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World Business Cycle, Local Specialization and Asset Prices

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This paper analyzes the contribution of the Southeast and Central Asian countries in international portfolio diversification. We characterize the stock cycles of six (6) Asian emerging countries (Korea, Malaysia, Philippines, Singapore, Indonesia and Thailand) by comparing their real cycles with the real and financial cycles of the US. The different phases of the cycles are identified using the Markov-switching autoregressive (MSAR) modeling procedure. The synchronization is then measured by the degree of concordance measure of Harding and Pagan (2002). The main result is that three groups of countries can be distinguished: (1) Indonesia, Philippines and Singapore where the financial markets do not depend on the local real conditions but which depend on the American financial market; (2) Korea and Malaysia which are not dependent on the local real conditions, and the US financial market and real conditions; and (3) Thailand unlike other countries does not present a link with its real economy while presenting a link with the US financial market and real US economy but in s countercyclical manner.

Keywords: stock cycle, real cycle, international portfolio diversification

1 Introduction

Benefits from international portfolio diversification have been widely proven since the first papers of Grubel (1968), Levy and Sarnat (1970), and Solnik (1974). However, there is a debate on the origin of these benefits. Following a "country approach", the benefits are based on a hypothesis of imperfect integration of the national economies, arising from differences in monetary and fiscal policies, and from differences in institutional and legal regimes. Nevertheless, the process of globalization and monetary regionalization which have taken place in the last two decades have, on one hand, reduced these potential gains by reinforcing the integration of the national economies, and, on the other hand, driven a restructuring of industrial sector as a response to growth in domestic and international markets. Consequently, the firms should be less dependent on the economic activity of their country, but should be more dependent on the evolution of their industrial sector. The international portfolio diversification should then be based more on a "sectoral approach" than on a "country approach". This difference in approaches, however, is not always very clear, as in the case of the emerging countries, because these countries may have radically different industrial structures.

The relative importance of "country effects" and "industrial effects" has been widely studied. Earlier studies (see Lessard, 1974; Solnik, 1974; Heston & Rouwenhorst, 1995a and 1995b; Bekers, Connor & Curds, 1996; Griffin &Karolyi, 1998; and Rouwenhorst, 1999) show the predominance of the "country effects" over the "industrial effects". More recent studies (see Baca, Garbe & Weiss, 2000; Cavaglia, Birghtman & Aked, 2000; Berdot, Goyeau & Léonard, 2001; L'her, Sy & Tnami, 2002; Brooks & Delnegro, 2002; Phylaktis & Xia, 2006) show that, since the late nineties, the industrial effects have become at least as important as the country effects in explaining the return of the stock markets, more particularly in Europe and North America.

Even so, these two approaches share the same hypothesis: they assume that the financial markets are linked to real activity. The stock markets are supposed to buy the future benefits of the listing firms, which are linked to the real economy cycle[1].

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[1] This lead of the financial markets on the real cycle is used in many studies (following the studies of Burn and Mitchell (1946) which try to identify leading indicators of the real activity). Depending on the financial variables or the composite indicator used, the financial markets are able to anticipate real cycle from one to three quarters. For more details, see for example Chauvet (1999), and Grégoir and Lenglart (2000).

Dynamic management of the international portfolios based on a country approach assumes there is an imperfect synchronization of the different national real cycles, and management based on an industrial approach assumes imperfect synchronization of the different industries in the course of the worldwide business cycle. Some industries are ahead of the international cycle, while some are behind the international cycle (Berdot, Goyeau & Léonard, 2005; 2006). In all cases, the managers of international portfolios have to base their investment strategies on the regularity of the lags between national economies or between industries.

This paper analyzes the impact of Southeast and central Asian countries in international portfolio allocation. This question was recently studied by Dunis and Shannon (2005). They used different advanced methodologies in order to measure the degree of integration of these markets. They showed that, for the period between August 1999 and August 2003, an international diversification including Asian emerging countries should be beneficial for an American investor. Therefore, a simple analysis of the degree of integration is adequate to justify a passive management (indicial), but it's incomplete for a dynamic (active) management of international portfolios, that is to say the rules on choices between countries or between industries. These choices have to support the real or financial "basics". In this way, we try to characterize the stock cycles of six Asian emerging countries (Korea, Malaysia, Philippines, Singapore, Indonesia and Thailand), on one hand, comparing their own business cycles, and on the other hand, comparing them to the business and financial cycles of the US. The choice of the US as worldwide reference is guided by it being recognized as a leader. The different phases of the cycles are identified using the Markov-switching autoregressive (MSAR) modeling procedure. The synchronization is then measured by the degree of concordance measure of Harding and Pagan (2002).

The second section of this paper presents the methodology used in order to analyze the synchronization of the different cycles (real and financial) in emerging markets and between emerging countries and the US, the data used, and the results of the regime classification.

The third section presents the different degrees of concordance and the robust tests in three cases:

- The first is the synchronization between the real and the financial cycle within each country. No significant test results are found across the different values of leads and lags in the real data cycles considered. This leads us to conclude that, for the period covered in the analysis, the financial cycle of each emerging country analyzed is disconnected or non-synchronized with its real data cycle. The results here lead us to the next question that this study wishes to address: if there appears to be no connection or relationship between the real and financial indices in emerging countries, is it possible to find a link between the financial indices of each emerging country and the US?
- Second, we analyze the synchronization between the financial markets of each emerging country and the US. The results indicate that the financial cycle of three emerging countries is most synchronized with the US financial cycles when they are considered to be leading the US financial index. This result is of course contrary to what we expect of the relationship between the financial markets of the US and the emerging countries, but this can be explained by the role of the expectation of financial markets. That means that the financial markets of these emerging countries are not driven by their own real conditions, but are speculative markets, which try to expect the worldwide financial cycle (via the American one). For 2 countries, we found that there is no synchronization between the local financial cycle and the US financial cycle. So, such financial markets are speculative too. For all these countries, we have to see if these markets are strictly speculative ones, or if they have a link with the real cycle. So we study the link between the financial cycle of emerging countries and the real cycle of the US.
- And third, we look at the synchronization of the financial market of each emerging country and the real sector of the US. The results indicate that the US real cycle is most synchronized with the financial cycles of Indonesia and the Philippines when they are considered to be leading the US real index.

2 Methodology

From the time Hamilton (1989) used a Markov-switching autoregressive model to measure the US business cycle, the procedure has become a popular and favored approach for detecting and dating business cycle turning points. Over the years, modifications and extensions to improve this procedure have been proposed. Krolzig (1997), for one, provides a complete discussion of the Markov-switching vector autoregressive (MSVAR) modeling procedure, an extension to the case of having a multivariate time series, over a large class of models. He also provides a program that may be used to estimate the parameters of these models using the EM algorithm.

The concordance or co-movement in business cycles, say of regions or sectors within a country, has also been of interest to business cycles researchers. Krolzig (2001b) shows that based on the real GDP growth rates in eight European Monetary Union (EMU) member states, there is a strong overall evidence for the presence of a common Euro-zone cycle. This, he says, is despite the fact that the business cycles in the Euro-zone have not been perfectly synchronized in the last two decades. Wall (2007) compares business cycles of eight regions in Japan from 1976 to 2005 and finds that recessions are experienced across a majority of regions, albeit the increase in the occurrence and lengths of recessions at the regional level over time.

The methodology used in this paper involves three steps:

- First, a univariate Markov-switching autoregressive (MSAR) model with two regimes is fitted to each of the time series to obtain the regime classification. The regime with the lower average growth rate is labeled *Regime 1*, while the regime with the higher average growth rate is labeled *Regime 2*;
- Second, the degree of concordance proposed by Harding and Pagan (2002) between cycles of two time series, which co-movement is of interest, is computed using the regime classifications obtained from the first step;
- Lastly, the robust test for strong non-synchronization developed by Harding and Pagan (2006) is performed to determine whether or not there is evidence that the cycles of the two time series are in sync.

A brief description for each of these three procedures is discussed in the succeeding sub-sections.

2.1 Markov-switching autoregressive models

The models used in this paper are special cases of the MSVAR models in Krolzig (1997) in that they are univariate. In an MSAR model, a time series y_t is defined conditionally on a random variable S_t, called the regime variable, which is unobservable. This unobservable regime variable is assumed to be generated by an ergodic Markov chain defined by the transition probabilities:

$$p_{ij} = \Pr(S_{t+1} = j | S_t = i)\,, \qquad \sum_{j=1}^{M} p_{ij} = 1\,, \qquad 0 < p_{ij} < 1, \qquad \forall i, j \in \{1,2,\dots,M\}$$

Here, M denotes the number of regimes. Conditional on S_t, the time series y_t is usually assumed to follow a linear model. In the MSAR case, the model is assumed to be an autoregressive model.

The class of MSVAR models in Krolzig (1997) allows the possibility that all parameters in the autoregressive model are subject to regime shifts. However, in practice, data limitations reduce the choice of models to the Markov-switching mean (MSM) type and the Markov-switching intercept (MSI) type. In this work, we consider only the case where there are two regimes and we also entertain the possibility of standard errors being regime dependent. Hence the models expand to the MSMH and MSIH types, where "H" stands for heteroscedastic. Only when no suitable model is found under these types of models will a more complex model be entertained. We use the MSVAR for Ox program developed by Krolzig in the estimation of the models.

Briefly, in the MSM(H) model, the change in the regime coincides with an immediate change in the mean of the time series, and is described in the MSVAR for Ox documentation as a "once-and-for-all

jump in the time series when the conditional process is subject to shifts in the mean." Thus, the time series y_t is expressed as:

$$y_t - \mu(S_t) = \alpha_1[y_{t-1} - \mu(S_{t-1})] + \alpha_2[y_{t-2} - \mu(S_{t-2})] + \cdots + \alpha_p[y_{t-p} - \mu(S_{t-p})] + \varepsilon_t \; ; \; \varepsilon_t \sim IID(0, \sigma_m^2)$$

On the other hand, the MSI(H) model, which has shifts in the intercept, implies a smooth adjustment of the time series after regime shifts. Here, y_t is expressed as

$$y_t = v_m + \alpha_1 y_{t-1} + \alpha_1 y_{t-2} + \cdots + \alpha_p y_{t-p} + \varepsilon_t \; ; \; \varepsilon_t \sim IID(0, \sigma_m^2)$$

In the case of the financial data used in this paper, the MSI(H) models give better fit than the MSM(H) models.

The regime classifications for the second step of the analysis are likewise obtained using the automatic *CycleDating* option of the MSVAR program. This option reports the regime classification based on the smoothed regime probabilities, which is the optimal inference on the regime at time t using the full sample information.

For the purposes of the succeeding steps in the analysis of co-movement of time series, the regime classifications are labeled 1 and 0. In our analysis, S_t = 0 refers to the period with higher average growth rate or the "expansion" phase, while S_t = 1 corresponds to the period with lower average growth rate or "contraction" phase[2].

2.2 Degree of concordance

Harding and Pagan (2002), recognizing the importance of understanding cycles and their behavior relative to reference cycles, propose that co-movement between cycles be measured by the *degree of concordance* between the specific cycle, say y_{jt} and the reference cycle, say y_{rt}. This quantity is simply the fraction of time that both series are simultaneously at the same regime, that is,

$$I_{jr} = \frac{1}{T}\{\#(S_{jt} = 1, S_{rt} = 1) + \#(S_{jt} = 0, S_{rt} = 0)\} \; ; \;\; t = 1,2, \ldots, T$$

where S_{jt} and S_{rt} denote the regime variable for the specific and reference cycles, respectively. The authors note that if y_{jt} is pro-cyclical, then the index will be equal to one, while an index value of zero means that y_{jt} is counter-cyclical.

The degree of concordance between a specific cycle and a reference cycle already provides information on the characteristics and behavior of the two series as they move over time. In our analysis, we also consider measuring the degree of concordance between the reference cycle y_{rt} and lagged values of the specific cycle, denoted as y_{jt+h}. The idea is that, it is possible for two cycles to be discordant contemporaneously, but concordant at different time periods. Another possibility is for the two cycles to be concordant at the same time period, but be more concordant at different time periods. That is, as we shift the specific cycle forward (or backward) in time, the number of regime disagreements with the reference cycle could possibly be smaller than when the two cycles are evaluated at the same time period. These first two cases help establish whether there is any indication that the reference cycle leads or lags compared to the specific cycle. Assuming the cycles are concordant at a specific value of h, as discussed in Berdot, Goyeau and Leonard (2006), we note that

- if $h > 0$, the reference cycle y_{rt} is in sync with a "future" value of the specific cycle y_{jt} indicating a lead for the reference cycle;
- if $h < 0$, the reference cycle y_{rt} is in sync with a "past" value of the specific cycle y_{jt} indicating a lag for the reference cycle; and

[2] The choice of the number of phases is arbitrary. The empirical studies lead by Sichel (1994) on the American economic business cycle tend to identify three phases. However, studies on American data show that financial data, since 1984, follow a two-phase model (Bellone, Gautier & Le Coent, 2005). According to Stock and Watson (2003), this breakdown may come from the change of the monetary policy nature, which became, since the beginning of the eighties, more turn to the price stability target, and which is, consequently, more credible.

- if h = 0, the reference cycle y_{rt} and the specific cycle y_{jt} are in sync at contemporaneous time periods.

A third possibility is for the two cycles to be discordant at contemporaneous and at different time periods. Of course, it may also be possible for the two cycles to be counter-cyclical. Hence, the index proposed by Harding and Pagan (2002) defined above is "modified" to become:

$$I_{jr}^{h} = \frac{1}{n}\{\#(S_{jt+h} = 1, S_{rt} = 1) + \#(S_{jt+h} = 0, S_{rt} = 0)\}$$

where n denotes the number of time periods common to the reference cycle and the lagged specific cycle. In this report, we evaluate this modified version of the degree of concordance for values of h from -6 to +6. This range of values for h accommodates the possibility that the reference cycle either leads or lags the specific cycle for as long as 6 months.

It should be pointed out that the term reference cycle as used in this paper does not refer to the common cycle of a set of some synchronized cycles. Rather, the term is used for a cycle that is used as a point of comparison for specific cycles.

2.3 Robust test for strong non-synchronization (SNS)

After introducing the degree of concordance as a measure of co-movement between cycles, Harding and Pagan (2006) provide heteroscedasticity and serial correlation robust tests of the hypotheses that cycles are either unsynchronized or perfectly synchronized. In this paper, the robust test for strongly non-synchronized (SNS) cycles is used. The test is based on the correlation coefficient, ρ_s, between the regime variables S_{jt} and S_{rt} of the specific and reference cycles, respectively.[3] The null hypothesis $\rho_s = 0$ is the hypothesis of strong non-synchronization. The authors assert that the value of one for the estimated correlation coefficient, denoted $\hat{\rho}_s$, corresponds to a concordance index of one and $\hat{\rho}_s = -1$ to a concordance index of zero. Thus, we conclude that the cycles are pro-cyclical when the test is significant and the robust t-statistic is positive. On the other hand, we say that the cycles are counter-cyclical when the test is significant and the robust t-statistic is negative. If we fail to reject the null hypothesis, then we conclude that the data do not provide sufficient evidence that the cycles are not SNS.

In our analysis, we use the test for SNS in both the contemporaneous and non-contemporaneous cases. We provide the t-statistics for testing $\hat{\rho}_s = 0$ with and without the "correction" for serial correlation and heteroscedasticity in the case that $h = 0$ (contemporaneous case). This is so that readers will see the difference in results. For the case where $h \neq 0$, only the degree of concordance and the robust t-statistics are reported. We report on (i) whether there is evidence that the cycles are synchronized at contemporaneous time periods, and (ii) at which value of h is the robust t-statistic the highest. As discussed earlier, if the value of h in (ii) is not equal to zero, this provides evidence that the reference cycle is more in sync with a lead or a lag of the specific cycle.

3 Data Set and Results

3.1 Data set used

For the purpose of this study, we use monthly data on production index and price index of the US and the six emerging countries considered that come from Datastream International. Monthly growth rates of the indices are obtained by computing $100 * \ln(y_t/y_{t-1})$ for each index y_t, t =1, 2, …, T. The growth rates are the input variables for the MSAR models. The period of coverage for most countries is from January 1996 to May 2007. Table A1 (Appendix) provides a list of the variables used in this study and the periods of coverage. Note that the period of coverage for the corresponding regime variables depends on the number of autoregressive parameters used in the models.

[3] Harding and Pagan (2006) illustrate that under the assumption that the correlation is 0 (or independence of cycles), it is possible for the expected value of the concordance index to be near 1. In this case, they say, one could easily think that the cycles are synchronized even though there is no relation between them. The test is thus based on the correlation coefficient, and not on the concordance index.

There are two major events within the period of coverage that may prove to be useful in our analysis later. First is the financial crisis that hit most Asian countries in 1997, and second is the September 11, 2001 attack at the World Trade Center which affected the financial markets for several days.

3.2 The MSAR models used

Table A2 in Appendix gives the estimates for the univariate MSAR models of growth rate of production index for the seven countries considered. The highest order p of autoregressive parameter considered is 12, which is equivalent to one year. The final model for each country is chosen based on the significance of the p^{th} autoregressive parameter, the Akaike information criterion (AIC), the Hannan-Quinn criterion, and the Schwarz criterion. The diagnostics produced by MSVAR for Ox are also considered.

As noted earlier, most "best-fitting" models are of the Markov-switching intercept (MSI) type. For Singapore and the US, the standard errors do not appear to be regime-dependent. On the other hand, the standard errors of production index growth rates of Indonesia, Korea, Malaysia and Thailand appear to be regime dependent. The model used for the Philippines is neither an MSI nor an MSM type. Under these classes of models, the Markov-switching model for the production index growth rate of the Philippines is no better than an ordinary autoregressive model. Hence, more complex Markov-switching models are fitted to the data. The "best-fitting" model in the case of the Philippines is a Markov-switching autoregressive parameters (MSA) type, one that allows the autoregressive parameters to be regime-dependent while the intercept and standard error are not. This explains the two columns of autoregressive parameters under Philippines, but single entries for the intercept and the standard error.

Similarly, Table A3 (Appendix) gives the estimates for the univariate MSAR models of growth rate of price index for the seven countries considered. While the 12^{th}-order autoregressive parameter is significant in the models for production growth rates, the models for global price growth rates of the different countries have different orders of autoregressive parameters. Korea and Malaysia have models of order 12, while Philippines, Singapore and Thailand have models of order 11. Indonesia, on the other hand, has a model of order 9. The US model is only of order 4. All models are of the MSI type with regime-dependent standard errors except for Malaysia and Thailand where the respective standard errors appear to be the same in both regimes.

As we have stated in the previous section, the regime classification is determined using the automatic cycle dating option of the program, which assigns a period to a regime on the basis of the smoothed probability. The regime classification used in this study is solely based on the information from the empirical data. It is important to differentiate what such an automatic procedure does and a group, such National Bureau of Economic Research (NBER) or Economic Social Research Institute (ESRI), does. As a result, the durations of regimes for the production index of emerging countries do not conform to the censoring rules set by most cycle dating algorithm: that a regime should last for a certain minimum length of time (usually set at 6 months or 2 quarters), and that a period of "contraction" should relatively be shorter than a period of "expansion" (expansion being the normal state of the economy). Indonesia and Thailand both appear to have about the same durations of "contractions" and "expansion". Malaysia and the Philippines both have longer durations of "contraction" than of "expansion". In the case of Korea and Singapore, the durations of "expansion" are longer than of "contraction", however, the duration of "contraction" is only one month. It is only the production index growth rate of the US which appears to satisfy the censoring rules despite the use of an automatic cycle dating procedure.

The financial data appear to show better results in this aspect. From Table A3, we note that all emerging countries and the US have shorter durations of "contraction" than of "expansion". Most countries also satisfy the censoring rule on the minimum length of time for a regime. Only Malaysia and Thailand have regime durations shorter than 6 months at 2.33 months and 3.88 months, respectively, for the "contraction" phase.

The discrepancy between the durations of regimes leads us to conclude that, for emerging countries, the results indicate that the cycle obtained from the real data appears to be different from the cycle obtained from the financial data. But for the US, this may not be the case. It is interesting to

note that, although the durations of "contraction" for the real and financial data of the US are markedly different, the durations of "expansion" are not.

To examine further the relationship between cycles produced by the real and financial data, we proceed to analyzing the concordance between the two cycles for each of the countries considered.

3.3 The concordance between real and financial cycles of the US and the emerging countries

Table 1 presents some descriptive statistics of regime variables obtained from growth rates of both production and global price indices. For the purposes of these computations and the succeeding robust tests, the regimes are labeled 1 for "contraction" and 0 for "expansion".

In the case of emerging countries, the estimated proportions of periods of "contraction" using real data are very different from the estimates using financial data except for Indonesia and the Philippines. These differences in the estimates of proportions of "contraction" further strengthen the differences on durations of regimes observed in the previous section. There is also low correlation coefficient between the regime variables obtained from real and financial data for each emerging country.

We are then able to check if there is a relationship between the financial cycle and the real cycle, in order to use one of the two methodologies (country approach versus economic approach) presented in the introduction. Table 2 presents the degree of concordance and the t-ratios for the test for strong non-synchronization (SNS).

Table 1. Descriptive Statistics of Regime Variables from Production Index and Global Price Index of US and Each Emerging Country

Country	mu_prod[a]	mu_fin[b]	std_prod[a]	std_fin[b]	Pairwise Correlation[c]
US	0.154	0.252	0.363	0.436	0.529
Indonesia	0.364	0.415	0.483	0.495	-0.102
Korea	0.049	0.566	0.217	0.498	-0.030
Malaysia	0.762	0.082	0.427	0.275	-0.114
Philippines	0.604	0.458	0.492	0.501	0.018
Singapore	0.082	0.426	0.275	0.497	-0.076
Thailand	0.467	0.164	0.501	0.372	0.073

[a] *Based on production index*
[b] *Based on global price index*
[c] *Pairwise correlation between the regime variables for production index and global price index*

The degrees of concordance between real and financial cycles of emerging countries are around the middle value of 0.5, with Malaysia registering the lowest concordance index value of 0.254. The t-ratios for the test for SNS are also less than 2 in absolute value across all emerging countries. The results of the tests tell us that there is evidence of strong non-synchronization between the real and financial cycles of emerging countries. In fact, except for the Philippines and Thailand, the expected value of the degree of concordance assuming independence of cycles is even higher than the actual computed index of concordance. This implies that the common regimes shared by the two cycles for each emerging country appears to be out of pure coincidence. These results suggest that there is no concordance at contemporaneous time between financial and real cycle. But we have to extend the analysis by considering leads and lags.

Table 2. Degree of Concordance and Test-statistic Value for the Test for Strong Non-Synchronization Between Production Index and Global Price Index Cycles of US and Each Emerging Country

Country	Concordance Index	Concordance Assuming Independence	Standard t - statistic	Robust t - statistic
US	0.837	0.671	6.858	4.142
Indonesia	0.475	0.523	-1.105	-1.071
Korea	0.434	0.441	-0.330	-0.363
Malaysia	0.254	0.281	-1.256	-1.032
Philippines	0.500	0.491	0.173	0.133
Singapore	0.541	0.562	-0.838	-0.851
Thailand	0.549	0.522	0.807	1.221

Table 3 now presents the degree of concordance and the resulting t-ratio of the test for SNS between the financial and lagged real cycles for the US and each emerging country. The financial cycle serves as the reference cycle.

For the emerging countries (except for Singapore, but the t-statistic value is very low (2.004)), no significant test results are found across the different values of leads and lags in the real data cycle considered. This leads us to conclude that, for the period covered in the analysis, the financial cycle of each emerging country analyzed is disconnected or non-synchronized with its real data cycle. Of course, the result is different for the US: the financial cycle is "most" synchronized with the real data cycle if we consider it to be leading the real data cycle by three (3) months. This result is consistent with other studies.

Thus, while the financial and real data in the US are very much connected, the opposite is true in the emerging countries.

The result may be a little difficult to accept at the onset, but we emphasize that a high degree of concordance (and/or a significant test for SNS result) indicates that when a reference series is in expansion (contraction) there is high probability that the specific series is also expanding (contracting), and thus we say that there is significant co-movement between the reference and specific cycles. On the other hand, a low degree of concordance (and/or a non-significant test for SNS result) does not necessarily mean that there is nothing common between the reference and specific series, but rather the common cycle or shock explains only a little part of the dynamics of these two series. This implies then that specific shocks may contribute more in explaining the behaviors of the series separately.

The results here lead us to the next question that this study wishes to address: if there appears to be no connection or relationship between the real and financial indices in emerging countries, is it possible to find a link between the financial indices of each emerging country and the US? We answer this question in the next subsection using the same techniques done between the real and financial data of each country.

Table 3. Degree of Concordance and Test-Statistic Value for the Test for Strong Non-Synchronization between Global Price Index Cycle and Lagged Production Index Cycle of US and Each Emerging Country (Point of Reference is the Global Price Index Cycle)

Country	Concordance Index at lag -1	Robust t - statistic	Concordance Index at lag -2	Robust t - statistic	Concordance Index at lag -3	Robust t - statistic
US	0.837	4.207	0.837	4.230	0.836	4.214
Indonesia	0.479	-0.929	0.508	-0.328	0.521	-0.077
Korea	0.443	-0.316	0.451	-0.268	0.443	-1.154
Malaysia	0.270	-0.587	0.303	1.557	0.303	1.693
Philippines	0.500	0.127	0.500	0.133	0.500	0.128
Singapore	0.590	1.250	0.590	1.290	0.598	1.370
Thailand	0.541	1.047	0.533	0.501	0.525	0.047
Country	Concordance Index at lag -4	Robust t - statistic	Concordance Index at lag -5	Robust t - statistic	Concordance Index at lag -6	Robust t - statistic
US	0.835	4.192	0.833	4.165	0.832	4.133
Indonesia	0.545	0.420	0.567	0.899	0.563	0.783
Korea	0.455	-0.650	0.492	1.480	0.496	1.470
Malaysia	0.306	1.599	0.292	0.403	0.294	0.309
Philippines	0.500	0.132	0.495	0.045	0.468	-0.397
Singapore	0.612	1.697	0.600	0.988	0.622	2.004
Thailand	0.537	0.534	0.525	0.000	0.555	1.464
Country	Concordance Index at lead +1	Robust t - statistic	Concordance Index at lead +2	Robust t - statistic	Concordance Index at lead +3	Robust t - statistic
US	0.837	4.032	0.837	3.884	0.837	4.614
Indonesia	0.487	-0.705	0.500	-0.418	0.513	-0.111
Korea	0.430	-0.388	0.425	-0.409	0.437	0.496
Malaysia	0.264	-0.687	0.267	-0.556	0.269	-0.547
Philippines	0.500	0.134	0.500	0.130	0.479	-0.183
Singapore	0.541	-0.862	0.570	0.486	0.575	0.821
Thailand	0.541	1.116	0.521	0.106	0.542	0.858
Country	Concordance Index at lead +4	Robust t - statistic	Concordance Index at lead +5	Robust t - statistic	Concordance Index at lead +6	Robust t - statistic
US	0.837	4.473	0.821	3.565	0.805	2.868
Indonesia	0.526	0.179	0.504	-0.223	0.509	-0.128
Korea	0.432	0.475	0.427	0.449	0.422	0.421
Malaysia	0.254	-1.173	0.256	-1.293	0.293	0.331
Philippines	0.479	-0.193	0.479	-0.191	0.510	0.272
Singapore	0.571	0.788	0.551	0.024	0.530	-0.870
Thailand	0.521	0.118	0.542	0.904	0.521	0.113

3.4 The concordance between financial cycles of the US and emerging countries

Table 4 presents the descriptive statistics of regime variables based on the growth rates of the global price indices of the countries analyzed. Among the six emerging countries considered, the Philippines have the most correlated financial cycle with that of the US, with correlation coefficient of 0.609. Indonesia closely follows with a correlation coefficient of 0.519, then Singapore with 0.345. The lowest correlation coefficient is 0.036 for Malaysia, while Thailand registers a negative correlation coefficient at -0.206.

Table 4. Descriptive Statistics of Regime Variable from Global Price Index of Each Emerging Country (Common Sample with US)

Emerging Markets	mu_EC[a]	mu_US[b]	std_EC[a]	std_US[b]	Pairwise Correlation[c]
Indonesia	0.405	0.256	0.493	0.438	0.519
Korea	0.552	0.248	0.499	0.434	0.108
Malaysia	0.080	0.248	0.272	0.434	0.036
Philippines	0.487	0.261	0.502	0.441	0.609
Singapore	0.413	0.246	0.494	0.432	0.345
Thailand	0.167	0.246	0.374	0.432	-0.206

[a] *Based on global price index of an emerging country*
[b] *Based on global price index of the US*
[c] *Pairwise correlation between the regime variables from the global price index of US and an emerging country*

Indonesia, Korea, Philippines and Singapore have estimated proportions of "contraction" which are one-and-a-half to two times more than estimated proportion of "contraction" for the US. Malaysia and Thailand, on the other hand, have registered lower estimated proportions of "contraction" than the US.

Table 5. Degree of Concordance and Test-Statistic Value for the Test for Strong Non-Synchronization between Global Price Index Cycles of the US and each Emerging Country (Point of Reference is the US Cycle)

Emerging Markets	Concordance Index	Concordance Assuming Independence	Standard t - statistic	Robust t - statistic
Indonesia	0.769	0.546	6.616	3.267
Korea	0.520	0.474	1.200	0.702
Malaysia	0.720	0.712	0.394	0.320
Philippines	0.773	0.506	8.298	4.046
Singapore	0.690	0.544	4.087	2.132
Thailand	0.603	0.669	-2.344	-2.209

Table 5 shows that the degrees of concordance between the financial cycles of US and each emerging country are relatively high except for Korea. As one might suspect, the financial cycle of Korea is found to be strongly non-synchronized with the financial cycle of the US by the test for SNS. In the case of the other emerging countries with higher concordance indices, as we have noted earlier, the test for SNS also depends on the expected concordance index value under the assumption of independence. Of these five other countries, the financial cycles of Indonesia, Philippines and Singapore are found to be synchronized with the US financial cycle at contemporaneous time periods. The Thailand financial cycle is found to be counter-cyclical with the US financial cycle since the resulting t-ratio is negative. This is so since the observed degree of concordance between financial cycles of Thailand and the US is lower than when the two cycles are assumed to be independent. In the case of Malaysia, the expected concordance index between its financial cycle and that of the US under the assumption of independence is nearly the same as the observed degree of concordance; hence the resulting t-ratio is even smaller than the value for Korea.

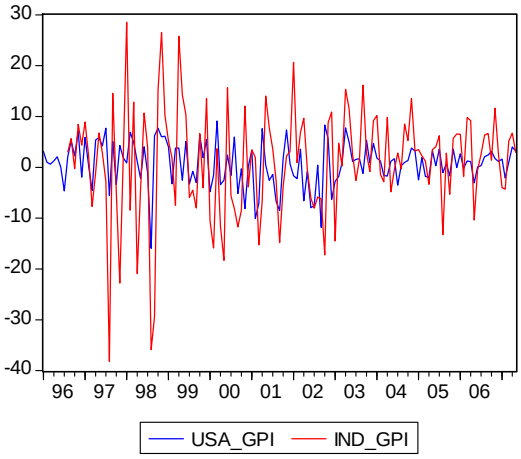
We next find if there is evidence of synchronization between the US financial cycle and leads or lags in the emerging countries financial cycles. Table 6 below summarizes the results of the tests for SNS.

Table 6. Degree of Concordance and Test-Statistic Value for the Test for Strong Non-Synchronization between Global Price Index Cycle of the US and Lagged Global Price Index Cycle of each Emerging Country (Point of Reference is the US Cycle)

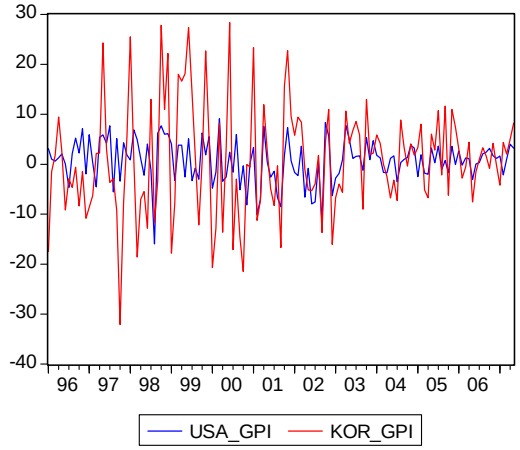
Emerging Markets	Concordance Index at lag -1	Robust t - statistic	Concordance Index at lag -2	Robust t - statistic	Concordance Index at lag -3	Robust t - statistic
Indonesia	0.767	3.304	0.765	3.317	0.763	3.313
Korea	0.516	0.678	0.512	0.647	0.508	0.608
Malaysia	0.718	0.329	0.715	0.323	0.713	0.302
Philippines	0.771	4.076	0.769	4.099	0.767	4.114
Singapore	0.688	2.030	0.685	2.144	0.683	2.217
Thailand	0.616	-1.709	0.629	-1.038	0.642	-0.491
Emerging Markets	Concordance Index at lag -4	Robust t - statistic	Concordance Index at lag -5	Robust t - statistic	Concordance Index at lag -6	Robust t - statistic
Indonesia	0.761	3.291	0.759	3.237	0.757	3.131
Korea	0.504	0.561	0.500	0.507	0.513	0.733
Malaysia	0.711	0.269	0.692	-0.351	0.689	-0.365
Philippines	0.765	4.122	0.763	4.121	0.761	4.121
Singapore	0.680	2.248	0.678	2.240	0.675	2.204
Thailand	0.639	-0.523	0.636	-0.549	0.617	-0.984
Emerging Markets	Concordance Index at lead +1	Robust t - statistic	Concordance Index at lead +2	Robust t - statistic	Concordance Index at lead +3	Robust t - statistic
Indonesia	0.769	3.189	0.752	2.793	0.736	2.614
Korea	0.504	0.476	0.488	0.228	0.472	-0.029
Malaysia	0.704	-0.289	0.704	-0.290	0.704	-0.292
Philippines	0.756	3.629	0.756	3.634	0.756	3.615
Singapore	0.690	2.184	0.690	2.202	0.690	2.187
Thailand	0.587	-3.117	0.587	-3.136	0.587	-3.148
Emerging Markets	Concordance Index at lead +4	Robust t - statistic	Concordance Index at lead +5	Robust t - statistic	Concordance Index at lead +6	Robust t - statistic
Indonesia	0.719	2.404	0.702	2.174	0.686	1.936
Korea	0.456	-0.285	0.440	-0.533	0.424	-0.766
Malaysia	0.704	-0.291	0.704	-0.287	0.704	-0.281
Philippines	0.756	3.566	0.739	3.356	0.723	3.093
Singapore	0.675	1.886	0.675	1.856	0.675	1.810
Thailand	0.587	-3.154	0.587	-3.156	0.587	-3.156

The US financial cycle is found to be most synchronized with (i) the financial cycle of Indonesia shifted 2 months backward; (ii) the financial cycle of the Philippines shifted 4 months backward; and (iii) the financial cycle of Singapore shifted 4 months backward. There are no significant results for Korea and Malaysia, while the US financial cycle appears to be most counter-cyclical with the financial cycle of Thailand shifted 5 or 6 months forward.

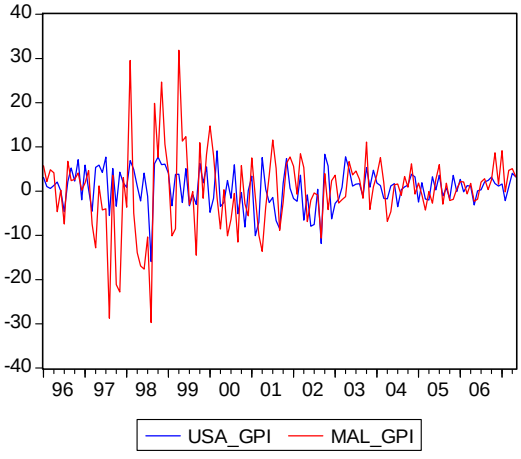
Figure 1. Plot of Growth Rates of Global Price Indices for US and Each Emerging Country



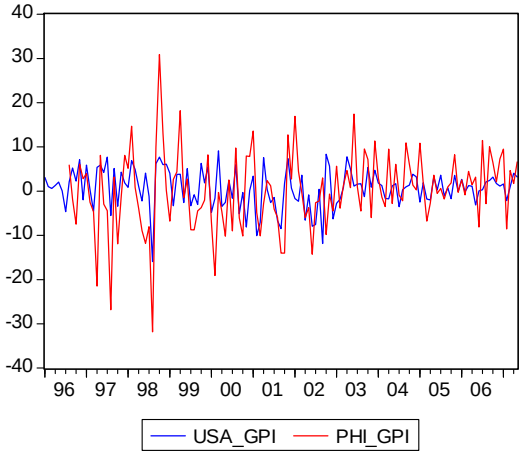
US vs. Indonesia



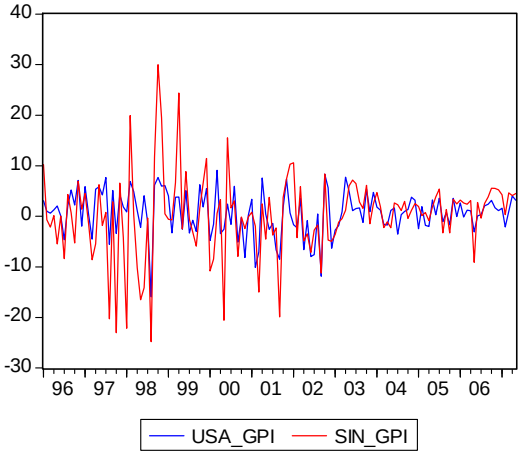
US vs. Korea



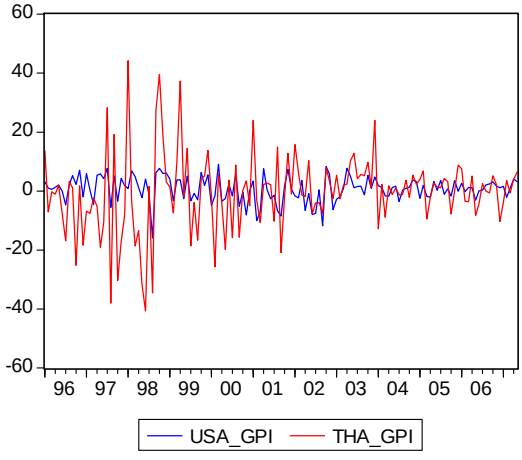
US vs. Malaysia



US vs. Philippines



US vs. Singapore



US vs. Thailand

Because the financial cycles for Indonesia, Philippines and Singapore are shifted backwards, the results indicate that the US financial cycle is most synchronized with the financial cycles of these three countries when they are considered to be leading the US financial index. This result is of course contrary to what we expect of the relationship between the financial markets of the US and the emerging countries, but this can be explained by the role of the expectation of financial markets. That means that the financial markets of these emerging countries are not driven by their own real conditions, but are speculative markets, which try to expect the financial cycle of the US. This point can be outlined by the high volatility in financial indices in emerging countries comparing to the US (see Figure 1).

The main conclusion of these results is that financial markets of emerging countries are speculative ones. This conclusion follows from two results found in the study:

- there is no relationship between financial and real cycles in these countries; and
- the financial markets of these countries are leading the US financial market or have no relationship with it; so these markets work as expecting markets.

But we have to see if these markets are strictly speculative ones, or if they have a link with the real cycle. So, in the next subsection, we are to going to study the link between the financial cycle of emerging countries and the real cycle of the US.

3.5 The concordance between real cycle of the US and the financial cycle of each emerging country

Table 7 presents the descriptive statistics of regime variables based on the growth rates of the global price indices of the countries analyzed.

The correlation between the financial cycle of each emerging country and the real cycle of the US is moderately sized only for Indonesia and the Philippines. The financial cycles of Korea, Malaysia and Singapore show a very low correlation with the real cycle of US. The Thailand financial cycle, on the other hand, posted a negative correlation with the US real cycle.

Table 7. Descriptive Statistics of Regime Variable from Production Index of US and Global Price Index of Each Emerging Country (Common Sample with US)

Emerging Markets	mu_EC[a]	mu_US[b]	std_EC[a]	std_US[b]	Pairwise Correlation[c]
Indonesia	0.412	0.160	0.494	0.368	0.335
Korea	0.561	0.154	0.498	0.363	0.061
Malaysia	0.081	0.154	0.274	0.363	0.037
Philippines	0.496	0.162	0.502	0.370	0.351
Singapore	0.423	0.154	0.496	0.363	0.044
Thailand	0.163	0.154	0.371	0.363	-0.188

[a] Based on financial index of an emerging country
[b] Based on production index of the US
[c] Pairwise correlation between the regime variables from the production index of US and financial index of an emerging country

Assessing the significance of the relationship between the series leads to Table 8, which shows that only the Philippine financial cycle is synchronized with the US real cycle. On the other hand, the Thailand financial cycle has a negative significant correlation with the US real cycle. This indicates that the Thailand financial cycle is counter-cyclical with the US real cycle.

Moving on to determine significant synchronization between the US real cycle and lagged financial cycles of emerging countries, Table 9 presents the result of the robust test with the US real cycle as point of reference.

For Korea, Malaysia and Singapore, there is evidence that the financial market of these countries is disconnected or non-synchronized with the US business cycle.

Table 8. Degree of Concordance and Test-Statistic Value for the Test for Strong Non-Synchronization between Production Index Cycles of the US and Global Price Index of each Emerging Country (Point of Reference is the US Cycle)

Emerging Markets	Concordance Index	Concordance Assuming Independence	Standard t - statistic	Robust t - statistic
Indonesia	0.681	0.560	3.840	1.738
Korea	0.480	0.458	0.670	0.500
Malaysia	0.797	0.789	0.413	0.296
Philippines	0.632	0.503	4.025	2.123
Singapore	0.569	0.553	0.485	0.340
Thailand	0.683	0.733	-2.110	-2.516

The test for strong non-synchronization between the US real cycle and lagged financial cycle of Indonesia shows that the highest significant robust t-statistic is for the case when the financial cycle of Indonesia is moved 5 months backward. This indicates that Indonesian financial cycle leads the US real cycle by 5 months. In the case of the Philippine financial cycle, the highest significant robust t-statistic corresponds to $h = -3$. Hence, the Philippine financial cycle appears to lead the US real cycle by 3 months. The lagged Thai financial cycle is still counter-cyclical with the US real cycle.

Table 9. Degree of Concordance and Test-Statistic Value for the Test for Strong Non-Synchronization between Production Index Cycle of the US and Lagged Global Price Index Cycle of each Emerging Country (Point of Reference is the US Cycle)

Emerging Markets	Concordance Index at lag -1	Robust t - statistic	Concordance Index at lag -2	Robust t - statistic	Concordance Index at lag -3	Robust t - statistic
Indonesia	0.695	2.084	0.709	2.365	0.707	2.403
Korea	0.492	0.772	0.488	0.748	0.500	1.159
Malaysia	0.795	0.288	0.793	0.280	0.792	0.272
Philippines	0.629	2.136	0.626	2.143	0.623	2.144
Singapore	0.553	-0.012	0.533	-0.404	0.512	-0.799
Thailand	0.675	-2.510	0.672	-2.499	0.686	-1.689

Emerging Markets	Concordance Index at lag -4	Robust t - statistic	Concordance Index at lag -5	Robust t - statistic	Concordance Index at lag -6	Robust t - statistic
Indonesia	0.704	2.424	0.702	2.433	0.699	2.427
Korea	0.513	1.481	0.508	1.427	0.504	1.341
Malaysia	0.790	0.263	0.788	0.253	0.786	0.240
Philippines	0.619	2.139	0.616	2.130	0.613	2.122
Singapore	0.525	-0.518	0.555	0.276	0.551	0.239
Thailand	0.700	-0.740	0.714	-0.151	0.712	-0.172

Emerging Markets	Concordance Index at lead+1	Robust t - statistic	Concordance Index at lead +2	Robust t - statistic	Concordance Index at lead +3	Robust t - statistic
Indonesia	0.667	1.576	0.653	1.378	0.636	1.141
Korea	0.472	0.191	0.463	-0.134	0.451	-0.477
Malaysia	0.797	0.296	0.797	0.295	0.795	0.282
Philippines	0.619	1.856	0.605	1.520	0.605	1.532
Singapore	0.585	0.670	0.602	0.965	0.623	1.244
Thailand	0.691	-2.517	0.699	-2.515	0.705	-2.513

Emerging Markets	Concordance Index at lead +4	Robust t - statistic	Concordance Index at lead +5	Robust t - statistic	Concordance Index at lead +6	Robust t - statistic
Indonesia	0.620	0.884	0.600	0.603	0.597	0.632
Korea	0.455	-0.442	0.458	-0.364	0.429	-0.971
Malaysia	0.793	0.267	0.792	0.249	0.773	-0.615
Philippines	0.605	1.540	0.605	1.543	0.605	1.543
Singapore	0.645	1.477	0.650	1.490	0.655	1.471
Thailand	0.711	-2.508	0.717	-2.500	0.723	-2.488

4 Conclusion

In the logic of international portfolio diversification, among the Southeast and the central Asian countries, three groups of countries must be distinguished:

- Indonesia, Philippines and Singapore, for which the financial markets do not depend on the local real conditions (or very slightly for Singapore) but which on the other hand depend on the American financial market. However this dependence with respect to the American market does not remove all their interest in diversification term insofar as they present a significant lead compared to the US financial market. In this case, the investor can apply a geographical strategy of rotation;
- Korea and Malaysia which are not dependent with the local real conditions, with the US financial market, or even with the US real conditions. In this case, the investor can use these financial markets to apply a strategy of diversification in purely speculative matter;
- Thailand which, like the other countries, does not present a link with its real economy while presenting a link with the US financial market and real US economy but in counter-cyclical nature. In this case, the investor can use this market in a simple logic of diversification. In any event, these markets remain speculative insofar as they are not anchored to their own real economy and thus what prevents the definition of a diversification strategy based on a country approach. One can then wonder whether a diversification strategy based on a sectoral approach is possible. However to answer this question, precise sectoral data (both real and financial) are essential but those available still remain insufficient.

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Appendices

Table A1. List of Variables and their Descriptions

Variable name	Description	Coverage
IND_GPI	Growth rate of the global price index in Indonesia	Aug 1996 – May 2007
KOR_GPI	Growth rate of the global price index in Korea	Jan 1996 – May 2007
MAL_GPI	Growth rate of the global price index in Malaysia	Jan 1996 – May 2007
PHI_GPI	Growth rate of the global price index in Philippines	Aug 1996 – May 2007
SIN_GPI	Growth rate of the global price index in Singapore	Jan 1996 – May 2007
THA_GPI	Growth rate of the global price index in Thailand	Jan 1996 – May 2007
USA_GPI	Growth rate of the global price index in USA	Jan 1996 – May 2007
IND_GPI_REG	Regime classification based on the growth rate of the global price index in Indonesia	
KOR_GPI_REG	Regime classification based on the growth rate of the global price index in Korea	
MAL_GPI_REG	Regime classification based on the growth rate of the global price index in Malaysia	
PHI_GPI_REG	Regime classification based on the growth rate of the global price index in Philippines	
SIN_GPI_REG	Regime classification based on the growth rate of the global price index in Singapore	
THA_GPI_REG	Regime classification based on the growth rate of the global price index in Thailand	
USA_GPI_REG	Regime classification based on the growth rate of the global price index in USA	
IND_PROD	Growth rate of the production index in Indonesia	Jan 1996 – Feb 2007
KOR_PROD	Growth rate of the production index in Korea	Jan 1996 – Feb 2007
MAL_PROD	Growth rate of the production index in Malaysia	Jan 1996 – Feb 2007
PHI_PROD	Growth rate of the production index in Philippines	Feb 1998 – Jan 2007
SIN_PROD	Growth rate of the production index in Singapore	Jan 1996 – Feb 2007
THA_PROD	Growth rate of the production index in Thailand	Jan 1996 – Feb 2007
USA_PROD	Growth rate of the production index in USA	Jan 1996 – Mar 2007
IND_PROD_REG	Regime classification based on the growth rate of the production index in Indonesia	
KOR_PROD_REG	Regime classification based on the growth rate of the production index in Korea	
MAL_PROD_REG	Regime classification based on the growth rate of the production index in Malaysia	
PHI_PROD_REG	Regime classification based on the growth rate of the production index in Philippines	
SIN_PROD_REG	Regime classification based on the growth rate of the production index in Singapore	
THA_PROD_REG	Regime classification based on the growth rate of the production index in Thailand	
USA_PROD_REG	Regime classification based on the growth rate of the production index in USA	

Table A2. Estimates for the Univariate MSAR Models of Growth Rate of Production Index

Country	**Indonesia**	**Korea**	**Malaysia**	**Philippines** *		**Singapore**	**Thailand**	**USA**
Model	**MSIH-AR(12)**	**MSIH-AR(12)**	**MSIH-AR(12)**	**MSA-AR(12)**		**MSI-AR(12)**	**MSIH-AR(12)**	**MSI-AR(12)**
Intercepts								
ν_1	-2.363	-10.754	-0.050	2.362		-13.985	-1.830	-0.836
ν_2	1.958	1.750	1.376			3.178	2.598	0.524
Autoregressive Parameters				Regime 1	Regime 2			
α_1	-0.352	-0.546	-0.338	-0.301	-0.418	-0.683	-0.389	-0.270
α_2	-0.203	-0.199	-0.014	-0.242	-0.455	-0.444	-0.164	-0.131
α_3	-0.091	0.032	0.091	0.046	-0.356	-0.081	0.071	-0.084
α_4	-0.081	0.082	0.014	-0.060	-0.785	-0.089	0.071	-0.059
α_5	-0.077	0.131	0.146	-0.086	-0.461	-0.120	-0.071	-0.036
α_6	-0.089	0.204	0.077	-0.030	-0.490	-0.182	-0.032	-0.014
α_7	-0.055	0.179	-0.045	0.219	-0.456	-0.216	-0.008	-0.026
α_8	-0.050	-0.101	0.013	-0.068	-0.106	-0.229	0.069	-0.063
α_9	-0.053	-0.311	-0.071	-0.408	0.183	-0.055	0.082	-0.070
α_{10}	-0.017	-0.366	-0.047	0.002	-0.167	-0.139	-0.064	-0.112
α_{11}	0.105	-0.214	-0.110	0.096	-0.278	-0.238	-0.100	-0.185
α_{12}	0.478	0.252	0.540	0.159	0.696	0.153	0.496	0.672
Standard errors								
σ_1	9.795	3.562	3.561		2.575	5.679	2.110	0.682
σ_2	1.635	3.405	0.089				3.373	
Duration of regimes								
contraction	2.57	1.00	7.00	3.76		1.00	1.27	6.40
expansion	3.21	17.03	1.86		2.81	10.09	1.45	33.66

* The model used for the Philippines is one where the autoregressive parameters are regime-dependent, but the intercept and standard error are not.

Table A3. Estimates for the Univariate MSAR Models of Growth Rate of Global Price Index +

Country	**Indonesia**	**Korea**	**Malaysia**	**Philippines**	**Singapore**	**Thailand**	**USA**
Model	MSIH-AR(9)	MSIH-AR(12)	MSI-AR(12)	MSIH-AR(11)	MSIH-AR(11)	MSI-AR(11)	MSI-AR(4)
Intercepts							
ν_1	-5.600	1.140	-20.728	-6.372	-1.433	-27.981	-2.761
ν_2	7.111	2.129	1.777	6.598	1.445	2.961	2.381
Autoregressive Parameters							
α_1	-0.110	0.282	0.051	-0.089	0.105	-0.172	-0.149
α_2	-0.261	-0.089	0.065	-0.228	0.148	0.032	-0.115
α_3	-0.187	0.039	-0.153	-0.294	-0.102	-0.132	-0.112
α_4	-0.110	-0.171	-0.114	-0.190	0.064	-0.234	-0.235
α_5	-0.124	0.002	0.069	-0.209	-0.026	-0.209	
α_6	0.007	-0.103	-0.146	-0.067	0.065	0.106	
α_7	-0.180	-0.087	0.080	-0.203	0.142	0.013	
α_8	-0.078	0.001	-0.192	-0.139	0.050	-0.200	
α_9	-0.185	-0.061	0.085	-0.113	-0.092	-0.027	
α_{10}		0.050	-0.107	-0.152	-0.117	-0.102	
α_{11}		-0.041	-0.182	-0.219	-0.116	-0.253	
α_{12}		-0.204	-0.138				
Standard errors							
σ_1	12.217	14.043	6.200	8.904	11.678	8.953	5.602
σ_2	6.352	3.733		5.642	2.355		3.066
Duration of regimes							
Contraction	11.09	12.81	2.33	27.09	8.44	3.88	12.18
Expansion	17.74	10.41	28.94	50.05	10.96	53.31	36.18

+ The models presented here are chosen based on the Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HQ) and Schwarz Criterion (SC).