program negotiations and approvals, along with the duration of programs. The results of the empirical analysis are shown in Table 3. For each country's return equations, the regressions include a number of lagged dependent variables as necessary to remove serial correlation in stock returns. Significant ARCH effects observed in initial OLS estimates motivated us to employ the maximum likelihood GARCH models. To best capture these effects, we experimented with standard GARCH as well as asymmetric threshold and exponential GARCH models. We found that the standard GARCH(1,1) model fits the data much better and it therefore is used in the rest of our estimations. Given the non-normality of stock returns in Table 1, all GARCH estimations employ the Bollerslev-Wooldridge standard errors.

In Table 3, we use the variable "window" to capture the uncertainty about the outcome of negotiations until the program announcement. This dummy variable takes a value of 1 from the day after the negotiations announcement until the day before the program announcement. In addition, we include dummy variables for the announcements of program negotiations and approval. These variables take a value of 1 at the day that negotiations begin ("negotiations") and the day in which program approval is announced for each country ("approval"), respectively. Similarly, we construct a dummy variable to capture the impact of the program duration on returns.

Now, we turn to the discussion of results regarding the relationship between stock returns and IMF-related news. Unless indicated otherwise, reported results are statistically significant at the 10 percent level or better. We first report the results for Indonesia. The announcement of Thai negotiations decreases returns by about 0.61 percent. The Indonesian stock returns continue to decline during the Thai window and by 1.2 percent. News about the Thai program approval does not have any statistically significant changes on the Indonesian returns. Overall, the results do not support the sequential moral hazard hypothesis that would have produced higher stock returns in Indonesia due to IMF-related news in Thailand under all the three models constructed.

When we consider Indonesia's own IMF-related news, stock returns increase by 1.56 percent on the day of the announcement regarding program negotiations. This result is consistent with Model 2 that assumes implicit guarantees. The stock returns decline during the Indonesian window period by 2.12 percent. Additionally, the change in Indonesian stock returns on the day of the program approval is not statistically significant. The results regarding the window and program approval may reflect the problematic relationship between the IMF and Indonesia. Growing political and social instability and well-publicized corruption in this country likely created uncertainty regarding the ownership and implementation of IMF programs, causing lower returns during the window period. At the same time, there was so much regional concern during this time period that, in addition to the U.S. and the EU, regional powers such as Japan and Australia intervened into the IMF-Indonesia relations. As to the duration, changes in stock returns during the Indonesian IMF program are not statistically significant. Considering the fact that Table 1 indicates the mean stock return in Indonesia to be 0.013

percent, it is clear that the impact of IMF announcements on asset returns was considerably high during the crisis period.

The results regarding Korea are richer in that they capture the impact of not only the Thai but also the Indonesian news. With respect to the sequential moral hazard hypothesis, our results indicate that negotiations and program approval in Thailand increase stock returns in Korea by 1.13 and 0.98 percent, respectively. This result is consistent with the moral hazard predictions of all three models. Whether there are bubbles or implicit guarantees in equity markets, higher returns are expected in a country due to IMF-related news in another country. With respect to the effects of Indonesian IMF-related news on Korean returns, while program negotiations decrease stock returns by 3.7 percent, program approval increase them by 2.1 percent. The result regarding negotiations is not consistent with our moral hazard expectations and can be explained by the problematic relations between the IMF and Indonesia or the social and political turmoil then in Indonesia. In fact, during the Thai and Indonesian window, we do not observe a statistically significant change in the Korean stock returns.

Regarding Korea's own IMF-related announcements, the announcement of program negotiations and approval increase the stock returns by about 6.0 and 7.0 percent, respectively. Higher stock returns on the day of the negotiation announcement are consistent with the creditor moral hazard models, assuming implicit guarantees with or without bubbles (Model 2). However, the Korean window is associated with a 2.8 percent decline in stock returns. Declining returns during the window may be an indication of difficulties or uncertainty during the negotiations. As in the case of

Indonesia, changes in Korean returns during the IMF program duration are not statistically significant.

Finally, the results for the conditional variance equation indicate that the volatility of stock returns increased during the IMF program both in Indonesia and Korea. This result, when it is combined with the finding in the mean equation that changes in stock returns are not statistically significant during the IMF programs, suggests that program duration does not affect investor wealth, but simply raises market volatility. Additionally, the reported Q and  $Q^2$  tests statistics indicate that the estimated GARCH(1,1) models do not suffer from additional serial correlation and accounts for all time-varying volatility up to 10 lags, respectively. We also attempted to include IMF news in the variance equation; however, the results were not reliable in the sense that we were not able to get convergence in the estimations. Because moral hazard effects are supposed to affect stock returns and our goal is not to study how IMF-related news affects conditional variance of returns, but simply to use an appropriate model to capture time-varying volatility of returns, exclusion of IMF news in the variance equation should not affect the inferences.

To summarize our empirical results, changes in stock returns associated with IMF-related news imply the following. First, regarding the sequential moral hazard hypothesis, increases in returns associated with the announcement of other countries' negotiations are consistent with the expectations of all three models. We observe this result only in the case of Korea with respect to the Thai and Indonesian negotiation news. Second, considering the countries' own IMF-related news, the impact of negotiations and approval news are generally consistent with our implicit guarantee models (Model 2). Both in Indonesia and Korea, most IMF-related own news is associated with higher

returns. Third, stock returns either decline during the window or remain unchanged, which is not consistent with creditor moral hazard. Fourth, changes in stock returns are not statistically significant during an IMF program.<sup>8</sup>

Overall, our results show that, if there is creditor moral hazard in equity markets, its duration could be measured only by days. This can be explained as follows. First, the initial increase in returns on the day of the negotiation announcement does not continue during the window period. Second, no significantly higher returns can be observed during the program. This finding implies investors react to new information quickly and creditor moral hazard, if it exists, is likely a short-term phenomenon.

Additionally, the evidence that the results for Korea is more consistent with the creditor moral hazard framework may simply indicate that the sequential occurrence of currency crises in South East Asia in terms of learning about IMF behavior. Following the IMF support to Thailand and Indonesia, by the time the Korean negotiations started, investors could have been questioned that the IMF would provide considerable amount of financial support to Korea to prevent the further spread of the crisis to others in the region and to other emerging markets in general.

#### **4. Conclusions and suggestions for further research**

This paper expands on the work of Sarno and Taylor (1999) and develops two alternative models of creditor moral hazard in equity markets under different assumptions of asset market bubbles and implicit guarantees. Incorporating IMF-related news associated with the own country and with other countries to the models, we predict the

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<sup>8</sup> Even though not reported, our results regarding Thailand do not imply creditor moral hazard. Thai stock returns either declined or remained unchanged on the days of IMF-related news and during the window.

expected changes in stock returns on the days of program negotiations and loan approval, as well during the implementation of IMF programs.

Our results regarding Korea and, to a lesser extent, Indonesia are consistent with the creditor moral hazard models that assume implicit guarantees and asset price bubbles. This result supports the findings of Sarno and Taylor (1999) and shows the general applicability of our models to test for creditor moral hazard in asset markets.

We find that IMF-related news associated with Thailand and Indonesia, which received IMF support prior to the Korean crisis, increased Korean stock returns. Additionally, Korea's own IMF-related news, both the announcement of negotiations and approval, increased Korean stock returns. The stronger evidence of creditor moral hazard for Korea may reflect some learning behavior as the IMF support to Korea marked the end of the crisis period in Southeast Asia. Having the ability to process available information fast and, therefore, to move fast, rational investors may have figured out the patterns of IMF behavior, revised their expectations accordingly, and used them for the Korean stock market. However, our findings suggest that creditor moral hazard effects may last only for a short time in equity markets as rational investors react to news quickly.

Clearly, one may argue that the results would have an alternative, non-moral hazard interpretation, simply indicating market reactions and asset substitution among various emerging markets. Still, we believe that our approach constitutes an improvement over earlier studies, because it uses the news approach in a systematic way, allowing for bubbles and guarantees. It is also consistent with Sarno and Taylor (1990) who report similar findings, using a different approach.

Regarding future research, our models could be applied to other forward-looking markets and crisis episodes in different regions. For example, an investigation into forward foreign exchange markets would capture investors' expectations in the absence of an IMF program, enabling us to better distinguish between usual investor response to news and creditor moral hazard. In addition, the issue of whether creditor moral hazard lasts for a short time needs to be further investigated. Finally, because it is hard to distinguish between investor behavior that reflects usual responses to news and investor behavior that implies moral hazard, future research need to focus on developing tests that could measure creditor moral hazard in equity markets more directly.

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Table 1: Descriptive statistics on the Indonesian and Korean stock returns

	Indonesia	Korea
Mean	.01307	.01697
Maximum	14.1689	11.3353
Minimum	-13.9306	-12.6943
Standard deviation	1.7981	2.1785
Skewness	.1557	.1113
Kurtosis	12.1839	6.4817
Jarque-Bera test	10076.69 (.0000) <sup>1</sup>	1452.45 (.0000)
Observations	2864	
Sample period	01/06/1992 – 12/27/2002	

<sup>1</sup> Numbers in parenthesis are p-values.

Table 2: Dates associated with IMF-related news and program duration <sup>1</sup>

	Thailand	Indonesia	Korea
Announcements associated with IMF programs <sup>2</sup>			
Start of negotiations	08/05/97	10/08/97	11/21/97
Program approval	08/20/97	11/05/97	12/04/97
Program duration <sup>3</sup>			
Effective date	08/20/97	11/05/97	12/04/97
Expiration date	06/19/00	11/04/00	12/03/00

<sup>1</sup> The term “program” implies standby arrangements.

<sup>2</sup> Dates associated with IMF-related announcements are based on Lane and Phillips (2000).

<sup>3</sup> *Annual Report* of the IMF in 1998 and 1999 provides the duration information. Effective and expiration dates imply the start and the end of a program respectively.

Table 3: GARCH estimations of daily stock returns in Indonesia and Korea

	Indonesia	Korea
Constant	.0419 (.0416) <sup>1</sup>	.0051 (.8695)
Thailand negotiations <sup>2</sup>	-.6064 (.0000)	1.1398 (.0000)
Window-Thailand	-1.2013 (.0439)	.0741 (.8225)
Thailand approval	-1.2477 (.6821)	.9876 (.0000)
Indonesia negotiations	1.5643 (.0000)	-3.7454 (.0000)
Window-Indonesia	-2.1221 (.0971)	-.3129 (.7172)
Indonesia approval	.2337 (.1925)	2.1019 (.0000)
Korea negotiations		6.0153 (.0000)
Window-Korea		-2.8422 (.0753)
Korea approval		7.0871 (.0000)
Program Duration	-.1099 (.1832)	.0554 (.6219)
Return (-1)	.1687 (.0000)	.0632 (.0018)
Return (-2)	.0374 (.1209)	
Return (-3)	.0349 (.1142)	
Return (-4)	-.0476 (.0263)	
Variance equation		
Constant	.0698 (.0008)	.0597 (.0013)
ARCH(1)	.1539 (.0000)	.0753 (.0000)
GARCH(1)	.8074 (.0000)	.9028 (.0000)
Program Duration	.3818 (.0026)	.2337 (.0197)
Diagnostic tests		
Log likelihood	-5021.317	-5863.263
Q(10)	11.313 (.3342)	7.0144 (.7242)
Q <sup>2</sup> (10)	5.4636 (.8581)	7.741 (.6541)

<sup>1</sup> Numbers in parenthesis are p values.

<sup>2</sup> See Table 2 for the dates associated with IMF-related news and program duration.