



OSIPP Discussion Paper : DP-2014-E-008

East Asian Financial Cycles:
Asian vs. Global Financial Crises

November 12, 2014

Akira Kohsaka

Professor, School of International Studies, Kwansei Gakuin University

Jun-ichi Shinkai

Specially Appointed Researcher, Osaka School of International Public Policy, Osaka
University

[Keywords] Business cycles, Financial Conditions Index (FCI), Asian Financial Crisis, Global Financial Crisis, East Asia

[JEL code] E32, E42, E44

[Abstract] We examine the role of financial shocks in business cycles in general and in financial crises in particular in East Asia (Indonesia, Korea, Malaysia and Thailand) since the 1990s. Estimating a Financial Conditions Index, we found that financial shocks explain most of business downturns in all the economies in the Asian Financial Crisis (AFC) in 1997-98, but that the effects of financial shocks are diverse across economies in the Global Financial Crisis (GFC) in 2008-09. In the GFC, the financial shocks played a relatively minor role in Indonesia, Malaysia and Thailand, while it played a similarly dominant role in Korea. Among individual financial channels, risk factors related to volatile external financial inflows were most significant in all the economies in the AFC and in Korea in the GFC.

Corresponding author: Akira Kohsaka, E-mail: kohsaka@kwansei.ac.jp. Kwansei Gakuin University. We gratefully acknowledge financial support from JSPS Grant-in-Aid for Challenging Exploratory Research (23653067). We are grateful to the attendees in 2013 JEA spring Meeting and in the 14th EAEA conference for their useful comments.

1. Introduction

The collapse of Lehman Brothers triggered sudden stops of financial flows to advanced economies even without the *original sin*, and then their resulting recession spilled over to emerging markets and other developing countries as well. Literature has discussed two types of transmission channels of international business cycles, i.e. through trade and financial flows. Particularly, in the latter, increased risk aversion causes sudden stops and/or capital flow reversals (Milesi-Ferretti and Tille, 2010), accompanying liquidity shortage and falling asset prices as well as decreases in credit supply (Cetorelli and Goldberg, 2010, Chudik and Frantzsher, 2011, Lane and Milesi-Ferretti, 2011).

The magnitude of the spillovers to peripheral economies depends on their macro-financial and other conditions. The larger, for example, the credit expansion and/or asset price increases before the crisis, the stronger the spillover through financial channels (Berkmen et al., 2009, Lane and Milesi-Ferretti, 2011, and Llaudes et al., 2010).

It is well known that East Asia, particularly Indonesia, Korea, Malaysia and Thailand, experienced one of the worst sudden stops together with harsh output losses during the Asian Financial Crisis (AFC) in 1997-98. Despite the above significant spillover effect of the Global Financial Crisis (GFC), however, East Asia appears to be least affected among peripheral economies. In fact, IMF (2012) argues that some emerging market economies including East Asia proved to be resilient against the GFC because of their policy frameworks and their policy space for monetary and fiscal stimulus.

The purpose of this paper is to examine how precisely different are the role of financial channels in explaining business cycles of East Asia between these two crises. We construct a Financial Condition Index (FCI) to summarize the impact of financial shocks on business cycles in these countries. Focusing on recessions, which include economic crises such as the AFC and the GFC, we show how *financial* some cycles are. That is, some business cycles led dominantly by financial shocks can be called as *financial cycles*. Furthermore, we clarify which financial market such as credit, stock, bond, property, and foreign exchange markets plays a leading role in financial cycles. Credit supply, asset prices, interest rates and exchange rates interact one another, of course. We try to disentangle their interdependence and to identify which financial market plays a leading role in impacting real economic activity in the four economies in the recent period.

We will show that the AFC was a financial cycle and literally a financial crisis in that it was a recession caused dominantly by financial shocks in all the four economies in East Asia. But it is not the case for the GFC when global shocks played a significant role. We will show this by looking at the role of financial shocks in business cycles in East Asia since the 1990s. Among individual financial markets, the foreign exchange market and the stock market are shown to play dominant roles to generate recessions in the four countries throughout the previous two decades. Particularly, it will be suggested that the exchange rate has reflected changes in risk perception rather than in

relative prices.

Below, in Section 2, we briefly discuss our methodology, a VAR model and data used to estimate a FCI. Estimating the VAR model, Section 3 shows the results of estimated impulse response functions and the variance decomposition of the real economic growth. In Section 4, we show the estimated results on the impact of the FCI, and the individual financial markets as well as global shocks on business cycles, and discuss how different are the roles of financial shocks in the two crises in East Asia. Finally, Section 5 concludes.

2. Estimation Methodology

2.1. Methodology

FCI is an index for financial conditions, which combine the impacts on the real economy of financial variables such as interest rates, asset prices, and exchange rates. As a broader measure of financial conditions, the FCI is used to predict business cycles and measure the impact of financial conditions on the real economy.¹

To construct an FCI, weights of financial variables need to be estimated.² We follow a VAR method in Swiston (2008) to construct FCI in this paper.³ First, we estimate a VAR model with financial variables and real GDP and then calculate structural shocks of the financial variables. Second, by combining the estimated financial shocks and the parameters of the impulse responses as weights, an FCI is constructed as follows:

¹ The Bank of Canada first constructed the Monetary Conditions Index (MCI) as a weighted average of exchange rate and short term interest rate with a macroeconomic model in order to show a monetary policy stance. Then the MCI was expanded to include additional financial variables such as a long term interest rate, a stock price, a real estate price and so on, and became an FCI.

² In prior studies, three types of methods had been used. They are a large-scale macroeconomic model (Beaton et al. 2009), reduced-form aggregate-demand equations such as IS and Phillips curves (Gauthier et al., 2004; Goodhart and Hofmann, 2001; Montagnoli and Napolitano, 2004), and a VAR model (Gauthier et al., 2004; Goodhart and Hofmann, 2001; Guichard et al., 2009). Regressing financial variables on the real economy, these methods use their relative impacts as weights.

Recently, there are two new methods that are a dynamic factor model (DFM) method (English et al., 2005; Hatzius et al., 2010; Matheson, 2011) and a Swiston's VAR method using impulse response function as weights (Beaton et al., 2009; Duttagupta and Barrera, 2010; Shinkai, 2012; Swiston, 2008), both of which are more dynamic in setting the weights.

³ Swiston's VAR method has two advantages. First, we can avoid an endogeneity problem. Since financial market and real economic variables are essentially endogenous, if we assume that the financial variables are exogenous in the estimation model for FCI, the estimators would be biased. Second, because the parameters of impulse responses are used as weights, we can analyze dynamic responses of the real economy to financial shocks.

$$FCI_t = \sum_{j=1}^m \left(\sum_{i=0}^n w_i^j u_{t-i}^j \right)$$

where w_i^j is a parameter for an i quarters-lagged impulse response of the real GDP growth rate to a shock of a financial variable j and u_{t-i}^j is a structural shock of a financial variable j in period t . Namely, FCI_t is a combination of impulse response parameters multiplied by shocks across time lags. In this paper, assuming that financial shocks persist for two years (eight quarters), we set 8 lags for the FCI.

2.2. Data

For the FCI, we select representative financial variables in view of their availability, the usage in prior studies and the statistical significance of the impulse responses of real GDP growth to their shocks. Here, we use five financial variables, i.e. credit volume, stock price, property price, exchange rate and short-term interest rate.

We use real credit to the private sector by financial institutions as credit volume for the credit market⁴ and a stock price index as stock price for the corporate stock market both from IMF's International Financial Statistics (IFS). As property price, we use a land price for Indonesia, a housing price for Korea, and a combined land and housing price for Thailand from the CEIC database. A housing price is available for Malaysia, but only after 1999, so that we drop it. Also, we use a real effective exchange rate as exchange rate and a money market rate for a short-term interest rate from the IFS and the Bank for International Settlements (BIS).

As variables for the real economy, we use a real GDP growth and CPI inflation from the IFS and Abeyasinghe and Rajaguru (2004). A crude oil price (West Texas Intermediate (\$)) downloaded from the IFS is included simply to avoid the "price puzzle" (Sims (1992)). Finally, in order to exclude the impact of common global shocks, we add the real GDP growth of the United States and her Federal Fund rate in our estimation.

2.3. VAR Model

In this subsection, we estimate a VAR model with 10 variables (oil price, US GDP growth, US Federal Fund (FF) rate, real effective exchange rate, short-term interest rate, credit volume, stock price, property price, inflation, real GDP growth) for Indonesia, Korea, and Thailand and a 9 variable VAR model without property price for Malaysia. We use quarterly data over the periods from

⁴ Prior studies such as Lown and Morgan (2006) and Bayoumi and Melander (2008) use lending attitudes of financial institutions instead of credit volume, because the former better reflects demand and supply conditions of the credit market. We use credit volume simply due to the data availability for the sample countries, while it is available since 2002 in Korea.

1994Q1 to the most recent available one, which are 2011Q2 for Indonesia, 2010Q4 for Korea, 2011Q4 for Malaysia and 2011Q2 for Thailand.

Structural shocks and impulse responses of the financial variables are calculated using the Cholesky decomposition, when the order of variables in VAR is important. We place, first, US GDP growth, the FF rate and the oil price as the most exogenous because it would be least affected by the financial conditions and business cycles in the four countries. Then, since our goal is to examine the effects of shocks through financial channels on the real GDP growth, the next are the financial variables and the last are the real economic variables, assuming that they are most endogenous. Among the financial variables, the first is real exchange rate because it is affected mostly by the international economic environment, and the next the short-term interest rate because it is expected to be significantly affected by the central bank—although it is not a policy rate itself. And then follow credit volume, the stock price and the property price which are affected by the domestic business cycles.

All the variables are seasonally adjusted and short-term interest rate, credit volume, stock price and property price are deflated by CPI. The Augmented Dicky-Fuller and the Phillips-Perron tests show all the variables as I(1), so that we take their log differences except for the interest rate. The AIC shows that 1 lag is appropriate for the VAR model.

3. Estimation Results 1: Impulse responses and variance decomposition

3.1. Impulse responses

Figure 1 shows the impulse responses of the real GDP growth to financial shocks in the four countries estimated over each sample period. Central solid lines stand for dynamic responses of the GDP growth and upper and lower dotted lines for confidence bands with one standard error, calculated by the Monte Carlo Integration.

>>**Figure 1 around here**

Expected effects of financial shocks on the GDP growth are generally as follows. First, a shock of real exchange rate appreciation decreases the real GDP growth through expenditure switching between domestic and foreign goods. Second, a positive shock of the stock price increases the real GDP growth by stimulating domestic investment as well as consumption. Third, a positive shock of the short-term interest rate puts a brake on the GDP growth by constraining investment and durable consumption. Finally, both a property price increase and a positive shock in credit volumes increase the GDP growth by stimulating investment through increased collateral values in the former and through reduced credit constraints in the latter.

As Figure 2 shows, however, these expected effects are sometimes not ensured in the four countries in practice. Let us discuss individual cases. First, the real exchange rate appreciation has a

positive, instead of negative, effect on the GDP growth in all the four cases and it is very significant. One possible interpretation of this paradoxical result is that the effect picks up the impact of actual and possible sudden stops of foreign financial inflows to these economies rather than expenditure switching or that the former overwhelms the latter. This effect appears to reflect changes in risk perception so that real exchange rate depreciation (appreciation) is a proxy for increasing (declining) risk aversion. In fact, currency depreciation often happens simultaneously with sudden stops of financial inflows and resulting output decline in these countries.

Second, positive shocks of the stock price, property price and credit volume show more or less significantly positive impacts on the GDP growth as expected. Third, the expected negative impacts of short-term interest rates are sometimes found only with lags. Indeed, impulse responses of the GDP growth to the short-term interest rate are unstable across time and country.

To sum, the estimated impulse responses are mostly usual as far as domestic financial variables are concerned, but those of real exchange rates and part of short-term interest rates in the very short run show some features specific to small open emerging market economies susceptible to possible sudden stops of foreign financial flows. In the next section we use these estimated impulse response functions to discuss the relative role of financial shocks in financial crises as extreme cases of business cycles.

3.2. Variance decomposition

Before discussing the role of financial shocks in business cycles, we show the results of the variance decomposition of forecast errors on the real GDP growth over the whole sample period. The values in Table 1 show (average) relative contributions of the financial variables and other global variables to forecast error variances of the real GDP growth at the 10th quarter after a shock.

>>**Table 1 around here**

In the case of Indonesia, in explaining the GDP growth variance, the (paradoxical) real exchange rate shock contributes more than the own shock, then followed by the short-term interest rate shock. Other financial variables, i.e. credit volume, stock price and property price, as well as global variables are minor contributors, explaining as little as 2-3 % of the total variance each.

In the other three countries, the real exchange rate shock also explains a significant part of the total variance of the GDP growth, but it is less than that of the own shock. Other financial variable shocks play a part, i.e. a short-term interest rate shock in Indonesia and Thailand, and a stock price shock in Korea and Malaysia. Credit volume and property price shocks are relatively minor contributors to the variance of the GDP growth. Note, further, that global shocks through US GDP and FF rate also contribute to growth variances of these economies to a non-negligible degree.

To sum, our impulse response estimates suggest major roles of the real exchange rate, the short-term interest rate and the stock price shocks in generating business cycles, and then a secondary role of global shocks, but minor ones of the credit volumes and property price shocks

throughout the sample period in the four countries. Note that, since we use ex post credit volumes for the credit market, the VAR model may fail to capture credit supply shocks, so that the role of the credit market for business cycles may be understated.

4. Estimation Results 2: Financial Cycles in East Asia

Now, using the VAR results obtained in the previous subsection, we calculate the FCI by combining the estimated exogenous shocks of the financial variables with their impacts on the real GDP growth, i.e. the estimated parameters of the impulse responses, as weights. Namely the FCI measures the total effect of exogenous financial shocks on the real GDP growth.

4.1. Casual observations

Figure 2 shows the FCI calculated as above and the actual GDP growth. Both are expressed in four-quarter moving averages. Shadowed periods in the Figure represent recessions or contraction phases (from peak to trough) of business cycles, where peaks and troughs are identified by applying the method of Harding and Pagan (2002). Estimated recession periods and their characteristics such as duration, amplitude, slope and average growth rate, are given in Appendix Table 1.

>>Figure 2 around here

The FCI in Figure 2 demonstrates the role of financial shocks in the business cycles quantitatively. Their positive (negative) values mean positive (negative) impacts on the real GDP growth. Among some recession periods, let us focus on two crisis periods, i.e. the Asian Financial Crisis (AFC) in 1997-98 and the Global Financial Crisis in 2008-09.

Casual observation shows apparently very close movements between actual GDP growth rates and FCIs in all the four countries in the case of the AFC. This implies that the AFC was driven dominantly by financial shocks, i.e. the AFC was a *financial cycle*. Then, if we turn to the GFC, we see some close movements between the two series in the case of Korea and Malaysia, to a less degree in Thailand and none in Indonesia, suggesting that the GFC is not a financial cycle at least in Indonesia, and probably in Thailand.

As a matter of fact, when we look at not only crisis periods, but also other recession episodes in Figure 2, we find diverse roles of financial shocks in affecting the real GDP growth. For example, in Indonesia, the negative FCI in the recession in 2005-06 was as large as that in the GFC, but the real economic activity was not affected much. In Malaysia, the FCIs in the 2000-01 recession appeared larger than that in the GFC, whereas the former recession appeared fairly financial but the latter did not. Only in Korea, the FCI in the GFC was almost as large as that in the AFC, while the FCIs in the 2000-01 (dot-com) recession and in the 2002-04 (credit-card scandal) recession were comparably large.

4.2. Cumulative effects of financial shocks

Now, beyond casual observation, we try to quantify FCIs relative to actual GDP growth in Table 2. The first two columns in Table 2 show the amplitude of actual GDP growth from peak to trough and the cumulative total effect of financial shocks, i.e. cumulative FCI during identified recessions including the two crisis periods. In all the four countries, the FCI dominated actual (negative) GDP growth in the AFC. In contrast, in the GFC, the FCI was significantly smaller than actual negative GDP growth in Malaysia and Thailand, and GDP slowdown itself was small in Indonesia, while the FCI overwhelmed actual negative growth in Korea.

>>Table 2 around here

The other five columns represent the cumulative effects of individual financial variables on the GDP growth. We can summarize what Table 2 suggests as follows:

In Indonesia, the short-term interest rate played the most dominant role generating a financial cycle in the AFC. In fact, the impact of this factor (-6.0%) was almost as large as the total economic slowdown (-6.2%). It probably reflected not only the degree of monetary tightening, but also increased risk premium in the market. While Indonesia witnessed a negative GDP growth in the GFC, the slowdown (-0.5%) was limited in scale, which was smaller than that in the 2001 recession. In the GFC, the real exchange rate played a relatively dominant role (-1.9%) larger than that (-0.5%) in the AFC, reflecting increased risk aversion. Similarly, real depreciation shocks played a relatively major role impacting on the GDP growth in the 2005-2006 recession.

Korea was among the hardest hit by the AFC and the deterioration of her FCI (-10.5%) explained more than a real economic slowdown (-3.6%). Major contributors to the slowdown were stock prices (-5.0%) and the real exchange depreciation (-4.8%). In contrast to the other three countries, only Korea experienced a harsh deterioration of the FCI (-6.3%) again in the GFC. Then, the major individual contributor is the real exchange depreciation first (-5.7%). In two other recession episodes in the early 2000s, financial shocks in terms of the FCI were -3 to -6 %, which were larger than actual cumulative GDP growths and the stock price contributed most to drive down the real growth.

Both Malaysia and Thailand suffered from harsh slowdown in the GDP growth (around -5%) in the AFC, whose main drivers were the real exchange depreciation, the short-term interest rate, and the stock price. In contrast to the AFC, even though they suffered from the GFC in terms of GDP growth (-3.4% each), financial variables were not major contributors to the slowdown, when the stock price drove down the GDP growth to some extent but financial risks did not work out this time. In other recession episodes in the early 2000s, the stock price mostly contributed to real growth slowdown.

To sum up, while the slowdown in actual GDP growth was relatively smaller in the GFC than that in the AFC, the role of financial variable shocks was very different in the two Crises. The AFC was a

financial cycle where the financial risk proxied by the real exchange depreciation and/or the short-term interest rate had an overwhelming negative impact on the GDP growth in all the four countries. Whereas, the GFC did NOT cause a financial cycle in Indonesia, Malaysia and Thailand, and only Korea suffered from similar impact to that in the AFC. The impact of the GFC spilled over to Korea, Malaysia and Thailand, but not very much to Indonesia. The FCI or the total effect of financial shocks on the GDP growth showed relatively minor contribution to real economic slowdown in Malaysia and Thailand. The GFC caused a financial cycle only in Korea.

As to the relative role of individual financial variables, the stock price is an important financial channel second to the risk factor across the four countries in the two crises. In the case of other recession episodes in the 2000s, however, our results suggest that the stock price turns out to be most dominant financial channel to affect real economic slowdown in the four countries.

5. Global Shocks

So far, we focused on the effects of financial shocks on the real economy. But, emerging economies have been susceptible to business cycles in advanced economies. Particularly in the GFC business cycles of emerging economies are pointed out to be highly correlated with those of advanced economies (IMF, 2013). Accordingly, in this section, we focus on the shocks of global variables and examine their impact on East Asia together with FCI.

Looking at impulse responses (Figure 3), a US GDP shock has significantly positive impact on GDP growth in East Asia except for Indonesia. It persists less than half a year, though. FF rate shock has significantly negative instantaneous impact in Indonesia, Korea and Malaysia, but significantly positive impact after the shock in Korea and Malaysia. The variance composition (Table 1) shows that US GDP shock explains 0.5%, 7.3%, 9.3% and 9.2% of variations in GDP growth in Indonesia, Korea, Malaysia and Thailand, respectively, while FF rate shock explains 3.3%, 8.4%, 4.5% and 0.8% each. This suggests that US GDP shock is relatively strong in Korea, Malaysia and Thailand, while FF rate shock is relatively strong in Korea and Malaysia.

>>Figure 3 around here

Figure 4 demonstrates the effect of global shocks together with FCI. It shows that, while global shocks did not influence much (or even positively affect) on GDP growth in the AFC, they depressed it in the GFC. In fact, Table 3 shows that their cumulative effects are -0.63%, 2.06%, -0.69% and 4.97% in Indonesia, Korea, Malaysia and Thailand in the AFC, while they are 0.02%, -1.44%, -2.08% and -2.16% in the GFC. In contrast to the AFC, negative global shocks are larger in the GFC in East Asia, particularly in Korea, Malaysia and Thailand, whose cumulative effects are as large as 60% of total shocks. Exception is Indonesia, where global shocks are small throughout the whole

period. Looking into the global shocks in the GFC, negative impacts come mainly from US GDP shocks, while FF rate shocks moderate negative shocks through monetary easing.

>>Figure 3 around here

>>Table 3 around here

6. Robustness Check

In this section we examine the robustness of the results of the previous sections.⁵ We have used the Cholesky decomposition to calculate financial and other shocks and impulse response functions. This method requires us to place exogenous variables before endogenous ones so that the order of variables may affect the estimation results. In the previous subsections we place global variables first, then financial variables, i.e. exchange rate, short-term interest rate, credit volume, stock price and property price, and finally real variables, i.e. inflation and real GDP growth. Here below, in order to check the robustness of our previous results, we estimate FCI using VAR models with different orders of variables within the three groups of variables as well as alternatively using the method of generalized impulse responses.

First, we estimate FCI with alternative orders of financial variables and then by placing real variables prior to financial ones. In the former, impulse responses and FCI do not change much, but the impacts of some individual financial shocks change particularly with exchange rates and short-term interest rates. This is probably because their shocks are very large in concentrated quarters so that their impacts are generally hard to be disentangled. In the latter case, FCI is estimated to be smaller as expected because financial shocks are not initially supposed to affect GDP growth, but general patterns remain the same. When using generalized impulse responses, impulse responses, FCI and individual effects all show the similar patterns to those in the previous sections.

We next examine alternative global variables. In previous sections we include US GDP and the Federal Fund (FF) rate as global shocks. Here, we use GDP-weighted averages of G6 advanced countries GDP and interest rates of France, Germany, Italy, Japan, UK and US. Instead of interest rates, we also use stock prices (US and G6) as controls. The results show patterns generally similar to the previous results, while the effects of stock price shocks in the GFC become a little weaker. All in all, we conclude that our examination on the order of variables and the use of alternative global variables show the robustness of our estimation results in the previous sections.

7. Concluding Remarks

⁵ The results are provided upon request.

We have examined the role of financial shocks in business cycles in general and in financial crises in particular in East Asia (Indonesia, Korea, Malaysia and Thailand) since the 1990s. Estimating a Financial Conditions Index, we found that financial shocks explain most of business downturns in all the economies in the Asian Financial Crisis (AFC) in 1997-98, but that the effects of financial shocks are diverse across economies in the Global Financial Crisis (GFC) in 2008-09. In the GFC, the financial shocks played a relatively minor role in Indonesia and Thailand, while it played a similarly dominant role as in the AFC in Korea and Malaysia. Among individual financial channels, the risk factor related to volatile external financial inflows were most significant in all the economies in the AFC and in Korea and Malaysia in the GFC, while the stock market remains another main conduit of financial cycles in Korea, Malaysia and Thailand more in the AFC, but less in the GFC.

We estimated a Financial Conditions Index by constructing a VAR model to consider the impact of financial market shocks on business cycles. Even within this limited framework, we need to address a few issues to solidify our results. First, our selection of financial variables could be problematic. It is well known that credit volume sometimes fails to reflect a true demand and supply condition in the credit market, some interest rates are regulated, and exchange rates are not always market-determined. Second, our interpretation of the puzzling effect of real exchange rates may not necessarily appropriate. It may have suggested that we simply could not distinguish crisis periods from normal ones. Third, this line of argument may lead us to possible structural breaks of a VAR model. These and other problems in mind, we would like to leave them for the future research.

One other not least important and interesting point is why are this difference in responses in these countries between the AFC and the GFC. Is it really because they have become resilient in the past decade as suggested by IMF (2012) or because they have become more financially internal-oriented than in the previous decade? Korea, who has dutifully followed the IMF guidance and then the most financially open economy among the four, could suggest some good answer to the question, but we will remain to see for the future research, again.

References

- Abeysinghe, T., Rajaguru G., 2004. Quarterly Real GDP Estimates for China and ASEAN4 with a Forecast Evaluation. *Journal of Forecasting*. 23, 431-447.
- Bayoumi, T., Melander, O., 2008. Credit Matters: Empirical Evidence on U.S. Macro-Financial Linkages. IMF Working Paper. WP/08/169.
- Beaton, K., Lalonde, R., Luu, C., 2009. A Financial Conditions Index for the United States. Bank of Canada Working Paper. 2009-11.
- Berkmen, P., Gelos, G., Rennhack, R., Walsh, J.P., 2012. The Global Financial Crisis: Explaining Cross-Country Differences in the Output Impact. *Journal of International Money and Finance*. 31, 42-59.
- Cetorelli, N., Goldberg, L., 2010 Global Banks and International Shock Transmission: Evidence from the Crisis. *IMF Economic Review*. 59, 41-76.
- Chudik, A., Fratzscher, M., 2011. Identifying the global transmission of the 2007-09 financial crisis in a GVAR model. ECB working paper. 1285.
- Duttagupta, R., Barrera, N., 2010. The Impact of the Global Crisis on Canada: What Do Macro-Financial Linkages Tell Us? IMF Working Paper. WP/10/5.
- English, W., Tsatsaronis, K., Zoli, E., 2005. Assessing the Predictive Power of Measures of Financial Conditions for Macroeconomic Variables, in: BIS (Eds.), Investigating the relationship between the financial and real economy. BIS Papers. 22, 228-252.
- Gauthier, C., Graham, C., Liu, Y., 2004. Financial Conditions Indexes for Canada. Bank of Canada Working Paper. 2004-22.
- Goodhart, C., Hofmann, B., 2001. Asset Prices, Financial Conditions, and the Transmission of Monetary Policy. Paper prepared for the conference on 'Asset Prices, Exchange Rates, and Monetary Policy' Stanford University, March 2-3, 2001.
- Guichard, S., Haugh, D., Turner, D., 2009. Quantifying the Effect of Financial Conditions in the Euro Area, Japan, United Kingdom and United States. OECD Economics Department Working Paper. 677.
- Harding, D., Pagan, A., 2002, Dissecting the Cycle: A Methodological Investigation. *Journal of Monetary Economics*. 49. 365-381.
- Hatzius, J., Hooper, P., Mishkin, F.S., Schoenholtz, K.L., Watson, M.W., 2010. Financial Conditions Index: A Fresh Look after the Financial Crisis. NBER Working Paper. 16150.
- International Monetary Fund (IMF), 2008. Financial Stress and Economic Downturns. in: World Economic Outlook, October 2008. International Monetary Fund. Washington.
- International Monetary Fund (IMF), 2013, Dancing Together? Spillovers, Common Shocks, and the Role of Financial and Trade Linkages. in: World Economic Outlook, October 2013. International Monetary Fund. Washington.

- Lane, P.R., Milesi-Ferretti, G.M., 2011. The Cross-Country Incidence of the Global Crisis, *IMF Economic Review*. 59, 77-110.
- Llaudes, R., Salman, F., Chivakul, M., 2010. The Impact of the Great Recession on Emerging Markets. IMF Working Paper. WP/10/237.
- Lown, C., Morgan, D.P., 2006. The Credit Cycle and the Business Cycle: New Findings Using the Loan Officer Opinion Survey. *Journal of Money, Credit, and Banking*. 38, 1575-1597.
- Matheson, T., 2012. Financial Conditions Indexes for the United States and Euro Area. *Economics Letters*. 115, 441-446.
- Milesi-Ferretti, G.M., Tille, C. 2010 The Great Retrenchment: International Capital Flows During the Global Financial Crisis. *Economic Policy*. 26, 285-342.
- Montagnoli, A., Napolitano, O., 2004. Financial Condition Index and Interest Rate Setting: A Comparative Analysis. Working Papers 8_2005, D.E.S (Department of Economic Studies), University of Naples "Parthenope", Italy.
- Shinkai, J., 2012 Financial Linkages and Business Cycles of Japan: An Analysis Using Financial Conditions Index. *Review of Monetary and Financial Studies*. 34, 28-43.
- Sims, C.A., 1992. Interpreting the Macroeconomic Time Series Facts: The Effects of Monetary Policy. *European Economic Review*. 36, 975-1000.
- Stock, J.H., Watson, M.W., 2003 Forecasting Output and Inflation: The Role of Asset Prices. *Journal of Economic Literature*. 41, 788-829.
- Swiston, A., 2008. A U.S. Financial Conditions Index: Putting Credit Where Credit is Due. IMF Working Paper. WP/08/161.

Table 1: Variance Decomposition: Relative Contribution to real GDP growth (%)

	US GDP	FF rate	Oil price	Exchange rate	Short-term rate	Credit volume	Stock price	Property price	Inflation	Real GDP
Indonesia	0.5	3.3	6.6	41.5	14.6	2.8	1.4	2.3	4.1	22.8
Korea	7.3	8.4	2.6	14.7	0.2	4.2	19.2	0.6	0.5	42.3
Malaysia	9.3	4.5	12.7	7.8	3.0	4.3	19.4		4.3	34.7
Thailand	9.2	0.8	4.2	19.8	12.0	2.8	9.6	4.2	1.1	36.2

This table shows the results of variance decomposition that shows the relative contribution of foreign and financial shocks to real GDP growth over the whole period. We show the values of 10 quarters after a shock.

Table 2: Cumulative Effects of Financial Shocks on GDP Growth (%)

Recession	GDP growth	FCI	Exchange Rate	Short-term Rate	Credit Volume	Stock Price	Property Price
A. Indonesia							
1997:4-1998:4	-6.19	-8.21	-0.52	-5.97	-1.31	-0.22	-0.19
2001:3-2001:4	-0.81	1.89	0.22	1.12	0.33	-0.83	1.05
2003:3-2003:4	-0.05	2.19	2.72	-0.43	-1.01	0.29	0.62
2005:1-2006:2	-0.50	-3.58	-8.06	4.10	0.60	0.63	-0.85
2008:4-2009:2	-0.50	-2.17	-1.85	0.73	-0.05	-0.07	-0.92
B. Korea							
1997:3-1998:3	-3.61	-10.53	-4.76	-0.02	-0.41	-5.00	-0.34
2000:4-2001:4	-1.54	-2.93	3.37	-0.01	-0.73	-6.61	1.05
2002:3-2005:1	-1.00	-6.21	-0.75	0.00	-0.73	-3.32	-1.41
2008:2-2009:1	-2.42	-6.29	-5.66	0.02	0.34	-0.96	-0.03
C. Malaysia							
1998:1-1998:4	-4.46	-4.42	-3.89	2.12	-0.07	-2.58	
2000:4-2001:4	-2.13	-4.79	2.09	-0.54	0.43	-6.76	
2002:4-2003:1	-0.22	-0.23	-0.79	1.10	0.48	-1.03	
2004:4-2004:4	-0.69	0.53	-0.33	-0.01	0.38	0.48	
2006:2-2006:3	-0.02	-0.14	0.32	-0.12	-0.33	0.00	
2008:2-2009:1	-3.38	-1.52	0.62	-0.43	-0.32	-1.39	
D. Thailand							
1996:3-1998:3	-5.24	-10.30	2.65	-6.12	-1.06	-4.76	-1.00
2000:2-2001:3	-0.89	-1.09	-1.62	3.20	0.73	-4.02	0.62
2008:2-2009:1	-3.38	0.89	0.65	-0.32	0.09	0.35	0.12

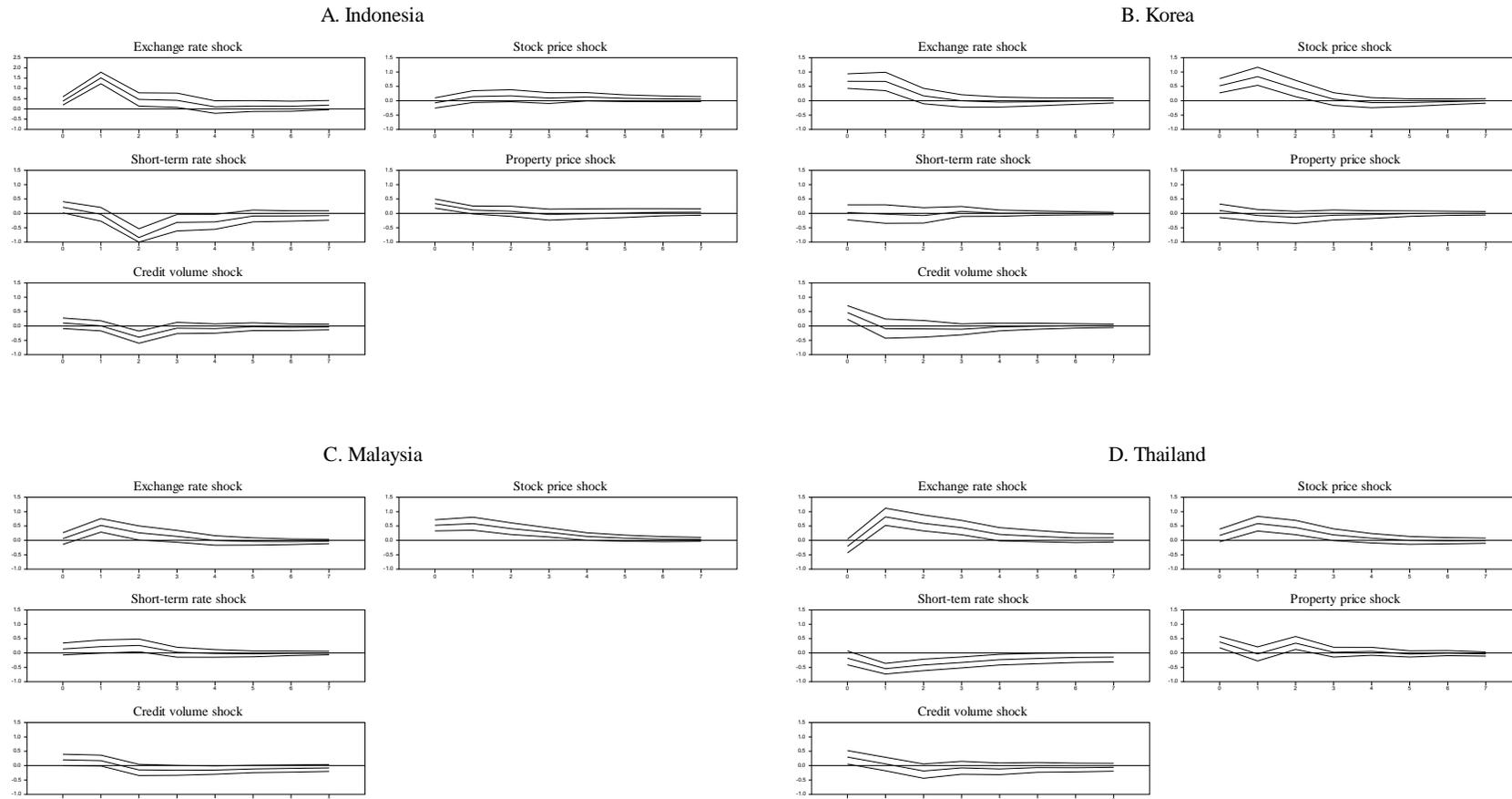
This table shows the estimated cumulative effects of financial shocks and their components on the real GDP growth during each recession. We define recession as from peak to trough on de-trended GDP, which were determined by method in Harding and Pagan (2002). Bold types show the largest negative effect in the recession. GDP growth is the amplitude of GDP growth rate from peak to trough.

Table 3: Cumulative Effects of Global Shocks on GDP Growth (%)

	GDP growth	FCI	Global shocks	US GDP	FF rate
A. Indonesia					
1997:4-1998:4	-6.19	-8.21	-0.63	-0.78	0.15
2001:3-2001:4	-0.81	1.89	-0.93	-0.14	-0.79
2003:3-2003:4	-0.05	2.19	0.14	0.22	-0.08
2005:1-2006:2	-0.50	-3.58	1.02	-0.67	1.69
2008:4-2009:2	-0.50	-2.17	-0.12	0.56	-0.68
B. Korea					
1997:3-1998:3	-3.61	-10.53	2.06	2.62	-0.56
2000:4-2001:4	-1.54	-2.93	1.90	0.84	1.06
2002:3-2005:1	-1.00	-6.21	1.59	2.50	-0.90
2008:2-2009:1	-2.42	-6.29	-1.44	-2.03	0.59
C. Malaysia					
1998:1-1998:4	-4.46	-4.42	-0.69	0.12	-0.81
2000:4-2001:4	-2.13	-4.79	3.21	0.88	2.32
2002:4-2003:1	-0.22	-0.23	0.48	-0.01	0.48
2004:4-2004:4	-0.69	0.53	-0.87	0.11	-0.98
2006:2-2006:3	-0.02	-0.14	0.81	1.24	-0.44
2008:2-2009:1	-3.38	-1.52	-2.08	-3.49	1.41
D. Thailand					
1996:3-1998:3	-5.24	-10.30	4.97	4.77	0.20
2000:2-2001:3	-0.89	-1.09	1.27	0.36	0.92
2008:2-2009:1	-3.38	0.89	-2.16	-2.44	0.28

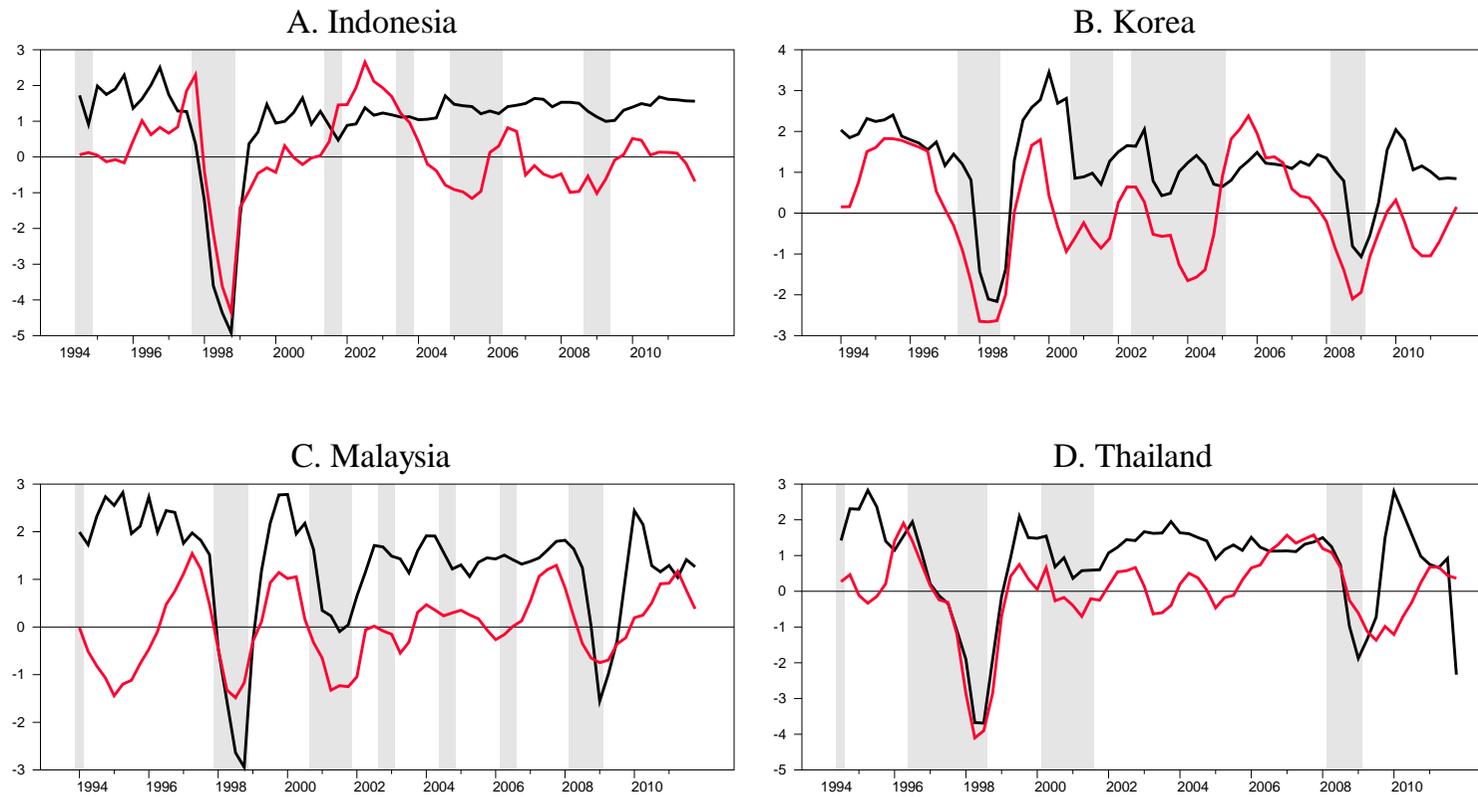
This table shows the estimated cumulative effects of global shocks and their components on the real GDP growth during each recession. We define recession as from peak to trough on de-trended GDP, which were determined by method in Harding and Pagan (2002). GDP growth is the amplitude of GDP growth rate from peak to trough.

Figure 1: Impulse Responses of real GDP growth



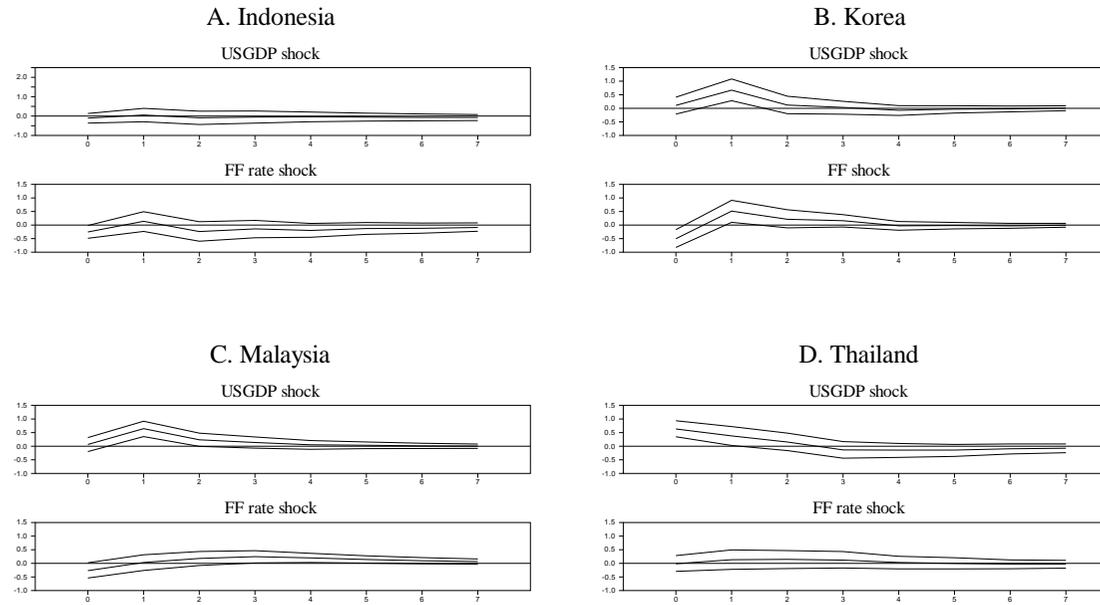
This figure shows the impulse responses of the real GDP growth to financial shocks. A solid line in the center is a point estimate of the impulse responses and top and bottom dotted lines are confidence bands with 1 standard error.

Figure 2: FCI and Business Cycles



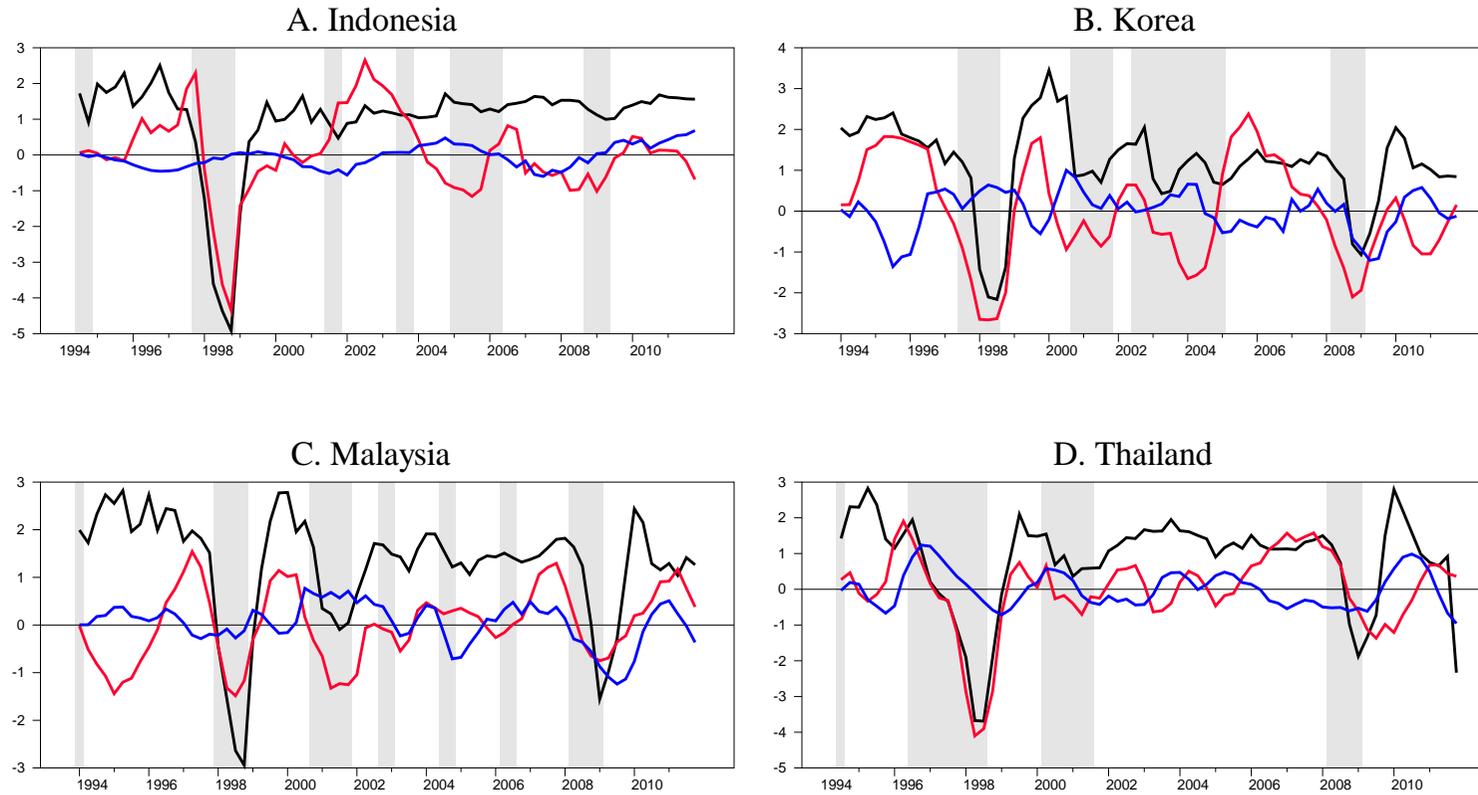
This figure shows the estimated FCI (a red line) and the actual real GDP growth (a black line), both in four-quarter moving averages. Shaded periods in the figure represent contraction phases (from peak to trough) of business cycles determined by a method in Harding and Pagan (2002). The value of FCI is a magnitude of the effect of changes in financial conditions on the real GDP growth, showing how large a positive (negative) change in financial conditions increase (decrease) the real GDP growth.

Figure 3: Impulse Responses of real GDP growth



This figure shows the impulse responses of the real GDP growth to financial shocks. A solid line in the center is a point estimate of the impulse responses and top and bottom dotted lines are confidence bands with 1 standard error.

Figure 4: FCI, Global Shocks and Business Cycles



This figure shows the estimated global shocks (a blue line), the actual real GDP growth (a black line), and FCI (a red line), all in four-quarter moving averages. Shaded periods in the figure represent contraction phases (from peak to trough) of business cycles determined by a method in Harding and Pagan (2002). The value of global shocks is a magnitude of the effects of changes in US economic conditions (real GDP and FF rate) on the real GDP growth, showing how large a positive (negative) change in US economic conditions increase (decrease) the real GDP growth.

Appendix Table 1: Contraction Phases

	Duration	Amplitude	Slope	Average
A. Indonesia				
1997:4-1998:4	5	-6.19	1.24	-2.75
2001:3-2001:4	2	-0.81	0.40	0.67
2003:3-2003:4	2	-0.05	0.03	1.12
2005:1-2006:2	6	-0.50	0.08	1.34
2008:4-2009:2	3	-0.50	0.17	1.13
B. Korea				
1997:3-1998:3	5	-3.61	0.72	-0.74
2000:4-2001:4	5	-1.54	0.31	0.94
2002:3-2005:1	11	-1.00	0.09	1.05
2008:2-2009:1	4	-2.42	0.60	-0.01
C. Malaysia				
1998:1-1998:4	4	-4.46	1.11	-1.89
2000:4-2001:4	5	-2.13	0.43	0.43
2002:4-2003:1	2	-0.22	0.11	1.58
2004:3-2004:4	2	-0.69	0.35	1.39
2006:2-2006:3	2	-0.02	0.01	1.46
2008:2-2009:1	4	-3.38	0.84	0.34
D. Thailand				
1996:3-1998:3	9	-5.24	0.58	-0.84
2000:2-2001:3	6	-0.89	0.15	0.78
2008:2-2009:1	4	-3.38	0.84	-0.22

This table shows the contraction phases (recession) defined as from peak to trough, which was determined by a method in Harding and Pagan (2002).

Recessions with the Asian financial crisis in Korea were modified because it included obvious expansion period. Duration, Amplitude, Slope and Average stand for the number of quarters in recession, a difference of growth rates between peak and trough, a GDP growth decline per quarter and the average GDP growth rate during recession, respectively.