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Equity prices as leading indicators: the Asian experience

Kenneth N Kuttner

Introduction

Formulating monetary policy inevitably requires making predictions about the economy. This has become increasingly true as central banks have moved away from policies based on the management of intermediate targets (e.g., money or exchange rates) and toward frameworks defined in terms of the ultimate policy objectives (i.e., output and inflation targets), using indicators or information variables to guide policy toward those objectives.[1] This shift is most explicit in inflation targeting (IT) regimes since, as emphasized by Svensson (1997), forecasts of output and inflation are essential ingredients in the implementation of IT – and publishing those forecasts is *de rigueur* for inflation targeters. While less explicit, economic forecasts are also central to the policy process of central banks that do not formally adhere to IT, such as the US Federal Reserve.

With monetary policy becoming increasingly forecast-based, the search for useful leading economic indicators has intensified. Much attention has been focused on the prices of assets such as stocks and bonds – including a variety of indicators derived from bond yields, such as the slope of the yield curve and risk spreads. There are good reasons to seek to extract information from asset prices: to the extent that they are forward-looking, they will reflect new information before it becomes incorporated into the macro data.

The focus of this paper is on the price of equities, which, in the case of the United States, has been seen as an important, but somewhat unreliable, leading indicator. While the stock price is included in the index of leading economic indicators published by the Conference Board, econometric analyses, such as those of Stock and Watson (1989, 2001), suggest it is not particularly helpful in out-of-sample forecasting exercises.[2] In recent years, however, stock market movements in the United States appear to have tracked macroeconomic fluctuations relatively closely, raising the possibility of a closer connection between the two. In particular, the boom of the late 1990s, the recession of 2001, and the period of robust growth that began in 2004 all appear to have been led by a corresponding movement in stock prices – and, at least until interrupted by the late-summer subprime mortgage crisis in the United States, record stock market gains seemed to point to continued economic expansion.

Similar observations could be made about equity prices among emerging market economies in Asia, where the spectacular gains enjoyed since 1998 (following the even more spectacular losses during the financial crises of 1997–98) have coincided with a period of rapid economic expansion. As shown in Figure 1, stock prices in much of emerging Asia have recovered most of the ground lost in 1997–98, with Korean equity prices even surpassing their previous peak. Stock prices have risen especially rapidly since 2003, even in Indonesia and the Philippines, where equity markets were very slow to recover from the crisis.

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[1] See Friedman (1990) for a thorough review of the targets, instruments, and indicators of monetary policy.

[2] An old joke among forecasters is that "stock prices have successfully forecast eight of the past five recessions".

Indeed, the sharp rise in stock prices has been viewed with alarm by some observers. One oft-stated fear is that the surge in the price of equities (and other assets, such as real estate) has been driven by some combination of over-borrowing and "excess liquidity" in the financial system, and that these factors will eventually contribute to another financial crisis. Collyns and Senhadji (2002), among others, have documented how such a process contributed to the crisis of 1997.

Against this background, the purpose of this paper is to investigate the information content of equity prices for a set of Asian economies. The primary focus of the analysis will be on the forecasting power of stock prices for real output growth and inflation. A secondary goal will be to determine the extent to which increases in equity prices (including the most recent rise) can be interpreted as a symptom of "excess liquidity".

The scope of the paper is intentionally narrow. It does not claim to be a systematic analysis of *all* plausible financial leading indicators, along the lines of Stock and Watson (2001). Conspicuously absent, for example, are long-term interest rates (or the yield spread), which have been found to be highly informative in the US context.[3] With liquid long-term bond markets a relatively recent development in many countries, however, data limitations preclude a rigorous quantitative analysis of indicators such as the yield spread.[4] Nor does the paper address the question of whether the monetary authority should respond to asset price fluctuations, independent of those fluctuations' implications for future macroeconomic outcomes.[5]

In its motivation and objectives, this paper is most similar to that of Mauro (1989), which examined the forecasting properties of equity prices for a large group of both developing and developed economies. There are a number of important differences, however: the present paper uses more recent data and focuses specifically on the emerging Asian experience, including two countries (Thailand and Indonesia) that did not appear in Mauro's analysis. Other differences are the inclusion in this paper of other financial indicators (such as interest rates and monetary aggregates), an analysis of stock prices' predictive power with respect to inflation, and an assessment of out-of-sample forecasting performance. In addition, this paper also examines the possible importance of "liquidity" growth in explaining stock price appreciation. A number of recent papers have examined this hypothesis in other contexts, including Baks and Kramer (1999), Gouteron and Szpiro (2005), and Rüffer and Stracca (2006).

To preview: the findings presented in section 1 show that stock prices *are* a reasonably good leading indicator for real output growth for Malaysia and Korea, and to a slightly lesser extent, Thailand. The improvement in out-of-sample forecasting performance is marginal, however, even in those countries where the in-sample relationship is strong. An analogous set of results is presented for inflation in section 2, the main conclusion of which is that stock prices contain virtually no information relevant for predicting inflation. Section 3 explores the connection between "liquidity" and stock prices. No evidence of a connection (at least in a forecasting sense) between "liquidity" and stock price fluctuations emerges from the analysis; nor is there a connection between (a proxy for) "excess *global* liquidity" and output or stock prices. In Korea and Malaysia, there has been a tendency for stock price changes to precede changes in liquidity, defined as narrow monetary aggregates – but this may reflect the effects of stabilization policy during the 1997–98 period.

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[3] See, for example, Estrella and Hardouvelis (1991).

[4] The Bank for International Settlements (2006) recently published a comprehensive overview of the development of bond markets in Asia.

[5] A large and still somewhat unsettled literature has grown up around this question: see, for example, Bernanke and Gertler (1999), and its rejoinders.

1. Stock prices and real output

Aside from their visibility and availability, there are several scenarios in which equity prices might contain information that would be useful, in the context of a simple macroeconomic model, for forecasting real output. First, an increase in (expected future) productivity (e.g., from a favorable supply shock) would tend to increase the stock price and output. Second, as discussed in more detail below, policy-induced interest rate reductions will, at least over some horizon, tend to increase (expected future) profits, while reducing the discount rate applied to those earnings; both will raise equity values, while the rate reduction itself will lead to an expansion in output. Third, equity prices should also contain information about other, non-monetary demand shocks, such as fiscal policy – but because the effect of the interest rate on equity values would work in the opposite direction from the profit effect, the *net* impact is *a priori* ambiguous. A particularly attractive feature of equity prices (as well as other indicators based on prices determined in financial markets) is that they are *forward-looking*, and incorporate information about fundamental shocks well before they have an effect on macroeconomic prices or quantities. This property may be especially useful in an emerging market context, where timely macroeconomic data are often not available.

The baseline analysis involves quarterly data for real output and a measure of equity prices. Industrial production (or alternatively, manufacturing output) is used as the gauge of real output. (Ideally, it would be desirable to use a broader measure of output, but the availability of real GDP data is more limited.) The MSCI/Barra country index is used as the gauge of stock prices. Also included in the analysis are a number of additional indicators: the exchange rate, the short-term interest rate, and various measures of money or credit (i.e., "liquidity"). Except for the stock price, all national data are available from the International Monetary Fund's International Financial Statistics (IFS). However, in some cases a longer or more complete time series was available directly from national sources, such as central banks. The series for global liquidity is that of Rüffer and Stracca (2006), and was obtained directly from the authors. A complete description of data sources can be found in the Appendix to this paper.

The analysis of emerging market data can present certain challenges, and the present exercise is no exception. One common problem is that many of the series – especially industrial production and the monetary aggregates – are characterized by jumps or discontinuities introduced by methodological or definitional changes. Fortunately, such discontinuities are relatively easy to detect (many are flagged in the IFS database) and correct using suitable level adjustments. In the case of Indonesia, several observations on industrial production from 1997 and 1999–2000 are simply missing, and there is no alternative but to leave these as missing values. Data availability is also an issue. In this case, the main constraint is the MSCI stock price series, which begin in December of 1987.

Figure 2 plots the four-quarter growth rates (in percentage terms) of equity prices and output for the five Asian economies covered by the analysis, plus the United States. The plots reveal a number of interesting patterns, and also some important differences across countries. Perhaps most notable is the strong co-movement between stock price and output fluctuations in Korea, Malaysia, and Thailand. (In annual data, the contemporaneous correlations of log differences are 0.40 and 0.55 for Korea and Thailand, but only 0.12 for Malaysia.) The high degree of correlation in these countries contrasts with the much weaker relationship observed for Indonesia and the Philippines, where the correlation coefficients are only 0.19 and −0.07. The US data make for an interesting comparison: here, the link between output and stock prices appears quite strong during some episodes, such as the 2001 recession, but markedly less so in others. Overall, the correlation coefficient is 0.38.

A high degree of correlation is not sufficient to make the stock price an informative leading indicator, of course. The crucial additional requirement is that stock price movements *precede* output fluctuations. Although this is a rather subtle feature to discern from the plots, the link between the two series seems to be nearly contemporaneous for the three countries in which a strong correlation is observed. In Korea and Malaysia, there do appear to be some instances in which the stock price leads output by a few months; however, comparable episodes are not evident in the Thai data. Again, a comparison with the United States is revealing: here, sharp stock price movements clearly signaled many of the turning points of the 1970s and 1980s with a lead of many months. Stock prices failed to anticipate the 2001 recession, however, and the overall level of equity prices did not decline significantly until the downturn was already underway.

Forecasting regressions are a simple but useful tool for gauging the information content of leading indicators, such as stock prices. The baseline regression used to assess the predictive power of equity prices is

$$\Delta y_t = \alpha + \sum_{i=1}^{4} \beta_i \Delta y_{t-i} + \sum_{i=1}^{4} \gamma_i \Delta s_{t-i} + \sum_{i=2}^{4} \delta_i q_{i,t} + e_t \qquad (1)$$

where y is the log of real output, s is the log of the equity price index (deflated by the consumer price index), and the q_i are quarterly dummies included to capture the strong pattern present in many of the series, particularly real output. Since equation (1) corresponds to the output equation from a bivariate vector autoregression (VAR), tests for the exclusion of the Δs terms can be interpreted as tests for Granger causality from stock prices to output.[6]

Specifications similar to (1) which are commonly used in forecasting applications implicitly incorporate important assumptions about the series' time series properties. Specifically, it is assumed that the logs of real output and the real stock price are both integrated of order 1, and that the two series are not cointegrated. If the data were trend stationary, first differencing would produce a misspecified model whose forecasting performance would be impaired by the failure to incorporate trend reversion. Similarly, if a cointegrating relationship existed between the variables, forecasting performance would be improved by the inclusion of an error correction term.

Fortunately, a preliminary analysis of the data shows that difference stationarity is an appropriate assumption for industrial production and stock prices: only for Korean industrial production does the Augmented Dickey-Fuller test reject the null of non-stationarity. (As noted below, however, using linearly detrended industrial production for Korea dos not alter the results.) Engle-Granger cointegration tests similarly fail to reject the null of no cointegration between the two variables. Thus, the differenced specification (1) is reasonably appropriate for the data used in the analysis.

In assessing the information content of stock prices at a slightly longer horizon, a similar equation was used to forecast four-quarter-ahead output growth as a function of lagged four-quarter output growth, and the *one-quarter* change in the stock price,

$$\Delta_4 y_t \equiv y_t - y_{t-4} = \alpha + \beta \Delta_4 y_{t-4} + \gamma \Delta s_{t-4} + e_t \, . \qquad (2)$$

Note that both specifications assume output and the price level are integrated of order one, and neither incorporates the possibility of cointegration between (the levels of) real stock prices and real output.

The results from estimating equations (1) and (2) for each of the five Asian economies, plus the United States, are given in Table 1. The results generally confirm the impressions gleaned from Figure 2: at least on an in-sample basis, stock prices have a great deal of predictive power for real output in Korea and Malaysia, and to a slightly lesser extent, in

[6] By reducing the amount of idiosyncratic "noise" inevitably present in any one indicator, factor methods, such as that proposed by Stock and Watson (2002), and used by English et al. (2005), could be useful.

Thailand.[7] For all three of these countries, the sum of the four γ_i coefficients in (1) is highly significant, as is the sole γ in specification (2). (The estimates are reported in the top line of the table, and the associated p-values in italics on the second line.) Moreover, the estimated coefficients are consistent with an *economically* significant relationship, with a 10 percent downturn in stock prices implying a 1 to 2 percent decline in industrial production. For Thailand, the exclusion restriction is not rejected at the 10 percent level, suggesting a slightly less statistically robust relationship. Consistent with the plots in Figure 2, the γ stock price coefficients are statistically insignificant for the Philippines and Indonesia, regardless of which specification is used. The strong results for Korea and Malaysia are broadly consistent with those for the United States, where the stock price terms are highly significant in forecasting regressions estimated over the same sample period.[8]

Having established some degree of forecasting ability, for at least a subset of the countries being analyzed, a natural question to ask is whether stock prices have any *additional* predictive power over and above that contained in other financial indicators, such as interest rates or monetary aggregates. An answer in the affirmative would strengthen the case for using the stock price as an information variable for monetary policy, while an answer in the negative would indicate that using the alternative financial indicator (or indicators) is more informative.

A straightforward way to assess the marginal information content of equity prices is simply to include alternative indicators (represented by the variable x) in the two forecasting equations used above, resulting in

$$\Delta y_t = \alpha + \sum_{i=1}^{4} \beta_i \Delta y_{t-i} + \sum_{i=1}^{4} \gamma_i \Delta s_{t-i} + \sum_{i=1}^{4} \theta_i x_{t-i} + \sum_{i=2}^{4} \delta_i q_{i,t} + e_t \qquad (3)$$

and

$$\Delta_4 y_t = \alpha + \beta \Delta_4 y_{t-4} + \gamma \Delta s_{t-4} + \theta x_{t-4} + e_t \,. \qquad (4)$$

As in Friedman and Kuttner (1992), the relevant test for marginal predictive power will be whether the γ coefficients remain significant once the x has been included. The set of candidate financial indicators considered in the analysis includes six variables: a real short-term interest rate (defined as the nominal interest rate, minus the inflation rate over the previous year), the depreciation of the real exchange rate (defined as the rate of change in the bilateral exchange rate vis-à-vis the United States, minus the rates of change in the respective consumer price indexes), and the rates of change in real reserve money, real narrow money, real broad money, and real credit. All rates of change are calculated as quarterly log differences.

The sums of the estimated γs from equation (3), and the F-statistics for their joint exclusion, appear in Table 2. (As before, the associated p-values appear in italics, below.) Although the table contains a proliferation of numbers, the basic message is quite simple: the inclusion of alternative financial variables does little to change the (in-sample) predictive power of stock prices. For Korea and Malaysia, the stock price remains highly significant regardless of which indicator is included in the forecasting regression. The Thai results are again slightly weaker, but the sum of the γs remains significant at the 5 percent level, except for the case in which

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7 In the case of Korea, using detrended industrial production instead of its growth rate yields very similar results: the stock price coefficients are jointly significant at the 5 percent level, and the coefficient in the four-quarter-ahead specification is significant at 1 percent.

8 The results are not qualitatively changed by the exclusion of the 1997–98 period of financial crisis, although the statistical significance is somewhat reduced. The possible impact of the crisis period on the results will be examined more closely below in the analysis of out-of-sample forecasting performance.

narrow money is the competitor (and even then, the p-value is 0.056).[9] Similar results are obtained using the four-quarter-ahead regression (4) instead of (3), but for brevity, these estimates are not reported. The robust statistical significance of the γs suggests that stock prices contain information over and above that contained in other, commonly used financial indicators.

As is well known, good *in-sample* predictive power often fails to translate into an improvement in *out-of-sample* forecasts. Some examination of out-of-sample performance is therefore an essential step in determining any indicator's value in the policy process. The procedure used here to gauge that performance is similar to that used elsewhere, e.g., Stock and Watson (2001), and involves estimating the forecasting equation (2) up through some time period τ, and then calculating the forecast errors from period $\tau + k$ through the end of the sample.[10]

In order to address, in a limited way, the possible sensitivity of the results to the chosen estimation and forecasting periods, three different sets of dates are used. For the first exercise, the forecasting regression is estimated on data through 1996Q2 (i.e., the last observation forecast is output growth from 1996Q2 through 1997Q2), thus excluding the financial crisis that began in the fall of 1997. The forecast evaluation period in this first exercise begins with the 1996Q3 observation, and *includes* the crisis period. In the second exercise, the estimation end date and the forecast evaluation start date are both moved up to 1999Q4 and 2000Q1, respectively, so that the crisis period is included in the estimation, but not in the forecast evaluation. The third exercise excludes the crisis period entirely, with an estimation end date of 1996Q2 and a forecast evaluation start date of 2000Q1.[11]

The metric used to evaluate forecast performance is the standard one: the forecast root mean squared error (RMSE). In order to determine the value added of including the stock price in the forecasting equation, the forecast RMSE with the stock price included is compared to the RMSE of the forecast generated from (2) with the stock price omitted (i.e., with $\gamma = 0$): if including the stock price improves the out-of-sample forecasting performance, then the ratio of the former to the latter will be less than one.

The results from these forecasting exercises appear in Table 3. The key forecasting metric, the ratio of the RMSE from the model with the stock price to that without, is reported in the last column of the table. The second-to-last column gives the ratio of the RMSE from the model with the stock price to that from a naïve "no change" forecast, i.e., one in which next quarter's output growth rate is forecast to be the same as this quarter's.[12]

The main findings of these exercises are threefold. First, good in-sample predictive power does, to some extent, translate into an improvement in out-of-sample forecasting performance. Korea, Malaysia, and Thailand – the three countries for which the stock price entered the forecasting regressions significantly – all show a reduction in forecast RMSEs when the stock price is included. The same is true for the United States. By contrast, including the stock price fails to improve the output forecasts for either the Philippines or Indonesia.

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[9] The one unexpected result in the table is that, in the United States, the stock price is no longer significant when real credit is included.

[10] Sometimes, the estimates are updated recursively over the forecast evaluation period, although that is not done in this paper's analysis.

[11] Gaps in the industrial production series limit analysis for Indonesia to an estimation period ending in 1996Q2, and a forecast evaluation period starting in 2001Q2.

[12] This ratio of forecast RMSEs is sometimes referred to as Theil's U statistic.

The second conclusion to be drawn from these exercises is that the inclusion of the stock price yields a relatively modest reduction in forecast RMSE: the largest observed is a 7 percent improvement in the case of Malaysia, for the case in which the model is estimated on data through 1999Q4. This compares with a 12 percent improvement for the United States over the same period. In broad terms, these results are similar to those of Stock and Watson (2001), who found that the inclusion of asset prices (such as stock prices) yielded only small forecasting improvements for the G7 countries.[13]

The third finding to emerge from this analysis is that, while the 1997–98 crisis period may have been unusually volatile, it is not anomalous in terms of the link between stock prices and output. This conclusion follows from the observation that including this period in the sample used to estimate the model leads to a pronounced improvement in forecasting performance over the 2000–05 period. Had the crisis been anomalous, in the sense of generating spurious shifts in the regression coefficients, its inclusion should have led to a deterioration in the forecasts, rather than an improvement.[14]

2. Stock prices and inflation

Theoretical links between stock prices and inflation are less direct and more complex than they are for stock prices and output. To the extent that a rise in the stock price signals a positive demand shock, one would expect such a rise to foretell higher inflation. Similarly, to the extent that stock price increases are fueled by "excess liquidity" (a question to be explored in section 3) that liquidity might also be expected to generate inflation. But if the underlying shock is on the *supply* side, then the impact on inflation would be precisely the opposite. At the same time, the conventional wisdom, reflecting a well-known empirical regularity (at least in the United States) is that inflation is bad for stocks.[15]

In the end, of course, the inflationary implications of stock price movements is an empirical question, and a methodology similar to the one used in section 1 can be used to assess the information content of these movements with regard to future inflation. The results presented in this section show that stock prices are even *less* informative for inflation than they are for real output. While this finding might disappoint a forecaster, it is at least consistent with the theoretical ambiguity sketched in the preceding paragraph.

The inflation and stock price fluctuations plotted in Figure reveal no consistent picture, although the 1997–98 financial crisis produced both a sharp drop in equity prices and a spike in the inflation rate. This pattern generates in a large, *negative* contemporaneous correlation between the two series in Korea, Thailand and Indonesia, where the coefficients are −0.39, −0.31, and −0.45.

Estimated forecasting equations analogous to those used for real output reveal any significant *predictive* power for stock prices with regard to inflation, however. As shown in Table 4, the stock price is generally insignificant in suitably modified equations (1) and (2) in which the output growth Δy has been replaced by the inflation rate π. The only exception is

13 Interestingly, the stock price seems to have done a much better job of forecasting real output in the United States during this 2000–05 period than it did over the 1985–99 period analyzed in Stock and Watson (2001), where the comparable ratio of RMSEs is 2.06.

14 A generic concern in this sort of analysis is that the measured forecasting power of stock prices can be quite sensitive to the choice of sample, as shown by Stock and Watson (2001) for the G7. Unfortunately, data constraints do not permit a comparably thorough sensitivity analysis for these five Asian economies.

15 See, for example, Fama (1981).

Malaysia, using specification (1), where the joint exclusion of the stock price terms is rejected. However, the small size and statistical insignificance of the sum of the coefficients, and the lack of a significant γ estimate in equation (2), all suggest that the rejection of the exclusion restriction may be spurious. In light of the weak results from the simple specifications involving only the stock price and inflation, there is little chance that expanded specifications with additional financial indicators would reveal a significant relationship – and this suspicion is confirmed by the (unreported) results from estimating suitably modified versions of (3) and (4).

Given the lack of a significant in-sample predictive relationship, it is no surprise that the inclusion of equity prices is of no help in improving out-of-sample forecasts. Table 5 reports the results of a number of forecasting exercises, similar to those reported earlier for real output growth. Again, the key measure of forecasting performance is the ratio of the forecast RMSE from a model that includes the stock price to that from one in which the stock price is omitted. Also reported is the ratio of the forecast RMSE relative to that from a naïve "no change" forecast. A cursory inspection of the table reveals that in no case does the inclusion of the stock price lead to a reduction in forecast RMSE, relative to the autoregressive model (i.e., a regression of future four-quarter inflation on the current four-quarter inflation rate). In fact, the RMSEs from the forecasting model with stock prices are almost uniformly greater than those from the "no change" forecast. The underlying reason for this finding is that the inflation rate is reasonably well approximated by a random walk; consequently, it is hard for *any* forecasting model to beat the "no change" forecast. Indonesia is the only exception (along with the United States), apparently because over the sample considered, there has been a distinct tendency for Indonesian inflation to revert to something close to an 8 percent annual rate.[16]

Overall, the results for inflation are quite similar qualitatively to those of Stock and Watson (2001) for the G7. This does not imply that stock prices bear *no* relation whatsoever to inflation, of course: it is clear from Figure that, especially during crises, large stock price declines have been associated with periods of sharply rising inflation. But purely as a matter of forecasting, today's stock price changes say little about *future* inflation.

3. Liquidity and stock price fluctuations

Discussions of stock price fluctuations, and what drives them, often focus on the role of monetary policy, and the related concept of "liquidity".[17] In particular, a widely-held view is that overly expansionary monetary policy and/or "excess liquidity" is an underlying cause of many episodes of asset price appreciation. Examples of this view are not hard to come by. Critics of Alan Greenspan, such as Fleckenstein (2005), blame expansionary Federal Reserve policy in the late 1990s for a boom in stock prices that appears, in retrospect, to have had some features of a bubble.[18] And, with the stock price as a key component of its proprietary financial conditions index, Goldman Sachs' assessment of the economy is

[16] In contrast with the findings of Stock and Watson (2001), and other studies looking at earlier periods, the model-based forecasts do somewhat better than the "no change" forecasts in the United States during this period, which suggests a greater degree of mean reversion in recent years.

[17] Note that this idea is only tangentially related to "liquidity" defined as the ease or speed of consummating transactions.

[18] Blinder and Reis (2005) provide a more sympathetic assessment of Greenspan's response (or lack thereof) to the stock market boom of the late 1990s.

significantly influenced by the strength of the equities market.[19] More recently, the business and financial press has been awash in articles linking excess liquidity – especially on a *global* scale – to a dangerous escalation in asset prices.[20]

The possible destabilizing effect of expansionary monetary and credit conditions on asset markets has also attracted the attention of policymakers in recent years. Borio and Lowe (2002), for example, hypothesized that an excessive buildup of credit will inflate asset prices, and increase the likelihood of a financial crisis in the future.[21] More recently, strong concerns about a "global liquidity glut" and its possible stimulative effect on asset prices, consumption and investment have been raised by leading policymakers, such as former IMF research director Raghuram Rajan (2006). In a similar vein, Bank of England Governor Mervyn King (2006) speculated that buoyant asset markets are "…the result of rapid growth in money and credit which, in a "search for yield", drives asset prices up and interest rates down".

Establishing a theoretical link between monetary policy, narrowly defined, and stock prices is straightforward. Thinking of the price of a share as the discounted sum of future earnings or dividends, a monetary expansion would raise the value of shares through at least two channels: first, by reducing the interest rate at which those earnings are discounted; and second, by increasing firms' earnings. While these effects have yet to be modeled in the context of a modern New Keynesian framework, the impact of monetary policy on the stock market was described, using a dynamic version of the IS-LM model, by Blanchard (1981).[22] Besides its impact on profits and the risk-free rate, monetary policy may also affect the equity premium associated with the share price; indeed, Bernanke and Kuttner (2005) showed that policy-induced stock price fluctuations in the United States are largely attributable to movements in the equity premium.[23] Thus, a link between monetary policy and stock prices can be explained in terms of conventional asset pricing principles, without appealing to a distinct "liquidity" channel.

Discussions of "liquidity", and its economic effects, often refer to effects *other than* those associated with interest rates and earnings. Part of this involves a focus on *quantity* variables, such as money or credit aggregates, as suggested by the Rajan and King remarks. This point of view is reminiscent of that of monetarist writers, such as Patinkin (1965) and Meltzer (1995), who emphasized the direct effects of quantities on asset prices.[24] This channel can be described crudely in terms of supply and demand: as the central bank injects liquidity into the economy, agents will try to get rid of it, exchanging money for other assets (including equities), thus driving up the price of those assets.

While this mechanism has a certain intuitive appeal, several conceptual issues require closer scrutiny. First, it is not clear why quantity variables would contain more information than the

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19 See, for example, Dudley and Hatzius (2000). As of June 2000, the year-ahead real GDP growth forecast from Goldman's financial conditions index was 3½ percent per year, due largely to the strength of the equity market. Instead, the economy and the stock market both contracted sharply in the first quarter of 2001.

20 See, for example, The Economist (2007), Lahart (2006), and Sender (2007); and in the Asian context, Liu (2007). Private-sector commentators, such as Wells Capital Management (2007), also often cite liquidity as a key driver of equity markets.

21 Interestingly, Kumar et al. (2003) found no statistically significant role for "global liquidity" in a logit analysis of emerging market currency crises.

22 In Blanchard's model, profits are a linear function of the level of output, and there is no equity premium. The main result is that, as expected, monetary expansions increase the stock price. Whether the stock price continues to rise, or subsequently declines, depends on the relative strength of the "profit" versus "discount rate" effects.

23 That is, by reducing the equity premium, monetary expansions also raise equity prices.

24 See Kuttner and Mosser (2002) for an overview of this "neo-monetarist" view of the transmission mechanism.

interest rate about the impact of monetary policy on financial markets. Specifically: suppose expansionary monetary policy generated an outward shift in the money supply curve, facing a downward-sloping money demand curve. In this case, the monetary expansion would be evident in both the interest rate and the money supply, and nothing would be gained by focusing on the monetary aggregates.

Quantity variables can, however, reveal useful information about underlying aggregate demand shocks, to the extent that those shocks lead to shifts in money *demand*. As pointed out by Friedman (1977), this would be a case in which the quantity of money might appropriately be used as an information variable, even though there is no sense in which money was the underlying causal factor. Quantity variables could also be informative to the extent that the adjustment to the asset market was a gradual one, creating a situation in which some measure of monetary "overhang" (such as that implied by "p-star" style models) would have some predictive power.

Another difficult conceptual issue is raised by the assertion that the relevant concept of "liquidity" is not adequately captured by conventional measures, such as interest rates and monetary aggregates. This view holds that "liquidity" is best defined in terms of investors' willingness to take risks.[25] Links from monetary conditions to this broader notion of "liquidity" are often hypothesized, but rarely made explicit. The IMF's *Global Financial Stability Report* (2005), for example, asserts that abundant liquidity encourages financial risk-taking, and creates unsustainable valuations. One attempt to model this link theoretically is that of Allen and Gale (2000), which shows how the expansion of credit (which is only partially under the central bank's control) can exacerbate the moral hazard issues associated with risky debt.[26] As a practical matter, however, the problem with this expansive definition of "liquidity" is that it can easily become circular: effectively, using rising asset prices (interpreted as a proxy for "excess liquidity") to "explain" rising asset prices.[27] At this point, "liquidity" becomes nothing more than a *deus ex machina* for rationalizing otherwise inexplicable asset price booms.

In light of these issues, it is worth examining empirically the extent to which increases in stock prices are symptomatic of expansionary monetary conditions. (Of necessity, the analysis is limited to observable liquidity measures, such as interest rates and money and credit aggregates.) Establishing such a link would have important implications for policy, as it would strengthen the case for taking into account gauges of financial conditions, such as the stock price, in assessing the stance of monetary policy. To anticipate: there is no clear statistical link between fluctuations in the various measures of "liquidity" and subsequent movements in either output or stock prices. In Korea and Malaysia, however, the evidence suggests a connection in the opposite direction, from stock prices to measures of narrow money – although this result is sensitive to the inclusion of observations from the 1997–98 crisis period.

One approach to characterizing the information content of liquidity measures is simply to determine the extent to which those measures help predict real output in a forecasting equation like that used in section 1,

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[25] This view is nicely summarized by Dixon (2007): "…liquidity isn't just a function of interest rates. It is best thought of as a willingness to play the financial game – by lending, borrowing, and betting money. That willingness is only partly determined by the cost of money. A bigger part of the story is appetite for risk." Liu (2007) contains a similar definition.

[26] The Allen-Gale story lines up nicely with Dixon's (2007) description of the collateralized loan obligation market and hedge fund industry as enmeshed in a "cat's cradle of one-way bets".

[27] This point has been made by some astute observers, such as Lahart (2006).

$$\Delta y_t = \alpha + \sum_{i=1}^{4} \beta_i \Delta y_{t-i} + \sum_{i=1}^{4} \gamma_i \Delta s_{t-i} + \sum_{i=1}^{4} \theta_i x_{t-i} + \sum_{i=2}^{4} \delta_i q_{i,t} + e_t, \tag{5}$$

in which the x variable now represents the proxy for "liquidity". Instead of the γs, the objects of interest are now the θ coefficients. The candidate liquidity proxies are the usual suspects, all but one of which appeared in the preceding analysis: the real short-term interest rate; and the real growth rates of reserve money, narrow money, broad money, and credit.[28] The new addition is the measure of "global excess liquidity" calculated by Rüffer and Stracca (2006), which is defined as the difference between broad money and nominal income growth for the G5. If expansionary policy (broadly defined) boosts real stock values through an expansion in output, as in Blanchard (1981), the impact should translate into significant positive estimates of the θs; the same would be true to the extent that liquidity fluctuations contained information about unobservable aggregate demand shocks.

The results in Table 6 uniformly fail to provide support for this view, however. In only one case (narrow money, for Korea) is there evidence of a liquidity measure having significant (at the 5 percent level) in-sample predictive power for real output. Only in the United States and Thailand is there even weak evidence (i.e., significant at the 10 percent level) for transmission from either the interest rate or reserve money to real output growth. The lack of a significant interest rate effect is somewhat surprising, as the short-term interest rate is generally viewed as the central bank's primary (if not its *only*) policy instrument. A critically important caveat, however, is that the interest rate is *endogenous* with respect to the state of the economy. While it may be true that, *ceteris paribus*, an increase in the real interest rate is contractionary, central banks tend to raise the rate as the economy expands.[29] Reduced-form regressions like (5) could therefore fail to capture the true impact of policy actions. For this reason, the results in Table 6 should be interpreted with caution.

Another simple way to characterize the links (if any) between "liquidity" and stock prices is simply to check for Granger causality between the two variables in a bivariate VAR system,

$$\begin{aligned} \Delta s_t &= \alpha^s + \sum_{i=1}^{2} \gamma_i^s \Delta s_{t-i} + \sum_{i=1}^{2} \theta_i^s x_{t-i} + \sum_{i=2}^{4} \delta_i^s q_{i,t} + e_t^s \\ \Delta x_t &= \alpha^x + \sum_{i=1}^{2} \gamma_i^x \Delta s_{t-i} + \sum_{i=1}^{2} \theta_i^x x_{t-i} + \sum_{i=2}^{4} \delta_i^x q_{i,t} + e_t^x. \end{aligned} \tag{6}$$

In this framework, one estimate of interest would be the influence (in a predictive sense) of "liquidity" on stock prices, as captured by the θ^s coefficients. Also interesting is the predictive power of stock prices for liquidity, as captured by the γ^s coefficients: non-zero estimates would be suggestive of some mechanism in which stock prices drove liquidity, rather than the other way around. As before, quarterly dummies are included to capture seasonal patterns.[30]

The Granger causality tests calculated from estimates of equation (6) appear in Table 7. Overall, there is no clear pattern of "liquidity" Granger-causing stock prices: the exclusion of the liquidity terms in the stock price equation is rejected at the 5 percent level only for credit

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[28] Although the distinction is not central to this paper's analysis, it is worth noting that some of these variables, such as the real interest rate or reserve money, are, at least in principle, under the central bank's control; while others, such as broad money or credit, are not.

[29] See Kuttner and Mosser (2002) for a further discussion of this point.

[30] The lag length has been reduced from four to two on the assumption that there should be less of a lag in the response of "liquidity" to stock prices, and vice versa, than there would be for real output and inflation. The results are generally similar with four lags, but weaker in terms of statistical significance.

in the United States, and the real interest rate in Thailand.[31] Nor is there any evidence for a role for "global excess liquidity" in driving stock prices, in either Asia or the United States.

Again, some caution is warranted in interpreting the results, since the Granger causality approach ignores the possibility of a *contemporaneous* impact on stock prices. In addition, to the extent that equity markets are efficient, surprise changes in policy are likely to have a larger effect on stock prices than the "old news" embodied in lagged liquidity measures.[32] The negative test results nonetheless indicate that run-ups in stock prices are not systematically preceded by increases in liquidity. In this regard, the results corroborate those of Posen (2003), who, using completely different methods, found no consistent tendency for asset price booms to be preceded by monetary easing.

The evidence is slightly stronger for causality running from stock prices *to* liquidity. Here, the exclusion restrictions corresponding to no causality are strongly rejected, at the 5 percent level or better, for reserve and narrow money in Korea and Malaysia – intriguingly, the two Asian countries in the sample in which stock prices had significant predictive power for real output. Stock prices also Granger-cause narrow money in the United States, and, with a p-value of 0.055, the stock price terms are almost significant in the interest rate equation. In this regard, there would appear to be a similarity between Korea, Malaysia and the United States.

There is one critical difference, however. In the United States, the (unreported) coefficients on the stock price in the narrow money equation are negative, and those in the interest rate equation are positive, consistent with a contractionary response to rising stock prices.[33] In Korea and Malaysia, on the other hand, the coefficients on the stock price in the money equation are positive, which suggests an *expansionary* response to rising stock prices – or equivalently, a contractionary response to falling stock prices. This particular result turns out to be sensitive to the inclusion of the 1997–98 crisis period; the stock price terms are insignificant when that period is excluded. Presumably, this is because the crisis, which first precipitated a collapse in equity prices, also led central banks to conduct a more contractionary monetary policy in an effort to stabilize the currency.

Overall, the results presented in this section fail to clearly establish a consistent link in either direction between stock prices and observable measures of "liquidity". Needless to say, these results do not imply that there is *no* connection with monetary policy: for all the reasons discussed above, there is good reason to believe that, *ceteris paribus*, an (unexpected) change in the interest rate set by the monetary authority will have an impact on the prices of assets, including equities. But it is going to take more than just a series of surprise interest rate cuts for monetary policy to generate a sustained, bubble-like rise in equity prices – that would require a change in the perceived *rule* being used to conduct policy, which, in turn, should manifest itself in the behavior of interest rates and/or quantity variables. No such relationship is evident in the data.

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[31] This rejection rate of 0.055 is roughly what one would expect if the null hypothesis of no relationship were true, assuming the tests were independent of one another.

[32] For evidence supporting this view, see Bernanke and Kuttner (2005).

[33] This does not necessarily imply that the Federal Reserve is responding to stock prices *per se*, as the specification omits other macroeconomic variables that are likely to be correlated with stock price movements.

Conclusions

The main purpose of this study has been to discuss the possible role for equity prices as a leading economic indicator, and to assess empirically the usefulness of stock price data in an Asian emerging market context. One broad conclusion from the analysis in the paper is that the information content of stock prices varies a great deal across countries. Equity prices in Korea, Malaysia, and to a somewhat lesser extent, Thailand, seem to be closely linked to the macroeconomy – but much less so in the Philippines and Indonesia.

Even for Korea, Malaysia and Thailand, where the stock price is a good in-sample predictor of output, including the stock price yields only modest improvements in out-of-sample forecasting performance. The results for these three countries are very similar to those for the United States, where the stock price is a useful – but somewhat unreliable – leading indicator.

The key finding of section 2 is that Asian equity prices fail to display a systematic relationship, either in sample or out of sample, with inflation. In large part this is because, over the sample used in the analysis, inflation resembles a random walk, and consequently it is hard to do better than a naïve "no change" forecast. Again, the results for Asia are similar to those for the United States presented in this paper, and in other published research.

The relationship between "liquidity", stock prices, and the economy, discussed at length in section 3, is a complex one. The main conclusion from that discussion is that, while there are sound theoretical reasons for monetary policy to have an effect on equity valuations, the role of broader and more nebulous "liquidity" concepts is not well motivated; nor is it clear exactly how "excess liquidity" promotes financial risk-taking. As a practical matter, it turns out none of the liquidity measures considered in the analysis has any significant predictive power for either real output or stock prices, calling into question the popular view that "liquidity" (or at least observable proxies for it) is an important driving force in either financial markets or the real economy.

Appendix:
Data sources

Industrial production. For Korea, Malaysia, the Philippines and Indonesia, the source is the International Monetary Fund's International Financial Statistics (IFS) database. For Thailand, the source is the Bank of Thailand, and US data were obtained from the Federal Reserve Bank of Saint Louis FRED database. Adjustments were made to correct for the discontinuities in the series for Malaysia in May 1988 and January 1991, and in the series for Indonesia in January 2003.

Consumer prices. For the five Asian countries, the source is the IFS database. US data were obtained from the FRED database.

Money and credit. For all countries, the money and credit series are from the IFS database. Reserve money is from the data on Monetary Authorities (line 14). For every country except Malaysia, data from the Monetary Survey is used for narrow money, broad money, and credit (lines 34, 35 and 32). National definitions of money are used for Malaysia. Adjustments were made to correct for the discontinuities in the series for Malaysia in January 1990 and January 1992, and in the series for the Philippines in 2003Q3. Y2K-related spikes were removed from the money series for Malaysia and Thailand.

Interest rates. For the five Asian countries, short-term interest rates (typically the money market rate) are taken from the IFS database. The short-term rate for the United States is the federal funds rate, obtained from the FRED database.

Stock prices. All stock price indexes are from MSCI/Barra, and obtained from http://www.mscibarra.com/.

Global excess liquidity. The data, as described in Rüffer and Stracca (2006), were obtained directly from the authors.

Table 1

In-sample predictive power of stock price for real output, no controls

	Number of observations	One-quarter-ahead model		Stock price coefficient, four-quarter-ahead model
		Sum of coeffs	Exclusion test	
Korea	72	0.133	3.949	0.152
		0.007	***0.007***	***0.002***
Malaysia	72	0.206	5.791	0.226
		0.000	***0.001***	***0.000***
Philippines	72	0.015	0.836	0.031
		0.849	*0.508*	*0.716*
Thailand	72	0.140	2.003	0.109
		0.009	*0.106*	***0.026***
Indonesia	53	0.056	0.241	0.093
		0.445	*0.914*	*0.342*
United States	72	0.081	5.990	0.200
		0.003	***0.000***	***0.006***

Notes: the one-quarter-ahead forecasting model is given by equation (1) in the text, and the four-quarter-ahead model is given by equation (2). For each country, the number in the first row under the “Sum of coeffs” column gives the sum of the estimated γ coefficients, and the number under the “Exclusion test” column gives the F-statistic for the exclusion of the four coefficients. P-values for the hypotheses that the sum equals zero, and that the γs are jointly zero, appear below, in italics. For the four-quarter-ahead model, the table gives the estimated γ, and the p-value for the hypothesis that it is equal to zero; standard errors are corrected for MA(3) errors. Boldface type is used to highlight results that are significant at the 5 percent level or better.

Table 2

In-sample predictive power of stock price for real output, including other financial variables

	Real rate		**Real depreciation**		**Reserve money**		**Narrow money**		**Broad money**		**Credit**	
	Sum	**Excl.**	**Sum**	**Excl.**	**Sum**	**Excl.**	**Sum**	**Excl.**	**Sum**	**Excl.**	**Sum**	**Excl.**
Korea	0.181	6.421	0.127	4.295	0.117	3.753	0.122	3.872	0.141	4.115	0.118	3.121
	0.001	***0.000***	***0.008***	***0.004***	***0.030***	***0.009***	***0.013***	***0.008***	***0.005***	***0.005***	***0.028***	***0.022***
Malaysia	0.216	5.076	0.172	3.699	0.213	4.715	0.254	5.121	0.208	5.179	0.195	4.747
	0.001	***0.002***	***0.004***	***0.010***	***0.000***	***0.002***	***0.000***	***0.001***	***0.000***	***0.001***	***0.001***	***0.002***
Philippines	–0.012	0.413	–0.047	0.601	0.001	1.011	–0.022	1.518	0.011	0.534	0.039	0.526
	0.879	*0.798*	*0.651*	*0.664*	*0.994*	*0.409*	*0.766*	*0.209*	*0.887*	*0.711*	*0.656*	*0.717*
Thailand	0.113	1.137	0.121	1.778	0.138	1.771	0.107	1.787	0.144	1.928	0.140	1.869
	0.043	*0.349*	***0.015***	*0.146*	***0.012***	*0.148*	*0.056*	*0.144*	***0.010***	*0.118*	***0.011***	*0.129*
Indonesia	0.099	0.703	0.056	0.316	0.053	0.299	0.043	0.073	0.040	0.187	0.026	0.101
	0.265	*0.595*	*0.460*	*0.865*	*0.470*	*0.877*	*0.683*	*0.990*	*0.640*	*0.944*	*0.777*	*0.981*
United States	0.102	6.215	0.079	5.362	0.107	7.423	0.089	6.094	0.078	4.679	0.027	1.271
	0.001	***0.000***	***0.008***	***0.001***	***0.000***	***0.000***	***0.002***	***0.000***	***0.005***	***0.002***	*0.443*	*0.292*

Notes: the results are based on the one-quarter-ahead forecasting model given by equation (3) in the text. For each country, the number in the first row under the "Sum" column gives the sum of the estimated γ coefficients, and the number under the "Excl." column gives the F-statistic for the exclusion of the four coefficients. P-values for the hypotheses that the sum equals zero, and that the γs are jointly zero, appear below, in italics. Boldface type is used to highlight results that are significant at the 5 percent level or better.

Table 3

Out-of-sample forecasting performance for real output

	End of estimation period	Forecasting period		RMSE	RMSE relative to:	
		Start	End		"No change"	No stock price
Korea	1996Q2	1996Q3	2005Q4	7.94	**0.61**	**0.99**
	1999Q4	2000Q1	2005Q4	3.38	**0.39**	**0.95**
	1996Q2	2000Q1	2005Q4	3.18	**0.37**	**0.98**
Malaysia	1996Q2	1996Q3	2005Q4	9.14	**0.70**	**0.96**
	1999Q4	2000Q1	2005Q4	6.61	**0.60**	**0.93**
	1996Q2	2000Q1	2005Q4	7.92	**0.72**	**0.97**
Philippines	1996Q2	1996Q3	2005Q4	10.74	**0.90**	1.04
	1999Q4	2000Q1	2005Q4	8.39	**0.71**	1.00
	1996Q2	2000Q1	2005Q4	10.37	**0.88**	1.01
Thailand	1996Q2	1996Q3	2005Q4	7.76	**0.78**	**0.99**
	1999Q4	2000Q1	2005Q4	3.60	**0.73**	**0.94**
	1996Q2	2000Q1	2005Q4	3.81	**0.77**	**0.99**
Indonesia	1996Q2	2001Q2	2005Q1	16.56	2.13	1.00
United States	1996Q2	1996Q3	2005Q4	3.21	**0.87**	1.08
	1999Q4	2000Q1	2005Q4	3.10	**0.71**	**0.88**
	1996Q2	2000Q1	2005Q4	3.24	**0.74**	**0.98**

Notes: the results are based on equation (2), estimated from 1988Q1 to the indicated periods. RMSE denotes the forecast root mean squared error. The ratios of this RMSE to that of the naïve "no change" forecast, and to that of the model with no stock price, appear in the final two columns. Boldface type is used to highlight reductions in forecast RMSE.

Table 4

In-sample predictive power of stock price for inflation, no controls

	Number of observations	One-quarter-ahead model		Stock price coefficient, four-quarter-ahead model
		Sum of coeffs	Exclusion test	
Korea	72	–0.006	1.161	–0.012
		0.440	0.337	0.089
Malaysia	72	–0.003	4.547	–0.007
		0.179	**0.003**	0.200
Philippines	72	–0.005	1.407	–0.009
		0.121	0.242	0.095
Thailand	72	–0.001	0.152	–0.002
		0.845	0.961	0.812
Indonesia	72	–0.002	1.005	–0.012
		0.338	0.412	0.270
United States	75	0.002	1.211	0.006
		0.253	0.315	0.255

Notes: see notes to Table 1.

Table 5

Out-of-sample forecasting performance for inflation

	End of estimation period	**Forecasting period**		**RMSE**	**RMSE relative to:**	
		Start	**End**		**"No change"**	**No stock price**
Korea	1996Q2	1996Q3	2005Q4	2.67	1.01	1.01
	1999Q4	2000Q1	2005Q4	1.84	1.43	1.10
	1996Q2	2000Q1	2005Q4	2.18	1.70	1.04
Malaysia	1996Q2	1996Q3	2005Q4	1.50	1.00	1.00
	1999Q4	2000Q1	2005Q4	1.76	2.02	1.06
	1996Q2	2000Q1	2005Q4	1.46	1.68	1.04
Philippines	1996Q2	1996Q3	2005Q4	4.93	1.19	1.11
	1999Q4	2000Q1	2005Q4	2.56	**0.71**	1.00
	1996Q2	2000Q1	2005Q4	4.25	1.17	1.13
Thailand	1996Q2	1996Q3	2005Q4	3.20	1.00	1.01
	1999Q4	2000Q1	2005Q4	2.61	1.68	1.03
	1996Q2	2000Q1	2005Q4	2.86	1.84	1.01
Indonesia	1996Q2	1996Q3	2005Q4	15.33	**0.74**	1.01
	1999Q4	2000Q1	2005Q4	4.49	**0.80**	1.09
	1996Q2	2000Q1	2005Q4	3.76	**0.67**	1.00
United States	1996Q2	1996Q3	2005Q4	0.94	**0.91**	1.03
	1999Q4	2000Q1	2005Q4	0.97	**0.91**	1.06
	1996Q2	2000Q1	2005Q4	0.99	**0.92**	1.05

Notes: see notes to Table 3.

Table 6

In-sample predictive power of liquidity measures for real output

	Real rate		Reserve money		Narrow money		Broad money		Credit		Global liquidity	
	Sum	**Excl.**	**Sum**	**Excl.**	**Sum**	**Excl.**	**Sum**	**Excl.**	**Sum**	**Excl.**	**Sum**	**Excl.**
Korea	0.113	1.868	0.000	0.526	0.000	**3.447**	0.000	1.655	–0.000	1.621	0.767	0.603
	0.312	*0.129*	*0.388*	*0.717*	*0.738*	***0.014***	*0.297*	*0.173*	*0.567*	*0.182*	*0.408*	*0.662*
Malaysia	0.146	1.041	–0.000	1.123	–0.000	0.654	–0.000	0.470	–0.000	1.623	–0.063	0.568
	0.523	*0.394*	*0.217*	*0.355*	*0.183*	*0.627*	*0.253*	*0.758*	*0.271*	*0.181*	*0.944*	*0.687*
Philippines	0.073	0.396	0.078	0.896	0.120	0.659	0.039	0.438	0.009	0.224	–2.792	0.995
	0.737	*0.811*	*0.454*	*0.473*	*0.346*	*0.623*	*0.268*	*0.781*	*0.586*	*0.924*	*0.113*	*0.418*
Thailand	–0.069	2.085	–0.029	2.276	0.041	0.851	0.006	0.187	–0.003	0.613	1.636	1.232
	0.562	*0.095*	*0.478*	*0.072*	*0.469*	*0.499*	*0.596*	*0.944*	*0.252*	*0.655*	*0.080*	*0.308*
Indonesia	0.160	0.439	0.000	0.707	–0.000	0.211	0.000	0.480	0.000	0.180	–3.341	1.412
	0.572	*0.780*	*0.782*	*0.592*	*0.866*	*0.931*	*0.553*	*0.751*	*0.746*	*0.947*	*0.164*	*0.249*
United States	–0.093	0.761	0.072	2.049	0.013	0.477	0.001	0.604	0.002	1.458	–0.265	1.592
	0.102	*0.555*	*0.055*	*0.099*	*0.273*	*0.753*	*0.811*	*0.661*	*0.185*	*0.227*	*0.337*	*0.188*

Notes: see notes to Table 2.

Table 7

Granger causality tests for real stock prices and liquidity

	x = Real rate		*x* = Reserve money		*x* = Narrow money		*x* = Broad money		*x* = Credit		*x* = "Global liquidity"	
	$s \rightarrow x$	$x \rightarrow s$	$s \rightarrow x$	$x \rightarrow s$	$s \rightarrow x$	$x \rightarrow s$	$s \rightarrow x$	$x \rightarrow s$	$s \rightarrow x$	$x \rightarrow s$	$s \rightarrow x$	$x \rightarrow s$
Korea	0.011	2.042	**4.040**	0.051	**4.620**	0.672	1.446	0.025	1.094	0.022	2.226	1.100
	0.989	*0.138*	***0.022***	*0.950*	***0.013***	*0.514*	*0.243*	*0.975*	*0.341*	*0.979*	*0.116*	*0.339*
Malaysia	2.063	1.094	**7.744**	0.330	**5.558**	0.248	0.678	1.836	1.229	2.518	**3.394**	0.981
	0.135	*0.341*	***0.001***	*0.720*	***0.006***	*0.781*	*0.511*	*0.167*	*0.299*	*0.088*	***0.040***	*0.380*
Philippines	1.458	1.477	0.476	0.397	0.320	0.126	1.219	0.009	3.031	0.802	2.108	0.018
	0.240	*0.236*	*0.624*	*0.674*	*0.727*	*0.882*	*0.302*	*0.991*	*0.055*	*0.453*	*0.130*	*0.982*
Thailand	0.912	**3.407**	0.248	0.835	0.002	0.495	2.541	0.128	1.109	0.402	0.424	0.338
	0.407	***0.039***	*0.781*	*0.438*	*0.998*	*0.612*	*0.087*	*0.880*	*0.336*	*0.670*	*0.656*	*0.715*
Indonesia	0.560	1.683	0.342	0.958	1.460	1.485	0.641	1.573	0.440	1.457	0.060	0.639
	0.574	*0.194*	*0.712*	*0.389*	*0.240*	*0.234*	*0.530*	*0.215*	*0.646*	*0.240*	*0.942*	*0.531*
United States	3.022	0.428	0.539	0.084	**3.720**	0.456	2.822	1.028	1.920	**3.208**	**4.547**	0.784
	0.055	*0.654*	*0.586*	*0.920*	***0.029***	*0.635*	*0.066*	*0.363*	*0.154*	***0.047***	***0.014***	*0.461*

Notes: the results are based on the VAR given by equation (6) in the text. For each country, the number in the first row under the "$s \rightarrow x$" column gives the F-statistic for the exclusion of the four stock price coefficients in the "liquidity" equation; the numbers in the "$x \rightarrow s$" columns are those for the exclusion of the "liquidity" proxy in the stock price equation. P-values associated with the F-statistics appear below, in italics. Boldface type is used to highlight results that are significant at the 5 percent level or better.

Figure 1

Real stock prices in emerging Asia

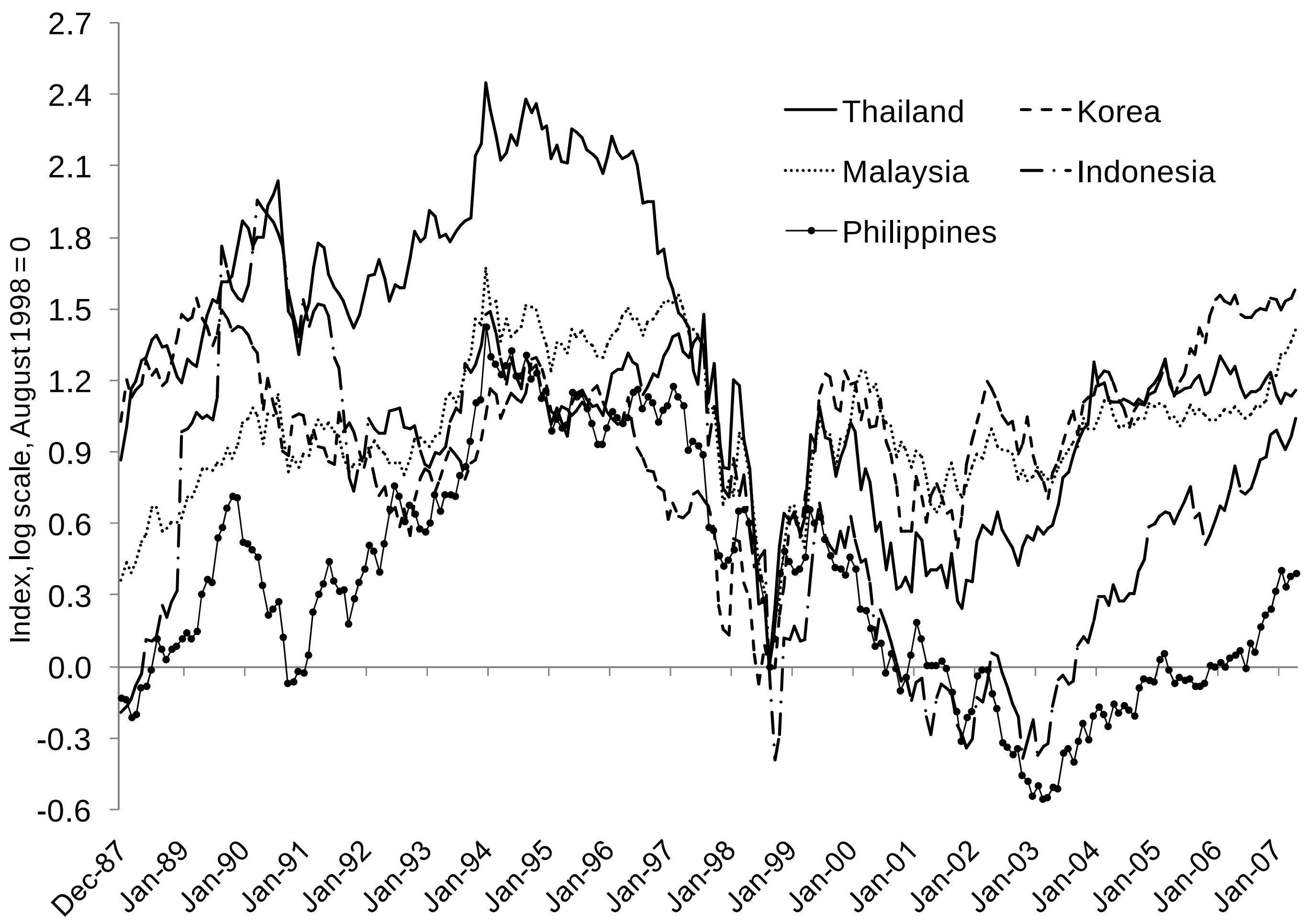


Figure 2

Stock price and industrial production growth

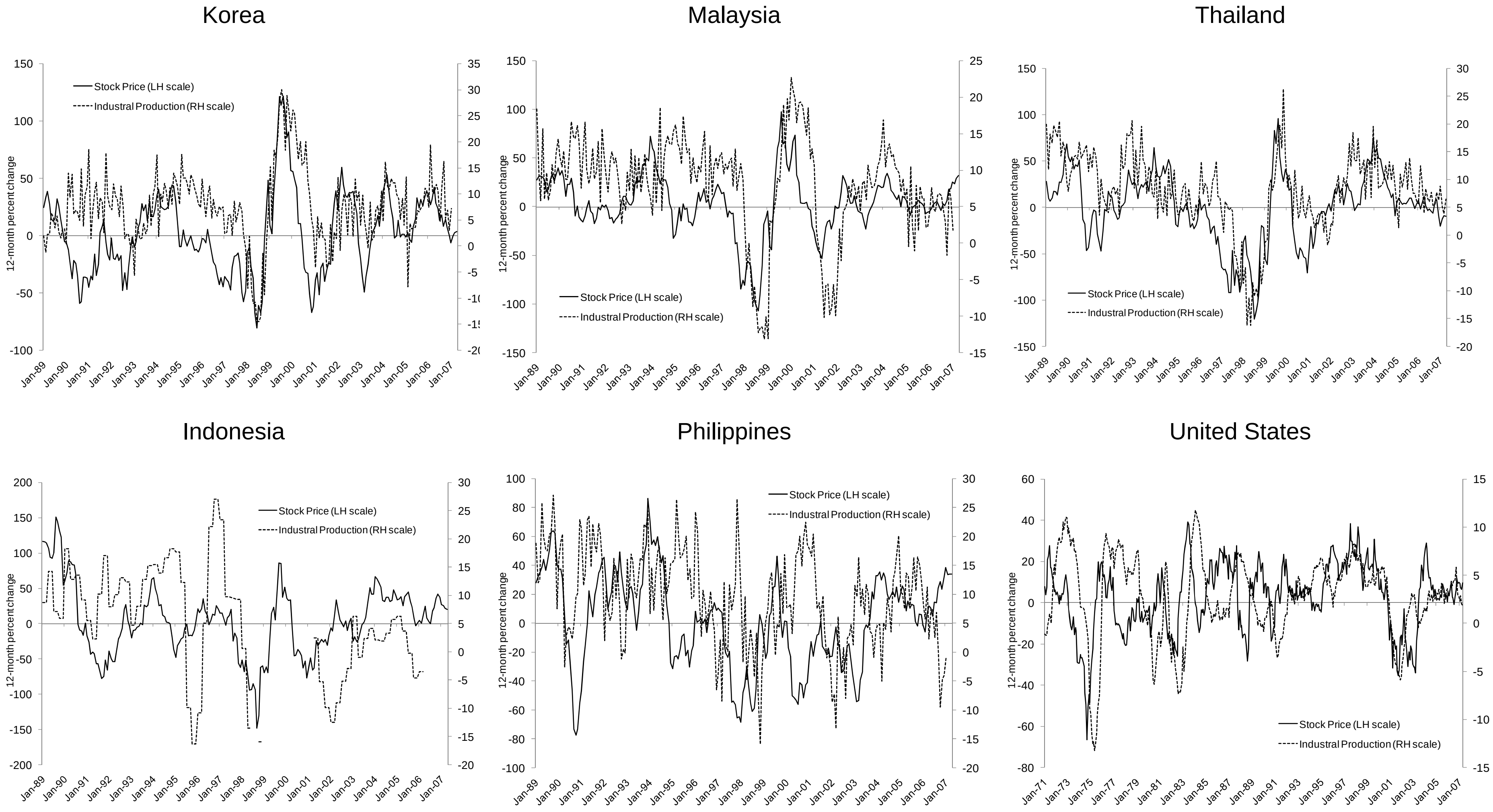
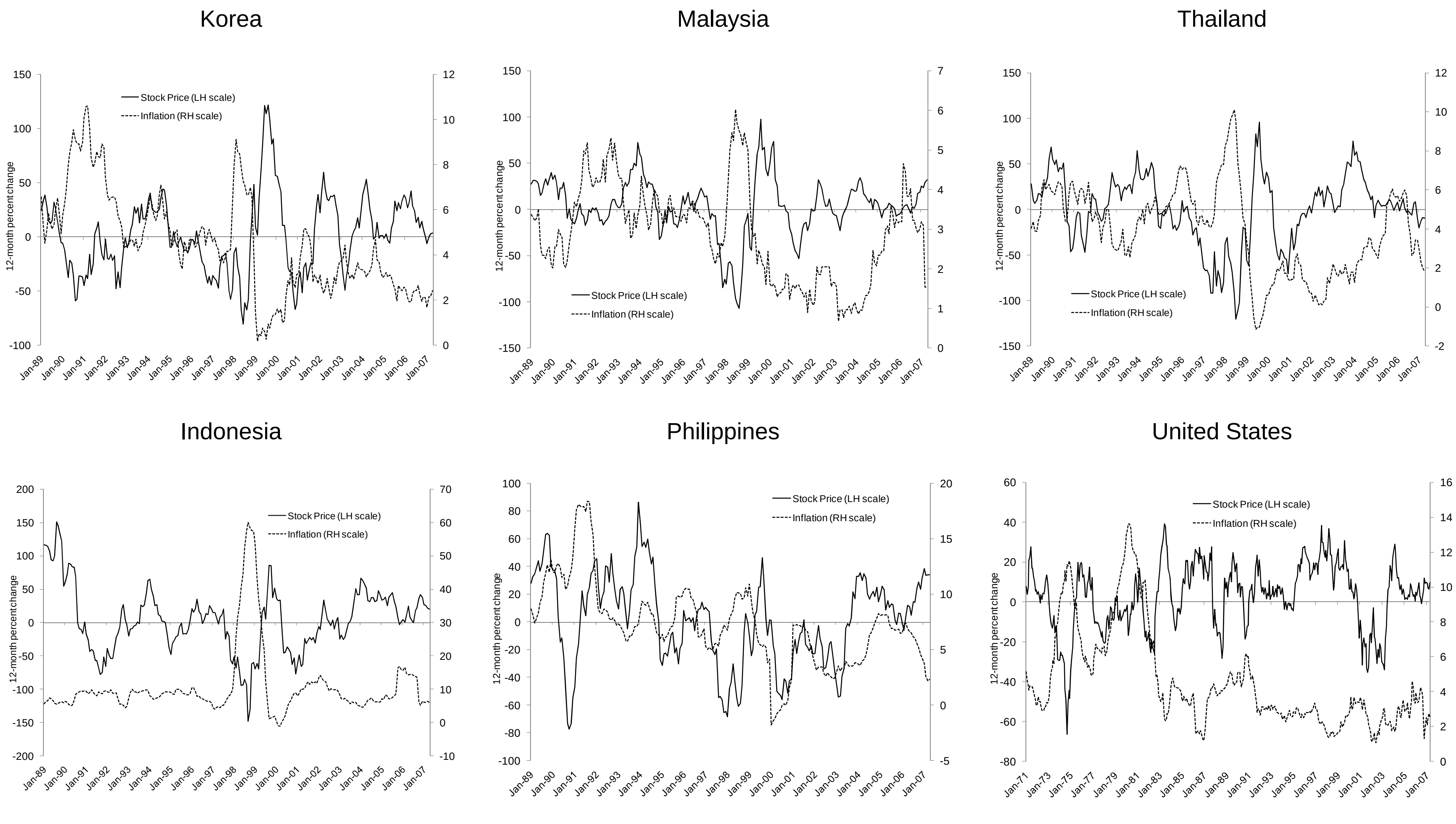


Figure 3

Stock price growth and inflation



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