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Currency Crisis and Contagion: Evidence from Exchange Rates and Sectoral Stock Indices of the Philippines and Thailand

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Currency Crisis and Contagion: Evidence from Exchange Rates and Sectoral Stock Indices of the Philippines and Thailand

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Abstract

This paper analyzes empirically the recent Asian financial crisis using high frequency data of exchange rates and stock indices of the Philippines and Thailand. Utilizing standard time-series techniques, this study confirms that there is evidence that developments in some sectoral indices—including those of banking and financial sectors—seem to have caused upward pressure on exchange rates. A correlation between some of these variables is also found to be strong across countries in the crisis period, thereby confirming the importance of the linkages between financial markets as a transmission channel of the Thai crisis to the Philippines.

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I. INTRODUCTION

This paper analyzes empirically the recent Asian financial crisis (1997-98) using the time-series data of exchange rates and stock indices of the Philippines and Thailand[2] which were the first two countries confronted by massive movements in financial asset prices. Before the eruption of the currency crisis, Thailand had maintained its currency, the baht, linked to a basket of other currencies weighted heavily to the U.S. dollar. Meanwhile, Thailand's financial market came under continuous pressure in 1996, which continued with a series of speculative attacks beginning in early 1997. The Thai authorities attempted to defend the baht by increasing short-term interest rates and intervening heavily in the market, but despite their efforts, the currency was forced to float on July 2, 1997.[3] Economic and financial turmoil in Thailand spread to neighboring countries including the Philippines, which is a relatively smaller economy with a solid financial market and economic fundamentals.[4] A massive devaluation of the Philippines' peso occurred on July 11, 1997, followed by the Malaysian ringgit on July 14, the Indonesian rupiah on August 14, and the South Korean won on December 16, 1997. A high probability of financial market crisis in Thailand was to some extent anticipated by the IMF (International Monetary Fund, 1998a); however, the size and the duration of the crisis and contagion seemed beyond anyone's expectations.

A recent research study has concluded that the Asian crisis was triggered by several factors.[5] As with the Mexican crisis, the low interest rates in industrialized countries, particularly in this case, Japan, contributed to an increase in capital inflow to Thailand and the Philippines. Endogenous factors included the existence of macroeconomic misalignment, such as current account deficits in Thailand, and the implementation of deregulation and liberalization of financial markets in this region in the 1990s, which accelerated the speed and the volume of the inflow.[6] These inflows were often channeled to nonproductive sectors due to weak

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[2]The term "financial crisis," refers to simultaneous occurrence of banking and currency crises in this paper.

[3]Bank of Thailand (1998).

[4]Sicat (1998) argues that the development in financial regulations and liberalization in the early 1990s was one reason why the Philippines was relatively less affected by contagion. In addition, the Philippines was probably less affected by non-economic factors. For example, political issues related to the credibility of the Suharto regime, are seen as important factors in understanding the financial crisis in Indonesia.

[5]International Monetary Fund (1998b), for example, summarizes how the crises evolved.

[6]During this time period, Thailand implemented several measures including interest rate liberalization and the establishment of the Bangkok International Banking Facility.

domestic banking and financial intermediation and poor corporate governance,[7] and as a result, there was a substantial increase in short-term debt and nonperforming loans during this period.[8] The simultaneous occurrence of banking and currency crises have been a more common phenomenon in recent years in emerging countries where financial deregulation and liberalization are often in process concurrently (Kaminsky and Reinhart 1999). This realization directed researchers to investigate an explicit link between financial sector vulnerability and currency crises by adding another dimension into previous theories developed by Krugman (1979), Flood and Garber (1986) and Obstfeld (1996), which focus largely on international reserves and/or investors' expectations.[9]

As it is well known, there are several ways in which the economic and financial turmoil of one country can be transmitted to other countries, including financial market and international trade linkages (e.g., Krugman 1991).[10] These linkages become increasingly important in explaining the vulnerability of an emerging market economy, since these markets have been liberalized and have more direct access to foreign markets. Several studies, generally, suggest that these links are empirically found to be important channels of transmission and that contagion is stronger at the regional than at the global level (Glick and Rose 1998; Kaminsky and Reinhart 1998; Fratzscher 1998).

However, at the same time, many studies conclude that the above arguments alone do not provide a full explanation of currency crises or contagion. For example, Eichengreen and others (1998) discuss the role of the herding behavior of investors as one other potential reason for the Asian crisis and contagion. In addition, Fratzscher argues that macroeconomic weakness is not a determinant of contagion in Asia. These contentions naturally led to research focusing on noneconomic fundamentals such as the cross-market hedging practice of investors by which Kodres and Pritsker (1999) demonstrate the possible occurrence of contagion in the absence of news or common macroeconomic shocks in a rational expectations model.

This paper does not attempt to find further reasons for the eruption of the Asian crisis. Rather, using disaggregated high frequency stock indices, it tries to identify the statistical

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[7]Recent literature, which emphasizes weak banking and financial sectors as one factor in currency crises, includes McKinnon and Pill (1996), Chan-Lau and Chen (1998), Chang and Velasco (1998), Krugman (1998), and Marshall (1998).

[8]To this end, the Asian crisis differs from the Mexican case, since the private sector seems to be the cause rather than the public sector (World Bank 1998).

[9]See Flood and Marion (1999) for a survey on recent theoretical currency crisis literature.

[10]Furthermore, Goldstein (1998) centers his arguments on a change in expectations and in the assessment of investors about economic conditions. He also introduces a "wake-up call" hypothesis—for instance, the Thai crisis became a wake-up call for investors to re-assess the credibility of other Asian countries whose economies were believed to be sound, but in fact were weak.

significance of stock indices in explaining exchange rate movements. Moreover, an attempt is made to identify sectors that were perceived by investors as susceptible to large exchange rate movements during the crisis which acted as driving forces for currency devaluation. The selection and the nature of the time-series data, therefore, lead to the examination of the financial market linkages as well as noneconomic fundamental factors since financial high frequency data tend to react, possibly solely, to expectations of investors and noise factors rather than to macroeconomic fundamentals.[11] Previous studies (e.g., Granger and others 1998) which investigate causality between benchmark indices and currencies, fail to find clear evidence for one direction of causality in Asian countries. Sectoral indices are expected to produce a clearer relationship since recent studies suggest that the banking, financial and trading sectors had a more direct effect on the currencies compared with other sectors. To examine the robustness of these findings, the threshold autoregressive model is used to allow for heterogeneous effects of stock prices on currencies during tranquil and crisis periods. This study also covers the contagion effects of the Thai crisis on the Philippine peso, as well as the persistence of the effects of the stock index on the currency, using the generalized impulse function method.

II. Relationship Between Exchange rates and Stock Indices

Theoretical studies that argue for weak banking and financial sectors as causes for currency crises include Chang and Velasco (1998) and Marshall (1998), who developed simple theoretical currency crisis models within an overlapping generations framework. Chang and Velasco focus on illiquid banks in the country as a condition for financial crisis, as well as contending that the high level of financial liberalization and short-term capital flow may aggravate the situation. Marshall's model is essentially an extension of the standard dividend model. Thus, in his forward-looking model, the expected value of the future dividend determines the current stock price, and an increase in investors' expectations of the currency crisis results in a decline in the stock price since the expected dividend will be discounted by the greater probability of the currency crisis.

For illustrative purposes, we develop below a simple theoretical model based on the dividend model to establish the relationship between stock prices and exchange rates. A standard dividend model can be expressed as:

$$P_t = E\left[(P_{t-i} + D_{t+i})/(1 + R_{t+i})\,|\,I_t\right] \tag{1}$$

where $t = 1, \ldots, T$, $i = 1, \ldots, T - 1$, P is the stock price, D the dividend of the stock, R a return of the stock—all being non-negative—and I the information set. The dividend model predicts the current stock price to be equal to the expected value of discounted future income $(P + D)/(1 + R)$. For an open country like Thailand, a company's dividend can be assumed to be

[11]To this end, this study focuses on "pure" contagion as defined by Masson (1998) which occurs because of factors which cannot be explained by macroeconomic fundamentals and which often involves self-fulfilling factors and multiple equilibria.

closely linked to exchange rate movements, and therefore can be expressed as a function of exchange rates: $D_t = \phi + \beta S_t$, where S is the nominal exchange rate and β is a parameter measuring the sensitivity of the exchange rate to the dividend. The sign of the parameter, β, could be positive when currency devaluation contributes to an increase in the dividend due to an increase in competitiveness abroad and thus profits. However, on the other hand, the dividend may be negatively correlated with the devaluation when the higher import prices caused by devaluation will wipe up the profit of the firm. Equation (1), based on the above, can be re-written as:

$$P_t = E[(P_{t+i} + \phi + \beta S_{t+i})/(1 + R_{t-i}) \mid I_t], \tag{2}$$

Equation (2) can furthermore, be solved forwardly using the law of iterated expectations and an assumption of constant return ($E[R_{t+i} \mid I_t] = R$). Then, we can derive the following forward-looking dynamic equation:

$$P_t = E[(1/(1+R))^i P_{t+i} \mid I_t] + E[\sum_{i=1}^{\infty} (1/1+R))^i \phi \mid I_t] + \beta E[\sum_{i=1}^{\infty} (1/(1+R))^i S_{t+i+1} \mid I_t], \tag{3}$$

When two terminal conditions, $(1/(1+R))^i \to 0$ and $\Sigma(1/(1+R))^i \to \kappa$ ($\kappa > 0$) as $i \to \infty$, are met, equation (3) can be simplified as follows:

$$P_t = \kappa\phi + \beta E[\sum_{i=1}^{\infty} (1/(1+R))^i S_{t+i+1} \mid I_t], \tag{4}$$

One implication of equation (4) is that the current stock price is determined by the expected value of the exchange rate, and therefore a causal relationship exists from the stock price to the exchange rate.[12] When there is evidence for this particular direction of causality, the stock indices are proved to provide some explanation of the currency crisis. Therefore, this theoretical prediction may be more valid for stock indices in the trading sectors that are more susceptible to exchange rate changes.

In this paper, the causality tests are conducted using the vector autoregressor, VAR, (Granger 1969). Solid evidence from this exercise can be obtained by conducting two tests and thus analyzing two null hypotheses: one test examines the null hypothesis that the exchange rate does not Granger-cause the stock index, and the second test the null that this stock index does not Granger-cause the exchange rate. Acceptance of the former null hypothesis and rejection of the latter lead to the conclusion that currency devaluation is Granger-caused by a change in the stock price.

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[12]Campbell and Shiller (1987) discuss issues of causality in the context of the present value model, and the causality relationship establishes when the stock price is not an exact linear function of current and past exchange rates.

A general specification of our test in the bivariate context (x, y), therefore, can be expressed as:

$$\Delta y_t = \kappa_1 + \sum_{i=1}^{p} \xi_{1i} \Delta x_{t-i} + \sum_{i=1}^{q} \zeta_{1i} \Delta y_{t-i} + \varepsilon_{1t} \tag{5}$$

$$\Delta x_t = \kappa_2 + \sum_{i=1}^{p} \xi_{2i} \Delta x_{t-i} + \sum_{i=1}^{q} \zeta_{2i} \Delta y_{t-i} + \varepsilon_{2t}, \tag{6}$$

where ε is a white noise error, and Δ is the first difference operator. All time-series are in the logarithm form. The constant parameters, κ_1 and κ_2, represent the constant growth rate of each variable, and thus the trend in these variables in levels which can be interpreted as general movements of these financial time-series in response to, say, changes in economic fundamentals. This specification is appropriate in the absence of cointegration between x and y which follow the unit root process. The Granger non-causality test involves examination of the statistical significance of the parameters of Δx in equation (5) and those of Δy in equation (6). For example, the null hypothesis of x not Granger-causing y is tested using the joint parameter restrictions, $\xi_{11} = \xi_{12} = ... = \xi_{1p} = 0$. Acceptance of this restriction raises evidence for the above null of non-causality. Finally, stationary stock indices enter equations (5) and (6) in levels.

There is one potential concern regarding analysis of causality during the pre-crisis period. That is, under the inflexible exchange rate regime, this causality analysis may not provide useful insights, since nominal exchange rates are at the predetermined level regardless of the economic and market developments. Actually, the model in this study also points to this issue: when the current exchange rate is totally fixed, the dividend will not be a function of the exchange rates and remains constant. Thus, equation (4) may be a more reasonable representation under a more flexible exchange rate regime. However, the existence of the fluctuation of the currencies, although to a limited degree, provides some justification to conduct the causality test in a pre-crisis period.

III. Time-Series Properties of the Data

The data are daily (five days a week) covering the period 11/15/96-12/31/1998 and are obtained from the *Bloomberg* dataset. The date at the beginning of our sample has been determined by the data availability of the financial sector index of the Philippines. Descriptions of all data are summarized in Table 1, and benchmark stock indices (PCOMP and SET) and exchange rates which are expressed in terms of the U.S. dollar, are plotted on Figure 1. This figure suggests a negative correlation between these two time-series, indicating that a depreciation of the domestic currency (increase in the exchange rate) was associated with a fall in stock prices. Furthermore, casual observation shows that stock prices in these two countries had dropped before the exchange rates started to sour on July 2 in Thailand and July 11 in the Philippines. The magnitude of the currency devaluation was so high during the crisis that it was often difficult to observe currency fluctuations in the pre-crisis period.

Further data examination was conducted using unit root and cointegration techniques. Here two types of each test are used—the Augmented Dicky-Fuller (ADF) and the Perron (1997) methods for the unit root test; and the Engle-Granger (1987) and the Gregory-Hansen (1996) techniques for the cointegration test. The Perron and the Gregory-Hansen methods differ from the ADF and Engle-Granger tests in that the former methods take into account a possible regime shift in our time-series,[13] while at the same time they allow analysis of the time-series property of the data without prior knowledge of the date of a regime shift. Use of two types of each test may be a useful exercise since the null hypothesis of the ADF is likely to fail to reject the null hypothesis of the unit root test in the presence of a structural break, and applying the standard unit root test into the subset of the data also results in a loss of statistical power to reject the false null (Perron 1989). Similarly, in the presence of a regime shift in the time-series, the conventional cointegration test is likely to form a bias in statistical results in favor of nonexistence of a long-run relationship (Gregory and Hansen 1996).

Two specifications of the Perron unit root test are considered and explained in Table 2. While Model A.1 is designed to allow for a change in the mean value of the trend function at break point, *TB*, Model A.2 allows for a change in the slope of the trend function at time *TB* that makes it possible to capture a more sudden change. Model A.2 consists of two steps. The first stage is to transform the time-series (x) into the de-trended variable (x^*), and the second stage is to test the stationarity of x^* *à la* ADF. These models utilize dummy variables: $DC = 1$ if $t > TB$ and otherwise 0; $DTB = 1$ if $t = TB + 1$; and $DT = t - TB$ if $t > TB$, to capture the possible effects of the regime shift, and analyze the null hypothesis of the unit root by testing the parameter restriction, $\delta = 1$ in equations A.1 and A.2. These tests are conducted by computing t-statistics attached to δ by OLS for all possible dates of the structural break, and the smallest t-statistic is used to determine *TB*.

Similarly, two specifications of the Gregory-Hansen method are employed in order to analyze the possible existence of cointegration. The specifications of the first and second steps are explained in Table 3. This test can be viewed as an extension of the Engle-Granger test and becomes identical when a parameter restriction, $\alpha_1 = 0$, is imposed on these specifications. Model B.1 allows for the level shift again using a dummy variable: $DC = 1$ if $t > TB$ and otherwise 0, and Model B.2 for the level shift and the time trend. Like the Engle-Granger test, the second stage involves testing the stationarity of the residual, ε. The t-statistics on ε_{t-1} for all possible regime shifting dates are computed by OLS and the smallest t-statistic is used to evaluate the null hypothesis of noncointegration.

The results of these tests are presented in Tables 2 and 3 where the statistics rejecting the null hypothesis based on critical values in Perron (1997) and Gregory and Hansen (1996), are shown in bold. The appropriate lag length is determined by the general-to-specific approach studied by Hall (1990) starting with the maximum of six lags. Our results show that the Perron and Gregory-Hansen tests, as expected, tend to reject the null hypothesis slightly more frequently than other tests that do not consider the possible existence of a structural break. However, there are not many cases where there is a large discrepancy in the conclusions from these tests. Furthermore, Table 2 suggests that most exchange rates and

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[13]See, for instance, Hamilton (1994) for details of the Engle-Granger and the Augmented Dicky-Fuller tests, which are frequently used by researchers. Granger *et al* (1998) use similar types of tests.

stock indices are integrated of order one with the possible exception of four Thai sectoral indices (SETHOLD, SETOTHER, SETPHARM, and SETPULP) which seem to be stationary. Our findings about the unit root process of our data is consistent with a theoretical explanation for asset price movements (i.e., the Markov process) such that only the present value of the asset price contains useful information for predicting the future value. The cointegration tests are applied to the combination of exchange rates and stock indices, both of which are found to be integrated of order one. In general, this study has confirmed the nonexistence of the long-term relationship between exchange rates and stock indices (Table 3). The failure to establish cointegration in most of the data is not unusual given the sample period of two to three years.[14]

IV. Empirical Analysis

We implement the Granger noncausality test in two subsets of data in order to take into account a possible regime shift: i) a pre-crisis period (11/18/96-7/1/97 for Thailand and 11/18/96-7/10/97 for the Philippines); and ii) a crisis period (7/2/97-12/31/98 for Thailand and 7/11/97-12/31/98 for the Philippines). These break points are consistent with the largest change in exchange rates and are also used by Baig and Goldfajn (1998).

Each individual country's results are reported in the upper half of Table 4 where the null hypotheses mentioned in the previous section are examined using the 10 percent significance criterion. In the same table, the statistics that support, by the two tests, existence of causality from the stock indices to the exchange rates are shown in bold. We have also observed the existence of the opposite direction of causality (i.e., from the exchange rate to the stock index) and many inconclusive cases where one direction of causality cannot be supported by the two tests. This finding seems to contribute to our findings and those of previous studies that the benchmark stock indices (PCOMP and SET) provide inconclusive evidence of their relationship with the currency. At the same time, however, evidence has successfully been found for stock indices, including those of the banking, financial and trading sectors, all causing pressure on currencies.[15] Thus, the results in this study seem to support recent currency crisis literature that focuses on financial and trading sectors.

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[14]Another possible source of the failure to establish cointegration in this time-series may be the assumption of a constant return on the financial assets in equation (3).

[15]The top three imports in Thailand are non-electrical machinery and parts, electrical machinery and parts, and chemicals; the top three exports are computers and parts, garments, and rubber. For the Philippines, the main imports include telecommunications equipment and electrical machinery, materials and accessories for the manufacture of electrical equipment, and semi-processed manufactured goods. The main exports are electrical and electronic equipment and components, and garments.

More specifically, for the Philippines, the tests have identified three sectors (mining, commercial and financial sectors) as being relevant in understanding the crisis. Before the actual eruption of the crisis, the commercial sector was a driving force in the peso devaluation, as was the financial sector during the crisis. Similarly, for Thailand, evidence has been found to support the view that the eruption of the crisis was closely linked with banking and financial activities. The financial sectoral index is found to be one key variable in understanding the baht devaluation in the empirical study presented in this paper, regardless of the sample period, and similarly the banking sector index is found to start affecting the currency once the crisis occurred. Furthermore, in addition to the banking/financial factors, the stock indices of the trading sector (in particular, the import sector) were often found to foreshadow and to aggravate the crisis. Indeed, the stock prices of the electronic components, food and hotel industries had already exerted pressure on the baht before July 2, 1997. The importance of the electronic component index in explaining exchange rates in this early period reflected the weak world demand for electronic goods, which was one reason for the deterioration of Thailand's terms of trade. Meantime, the contribution of the food sector index is also consistent with a reduction in the average revenue of this industry.[16] During the crisis, changes in stock prices of many import- and raw material-oriented sectors were also found to increase pressures on the foreign exchange market. They include the chemical, energy, electrical, and hotel/tourism industries.

The bottom half of the table presents results of empirical tests on contagion effects from Thailand to the Philippines using the two sample periods: the pre-crisis period (11/18/96-7/1/97) and the crisis period (7/2/97-12/31/98). Here, we analyze causality between the Philippine currency, the peso, Thai benchmark stock indices, and Thai sectoral stock indices that are found to have caused the baht devaluation. The table shows that it is only the banking sector during the peso crisis whose stock price was exerting pressure on the peso. There is no clear evidence of trading sector variables Granger-causing the peso. This may be consistent in part with the fact that Thailand is not a major trading partner of the Philippines and thus a deterioration in the Thai trading sector may not have affected directly its counterpart in the Philippines.[17] Results of this analysis, therefore, raise some evidence that Thai financial problems seem to have transmitted to the Philippines via the financial market linkages.

The robustness of these findings is also examined using a more systematic approach—the threshold autoregressive model which accounts for heterogeneous effects of stock prices on the exchange rate movements. A general form of the model can be expressed in the equation in Table 5, where the parameters, α and ϕ, are allowed to vary according to the sample periods. In our exercise y and x represent exchange rates and stock indices which are found to Granger-cause exchange rate movements. The specification for the Philippines, therefore, includes the Thai bank stock data (SETBANK) in addition to its own sectoral stock data. The term, Z, represents the threshold point and thus equals 7/1/97 for Thailand and 7/10/97 for

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[16]The growth level in the food sector dropped from 9.4 percent in 1994 to 5.8 percent in 1996. This growth rate in 1996 is the lowest among all sectors.

[17]In 1996, the Philippine exports to ASEAN accounted for 14.4 percent of the total, while its imports from ASEAN accounted for 12.3 percent.

the Philippines. This equation has been estimated following a general-to-specific approach with the initial lag of 6, with the final models obtained by removing all statistically insignificant variables until the error (ε_t) does not suffer from autocorrelation.

Table 5 summarizes these results, showing that the findings are in conformity with some of our main conclusions; the banking and financial sectoral indices are found to be relevant in explaining exchange rates. For the Philippines, the Thai banking stock is also found to be important in that it is statistically significant. In all cases, the current and lagged exchange rates are found to be highly correlated. However, all other variables such as those related to the trading sector, are not found to be statistically significant and are not included in the final estimations. What is more interesting is that all variables left in our models serve to explain exchange rate movements in the crisis period. To some extent, this may not be a very surprising result, given that most variations in exchange rates take place in the crisis period. In addition, the sign of the coefficient indicates the negative relationship between exchange rates and these stock indices, thereby confirming that a fall in these stock incides caused an exchange rate depreciation.

Finally, this paper presents an analysis of the convergence speed of currencies in response to the shock to stock indices. The generalized impulse response analysis, which is based on the VAR and does not require prior knowledge of the order of variables, is employed (Pesaran and Pesaran, 1997; Pesaran and Shin, 1998). Over two sample periods (pre-crisis and crisis periods), consideration is given to the cases where a stock index is hit by a shock equal to one standard error, and the effects of this shock on other variables are plotted in Figures 2 to 4. The stocks that are found to cause baht devaluation are used here and asterisks are attached to the variable which is given a shock in these figures. Based on the VAR with the lag length equal to 6, one can observe that the stocks of the financial and banking sectors are very sensitive to and positively correlated with a change in the stock prices of other sectors. Furthermore, the shock to a stock has a negative impact on exchange rates and for all cases, the shock seems to disappear within two weeks or so.

V. CONCLUSION

This paper analyzes the recent Asian crisis by empirically examining the benchmark and sectoral stock indices, in addition to the exchange rates, of Thailand and the Philippines. The results present some interesting evidence which supports recent literature on financial crises and contagion. Confirmation is established that results of previous studies showing the benchmark stock often does not provide useful information of the unique direction of the causality. But we are successful in identifying some sectors—in particular, the banking and financial sectors—as often acting as the driving forces of the currency devaluation. Contagion effects running from Thailand to the Philippines are identified, and our data provide evidence that the Thai banking sector has become a channel to transfer volatility through the stock index to the Philippine peso. Using a generalized impulse function method, a shock to the stock price indices is found to last for only a very short time.

This study also has several implications for monitoring financial markets. First, currently, the monitoring practices of financial sectors based on the portfolio-based type approach (e.g., CAMEL) often rely on a low frequency of data partly due to the publication practices of financial entities. However, as it is well known, it is very difficult to detect or predict any types of crisis based on such a method because the crises often occur without a great deal of advance notice (if any at all). Furthermore, the herd behavior of investors is unlikely to be captured by this standard method.[18] Against this background, the high frequency financial indices such as stock indices can supplement some deficiencies of the conventional method. Second, sectoral indices have proven to provide more useful information than the aggregated benchmark index. In particular, in this study, some sectoral indices are shown to help in assessing the likelihood of currency devaluation before the eruption of the crisis. Therefore, these variables deserve close monitoring and appear to perform better than aggregated indices

[18]See Saunders (1999) for discussion of the importance of considering the off-balance sheet items in evaluating a financial portfolio.

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Table 1. Description of the Data

Philippines	
PCOMP	Philippines Composite Index
PCOMM	Commercial
PFINC	Finance
PMINI	Mining
POIL	Oil
PPROP	Property
PESO	Currency
Thailand	
SET	Stock Exchange of Thailand Index
SETAGRI	Agri-business
SETBANK	Banking
SETBUILD	Building/Furnishing
SETCHEM	Chemical
SETCOM	Commerce
SETCOMUN	Communication
SETELEC	Electrical
SETENERG	Energy
SETENTER	Entertainment
SETETRON	Electronic Components
SETFIN	Finance
SETFOOD	Food and Beverage
SETHELTH	Health Care Service
SETHHOLD	Household Goods
SETHOT	Hotel and Travel
SETINS	Insurance
SETJEWEL	Jewelry and Ornaments
SETMACH	Machinery and Equipment
SETMINE	Mining
SETOTHER	Others
SETPHARM	Pharmaceutical products
SETPKG	Packaging
SETPRINT	Printing
SETPROF	Professional Services
SETPROP	Property
SETPULP	Pulp and Paper
SETSILO	Warehouses
SETTEXT	Textile and Cloth
SETTRANS	Transportation
SETVEHIC	Vehicles and Parts
BAHT	Currency

Source: Bloomberg.

Table 2. Unit Root Test

	ADF				Perron (1997)			
	Level		Difference		Level		Difference	
	C	C + T	C	C + T	A.1	A.2	A.1	A.2
PCOMP	-1.453 (1)	-1.578 (1)	-18.84 (0)	-18.84 (0)	-2.924 (1)	-2.604 (1)	-18.08 (0)	-16.19 (1)
PCOMM	-1.443 (1)	-1.434 (1)	-19.77 (0)	-19.78 (0)	-2.788 (2)	-2.493 (1)	-19.90 (0)	-16.55 (1)
PFINC	-1.249 (1)	-1.046 (1)	-17.16 (0)	-17.18 (0)	3.223 (1)	-2.649 (1)	-17.98 (0)	-17.44 (0)
PMINI	-0.431 (0)	-2.450 (0)	-21.92 (0)	-21.92 (0)	-3.082 (1)	-2.662 (1)	-22.53 (0)	-22.05 (0)
POILI	-0.390 (6)	-1.949 (6)	-19.21 (0)	-19.19 (0)	-3.079 (6)	-2.448 (6)	-22.51 (0)	-10.17 (5)
PPROP	-1.411 (1)	-2.137 (1)	-9.925 (5)	-9.918 (5)	-3.342 (1)	-2.669 (1)	-19.94 (0)	-19.30 (0)
PESO	-1.160 (3)	-1.003 (3)	-11.07 (6)	-11.12 (6)	-3.111 (3)	-2.442 (3)	-12.33 (6)	-11.58 (6)
SET	-1.659 (1)	-1.615 (1)	-19.81 (0)	-19.86 (0)	-3.270 (1)	-2.610 (1)	-20.68 (0)	-20.03 (0)
SETAGRI	-1.451 (4)	-2.073 (4)	-9.815 (3)	-9.808 (3)	-3.973 (4)	-2.140 (4)	-10.66 (3)	-9.906 (3)
SETBANK	-1.428 (1)	-1.047 (1)	-21.30 (0)	-21.34 (0)	-3.339 (5)	-2.566 (3)	-21.78 (0)	-21.48 (0)
SETBUILD	-1.791 (4)	-0.772 (4)	-11.94 (3)	-12.07 (3)	-3.336 (4)	-2.395 (4)	-12.54 (3)	-12.29 (3)
SETCHEM	-1.392 (3)	-1.858 (3)	-11.67 (2)	-11.68 (2)	-2.940 (3)	-2.224 (3)	-12.35 (2)	-11.79 (2)
SETCOM	-2.110 (0)	-0.951 (0)	-21.78 (0)	-21.89 (0)	-2.923 (1)	-2.644 (1)	-22.16 (0)	-22.03 (0)
SETCOMUN	-1.831 (1)	-2.424 (1)	-8.297 (6)	-8.328 (6)	-3.320 (1)	-2.843 (1)	-20.17 (0)	-8.370 (6)
SETELEC	-1.464 (1)	-2.261 (1)	-9.146 (6)	-9.179 (6)	-3.277 (1)	-2.541 (1)	-21.69 (0)	-9.293 (6)
SETENERG	-1.960 (0)	-2.663 (0)	-24.13 (0)	-24.12 (0)	-3.552 (0)	-3.053 (0)	-25.04 (0)	-14.93 (2)
SETENTER	-1.441 (0)	-2.288 (1)	-21.69 (0)	-21.68 (0)	-3.794 (1)	-2.751 (1)	-23.49 (0)	-21.76 (0)
SETETRON	-1.254 (6)	-0.988 (6)	-9.026 (6)	-9.092 (6)	-3.403 (6)	-2.656 (6)	-10.59 (6)	-9.335 (6)
SETFIN	-2.143 (0)	-1.293 (0)	-22.77 (0)	-22.86 (0)	-2.548 (0)	-2.259 (2)	-23.69 (0)	-22.98 (0)
SETFOOD	-2.283 (4)	-2.148 (4)	-6.808 (6)	-6.852 (6)	-3.497 (4)	-2.291 (4)	-7.585 (6)	-6.915 (6)
SETHELTH	-1.664 (0)	-1.066 (0)	-22.03 (0)	-22.09 (0)	-2.887 (0)	-2.561 (1)	-22.75 (0)	-22.22 (0)
SETHHOLD	-1.756 (5)	-1.632 (5)	-8.774 (4)	-8.814 (4)	-5.055 (5)	-2.080 (5)	-10.16 (4)	-8.862 (4)
SETHOT	-1.155 (5)	-2.122 (5)	-11.63 (4)	-11.64 (4)	-3.902 (5)	-2.178 (5)	-12.53 (4)	-11.72 (4)
SETINS	-0.932 (5)	-2.374 (3)	-9.899 (4)	-9.895 (4)	-3.039 (5)	-3.008 (3)	-11.84 (2)	-10.22 (4)
SETJEWEL	-1.651 (4)	-1.619 (4)	-14.09 (3)	-14.10 (3)	-2.756 (6)	-1.735 (6)	-14.29 (3)	-9.700 (6)
SETMACH	0.085 (1)	-1.438 (1)	-21.32 (0)	-21.32 (0)	-4.187 (2)	-1.508 (2)	-22.14 (0)	-21.80 (0)
SETMINE	-2.069 (0)	-2.943 (0)	-22.22 (0)	-22.20 (0)	-4.075 (1)	-3.530 (1)	-23.47 (0)	-22.28 (0)
SETOTHER	-3.187 (0)	-1.974 (0)	-22.09 (0)	-22.30 (0)	-5.212 (0)	-3.608 (0)	-23.27 (0)	-22.45 (0)
SETPHARM	-0.880 (4)	-3.226 (5)	-10.38 (3)	-10.37 (3)	-5.899 (5)	-3.270 (5)	-22.45 (0)	-10.44 (3)
SETPKG	-1.460 (0)	-1.898 (0)	-10.13 (5)	-10.15 (5)	-3.582 (3)	-3.473 (3)	-24.02 (0)	-10.24 (5)
SETPRINT	-2.292 (1)	-1.037 (1)	-19.99 (0)	-20.16 (0)	-2.388 (1)	-2.955 (3)	-20.64 (0)	-20.22 (0)
SETPROF	-1.443 (1)	-1.865 (1)	-21.33 (0)	-21.32 (0)	-3.512 (1)	-2.523 (3)	-22.45 (0)	-21.46 (0)
SETPROP	-1.310 (0)	-1.276 (0)	-22.91 (0)	-22.92 (0)	-2.912 (3)	-2.740 (4)	-23.42 (0)	-22.26 (0)
SETPULP	-1.612 (0)	-4.924 (0)	-11.14 (6)	-11.13 (6)	-5.884 (4)	-5.271 (4)	-11.65 (6)	-11.18 (6)
SETSILO	-0.028 (0)	-2.778 (0)	-24.29 (0)	-24.29 (0)	-4.296 (0)	-3.694 (0)	-25.57 (0)	-11.84 (4)
SETTEXT	-1.104 (0)	-2.497 (0)	-23.24 (0)	-23.22 (0)	-3.242 (6)	-2.611 (6)	-23.76 (0)	-23.33 (0)
SETTRANS	-2.719 (0)	-2.695 (0)	-24.79 (0)	-24.78 (0)	-3.920 (0)	-2.852 (0)	-25.80 (0)	-24.93 (0)
SETVEHIC	-1.664 (1)	-0.332 (1)	-21.25 (0)	-21.36 (0)	-3.247 (5)	-3.333 (1)	-21.57 (0)	-11.16 (4)
BAHT	-1.422 (5)	-0.821 (5)	-9.579 (4)	-9.652 (4)	-3.891 (5)	-2.538 (5)	-10.60 (4)	-9.204 (6)
90 percent cv	-2.570	-3.120	-2.570	-3.120	-4.580	-4.070	-4.580	-4.070
95 percent cv	-2.860	-3.410	-2.860	-3.410	-4.800	-4.360	-4.800	-4.360

Note: The sample (11/18/96-12/31/98), and the number in parenthesis is the lag length used for the tests. The critical values for the Augmented Dicky-Fuller (ADF) and Perron tests are obtained from MacKinnon (1991) and Perron (1997), respectively. The lag length is shown in the parenthesis.
The Perron test specifications to examine the null of the unit root for time-series x_t are:

$$x_t = \alpha_s + \alpha_t DC_t + \beta_s t + \beta_t DTB_t + \delta x_{t-1} + \sum_{i=1}^{p} \theta_i \Delta x_{t-i} + \varepsilon_t \qquad (A.1)$$

$$x_t = \alpha + \beta_t t + \gamma DT_t + x_t^*, \ x_t^* = \delta x_{t-1} + \sum_{i=1}^{p} \theta_i \Delta x_{t-i} + \varepsilon_t \qquad (A.2)$$

where $t = 1, \ldots, T$, and ε is a white noise error. Model A.1 is designed to allow for a change in the mean value of the trend function at a break point, TB, which is captured by dummy variables: DC_t and DTB_t, where $DC_t = 1$ if $t > TB$ and otherwise 0, and $DTB_t = 1$ if $t = TB + 1$ and otherwise 0. Model A.2 allows for a change in the slope of the trend function at time TB in order to capture a more sudden change. A dummy, DT_t, can be defined as: $DT_t = t - TB$ if $t > TB$ and otherwise 0. The null hypothesis of the unit root is tested if the parameter restriction, $\delta = 1$, is accepted by the data, and is evaluated using the critical values in the finite sample (Perron 1997).

Table 3. Cointegration Test

End. variable	Engle-Granger (EG)				Gregory-Hansen (GH)			
	Dependable variable							
	Exchange rate		Stock index		Exchange rate		Stock index	
	C	C/T	C	C/T	B.1	B.2	B.1	B.2
PCOMP	-1.726 (3)	-1.903 (3)	-2.051 (2)	-2.025 (2)	-3.611 (3)	-3.611 (3)	-2.830 (3)	-3.029 (3)
PCOMM	-1.649 (3)	-1.837 (3)	-1.965 (2)	-1.932 (2)	-3.522 (3)	-3.812 (2)	-2.706 (3)	-2.884 (3)
PFINC	-2.163 (3)	-2.314 (3)	-2.211 (3)	-2.200 (3)	**-4.745 (3)**	**-4.665 (3)**	-4.127 (3)	**-4.601 (2)**
PMINI	-2.205 (3)	-1.815 (3)	-1.897 (3)	-2.107 (3)	-3.485 (3)	-3.485 (3)	-3.211 (3)	-3.305 (3)
POILI	-1.926 (3)	-1.898 (3)	-1.702 (3)	-2.027 (3)	-3.229 (3)	-3.229 (3)	-3.793 (2)	-3.456 (3)
PPROP	-2.473 (0)	-2.541 (0)	-2.524 (0)	-2.542 (0)	-4.203 (0)	-4.203 (0)	-3.029 (0)	-3.919 (0)
SET	-1.547 (5)	-1.532 (5)	-1.769 (5)	-1.877 (5)	-3.004 (5)	-3.220 (5)	-3.221 (5)	-2.571 (1)
SETAGRI	-1.312 (5)	-1.057 (5)	-1.386 (4)	-1.670 (4)	-3.116 (4)	-2.945 (0)	-3.001 (5)	-3.161 (4)
SETBANK	-1.375 (5)	-1.339 (5)	-1.390 (0)	-1.456 (0)	-2.924 (5)	-3.223 (5)	-3.035 (0)	-2.488 (0)
SETBUILD	-1.764 (5)	-1.854 (5)	-1.919 (0)	-1.732 (0)	-3.036 (5)	-3.252 (5)	-2.318 (1)	-2.478 (1)
SETCHEM	-1.566 (5)	-1.488 (5)	-1.411 (1)	-1.685 (1)	-2.903 (4)	-3.068 (5)	-3.241 (3)	-3.128 (3)
SETCOM	-1.980 (5)	-2.018 (5)	-2.315 (5)	-2.198 (5)	-3.043 (5)	-3.170 (6)	-2.949 (6)	-2.725 (0)
SETCOMUN	-1.856 (5)	-1.844 (5)	-2.226 (5)	-2.415 (5)	-2.961 (0)	-2.999 (6)	-3.855 (5)	-3.381 (5)
SETELEC	-1.334 (5)	-1.280 (5)	-1.318 (0)	-1.642 (0)	-3.411 (0)	-3.265 (0)	-3.791 (0)	-3.375 (0)
SETENERG	-1.389 (5)	-1.026 (5)	-1.928 (0)	-2.298 (0)	-2.995 (5)	-3.255 (5)	-3.413 (5)	-3.018 (5)
SETENTER	-1.839 (0)	-1.767 (0)	-1.839 (0)	-1.767 (0)	-2.879 (4)	-3.181 (0)	-3.460 (1)	-3.539 (1)
SETETRON	-1.597 (3)	-2.458 (0)	-1.521 (3)	-1.726 (3)	-3.576 (1)	-3.121 (0)	-3.676 (1)	-4.278 (1)
SETFIN	-1.327 (5)	-1.345 (5)	-1.790 (5)	-1.671 (5)	-2.866 (0)	-3.094 (0)	-3.203 (6)	-2.734 (6)
SETFOOD	-1.385 (5)	-1.469 (5)	-2.344 (5)	-2.269 (5)	-3.064 (4)	-3.002 (0)	-2.684 (5)	-3.264 (5)
SETHELTH	-1.143 (3)	-1.198 (3)	-1.078 (3)	-1.526 (3)	-3.510 (1)	-3.628 (0)	-3.902 (0)	-3.450 (1)
SETHOT	-1.887 (6)	-1.525 (6)	-1.734 (6)	-2.020 (6)	-3.160 (5)	-3.186 (5)	-3.618 (1)	-3.909 (1)
SETINS	-1.247 (0)	-1.165 (0)	-0.971 (2)	-1.642 (2)	-3.084 (5)	-3.146 (4)	-3.750 (5)	-3.452 (3)
SETJEWEL	-1.188 (5)	-0.834 (5)	-1.397 (6)	-1.359 (6)	-3.175 (4)	-2.383 (5)	-2.994 (0)	-3.598 (0)
SETMACH	-1.151 (0)	-0.798 (0)	0.049 (0)	-0.971 (0)	-3.196 (6)	-2.938 (6)	-4.309 (0)	-4.072 (0)
SETMINE	-2.243 (0)	-2.201 (0)	-2.767 (0)	-2.972 (0)	-3.005 (6)	-3.207 (0)	-4.143 (2)	-4.021 (1)
SETPKG	-2.477 (0)	-2.541 (0)	-2.520 (0)	-3.059 (0)	-3.987 (5)	-4.919 (5)	-4.475 (4)	**-5.099 (4)**
SETPRINT	-2.065 (0)	-2.052 (0)	-2.305 (0)	-2.338 (0)	-2.718 (0)	-3.753 (5)	-3.082 (1)	-3.880 (1)
SETPROF	-2.172 (0)	-2.124 (0)	-2.200 (0)	-2.403 (0)	-3.085 (5)	-3.813 (0)	-3.366 (1)	-3.638 (0)
SETPROP	-1.313 (5)	-1.260 (5)	-1.151 (0)	-1.513 (0)	-2.851 (0)	-3.215 (4)	-3.045 (0)	-2.532 (4)
SETSILO	-1.134 (5)	-0.883 (5)	-0.048 (0)	-1.123 (0)	-3.224 (0)	-3.436 (0)	-2.977 (0)	-4.560 (0)
SETTEXT	-1.054 (0)	-0.829 (0)	-0.935 (6)	-1.513 (6)	-3.272 (7)	-3.198 (6)	-3.615 (6)	-3.390 (0)
SETTRANS	-1.422 (5)	-0.818 (5)	-2.720 (0)	-2.696 (0)	-3.152 (0)	-3.042 (0)	-3.544 (0)	-4.037 (0)
SETVEHIC	-1.393 (3)	-1.424 (3)	-1.478 (0)	-1.804 (0)	-2.892 (2)	-3.935 (5)	-3.297 (2)	-2.333 (4)
90 percent cv	-2.570	-3.120	-2.570	-3.120	-4.340	-4.680	-4.340	-4.680
95 percent cv	-2.860	-3.410	-2.860	-3.410	-4.610	-4.950	-4.610	-4.990

Note: Full sample. The lag length is shown in the parenthesis. The specifications of the Gregory-Hansen test are as follows:

$$y_t = \alpha_0 + \alpha_1 DC_t + \delta x_t + \varepsilon_t, \quad \varepsilon_t = \mu + \delta\varepsilon_{t-1} + \sum_{i=1}^{r} \theta_i \Delta\varepsilon_{t-i} + \varphi_t \qquad \text{(B.1)}$$

$$y_t = \alpha_0 + \alpha_1 DC_t + \beta_0 t + \delta x_t + \varepsilon_t, \quad \varepsilon_t = \mu + \delta\varepsilon_{t-1} + \sum_{i=1}^{r} \theta_i \Delta\varepsilon_{t-i} + \varphi_t \qquad \text{(B.2)}$$

where $t = 1, \ldots, T$. A potential regime shift is captured by a dummy variable: $DC_t = 1$ if $t > TB$ and otherwise 0. The null hypothesis of non-cointegration is tested by $\delta = 0$ based on the asymptotic critical values provided by Gregory and Hansen (1996).

Table 4. Causality Test Between Stock Indices and Exchange Rates

Sample period	Pre-Crisis Period			Crisis Period		
Null hypothesis:	Exchange rate does not Granger-cause stock index	Stock index does not Granger-cause exchange rate	Lags	Exchange rate does not Granger-cause stock index	Stock index does not Granger-cause exchange rate	Lags
			A) Individual Country Study			
PCOMP	1.058 [0.391]	1.492 [0.184]	(6)	1.973 [0.069]	2.480 [0.023]	(6)
PCOMM	**0.890 [0.504]**	**1.874 [0.088]**	(6)	2.024 [0.062]	2.586 [0.018]	(6)
PFINC	1.301 [0.260]	0.420 [0.866]	(6)	**1.392 [0.217]**	**3.802 [0.001]**	(6)
PMINI	**1.349 [0.239]**	**2.094 [0.057]**	(6)	**1.789 [0.100]**	**3.328 [0.003]**	(6)
POILI	1.797 [0.103]	0.985 [0.437]	(6)	2.284 [0.035]	1.870 [0.085]	(6)
PPROP	1.449 [0.199]	1.037 [0.403]	(6)	1.985 [0.067]	2.068 [0.056]	(6)
SET	3.780 [0.003]	1.334 [0.253]	(5)	2.002 [0.065]	2.589 [0.018]	(6)
SETAGRI	1.339 [0.243]	0.227 [0.968]	(6)	0.392 [0.884]	0.981 [0.438]	(6)
SETBANK	4.283 [0.001]	1.950 [0.076]	(6)	**1.556 [0.159]**	**2.314 [0.033]**	(6)
SETBUILD	4.062 [0.001]	0.260 [0.955]	(6)	1.346 [0.236]	1.425 [0.204]	(6)
SETCHEM	6.007 [0.015]	1.374 [0.243]	(1)	**0.815 [0.559]**	**2.274 [0.036]**	(6)
SETCOM	2.100 [0.068]	1.040 [0.396]	(5)	0.886 [0.505]	0.561 [0.761]	(6)
SETCOMUN	3.087 [0.011]	1.158 [0.333]	(5)	1.803 [0.097]	2.308 [0.034]	(6)
SETELEC	0.922 [0.481]	0.482 [0.821]	(6)	**1.591 [0.148]**	**2.507 [0.022]**	(6)
SETENERG	3.133 [0.006]	1.429 [0.207]	(6)	**1.430 [0.202]**	**2.482 [0.023]**	(6)
SETENTER	4.091 [0.001]	2.141 [0.052]	(6)	0.821 [0.535]	0.386 [0.858]	(5)
SETETRON	**1.170 [0.326]**	**2.033 [0.065]**	(6)	1.478 [0.184]	1.396 [0.215]	(6)
SETFIN	**1.423 [0.209]**	**1.983 [0.072]**	(6)	**0.892 [0.501]**	**2.742 [0.013]**	(6)
SETFOOD	**1.187 [0.316]**	**2.269 [0.040]**	(6)	2.530 [0.021]	0.593 [0.736]	(6)
SETHELTH	0.890 [0.504]	0.687 [0.660]	(6)	2.066 [0.056]	0.418 [0.867]	(6)
SETHHOLD	0.837 [0.543]	1.177 [0.322]	(6)	5.185 [0.000]	0.762 [0.600]	(6)
SETHOT	**1.020 [0.408]**	**1.962 [0.087]**	(5)	**0.907 [0.490]**	**2.051 [0.058]**	(6)
SETINS	2.366 [0.033]	0.264 [0.953]	(6)	2.279 [0.036]	1.831 [0.092]	(6)
SETJEWEL	1.864 [0.091]	1.470 [0.192]	(6)	1.772 [0.104]	0.665 [0.678]	(6)
SETMACH	0.882 [0.510]	0.477 [0.824]	(6)	0.660 [0.682]	0.392 [0.884]	(6)
SETMINE	0.451 [0.844]	0.522 [0.791]	(6)	0.250 [0.959]	0.533 [0.783]	(6)
SETOTHER	1.154 [0.335]	1.642 [0.152]	(5)	1.868 [0.085]	0.148 [0.989]	(6)
SETPHARM	0.492 [0.782]	0.806 [0.547]	(5)	0.877 [0.512]	0.716 [0.637]	(6)
SETPKG	3.187 [0.009]	1.719 [0.134]	(5)	0.539 [0.779]	0.338 [0.917]	(6)
SETPRINT	1.457 [0.197]	0.993 [0.432]	(6)	1.245 [0.282]	1.057 [0.388]	(6)
SETPROF	0.394 [0.882]	0.808 [0.566]	(6)	0.561 [0.761]	0.402 [0.878]	(6)
SETPROP	0.836 [0.544]	0.766 [0.598]	(6)	0.078 [0.998]	0.752 [0.608]	(6)
SETPULP	3.186 [0.006]	3.112 [0.007]	(6)	0.996 [0.428]	1.428 [0.203]	(6)
SETSILO	1.879 [0.088]	3.039 [0.008]	(6)	0.971 [0.444]	0.590 [0.739]	(6)
SETTEXT	0.927 [0.477]	0.750 [0.610]	(6)	1.658 [0.130]	0.903 [0.492]	(6)
SETTRANS	3.244 [0.008]	2.182 [0.059]	(5)	1.239 [0.285]	0.982 [0.437]	(6)
SETVEHIC	3.459 [0.003]	1.600 [0.151]	(6)	1.305 [0.254]	1.362 [0.229]	(6)
			B) Spill-Over Effects			
SET	1.522 [0.175]	1.238 [0.290]	(6)	1.433 [0.201]	1.652 [0.132]	(6)
SETBANK	--	--	--	**1.448 [0.195]**	**1.851 [0.088]**	(6)
SETCHEM	--	--	--	0.320 [0.926]	1.115 [0.353]	(6)
SETELEC	--	--	--	0.973 [0.443]	1.419 [0.206]	(6)
SETENERG	--	--	--	1.621 [0.140]	0.658 [0.684]	(6)
SETETRON	1.213 [0.303]	1.453 [0.198]	(6)	--	--	--
SETFIN	1.583 [0.156]	1.472 [0.194]	(6)	0.761 [0.601]	1.492 [0.180]	(6)
SETFOOD	0.550 [0.769]	1.458 [0.197]	(6)	--	--	--
SETHOT	0.519 [0.793]	0.893 [0.502]	(6)	0.923 [0.479]	0.617 [0.717]	(6)

Note: The 10 percent criterion is applied to all cases in order to examine the null hypothesis of non Granger-causality. The shaded statistics indicate evidence for causality from the stock index to the exchange rate.

The full sample period is 1996:11:18-1998:12:31, the pre-crisis period is 11/18/96-7/1/97 for Thailand and 11/18/96-7/10/97 for the Philippines, and the crisis period is 7/2/97-12/31/98 for Thailand and 7/11/97-12/31/98 for the Philippines. The contagion study is conducted using the same sample classification as the Thailand study.

Table 5. Theshold Autoregressive Model

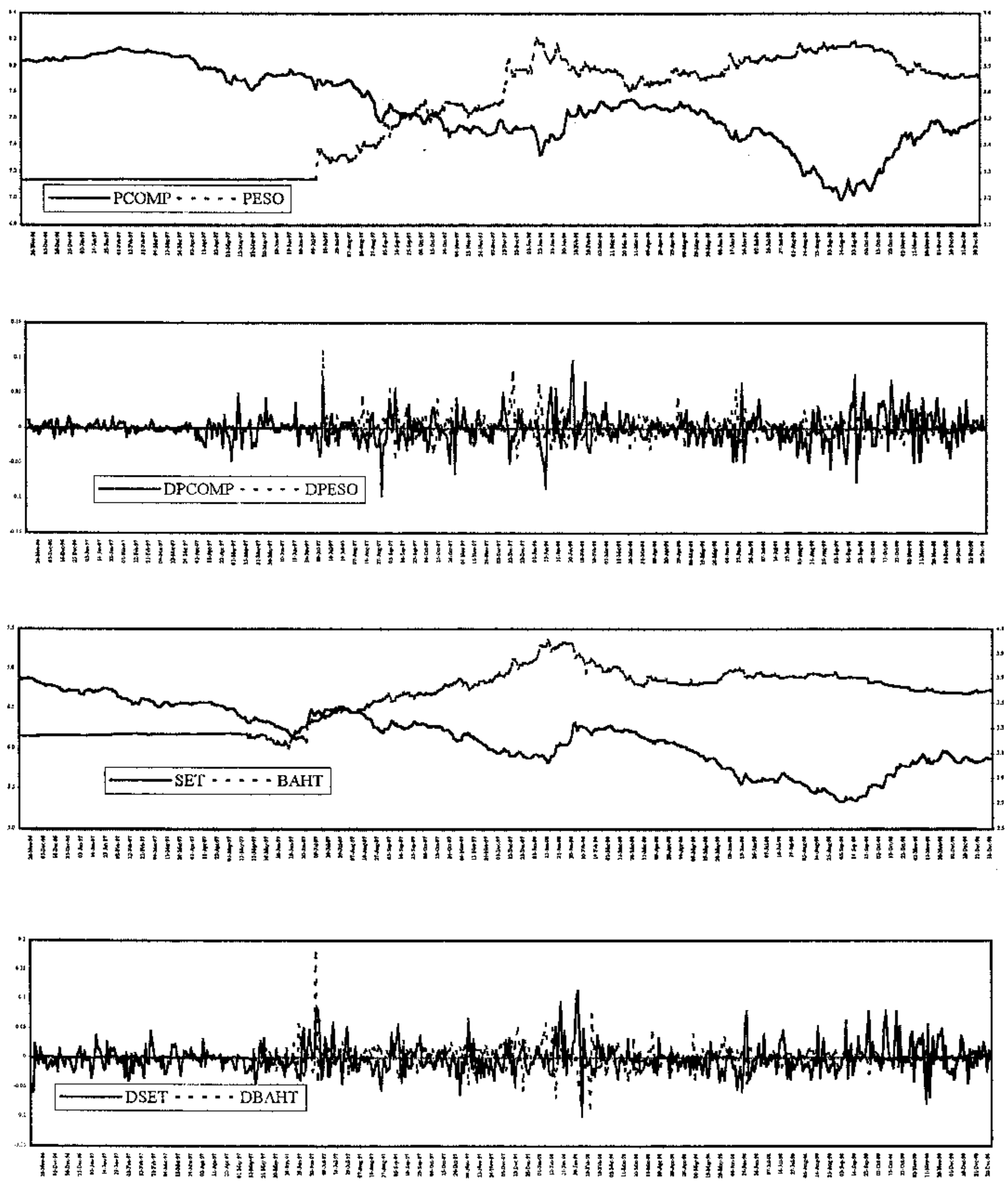
Model	Variables	Coefficient	Standard Error	Q-statistics
Philippines	PFINC (t > Z) (1)	-0.100	0.028	Q(6) = 4.091
	SETBANK (t > Z) (1)	-0.029	0.014	
	PESO (3)	-0.137	0.042	
Thailand	SETFIN (t > Z) (1)	-0.666	0.016	Q(6) = 9.198
	BAHT (3)	-0.076	0.042	

All variables are in the form of log and the first difference. The autocorrelation is tested by the Ljung-Box method and the test statistics are reported under Q-statistics. The general specification of the threshold autoregression can be expressed as follow:

$$\Delta y_t = \begin{cases} \alpha_1 + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \sum_{i=0}^{q} \phi_{1i} \Delta x_{t-i} + \varepsilon_t & \text{for } t \leq Z \\ \alpha_2 + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \sum_{i=0}^{q} \phi_{2i} \Delta x_{t-i} + \varepsilon_t & \text{for } t > Z \end{cases}$$

The Z is defined in the text and equals the beginning of the currency crisis.

Figure 1. Benchmark Stock Indices and Exchange Rates, 11/18/96-12/31/98

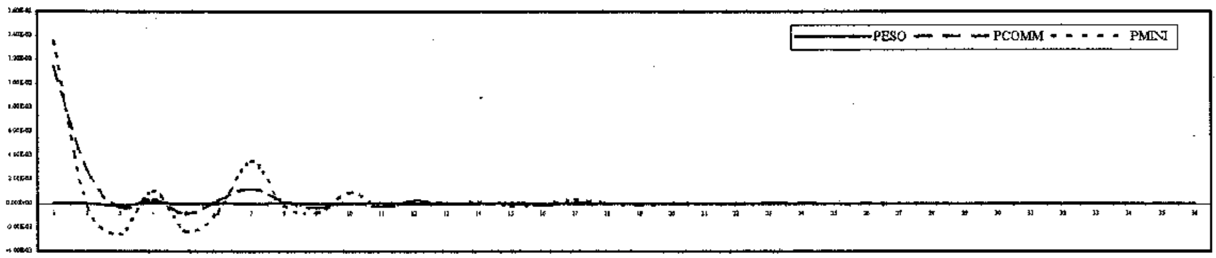


Source: Bloomberg.

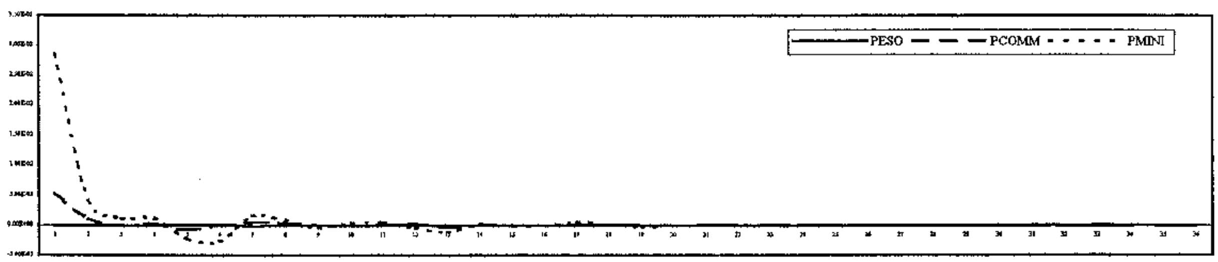
Note: The data are in logarithm, and the observations of the earliest previous working day is used for public holidays on weekdays. The first difference of a variable is expressed with "D" followed by the code name of the variable.

Figure 2. Generalized Impulse Response Functions, Pre-Crisis

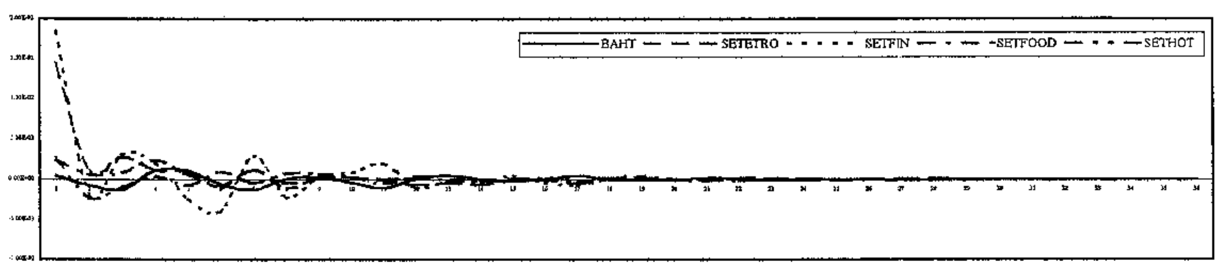
PESO_PCOMM*_PMINI



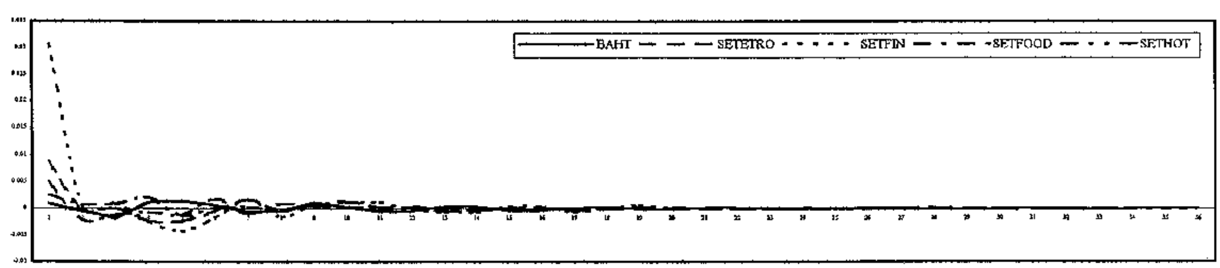
PESO_PCOMM_PMINI*



BAHT_SETETRON*_SETFIN_SETFOOD_SETHOT



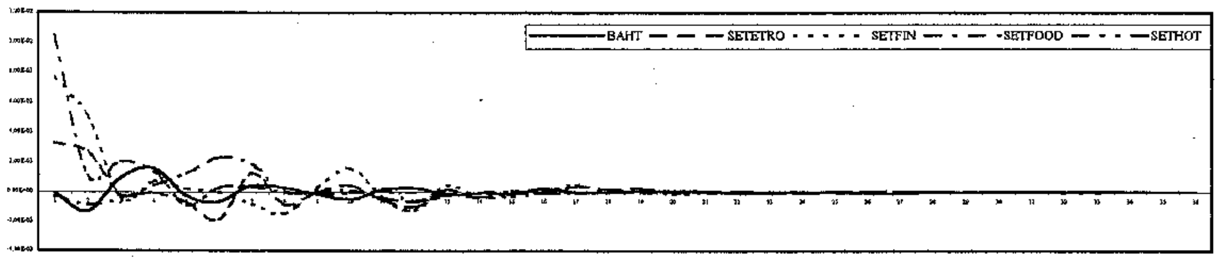
BAHT_SETETRON_SETFIN*_SETFOOD_SETHOT



Note: A shock (one standard error) is given to a variable with "*".

Figure 2. Generalized Impulse Response Functions, Pre-Crisis (concluded)

BAHT_SETETRON_SETFIN_SETFOOD*_SETHOT



BAHT_SETETRON_SETFIN_SETFOOD_SETHOT*

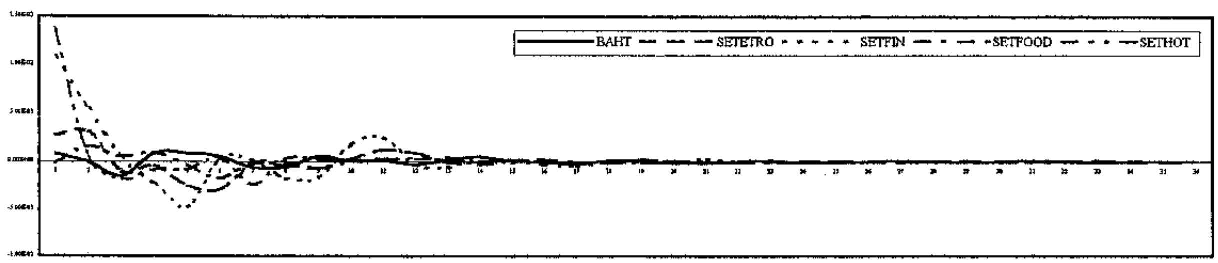
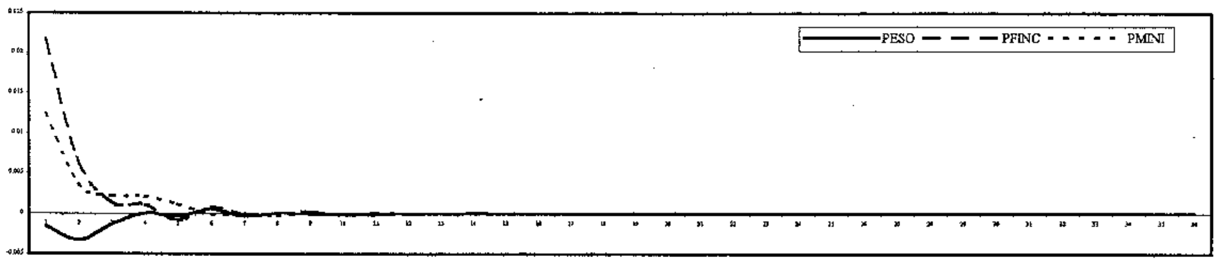
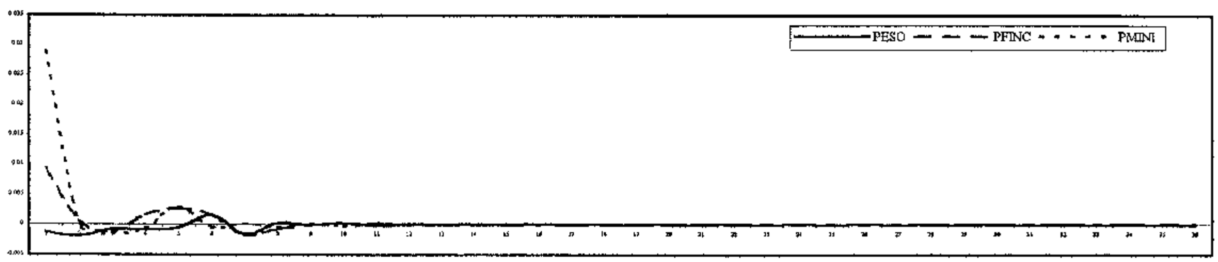


Figure 3. Generalized Impulse Response Functions, During Crisis

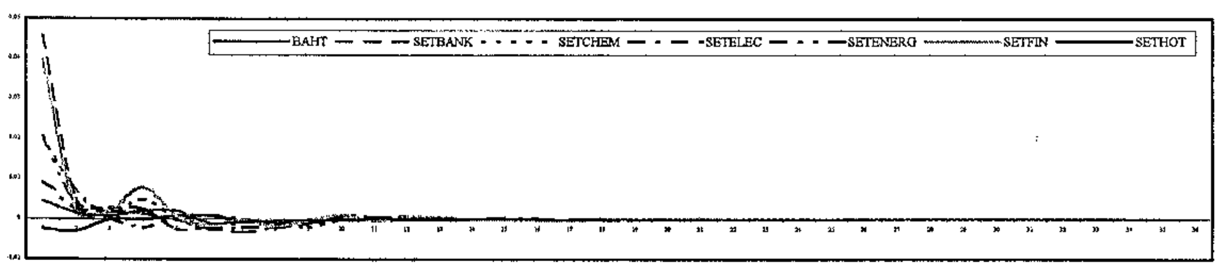
PESO_PFINC*_PMINI



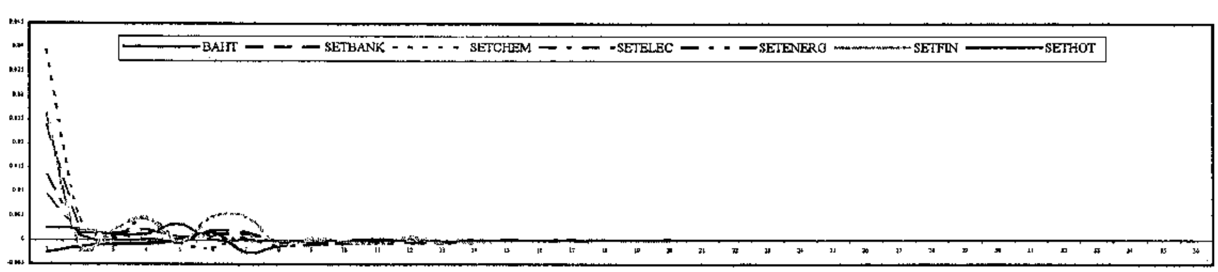
PESO_PFINC_PMINI*



BAHT_SETBANK*_SETCHEM_SETELEC_SETENERG_SETFIN_SETHOT



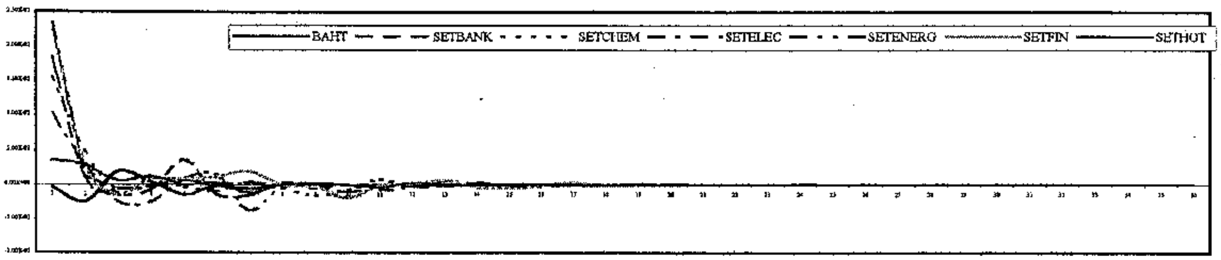
BAHT_SETBANK_SETCHEM*_SETELEC_SETENERG_SETFIN_SETHOT



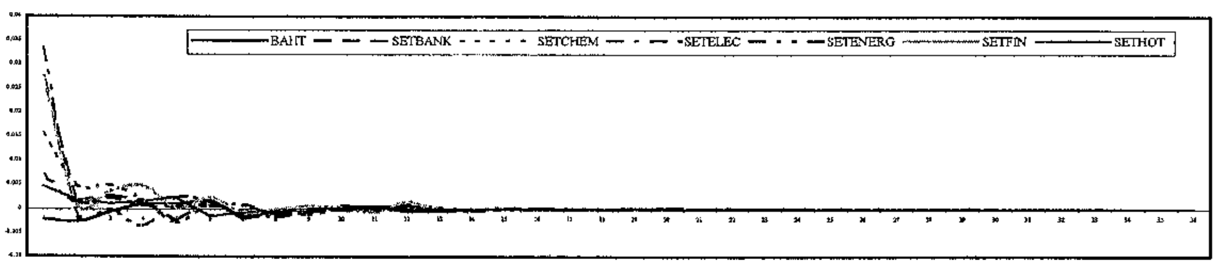
Note: A shock (one standard error) is given to a variable with "*".

Figure 3. Generalized Impulse Functions, During Crisis (concluded)

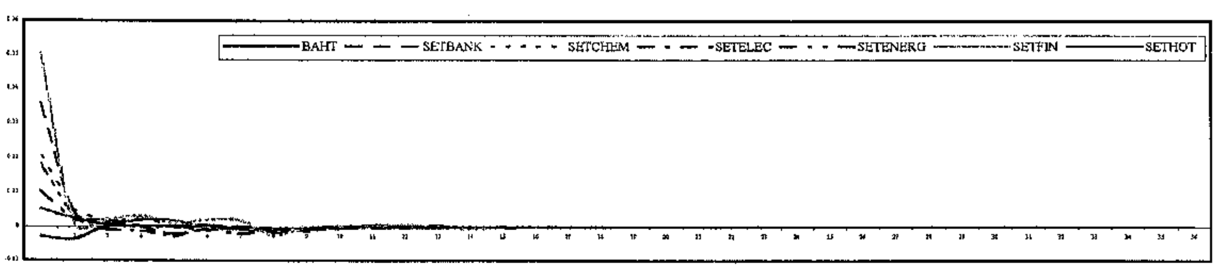
BAHT_SETBANK_SETCHEM_SETELEC*_SETENERG_SETFIN_SETHOT



BAHT_SETBANK_SETCHEM_SETELEC_SETENERG*_SETFIN_SETHOT



BAHT_SETBANK_SETCHEM_SETELEC_SETENERG_SETFIN*_SETHOT



BAHT_SETBANK_SETCHEM_SETELEC_SETENERG_SETFIN_SETHOT*

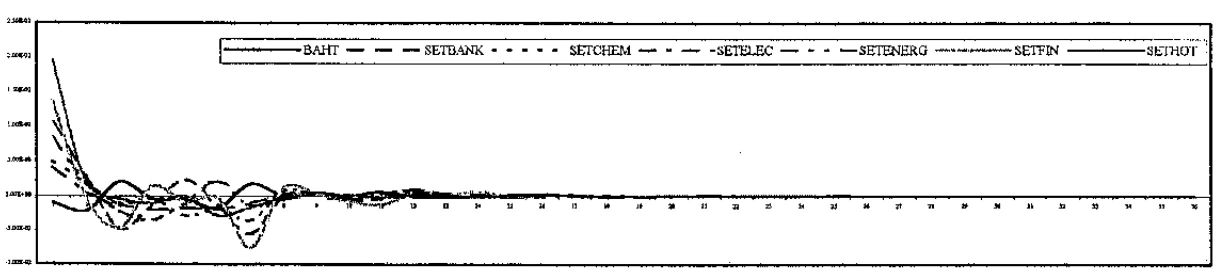
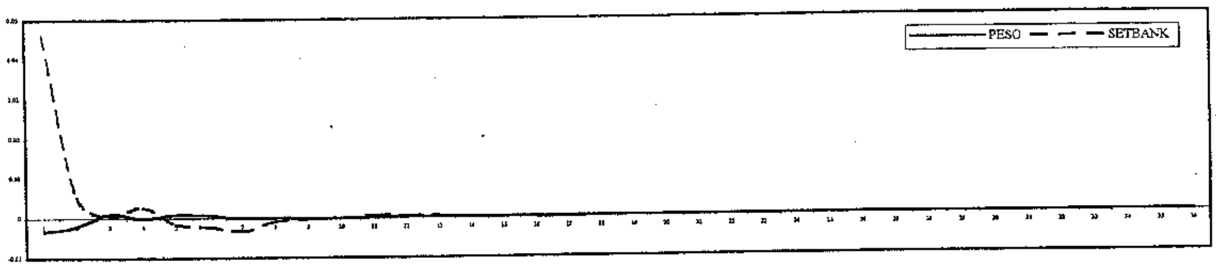


Figure 4. Generalized Impulse Response Functions, Contagion

PESO_SETBANK*



Note: A shock (one standard error) is given to a variable with "*".