The Asian crisis: what did local stock markets expect?[1]

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16 November 2007

Abstract

In this paper we investigate whether cross-sectional information from local equity markets contained information on devaluation expectations during the Asian crisis. We concentrate on the information content of equity prices as these markets are in general the largest and most liquid in Asia and, thus, presumably the best carriers of information. Using an event-study approach for the period leading up to each of the devaluations which occurred during the Asian crisis (namely those of Indonesia, Korea, Malaysia, the Philippines and Thailand), we compare returns in the equity prices of exporting and non-exporting firms Our hypothesis is that the expectation of a devaluation should help the stock of exporting firms outperform those of non-exporting firms, other things given. We find evidence supporting this hypothesis, although at different degrees depending on the country. In fact, the surprise to equity markets seems to have been larger in Thailand. In the same vein, we find that equity markets did react to devaluations in other countries. This indicates that local market participants attached a non-negligible probability to the possibility that Thailand's currency crisis would spread to other countries in the region.

JEL classification:

Key words: Asian crisis, currency crisis, stock market, information content of equity prices.

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Introduction

Currency crises are a major source of concern for emerging countries. Their output and fiscal losses are well documented in the literature. As a consequence, significant research efforts have been devoted to this area. Some of the efforts have been devoted to improving the ability to predict such crisis.

Our paper can be framed in that effort since its main objective is to assess the information content of equity prices to predict the devaluations which were to occur during the Asian crisis. More generally, our paper can be considered as a study of the informational embedded in local equity market prices during a period of stress. First, we focus on equity markets as these were more liquid and had a higher capitalization than local bond markets in Asia in the mid to late 1990s. Second, the devaluations during the Asian crisis are among the hardest to predict in the literature of early warning indicators because of their unexpected nature, specially the first ones..

Using an event study approach, we analyze whether prices in domestic stock markets convey information about expectations regarding devaluations during the Asian crisis. More specifically, we compare the evolution of exporting firms' equity prices with that of non-exporting firms or the general stock index for the five Southeast Asian countries which underwent a large devaluation during the period 1997-98.

The underlying assumption is that a large devaluation should benefit exporting firms relatively more than non-exporting firms, other things given. The implication being that if a depreciation is seen as likely, returns for exporting firm equities should be unusually high relative to non-exporting firm equities in the period leading up the event. We rely on three different specifications with different degrees of granularity. First we compare, where available an export sector subindex with the main index. Second, we compare individual firm equity prices for exporting firms with the main index. The third and final specification compares the export sector index with a non-export sector index.

Our results confirm using several different data combinations for the event study, that such short-term predictive power did indeed exist. We also find that the predictive power of the stock exchange increases right after Thailand's devaluation, which would seem to indicate that investors did expect Thailand's currency crisis to spread to other countries in the region, contrary to what many had thought. Using a panel regression, we also find that the event-study results are robust to the inclusion macroeconomic variables generally used in the literature.

Given the short-run predictive power of our indicator, our paper can be seen as a contribution to the literature on early warning indicators. Pioneered work was onducted by Kaminski, Lizondo and Reinhart (KLR henceforth, 1998). They monitor the evolution of a number of macroeconomic variables, such as the current account balance or the real exchange rate, and assess whether a variable deviates from its normal trend beyond a certain threshold value. If it does, this variable is said to issue a signal. Anzuini and Gandolfo (2003), though, report on the limited predictive power of the KLR model when testing whether it would have been able to forecast the Thai crisis in 1997.

Following KLR (1998) a great number of forecasting models has emerged both in the academic literature as well as in the private sector. Most of them move from the univariate approach followed by KLR and use multivariate logit or probit regressions. Berg et al. (2004) offer an excellent overview of the predictive capacity of such models and find it to be very poor in the short-term horizon and only slightly better in the long-term for the KLR model. The results are especially poor when applied to the Asian crisis.

Very few papers in the early warnings literature have considered the predictive power of domestic equity markets. This is a particularly relevant issue for Southeast Asia, given the much larger size of their financial system as compared to other emerging regions. Probably the roughest – but earliest – attempt is that of Ferri, Liu and Stiglitz (1999), who look into the informational value embedded in the sovereign ratings of Asian countries prior to the 1997 countries and conclude that credit rating agencies failed to predict the emergence of the crisis. More recently Crespo-Cuaresma and Slacik (2006) exploit the term structure of interest rates to obtain estimates of changes in the timing of the currency crises in the Czech Republic in 1997 and Russia in 1998. They find their indicator to have a very good short-term predictor power. One potential issue with an indicator based on the term structure, though, is endogeneity. In fact, it is constructed with exchange rate and money-market interest rates which are both indicators of exchange rate pressures.

In this paper, we focus on the information content of stock prices to predict devaluations during the Asian crisis. Using an event-study approach for the period leading up to each of the devaluations during that period (namely those of Indonesia, Korea, Malaysia, the Philippines and Thailand), we compare returns in the equity prices of exporting and non-exporting firms. Our hypothesis is that the expectation of a significant devaluation should help the stock prices of exporting firms to outperform those of non-exporting firms, other things given. We show evidence supporting this hypothesis although at different degrees depending on the country. In fact, such prior information seems to have been smaller in Thailand, in as far as investors did not favor exporting companies, relative to non-exporting ones, prior to the devaluation. In the same vein, we find that equity markets did react to devaluations in other countries. This indicates that local market participants attached a non-negligible probability to the possibility that Thailand's currency crisis would spread to other countries in the region. All in all, we find support for stock prices having useful information on the probability of a devaluation. Such predictive power, however, is very short-term so that while useful should be understood as a very short-term framework.

The paper is structured as follows. In the following section we present the hypothesis and data. The third section describes the methodology used. In the fourth section we present our results. The final section draws some conclusions which may be of relevance for Asian policymakers.

Hypothesis and data

The paper deals with stock market developments prior to the devaluations which occurred in Indonesia, Korea, Malaysia, the Philippines and Thailand in 1997. In particular, it compares stock returns of exporting companies versus those of non-exporting companies to determine whether investors favored the former prior to a devaluation in the form of a higher relative returns, compared to a calm period (i.e., well before the crisis). The fact that we can interpret such higher relative returns as a sign that investors were expecting a devaluation has a key underlying assumption, namely that exporting firms would generally benefit from a devaluation, relative to non-exporting firms. While this looks like a plausible assumption, one can think of two possibilities where this would not be the case. The first is that the amount of foreign currency indebtness was larger for exporting firms so that a devaluation would increase the cost of debt relatively more. Such expected balance sheet effect would need to be larger than the expected competitiveness effect in order for exporting firms not to be favored by a devaluation. Although we do not count with information of these firms' indebtness prior to the Asian crisis, we can refer to the literature on the impact of a large devaluation on large firms in other emerging countries. Bleakley and Kowan (2005) show that a devaluation tends to favor firms in emerging economies, which implies that the gain in competitiveness is larger than the balance sheet effect.

The second scenario where a devaluation would not favor an exporting firm would be one in which the major trading partners also devalue their currencies. This possibility is ruled out by

the trade structure of the five Asian countries which devalued in 1997. In fact, their most important export destinations prior to the Asian crisis were the US, Japan and Singapore and trade between the crisis countries was limited, ranging from the 7.9% of the total country exports for Thailand to 11.8% for Indonesia.

In order to compare stock market returns in the five countries in our sample, we single out the main exporting sector/firm and compare it with non-exporting sectors or, at least, the stock market general index. The scope of this exercise, though, is limited by the relatively small size of Asian stock markets prior to the Asian crisis. Table 1 offers details about the main indices of these countries' stock markets.

Characteristics of main equity indices in sample countries

Country	Name	Market Cap[1]	Average monthly turnover[1]	Nº Sub-sectors
Thailand	SET Index	2.5 TRI	108.5 BN	25
Philippines	PCOMP Index	2.0 TRI	55.7 BN	--
Malaysia	KLCI Index	745.9 BN	38.7 BN	--
Indonesia	JCI Index	216.0 TRI	6.3 TRI	9
Korea	KOSPI Index	117.3 TRI	11.8 TRI	19

Sources: CEIC; Bloomberg. [1] In local currency. Year 1996. [2] At March 2007. Unavailable for 1997. [3] Single equities used as proxies for the exporting sector.

Table 1

Export sector subindex

Ideally, we would like to compare the returns of *all* exporting sectors/firms with the non exporting ones. An exporting sector should be one in which firms obtain more than half of their revenues from exports. *Since such* detailed data do not really exist for as early as 1997, we opt for concentrating on the most export oriented sectors/firms relative to others for each country in our sample. In fact, we take the stock market sub-index of the most export oriented sector in each country's main equity index.

We choose the most export-oriented sectors by analyzing the trade composition of the sample countries in 1996 as reported by the Economist Intelligence Unit and we also reinforce our choice by looking on Bloomberg at the revenues composition for the 5 biggest companies listed on the chosen exporting sector. In the three countries where sub-indices for the exporting sectors exist, we find that the biggest companies listed have revenues from exports well above the 50% threshold.

For *Thailand* we use the electronic sector sub-index (SETETRON). This is composed of computers and computers parts, which comprised more than 11% of total manufactured goods exports in 1996, the second most important category of manufactured exports. Besides, the traditional main exporting categories, textiles and garments, were only rising at a 5% annual rate over the 1994-96 period, whereas high technology exports were growing at a 25-40% annually. Finally, the SETETRON represents only a small share of the overall SET Index (see Appendix 2), which limits the influence of this sub-index on the main index, used as benchmark in this exercise.

For *Indonesia* we use the mining sub-index (JAKMINE) since mineral fuels were the most important exporting sector, with as much as 25.8% of total exports, in 1996. Nonetheless, the JAKMINE sub-index is small enough (12.3%) relative to the main Jakarta Composite Index (JCI), used as benchmark.

For *Korea* we use the sub-index for heavy industries (KOSPTREQ) whose principal components are machines, motors, and ships producers all of which are export oriented with over 80% of the total production exported abroad, and some of its most prominent firms exporting their whole production. As in the case of Thailand and Indonesia, the proportion of the KOSPTREQ sub-index as compared to the main KOSPI index is not very large (10.2%).

For *Malaysia* and *Philippines* the markets have no sectoral breakdown so that we need to do a more granular analysis, based on firm-level information.

Non-export sector sub-index

The non-export sub-index chosen for each country should be the least export oriented. In the case of Southeast Asia, as in many other countries, the most suitable sectors should be the service sectors, such as banking, insurance and real estate.

For Thailand we use the insurance sub-index (SETINS), whose three biggest listed companies have 100% domestic revenues. For both Indonesia and Korea we use the real estate sub-index. In the case of Indonesia, we perform a robustness test with another available sector,,namely the chemical and industrial one, whose share of domestic revenues is close to 100%, as for the real estate sub-index. Details on the composition of these sub-indices can be found in the Appendix 2.

As in the case of the exporting sub-index, the absence of a detailed breakdown for Philippines and Malaysia prevents from identifying a non-exporting sub-index so that only the main stock market index can be used as benchmark.

Exporting firms

At the single equity level, we focus on companies easily identified as being highly export oriented. For Thailand we choose an electronics company, Muramoto, whose exports revenues account for more than 80% of the total. We conduct several robustness tests with alternative firms from the electronic sector. All of them have at least 50% of their revenues from exports.

For the Philippines we opted for a firm specialized in exporting telephone services, PLDT. This is because practically all its revenue comes from calls from abroad and is billed in USD.[2]. While PLDT accounts for a big share of the main index (25.8% of the PCOMP Index), its evolution does not seem to be influenced by its large size since the other large stocks did not perform as well as PLDT.

For Malaysia we choose the largest listed company in the palm oil production sector, Golden Hope Plantations. At the end of 1996, 86% of the total production of palm oil in Malaysia was exported abroad, making it the most export oriented sector in the Malaysian economy. In fact, Golden Hope Plantations concentrates more than 50% of its sales abroad. As a robustness test, we use another company in the same sector, Kuala Lumpur Kepong BHD, with a similar share of revenues from exports and with sales in other Asian countries not affected by the 1997 crisis.

In order to better compare results across countries, we select some exporting firms for those countries for which there is data on sub-sectors, namely Indonesia, Korea and Thailand. In the case of Indonesia, we choose a manufacturer of garments - Karwell ID - which

[2] A Bloomberg report dated 11th of July 1997 states: "While the economy may take a hit, many companies are expected to benefit from the devaluation, especially exporters whose goods will be cheaper abroad…. Revenues at Ph. Long Distance Tel. Co will swell because half its business comes from international calls, which are billed in dollars. Those dollars now buy more pesos when PLDT brings its earnings home".

exported most of its production at the time of the crisis.[3] In fact, the textile industry was the most export oriented at the end of 1996. We repeat the experiment by using two highly exports oriented companies in the mining sector, and the results do not change.

For Korea we choose Samsung Heavy Industries, which manufactures oil tankers, containers and passenger ferries. Almost 90% of its revenues come from sales in the rest of the world. In addition, given Korea's higher level of financial development, we are also able to perform an additional test, namely comparing two branches of the same firm. This exercise has the great advantage of controlling for firm heterogeneity as it is the same firm but with a different revenue composition. To that end, we choose Samsung Heavy Industries branch, which is fully export oriented, with the Samsung Securities branch, which is fully home based[3].

Procedures

We use an event-study methodology to compare the daily evolution of exporting firms' equity prices with that of the general stock index, or the non-export sector if available, for each of the countries in our sample. This methodology allows us to exploit the daily frequency of the equity market prices data, which is crucial to assess the information content of stock markets, as well as their capacity to predict the devaluations which followed.[4] We also perform a panel regression to control for potentially relevant macroeconomic and financial factors.

Event dates

Identifying event dates is key in event study methodology and is not always easy. The easiest one is the first devaluation, namely that of Thailand. On July 2, 1997. the Thai baht declined 14 percent, the lowest rate since January 1985 and there was also an official announcement that the exchange rate would be a managed float from that date.

For each of the remaining four countries we calculate the mean and standard deviation of the daily exchange rate variations for the two and a half years preceding the 2 July 1997. We then identify the periods in which the exchange rates depreciated vis-à-vis the US dollar by more than 3 times the standard deviation and for at least three consecutive days since 2 July 1997. Doing so we avoid picking up single-day events, and we rather concentrate on repeated violations of our established threshold. We, thus, implicitly define the event as a powerful and protracted deviation from a well consolidated pattern. The first period in which we observe three consecutive days over the threshold is taken as "devaluation" for the event study.

As can be seen from Figure 1, it is relatively easy to identify the date of the crisis for Philippines and Korea. Also July 2 for Thailand falls within this definition. For Malaysia and Indonesia, though, it is much harder to pinpoint an event date. This reflects the fact that the devaluation occurred in several stages.

Nine days after Thailand's devaluation, on July the 11th, the Philippines also abandoned the defence of the peso. On this day it declined 11.5 percent before trading was suspended. The

[3] As Bloomberg reports, the company's customers are mostly from overseas retail companies.

[3] We thank Doo Yong Yang for suggesting this specification.

[4] For details on the methodology, see Campbell, Lo and MacKinaly (1997).

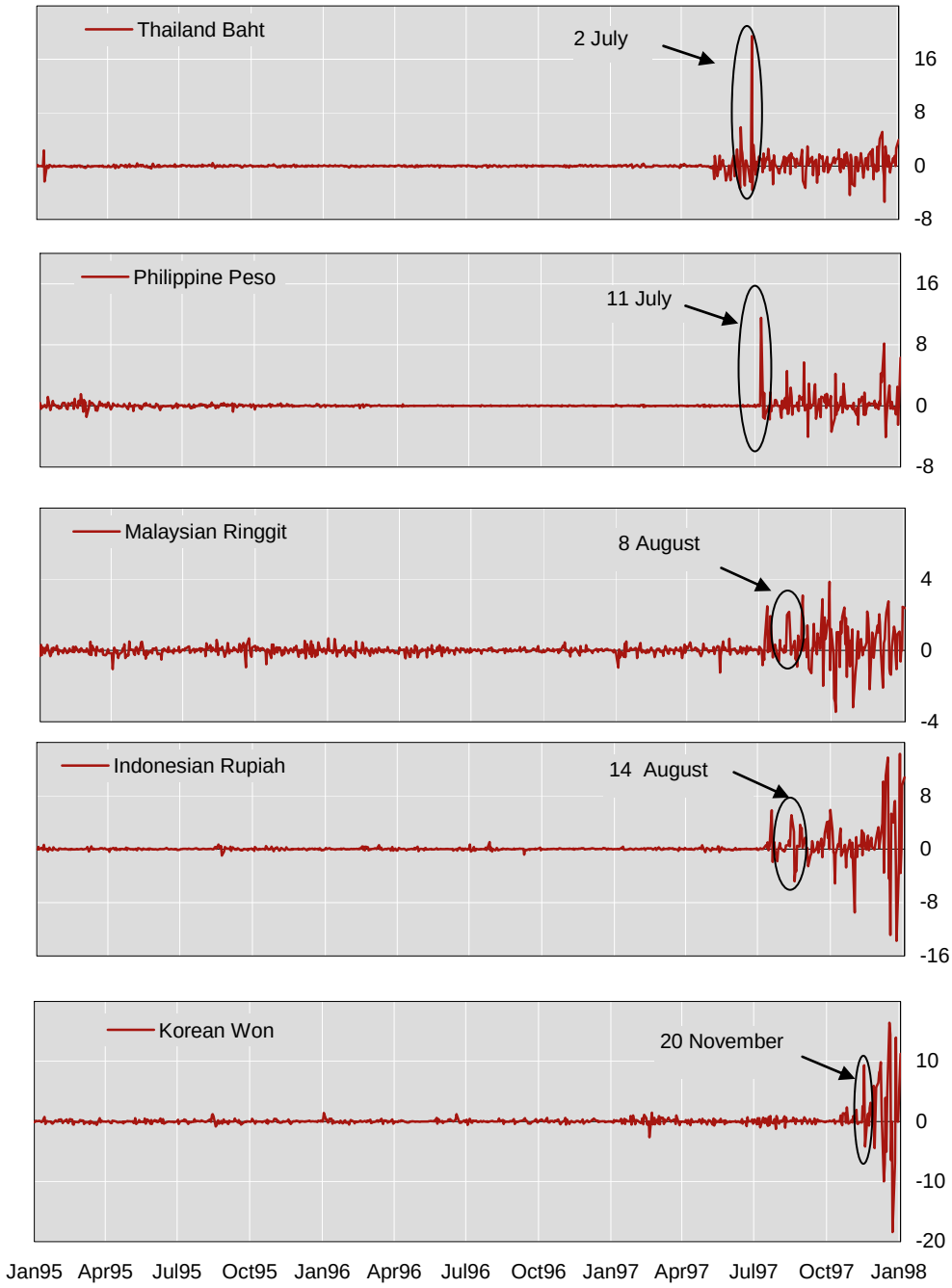
currency dropped to 29.45 against the US dollar, its lowest value in four years. In the previous one-and-a-half year, the peso had been virtually fixed to the dollar. It is perhaps worth noting that the Bangko Central tried not to let the peso float until the very last moment. On 10 July the overnight rate was raised to an unprecedented 32%.

The Malaysian ringgit had a series of repeated weekly depreciations of 4.5- 5.5 percent against the USD. Our procedure identified the event date on August 8 since this was the first time in which the ringgit outpaced our defined threshold for three consecutive working days. This is one week before the Bank Negara Malaysia stopped defending the ringgit. The ringgit lost 5.4 percent in this occasion on a weekly basis dropping to 24-year low against the US dollar on the August 15.

For Indonesia, the event date chosen following our definition was August 14, more than one month after the beginning of the financial turmoil in East Asia. On this day, the rupiah declined more than 4 percent, followed by a further devaluation of 6 percent on the following day. The rupiah began depreciating in July, following the initial depreciation of the Malaysian ringgit. The fluctuations had, however, been contained and insulated by the strong intervention by Bank Indonesia.

For Korea the first signs of difficulties appeared at the end of October. On October 28, the won depreciated by more than the official daily limit for the first time. Despite repeated reassurance by the Bank of Korea that the country had sufficient foreign currency reserves, speculative attacks continued during November. On the 18th and 19th of November, the won repeatedly hit the floor of the fluctuation band depreciating around 2.5% vis-à-vis the dollar. Following our methodology, the date chosen as event is November the 20th, the third day in a row where the won depreciated more than three times the standard deviation of the normal period daily variation. It is useful to note that on that day the Korean government widened the band to 10 percent allowed fluctuation from the previous 2.25 percent. In this respect, our definition thus succeeds in picking up such a representative date as the event date.

Daily variation in the exchange rate[1] and dates of the crisis



[1] Vis-à-vis the US Dollar. Positive value indicates depreciation.

Graph 1

Event window

Following event study methodology, we distinguish between the event window and the estimation window. The estimation window should be chosen as a suitably long period before the event, in our case the currency devaluation. Such estimation window is used to estimate differences in stock market returns between the export and non-export sectors during quiet times. Such "normal" returns will, then, be used as benchmark to calculate the "abnormal" returns, that is, those in the run up to the devaluation. The event window is the period over which the returns of the sectors involved in the event will be examined. In our case, this event coincides with the run-up to each country's currency devaluation. For all countries the event window is chosen as the 30 days preceding the event and 10 days after the event. The latter serve to investigate the short-run impact of the devaluation on the returns of exporting firms relative to others. In fact, *after* the devaluation occurs, we should observe a widening gap between the returns in the general index and those in the exporting sector, with these last ones taking effective advantage of the occurred devaluation. In any event study, the most relevant part of the exercise is the evolution of abnormal returns prior to the devaluation.

To avoid the influence of the Thai crisis on other countries and the overlapping of estimation and event windows, we consider one-year-and-a-half of daily observations (330 working days) up to May 16, 1997 (May 16 is exactly 30 trading days before Thailand devalued).

Normal returns, abnormal returns and cumulative abnormal returns

We now calculate normal, abnormal returns and cumulative abnormal returns following (Campbell, Lo and MacKinlay (1997)). In our setting, the differential return (R) is calculated as the difference between the exporting and the non-exporting sector/firm (or the general stock market index), depending on the specification.

$$R_t = \text{Day t returns for exporter} - \text{Day t returns for non-exporter}$$

To calculate the normal returns, E(R), we use the average differential return over the estimation window. This could be labelled a "constant-mean-difference-in-returns" model. Formally:

$$E(R) = \text{Average daily return in the estimation window}$$

To calculate the daily abnormal returns E_t in the event window we take the difference between the daily return differential during the event window and the average daily return in the estimation window.

$$E_t = R_t - E(R)$$

To calculate the cumulative abnormal returns (CAR) for a given period we simply sum over the daily abnormal returns in the event window, namely:

$$CAR_{t,t+n} = E_t + E_{t+1} + \ldots + E_{t+n}$$

The difference between the CAR and the normal returns should provide a measure of the impact of the event on the relative value of the exporting sector equity.

Results

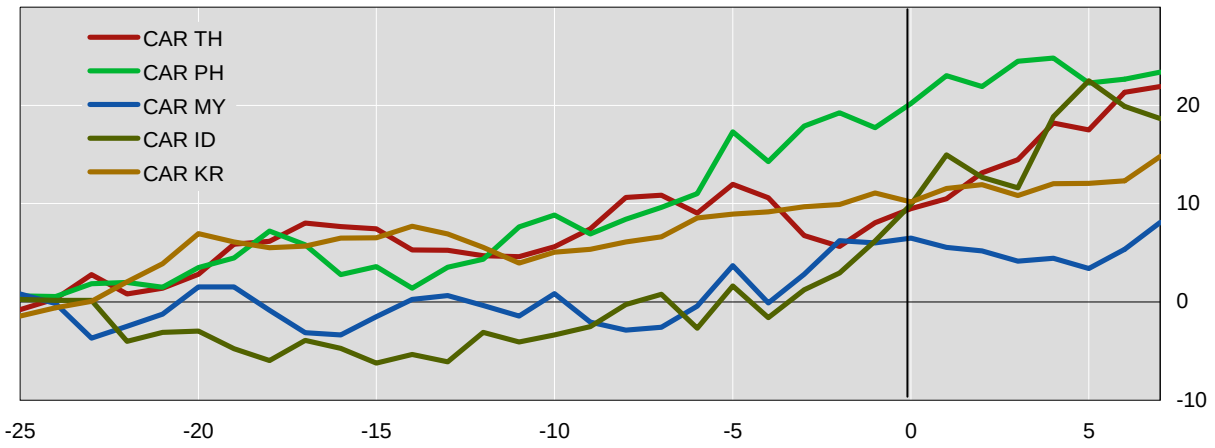
We find evidence that the cumulative abnormal returns of exporting firms' equity prices did indeed convey some information on how investors valued the likelihood of a devaluation in the Southeast Asian countries which experienced major devaluations in 1997. In other words, market participants did seem to bet in favour of a devaluation occurring soon. The gains that investors made because of such bet were substantial in some of the countries

reviewed. For example, if an investor in Korea had invested in the exporting sector one month before the crisis, at the end of the month he would have earned around 11% more than if he had invested in equities from non-exporting sectors. Of these CAR, 6% were concentrated in the last ten days before the crisis. More generally, for all the countries in our sample, the returns of the exporting sector relative to the general index increased as the devaluation dates got closer (Graph 2).

The lines shown in Graph 2 refer to the CAR of each individual country prior to the identified event or devaluation date. Thus, the time-0 date is different for each country.

Cumulative abnormal returns in event-window

In percent



Note: Horizontal axis represents the number of days preceding and succeeding the identified event date.

Source: BIS calculations. Graph 2

The CAR are increasing in all cases but the question is whether such positive slope is statistically significant (i.e., if the CAR are different from the normal excess returns one would expect from investing in the export sector shares relative to the market in normal times). To answer this question we turn to the observation of Table 2.

Table 2 shows the CAR by country in a period before the event which can be longer (25 days) or shorter (10 days). For example, the second column indicates that in Thailand, the cumulative abnormal returns from investing in the electronic (exporting) sector relative to the general index was 8.05% for the 25 days before the devaluation with a significance level of 10%. The statistical significance is obtained by comparing the excess returns with those that would have been obtained on the same time span during a normal period. In this case, the probability of observing in normal times an excess return of the exporting sector over the general index of as much as 8.05% in 25 working days is less than 10%. By the same logic, investing in the Philippines exporting firm 25 days before the crisis would guarantee 17.73% over the general index. The probability of observing such an excess return in normal periods is zero percent.

Overall the results provide support for the hypothesis that the devaluation was generally expected in all countries. Such evidence is weaker for Thailand, which is in line with the idea that the Thailand's devaluation was the least expected of all. In turn, the Korean stock market is the one which most accurately depicts the investors' preference for the exporting sector prior to the devaluation. This is not surprising if we consider that Korea had the largest and most sophisticated stock market at the time of the crisis.

Event study results with different data combinations

Cumulative abnormal returns and signficance level

	Specification I: Export sector – General index		Specification II Export firm – General index		Specification III: Export sector – Non-export sector	
	25 days	10 days	25 days	10 days	25 days	10 days
Thailand	8.05*	3.44	10.28	-6.86	9.71	6.93*
	(0.10)	(0.19)	(0.25)	(0.76)	(0.12)	(0.09)
Philippines			17.74***	10.11***		
			(0.00)	(0.01)		
Malaysia			6.01	7.44*		
			(0.25)	(0.10)		
Indonesia	6.20	10.26**	8.45	16.10*	1.50	6.61*
	(0.24)	(0.03)	(0.32)	(0.09)	(0.43)	(0.10)
Korea	11.09***	7.15***	25.01***	15.77**	5.13	5.67*
	(0.00)	(0.00)	(0.009)	(0.01)	(0.22)	(0.08)

Sources: Authors' calculations. * Significance between 5 and 10% ** Significance between 1 and 5% *** Significance below 1%.

Table 2

In the first specification, which compares the returns of the exporting sector with the general index, the observed CAR are positive and significant. The first specification compares the sub-index for the exporting sector with the main index. The CAR in Korea were large and significant 25 and 10 days before the event. In Thailand, they were significant 25 days before the devaluation and in Indonesia only 10 days before.

The second specification, which compares a single exporting firm with the main index, allows us to calculate CAR for all countries in our sample. For Malaysia and the Philippines, we were only able to find relevant stock market information could only be found at firm level. The above table shows a strong and significant abnormal behavior during the last 25 trading days before the event in Korea and the Philippines and only 10 days before for Malaysia, Indonesia. None of the CARs are significant for Thailand with this specification.

The third specification compares the exporting sector with the non-exporting sector. This specification provides only limited support for our hypothesis, although excess returns are still positive and weakly significant in the last 10 trading days for all countries where this specification could be used. For Korea we have also compared export oriented and non-oriented subsidiaries of the same firm. Here we find excess returns for the exporting subsidiary close to 16% for the last 10 trading days, with a significance level of 3%.

To check for robustness to changes in the estimation window we have moved the estimation period back one month. In Appendix 3 we report these results, which are very similar, and some cases marginally more significant stronger than those presented in Table 2.

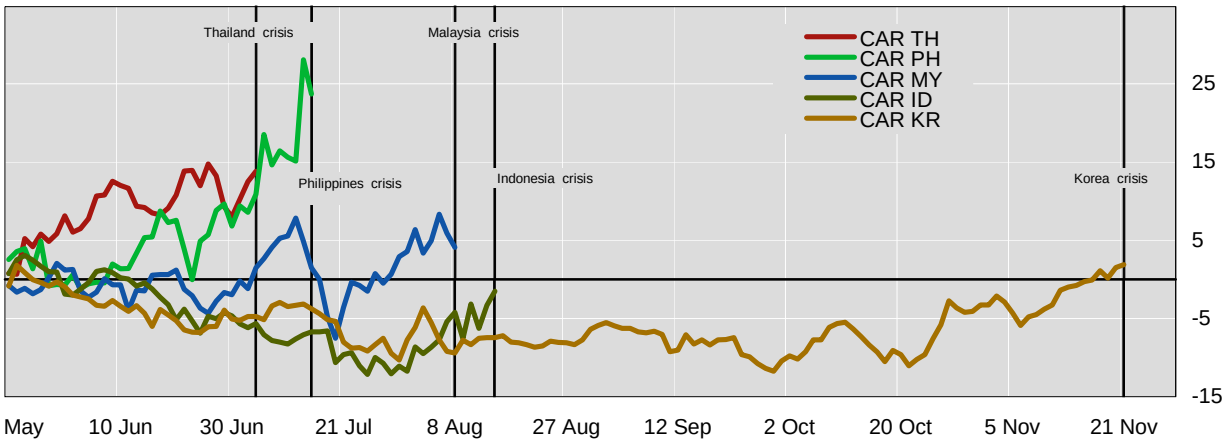
Impact of previous events

As mentioned before, Thailand appears as the least expected event in terms of stock market investors' differential treatment of exporting and non-exporting firms. We now explore this point further by analyzing whether other countries' CAR became larger after Thailand's devaluation. In other words, whether the Thai event helped investors' form their expectations of an imminent devaluation in their respective markets.

To that end, we repeat the exercise with a new starting date for the event window: the Thai devaluation. As shown in Graph 3, the Philippines, Malaysia and to a lesser extent Indonesia, did see the stock prices of exporting firms increasing after the Thai devaluation. This does not seem to be the case of Korea, probably because its devaluation occurred well after that of Thailand.

After the Thai devaluation

Cumulative abnormal returns for export sector



Source: Bloomberg; authors' calculations

Graph 3

With our data at hand, we can also test whether there has been a more general learning process in the domestic stock markets after previous devaluations in the other Asian countries. This is to say, we can test whether the Philippines investor reacted to the devaluation in Thailand, the Malaysian investor reacted to the devaluations in Thailand *and* Philippines and so on.

If the market learnt from previous devaluations and saw as more likely the event of a devaluation in their own country after the other Asian countries devaluated, we should expect an increase in the abnormal returns of the domestic stock market after the devaluations in the other countries. In this case, we exclude from our analysis Korea, which is too far apart in terms of time and whose likelihood of crisis should not be seen as affected by the others.

From the results in table 3, we can find some signal of learning in the markets. In particular, the cumulative abnormal returns registered in the Philippines in the time span between the Thai and the Philippines devaluation is to be considered statistically significant at the 1% level and highly unlikely to occur in normal periods. On the other hands, cumulative abnormal returns in the Malaysian markets even if positive after the Thailand and the Philippines events, are not statistically different from those which could occur in normal periods. Finally, the Indonesian markets do not seem to react to the Thai event, nor to the Philippines event, but do seem to be shaken by the Malaysian devaluation, as if the progressive fall of the other Asian markets would increase the perceived likelihood of a devaluation occurring also in Indonesia. The CAR obtained by the Indonesian exporters in the time span between the Malaysian and the Indonesian devaluations (only 4 working days) are statistically different from normal periods under all the different specifications of our model.

Impact of previous events

Cumulative abnormal returns and signficance

		After Thailand	After Thailand and Philippines	After Thailand, Philippines and Malaysia
Philippines[1]		7.97*** (0.01)	--	--
Malaysia[1]		5.08 (0.28)	6.71 (0.18)	--
Indonesia	Specification I	6.60 (0.23)	6.86 (0.18)	4.71* (0.07)
	Specification II	10.28 (0.23)	9.22 (0.22)	9.05** (0.03)
	Specification III	0.52 (0.47)	2.37 (0.38)	3.93* (0.09)

Source: Authors calculations. [1] specification II.

Table 3

Controlling for macroeconomic factors

Event study methodology is, by nature, a uni-variate methodology. To check the robustness of our results to the inclusion of other variables, we move to panel regression. This will allow us to control for potentially relevant financial and macroeconomic determinants of the devaluation which occurred during the Asian crisis, drawing from the literature of early warning indicators reviewed before. The disadvantage of this methodology, compared to the event study analysis, is obvious in our case: it cannot profit from the daily nature of the stock market information as control variables have a much lower frequency (monthly in few cases and, otherwise, quarterly or yearly).

However, even if we have to aggregate the daily data on the stock markets, so to make them comparable with the other macroeconomic control variables, we still succeed in building our objective variable (excess returns) starting from daily observations in the following way: we first consider two years of daily observations (from 10/1/1995 to 27/12/1996) and we obtain the daily average excess returns in this period. This will represent our out-of-sample period. We then get the daily average excess returns on a monthly basis for all the months starting from January 1997 until December 1998. This will represent our in-sample period. By taking the difference between the out-of-sample and the in-sample average daily excess returns, we obtain our objective variable.

The dependent variable is a categorical variable built in accordance with the literature on early warning systems: it characterizes an event as any devaluation in the exchange rate vis-à-vis the US Dollar which exceed the 90^{th} percentile of monthly variation in the two years in-sample-period. This means that of the 24 months under consideration (from January 1997 to December 1998), only three will be considered as events.

After controlling for unobserved heterogeneity with fixed effects, we find that excess returns by exporting companies are significantly higher just prior to the devaluation, as compared with those that had been obtained during a normal period (our out-of-sample period). None of the other controls are found to be significant, which confirms the general view in the literature that the Asian devaluations were extremely difficult to predict.

Logit Regression

Significance of the explanatory variables

Objective variable				
Excess returns	0.056***	0.062**	0.057***	0.065**
	(0.01)	(0.03)	(0.01)	(0.02)
Macroeconomic control variables				
Change in domestic credit		0.041		0.529
(one period lag)		(0.64)		(0.46)
Change in REER		0.024		0.025
(one period lag)		(0.74)		(0.74)
Change in CPI			0.035	0.011
(one period lag)			(0.81)	(0.93)
Change in industrial production			0.028	0.029
(one period lag)			(0.38)	(0.34)
	Observations:120	Observations:120	Observations:120	Observations:120
	Pseudo R^2 = 0.04	Pseudo R^2 = 0.05	Pseudo R^2 = 0.05	Pseudo R^2 = 0.06

Statistically significant at 5% confidence level. * Statistically significant at 1% confidence level. P-values are reported in parenthesis.

Sources: Authors' calculations. Table 4

Concluding thoughts

In this paper we have used event study methodology to analyze whether Asian stock markets could have conveyed useful information to predict the 1997 currency crises. Our testable hypothesis for stock market information to serve as an early warning of a devaluation, is that exporting firms' stocks should have outperformed those of non exporting firms prior to a devaluation, in as far as investors were expecting such devaluation.

We concentrate on the five Southeast Asian countries which devalued in 1997, namely Indonesia, Korea, Malaysia, the Philippines and Thailand and find evidence that the stock market contained valuable information to help predict the large exchange devaluations which took place in the five Southeast Asian countries analyzed. The fact that the predictive power

of stock prices increased after Thailand's devaluation would seem to indicate that investors did expect Thailand's currency crisis to spread to other countries in the region.

Our results are generally robust to different specifications of the event study. Panel regression is also used to control for potentially relevant financial and macroeconomic variables and our finding is confirmed.

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Appendix 1 – Data characteristics

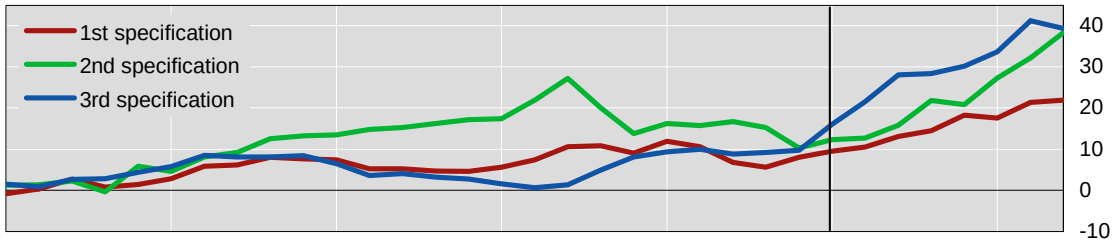
Data description		
NATION	VARIABLE	DESCRIPTION
THAILAND	SET	Main Stock Index.
	SETETRON	Electronic sub-index. Main export based sector in the SET Index. It represents 1.83% of the whole SET Index
	SETINS	Insurance sub-index. Main home-based sector in the SET Index
	Muramoto Electronics (alternative specifications include: Hana, MPT, Delta)	Manufactures and exports electronic components. More than 80% of revenues from sales abroad. Four biggest companies listed in the Setetron index
KOREA	KOSPI	Main Stock Index.
	KOSPTREQ	Heavy industrial equipment sub-index. Almost 100% export oriented in the five biggest listed companies (covering 70% of the sub-index). It represents 10.27% of the whole KOSPI Index
	KOSPCONS	Real estate sub-index. Main home-based sector in the KOSPI Index
	Samsung Heavy Industries Ltd	Manufactures crude oil tankers. Also produces steel and bridge structures. More than 80% of revenues from sales abroad
	Samsung Securities	Provides brokerage and investment trust. Revenues are 100% home based.
PHILIPPINES	PCOMP	Main Stock Index
	Philippine LDT	Provides domestic and international telephone services
MALAYSIA	KLCI	Main Stock Index
	Golden Hope Plantations (alternative specification includes: KPK)	Produces and processes rubber and palm oil. More than 50% of revenues from sales abroad. Two biggest companies in the palm oil production sector. For further information: www.ids.org.my/stats/Agriculture
INDONESIA	JCI	Main Stock Index
	JAKMINE	Mining sub-index. Main exporting sector in the JCI Index. It represents 12.34% of the whole JCI Index
	JAKCONS (alternative specification includes: JAKBIND)	Real estate sub-index. Three biggest companies (representing 65% of the sub-index) are 90% home-based. For the alternative specification, the four biggest companies in the Industrial and Chemicals sub-index (representing 70% of the whole index) are also 90% home-based
	Medco Energi Internasional (alternative specification includes: TINS)	Provides exploration, production and support services for oil, natural gas and other energy industries. Two biggest exporting companies listed in the Jakmine Index for which data are available
[1] Source: Economist Intelligence Unit		

Appendix 2 – Cumulative abnormal returns for individual countries

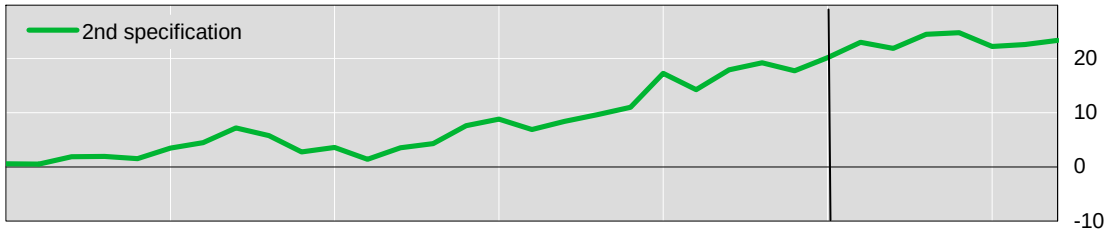
Cumulative abnormal returns with alternative specifications

Percent

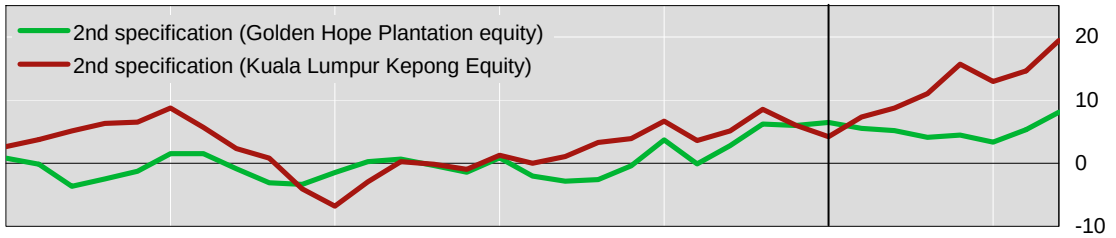
Thailand



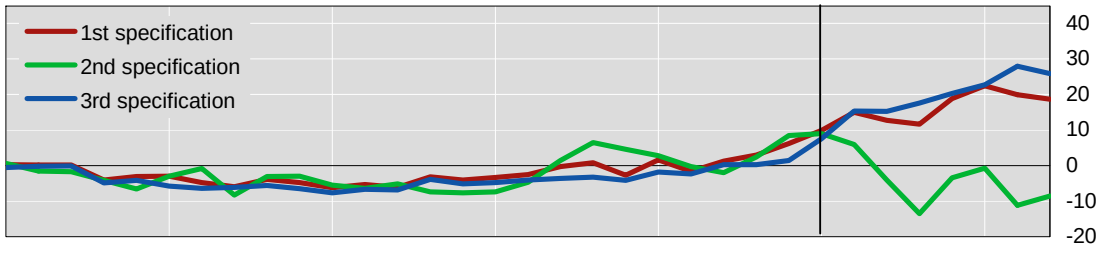
Philippines



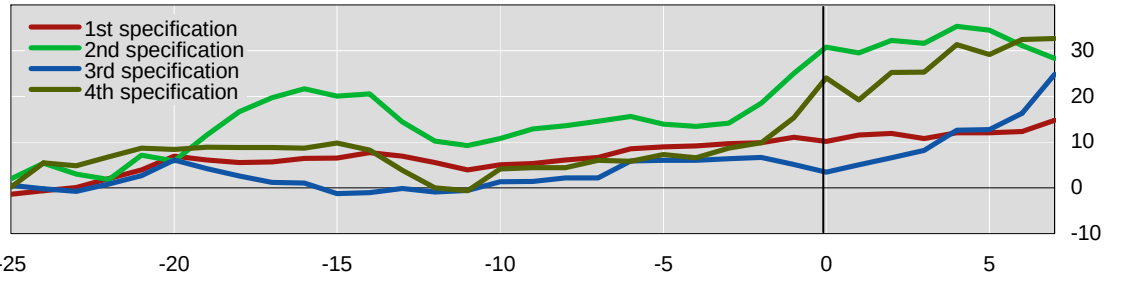
Malaysia



Indonesia



Korea



Source: Authors calculations.

Graph 4

Appendix 3 – Event study robustness to estimation window

Event study results with different estimation window

Cumulative abnormal returns and signficance level

	Specification I: Export sector – General index		Specification II Export firm – General index		Specification III: Export sector – Non-export sector	
	25 days	10 days	25 days	10 days	25 days	10 days
Thailand	9.11*	3.87	12.70	-5.89	9.58	6.88*
	(0.07)	(0.16)	(0.19)	(0.73)	(0.12)	(0.09)
Philippines			18.38***	10.39***		
			(0.003)	(0.01)		
Malaysia			6.90	7.80*		
			(0.22)	(0.08)		
Indonesia	6.33	10.31**	8.45	16.10*	1.74	6.71*
	(0.23)	(0.03)	(0.33)	(0.09)	(0.42)	(0.10)
Korea	11.48***	7.31***	26.52***	16.38***	5.97	6.006*
	(0.00)	(0.00)	(0.005)	(0.006)	(0.18)	(0.07)

Sources: Authors' calculations. * Significance between 5 and 10% ** Significance between 1 and 5% *** Significance below 1%.

Table 2