Monetary and Exchange Rate Policies for Sustained Growth in Asia

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I. Introduction and Summary

The more advanced economies in Asia are experiencing slower growth rates which appear to be consistent with the convergence hypothesis. Less advanced economies are not slowing as much and in some cases may be accelerating. We focus on policy prescriptions for the slowing economies. Structural reforms are the most important approach to keeping growth rates up, but this paper takes the growth slowdown as given and focuses on implications for monetary policy. The key policy implication is the importance of keeping core inflation at or above 2 percent to avoid prolonged periods of economic slack.

Flexible inflation targeting has provided a successful and adaptable framework for monetary policy worldwide (Wheeler 2014). It is hard to overstate the importance for monetary policy of keeping inflation within the central bank's policy mandate. Such mandates typically specify some target for average inflation in the medium term, either a single number or some range. In our view, such a target should be no less than, and possibly greater than, 2 percent.

A new global recession is not the baseline scenario for the next year or so. But with inflation expectations already low, monetary policy should react promptly to any significant negative shocks to real growth or to international financial markets (e.g. a new taper tantrum). In a few economies, notably Korea and Thailand, there is a case for additional monetary ease already. A medium-term focus (as for example adopted in Australia and New Zealand) can allow the central bank to maintain an expansionary stance of monetary policy even in the face of a temporary surge of the inflation rate.

Japan failed to keep inflation above zero after a severe financial crisis and it suffered two decades of excess unemployment and foregone output. The longer inflation is allowed to remain below target, the harder it is to raise inflation to target. When inflation expectations settle at low levels, central banks have less scope to use conventional monetary policy to stabilize cyclical fluctuations. Central banks, however, can still expand their balance sheets (so-called unconventional policy) when the conventional policy rate is near zero.

We rebut three possible criticisms of our advice.

First, it is argued that monetary policy has only a weak impact on inflation as reflected in declining estimates of the slope of the Phillips curve. We suggest that the Phillips curve slope is nonlinear in both the output gap and the level of inflation. When inflation is close to zero, a

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negative output gap has very little effect on inflation because of downward rigidities in nominal wages and prices. But a positive output gap is expected to have a significant effect, and this effect is likely to grow as the gap becomes larger.

Second, it is argued that central banks should stick to setting the overnight rate and should avoid the so-called unconventional balance sheet policies of the kind implemented by the Federal Reserve (Fed), the European Central Bank (ECB), the Bank of Japan (BOJ), and the Bank of England (BOE). This view is unhistorical. Central banks have used their balance sheets to advance their objectives since their inception more than 300 years ago. In Asia, the accumulation of foreign exchange reserves and the related policies to stabilize financial markets and control any excess liquidity in domestic banks were major planks of monetary policy in the years during and after the Asian financial crisis. What is new is that the substantial development of domestic financial markets in the emerging markets has widened the possibilities for balance sheet policies. Because bond markets have become more important in monetary policy transmission in Asia, and because the liquidity of such bond markets can be especially fragile when global markets are disturbed, balance sheet policies are on the policy agenda. This would be reinforced if weak growth and low inflation were to push the policy rate to zero.

Third, it is argued that easy monetary policy encourages risky behavior in financial markets. We argue that the evidence for such an effect is very weak. Moreover, ultra-low inflation and persistent negative output gaps themselves raise risks to financial stability. Prudential regulatory policies have far more potency for preserving financial stability than monetary policy. Regulatory policy includes tools such as: bank capital and liquidity requirements; rules on currency and maturity mismatches in banks; limits to interest rate exposures; and enhanced stress tests to make sure the balance sheets of financial intermediaries are resilient to any eventual tightening of monetary policy. New macroprudential policy tools (such as loan-to-value and debt-to-income ratios for house mortgages) give the central bank new ways of limiting financial stability risks arising from low interest rates.

II. Macroeconomic Developments in Asia

Figure 1 displays five-year moving averages of the growth rate of real per capita GDP for the 15 largest economies (based on 2016 GDP at market exchange rates) in the Asia-Pacific region. Many economies appear to be growing more slowly over time. However, for some economies there is no clear trend in the growth rate, and for a few economies growth seems to be increasing. Box 1 provides evidence that an important cause of differences in the growth experience of Asian economies is convergence in per capita incomes toward a common, high level. Convergence predicts that poor economies should grow faster than their rich brethren, at least when they are open to global market forces and have adequate standards of governance.

The main policy option to raise an economy's growth rate regardless of its relative income level is structural reform that opens up protected sectors to competition and encourages investments in human and physical capital and R&D. However, structural reform is the topic of

other papers at this conference. This paper focuses on implications for monetary policy, which can help to avoid prolonged periods of under-employed resources and to sustain investment. Monetary policy can thus contribute to the achievement of the economy's long-run potential growth rate.

Figure 2 displays inflation rates in the Asia 15 economies. In every case, inflation in 2016 was below its historic average, often by a considerable amount. In 2016, inflation was below 5 percent in 14 of the 15 economies; below 3 percent in 12 economies; below 2 percent in 8 economies; below 1 percent in 5 economies; and below 0 percent in 2 economies.

Economies with inflation below 1 percent in 2016—Singapore, Japan, Thailand, New Zealand, and Korea—tend to be economies in which GDP growth slowed the most over time. In these economies, there was probably a gap between actual GDP growth and potential GDP growth at some point either before or during the time when inflation was declining. As we discuss in the next section, a key priority for monetary policy in Asia should be keeping inflation from falling persistently below 2 percent and possibly even targeting a slightly higher rate of inflation than 2 percent.

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Box 1. Economic Convergence in Asia?

Table B.1 displays average per capita growth rates in the Asia 15 economies in the 1980s (column 1) and the last 10 years (column 2). The economies are ranked by the change in growth rates since the 1980s (column 3). Most economies have slowed down, but five economies have accelerated. The final column displays the level of PPP GDP per capita in 2016. Except for China, the economies that accelerated are the poorest. Except for Thailand, the economies that slowed down significantly are the richest. The correlation between the data in columns 3 and 4 is -0.67. This suggests that countries are converging in terms of per capita GDP.

The convergence hypothesis says that, over a given sample period, economies that start with low per capita GDP will grow faster than economies that start with high per capita GDP (Barro and Sala-i-Martin 1992). Thus, differences between economies in per capita GDP should narrow. Table B.2 presents results from convergence regressions in which the log change in PPP GDP per capita over the entire period is regressed on the initial log level of PPP GDP per capita. For all economies over the past 36 years, differences in initial GDP shrank by an average of 15 percent (β) and this convergence explains 8 percent of differences in growth rates across economies (R^2). For the Asia 15 economies, however, convergence was far stronger. Differences in initial GDP shrank by an average of 33 percent in Asia and this convergence explained 40 percent of the differences in growth rates. Similar results hold over a shorter sample, shown in the bottom half of the table.

Overall, it appears that about half of the larger Asian economies are slowing down, but about a third are speeding up. Much of this pattern reflects convergence toward similar levels of per capita GDP, in which richer economies tend to grow more slowly.

Table B.1. Growth Rate of Real Per Capita GDP

	1981-90 Average	2007-16 Average	Change from 1981-90	2016 PPP GDP per capita
Philippines	-0.7	3.6	4.4	7728
Bangladesh	1.0	4.9	4.0	3891
India	3.3	5.6	2.3	6616
Vietnam	3.7	4.8	1.1	6429
China	7.4	8.1	0.7	15399
Indonesia	4.3	4.2	-0.1	11720
Malaysia	3.1	3.0	-0.1	27267
New Zealand	1.2	1.0	-0.2	37294
Australia	1.8	1.1	-0.7	48899
Taiwan	5.0	2.7	-2.3	48095
Singapore	5.1	2.2	-2.9	87855
Hong Kong	5.2	2.2	-3.0	58322
Thailand	5.7	2.6	-3.1	16888
Japan	4.0	0.6	-3.4	41275
Korea	8.3	2.7	-5.6	37740

Sources: IMF World Economic Outlook database and author's calculations.

Table B.2. Convergence Regressions

Change in log PPP GDP per capita = α + β Initial log PPP GDP per capita

	α	β	R^2	Observations
		1980-2016 (36 years)		
All countries	2.67***	-0.15***	.08	139
	(.35)	(.04)		
Asia 15	4.82***	-0.33**	.40	15
	(0.88)	(.11)		
		1995-2016 (21 years)		
All countries	1.67***	-0.10***	.07	173
	(.24)	(.03)		
Asia 15	3.11***	-0.23***	.50	15
	(.56)	(.06)		

***, **, and * denote 1, 5, and 10 percent significance levels, respectively. Standard errors are in parentheses.

Sources: IMF World Economic Outlook database and author's calculations.

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III. The Dangers of Ultra-Low Inflation

Lessons from Japan

The bursting of the equity and real estate price bubbles in 1990-91 devastated the Japanese financial system but it was not until early 2000 that the authorities developed systematic policies to deal with insolvent banks[2]. Since 1993, nominal GDP growth and core CPI inflation in Japan have fluctuated around zero.[3] (See figure 3.) Real GDP growth slowed down after 1993. The severe impairment of financial intermediation during much of the 1990s, slower growth of the working-age population and convergence toward the per capita income levels of the most advanced economies would have caused real growth to slow regardless of monetary policy or inflation.

However, ultra-low inflation did make it harder to reduce the real value of debts, and banks find it difficult to improve their balance sheets when nominal GDP is stagnant. In any event, it does appear that the level of output has been below potential on average since the advent of ultra-low inflation. The Bank of Japan's estimate of the output gap fell from an average of 1.7 percent before 1993 to -1.0 percent since 1993. (See figure 3.) This estimate probably understates the economy's true underperformance. The unemployment rate rose from an average of 1.9 percent before 1993 to 4.1 percent since then. Even if the natural rate of unemployment is now close to 3 percent, as appears likely, Okun's Law suggests that an average excess unemployment rate of 1 percent implies a shortfall in GDP of 2 percent.[4] Cumulated over more than 20 years, this represents an enormous loss of goods and services that could have been consumed or invested in Japan.

In 1993--well after the bubbles had burst--the BOJ's policy interest rate was above 3 percent. Adam Posen (1998) provided one of the earliest critiques of Japanese macroeconomic policy after the bubbles. He argued for coordinated monetary and fiscal expansion to return output to potential and avoid deflation. Soon thereafter, the BOJ began to take more aggressive monetary policy measures (the Zero Interest Rate Policy in 1999 and Quantitative Targeting in 2001) but it reversed direction before deflation was fully conquered. A faster, stronger, and more sustained response to deflation in the early 1990s would have been warranted and might have maintained inflation near 2 percent in the subsequent decades (Ahearne et al. 2002). Twenty years of zero inflation, however, have changed the expectations of firms and workers in

[2] Nakaso (2001) provides an authoritative account of how it took years for the authorities in Japan to develop policies to deal with this financial crisis.

[3] In the four quarters following each increase in the consumption tax, the inflation rate shown in figure 3 was adjusted downward by the change in inflation in the first quarter minus the change in inflation in the fifth quarter divided by two. The consumption tax was increased in 1997q2 and 2014q2.

[4] Note that the BOJ estimates that output is slightly above potential in 2017 with an unemployment rate slightly below 3 percent.

Japan. Raising inflation back to 2 percent is much harder now, as evidenced by the limited success of the BOJ's massive quantitative easing policy since 2013 (Ball et al. 2016, 48-50). Surveys of professional forecasters reveal that long-term inflation expectations in Japan were very slow to decline and remained above actual inflation for most of the 1990s and 2000s.[5] Getting expectations to rise will also take time and is likely to require a sustained increase in actual inflation. A key lesson for Asian economies is not to allow inflation and inflation expectations to become entrenched below 2 percent.

Economic Costs of Ultra-Low Inflation

One important cost of ultra-low inflation is that relative prices become more difficult to change. When inflation is positive and prices and wages are rising on average, firms can adjust relative prices in response to shifts in tastes, technology, and competitive conditions by increasing some at a faster rate and others at a slower rate. When overall inflation is zero, adjustments in relative prices require firms to reduce some prices in nominal terms. If there is resistance to cutting prices, the economy needs to run below its full-employment level to force some wages and prices down in order to keep the average inflation rate near zero (Akerlof, Dickens, and Perry 1996; Benigno and Ricci 2011). Studies find evidence of such downward rigidities in wages in many countries (Dickens et al. 2007; Fallick, Lettau, and Wascher 2016). Once nominal wages begin to decline, the fear of a deflationary spiral can lead households and firms to cut spending, adding further downward pressure to an already weak economy.

Akerlof, Dickens, and Perry estimated that an overall inflation rate of at least 2 percent is needed in order to avoid the bulk of the economic cost of downward nominal wage rigidity.[6] In comments published with the Akerlof, Dickens, and Perry paper, Robert Gordon and Greg Mankiw suggested that downward nominal wage rigidity might become less apparent as people become used to low inflation or in the event of severe economic distress. However, Fallick, Lettau, and Wascher show that these conjectures did not prove correct in the aftermath of the Great Recession in the United States.

Another reason to prefer a positive inflation rate is that price indexes do not fully control for quality improvements and the welfare benefits of new goods. These omissions bias published inflation measures up by as much as 1 percent per year, so that a reported inflation rate of 1 percent may reflect constant true prices (Bank of Canada 2013).

Ultra-Low Inflation, Interest Rates, and Monetary Policy

Because economic equilibrium depends on the real rate of interest over both short and long horizons, an environment of low expected inflation must be accompanied by low nominal rates of interest. Moreover, recent studies document a decline in the equilibrium real rate of interest in many advanced economies (Holston, Laubach, and Williams 2016; and Williams 2017).

[5] *Consensus Forecasts*, various issues.

[6] Wyplosz (2001) also argues for optimal rates of inflation above 2 percent in major European economies.

Figure 4 shows that the real short-term interest rate has trended down in many of the Asia 15 economies. In 2016 it was below its historical average in all of these economies except India and Vietnam.

Figure 5 shows that, in most economies in the Asia-Pacific region with active and open bond markets, long-term interest rates have declined since 2000, a period in which long-term inflation expectations are likely to have been fairly stable.[7] This has mirrored the movement in average long-term rates in advanced economies. Since the mid-2000s local currency bond markets of many Asian emerging economies have thus become part of this expanding global market (Obstfeld (2015). Figure 6 shows, however, that the long-term rates of emerging Asian economies on average rose more sharply in the two periods of bond market turbulence – in 2008 and during and after the 2013 taper tantrum.

As Mervyn King and David Low (2014) have concluded, given the high correlation between bond yields of different countries (emerging as well as advanced economies), "it therefore is quite reasonable to talk about a 'world' interest rate". The real long-term rate has been declining for about thirty years. Observations for the most recent years using a principal components estimate based on 10-year government bonds of three major markets show that the world real long-term interest rate has been hovering around zero since mid-2011 (Graph 2 in Hördahl et al. 2016). Rachel and Smith (2015) attribute about two-thirds of the long-run decline to secular factors shaping desired saving and investment rates in the global economy. They argue that the likely persistence of these factors suggests that the underlying global neutral real rate will settle at around 1 percent in the medium to long run.[8] If this prognosis is correct, central banks will again grapple with the zero lower bound for the policy rate.

The decline in equilibrium rates of interest took both markets and central banks by surprise. Because policy rates have lagged the equilibrium rate in coming down, there has been a secular downward pressure on inflation. To some degree this downward trend in inflation has been welcome. However, in a few economies it has gone too far. Asian economies with slowing trend growth rates are at risk of getting trapped in harmful deflation, as in the case of Japan since the early 1990s.

With a low inflation rate and a low equilibrium real interest rate, the nominal policy interest rate will be close to zero in the future. The difficulty of setting the policy rate much below zero greatly reduces the scope for countercyclical monetary policy, at least using the conventional policy tool. Ball et al. (2016) show for the United States that the zero bound is likely to constrain conventional monetary policy in all but the mildest of recessions as long as inflation and inflation expectations remain near 2 percent. Although fiscal policy can, in principle, play an

[7] Malaysia is an exception to this pattern. We conjecture that Malaysian bond yields have been kept high by expectations that the short-term rate will not be reduced to very low levels. There may also be a direct policy aspect because the public pension scheme buys most of the very long-dated Malaysian government bonds.

[8] Laubach and Williams (2015) also estimate a long-run equilibrium real rate of around 1 percent for the United States. They attribute the decline in the long-run equilibrium real rate mainly to the decline in the growth rate of potential output.

important role in macroeconomic stabilization when monetary policy faces the zero bound, the experience of the major advanced economies in the aftermath of the Global Financial Crisis (GFC) demonstrates that political and institutional barriers to effective fiscal policy can be substantial.

The case of Korea is instructive. (See figure 7.) From 2000 through 2008, Korea's short-term interest rate averaged 4.3 percent and core inflation averaged 2.8 percent, implying a real interest rate of 1.5 percent. To stabilize the Korean economy during the GFC, the Bank of Korea cut short-term interest rates by more than 3 percentage points.

Since 2009, the short-term interest rate has averaged 2.2 percent and the core inflation rate also averaged 2.2 percent, implying a real interest rate of 0.0 percent. Currently, core inflation is 1.4 percent. If inflation were to settle in at 1 percent and the equilibrium real interest rate is now 0 percent, then the "new normal" policy rate would be 1 percent. In the event of a future negative shock to the Korean economy, the Bank of Korea would not be able to lower the policy rate by as much as it did in 2009. Without the help of fiscal policy or unconventional monetary policy (discussed below) Korea would be subject to longer recessions and slower recoveries. To reduce this risk, the Bank of Korea should set its policy to ensure that inflation returns at least to its target rate of 2 percent, and serious consideration should be given to a slightly higher target, say 3 percent, which had been the target only two years ago. An estimated output gap of -1.5 percent and core inflation below target make the case for policy easing at present.[9]

Figure 8 shows that Thailand is at risk of falling into sustained deflation. With the policy rate at 1.5 percent, the Bank of Thailand would not be able to deliver the 2 percentage point easing of conventional policy that it did during the GFC. Moreover, policy seems to be too tight as the real interest rate is higher than in Korea and core inflation is falling further below target. In the latest Article IV consultation, IMF staff recommended further monetary ease. Thai authorities preferred to preserve space for future policy action, arguing that inflation expectations are well-anchored and lower interest rates could raise risks to financial stability. However, as seen in Japan in the 1990s, measures of expectations do not necessarily provide a good forecast of future inflation trends. In addition, research suggests that preserving policy space is the wrong strategy for an economy at risk of deflation. In such circumstances, an inflation surprise to the downside is harder to deal with than a surprise to the upside. Therefore a central bank should be more aggressive than otherwise in easing policy as it approaches the zero lower bound in order to avoid the danger of the liquidity trap (Reifschneider and Williams 2000).

This assessment of the case for further monetary ease in these two countries is based on the current macroeconomic situation. We have not reviewed forecasts for 2017. Nor have we analysed how other policies might affect the outlook for inflation. The new government in Korea is developing an income-led growth strategy: a recent announcement suggests the minimum wage, affecting about one-quarter of employees directly, is to rise by 17 percent in

[9] Output gap is from IMF World Economic Outlook, April 2017.

2018. At a minimum, the Bank of Korea should welcome and not resist any inflationary effects of a higher minimum wage.

We also note that Singapore and Taiwan are currently at the zero lower bound. Any additional monetary ease in these economies must come in the form of unconventional monetary policies, which we discuss in section IV.

The Risks from Global Bond Markets: the "Taper Tantrum"

Central banks in Asia facing sub-par growth and below-target inflation are vulnerable to shocks from global bond markets that could suddenly tighten domestic financing conditions. The increased importance of domestic bond markets in monetary policy transmission (Mohanty 2014) means that central banks in Asia may have to make greater use of their balance sheets than when credit was supplied exclusively by banks at rates linked to the short-term interest rate set by the central bank.

Central banks need to be ready for external shocks to the world real interest rate. The unexpected depth and length of the post-GFC recession in advanced economies (and the associated pessimism about the future) has depressed the world long-term rate. If growth-friendly policies succeed in closing the global output gap and bring to an end the trend decline in inflation, investment rates would probably rise and precautionary savings fall. Global long-term rates would rise. We cannot know how suddenly this could happen. The taper tantrum of 2013 showed that expectations of monetary policy tightening in the United States could have a large effect on Asian bond markets even when domestic conditions in Asia had not changed. (See figure 9.)

The taper tantrum demonstrated how externally-driven swings in local bond market liquidity in emerging markets can affect local financial conditions in a dramatic way. Monetary policy, notably central bank balance sheet policies, may need to offset these shocks. During the taper tantrum, the average of yields on local currency government bonds in the more open Asian markets rose sharply: from 3.2 percent in April 2013 to 4.4 percent by January 2014 and market volatility spiked higher (Fong et al. 2015). Yields jumped most in Indonesia and the Philippines. In some emerging markets, currencies fell sharply just as bond prices declined.[10] Exchange rate movements in the Asia 15 economies were mixed and mostly rather small.

The bond markets in most emerging markets are of recent birth, and market liquidity is vulnerable to swings in foreign investor sentiment. In many countries, the domestic investor base is narrow, dominated by banks or state-run pension funds. Because the intrinsic liquidity of the markets for government bonds in many emerging markets is still comparatively low, some foreign investors tend to rely on intermediary instruments (bond funds, synthetic ETFs etc)

[10] Carstens (2015) notes that non-resident holdings of emerging market local currency government bonds now amount to 35-40 percent of the foreign exchange reserves. Non-resident sales of local currency bonds may lead to sales of the local currency on a scale that can lead to very volatile foreign exchange markets.

that promise daily liquidity. When market sentiment changes, this liquidity illusion can be shattered, leading to very heavy sales: Shek et al. (2015) have shown that investor flows into and out of emerging market funds tend to cluster much more than for advanced economy bond flows.

As discussed further in section V, the central bank can use its balance sheet to keep the markets for local financial assets operating in the face of a market liquidity shock. This can forestall any self-feeding price movements that could produce a sharp and unwarranted tightening of financial conditions. A particularly bold policy move along these lines was the decision of the Hong Kong Monetary Authority in 1998 to buy 7 percent of domestic equities to thwart a joint speculative attack on its currency peg and its stock market (Bayoumi and Gagnon 2017). This policy worked because the credibility of the central bank's commitment to free financial markets in normal times. In the aftermath of the GFC, several central banks in the emerging markets undertook to lend against (or even buy) financial assets, private as well as public (BIS 2009). Some offered to indemnify asset holders for any eventual losses from continuing to hold government bonds or other paper. The aim of such policies was to counter temporary bouts of extreme market illiquidity.

IV. Is Low Inflation beyond the Control of Central Banks?

The Phillips Curve is Dormant Not Dead

Many observers have noted that very large increases in unemployment rates during the Great Recession had only small effects on inflation in advanced economies. However, it does not follow that inflation is beyond the control of central banks. Rather, the very low trend rates of inflation coupled with downward nominal wage and price rigidity have put economies in a region where the Phillips Curve is flat. But the slope is likely to increase as economies exceed potential by a significant amount. And the slope is likely to be higher in general when inflation is significantly above zero.

This subsection examines the evidence on inflation and the output gap in the United States, which has the longest available series of these data. Figure 10 shows GDP inflation and a lagged survey of expected GDP inflation over the same four quarters as the actual inflation data.[11] In the 1970s, inflation typically turned out higher than had been forecasted, whereas in the 1980s and 1990s inflation often turned out lower than forecasted. Since the late 1990s, forecast errors have been mixed. Figure 11 shows the unemployment rate and the Congressional Budget Office's (CBO) estimate of the natural rate. In the late 1960s and early 1970s, when inflation was generally rising, the unemployment rate was generally below the natural rate. In the 1980s and early 1990s, when inflation was generally falling, the unemployment rate was generally above the natural rate. The very large excess unemployment in 2009 through 2014 was not associated with a comparably large and sustained fall in inflation below its forecasted value. This probably reflects the influence of downward nominal rigidities in wages and prices.

[11] The survey is limited to professional economic forecasters and is provided by Haver Analytics.

The first column in table 1 presents an estimate of an expectations-augmented Phillips curve (equation 1) using the data in figures 10 and 11. The dependent variable is the four-quarter percent change in the GDP deflator minus the value of inflation that had been predicted eight quarters ago for the following four quarters.[12] The gap is the difference between the CBO estimate of the natural rate and the actual unemployment rate. The inflation dummy equals zero when inflation is below 3 percent and one when inflation is above 3 percent.

(1) Inflation(t) – Expected Inflation(t-8) = $\alpha + \beta$ Gap(t-4) + γ Gap(t-4)*(Inflation Dummy(t-4))

The results show that the gap has only a small and statistically insignificant effect on inflation when inflation is below 3 percent, but that there is a large and strongly significant effect when inflation is above 3 percent. This simple model can explain nearly 40 percent of the overall variance of inflation, as shown by the R^2 statistic. The second column displays results using an alternative measure of the output gap: the Federal Reserve's index of capacity utilization in manufacturing, mining, and utilities. This specification does not show any discontinuity in the gap effect when inflation is high or low. However, the fit of the equation is considerably lower than that using the unemployment gap.

The remaining columns of table 1 display results using a lagged three-year moving average of inflation as a measure of inflation expectations (equation 2). This regression has a much longer sample, back to 1950, and a somewhat lower R^2 than column 1. But the coefficient on the unemployment gap is reasonably close to that in column 1. Column 4 displays the same regression starting in 1968. The coefficients are almost identical to those in column 1. The final column displays a regression using lagged inflation and capacity utilization. It obtains results similar to those of column 2 and has a considerably lower R^2 than the regression using the unemployment gap over the same sample period.

(2) Inflation(t) – 3-year Ave. Inflation(t-4) = $\alpha + \beta$ Gap(t-4) + γ Gap(t-4)*(Inflation Dummy(t-4))

To check whether the Phillips Curve slope may have changed over time, we also ran the regressions of table 1 starting in 1992Q1, just after US inflation fell below 3 percent on a sustained basis. There are only nine quarters with inflation above 3 percent in this subsample (2004Q4-2006Q3 and 2007Q1), yet we did obtain estimates of the gap*dummy coefficient that are not significantly different from those shown in columns 1, 3, and 4 and that are significantly greater than zero. As before, the gap*dummy coefficients in columns 2 and 5 remained near zero.

[12] The inflation forecast of four quarters earlier should have incorporated the effects of the gap of four quarters earlier, leaving no systematic prediction error if forecasters are efficient. An alternative specification based on the contemporaneous output gap and forecasted inflation with a four-quarter lag had a lower R^2 (0.15) and a much smaller coefficient on the gap*dummy of 0.36.

Figures 12 and 13 display the inflation surprises (left-hand sides of equations 1 and 2) and output gaps (right-hand sides of equations 1 and 2), where the sample is split between lagged inflation above and below 3 percent. The greater slope in the high inflation regime is apparent for both measures of expectations and both measures of the output gap. It also appears that the slope may steepen for the most positive values of the output gap. However, adding the interacted value of the output gap and a dummy when the output gap is above its mean value yields a significant coefficient (at the 10 percent level) in only the first of the five regressions shown in table 1.

Scope for Unconventional Monetary Policy

Central banks have the ability to ease policy and achieve their objectives even at the zero bound. It would be absurd to assume that – irrespective of circumstances – the only legitimate policy tool for a central bank is the overnight rate in interbank markets. Recalling Hawtrey's celebrated phrase that central banking is an art, the Deputy Governor of the Bank of Italy rightly stressed that, "monetary policy is not a mechanical exercise carried out by wooden technocrats" (Panetta 2016). The following paragraphs suggest some possibilities. What would work best will depend on country circumstances (including political constraints) and on macroeconomic conditions.

To a small extent, central banks can reduce policy rates below zero. Switzerland has pushed short-term interest rates more deeply negative than any other economy, at -0.75 percent. It may be possible to go more negative, but there is a risk at some point of encountering a tipping point at which banks and firms begin to store paper currency in large volumes. In addition, banks have not passed negative rates through to household deposits in any economy with negative policy rates. This lack of pass-through to household deposits limits the effectiveness of negative policy rates and hurts bank profitability.

Another channel for easing policy at the zero bound is to provide forward guidance to markets that the policy rate will remain near zero for several years. The credibility of such a commitment almost surely declines with the horizon of the commitment, as central bank governors and policy board members cannot legally restrict their own future actions, let alone those of their successors. But forward guidance does appear to have worked over horizons of two to three years (Campbell et al. 2012).

Probably the most general avenue for easing policy at the zero bound is the active use of the central bank's own balance sheet. Table 2 represents a stylized central bank balance sheet to show just how many tools a central bank has at its disposal. In almost all emerging economies in Asia, the central bank balance sheet is very large. A major driver of this expansion was the huge accumulation of foreign exchange reserves after the Asian financial crisis (discussed in section VI below). One consequence of this for the domestic financial system was to increase local bank deposits, usually raising commercial bank reserves held with the central bank. When the central bank wanted to prevent this leading to an increase in bank lending, it typically raised required reserve ratios. For much of this period, however, central banks welcomed the stimulus

coming from bank lending expansion that foreign reserve accumulation supported. Buying domestic financial assets or lending to domestic banks would similarly stimulate aggregate demand even if policy interest rates do not change.

Historically, central banks in the advanced economies have used their balance sheets extensively for macroeconomic purposes. Tobin's (1969) classic work on portfolio rebalancing mechanisms in the transmission of monetary policy (changes in the term premium and other risk spreads) found a recent echo in Gertler and Karadi (2013). Ben Friedman (2014) has argued that the central bank's balance sheet is likely to become a part of the standard toolkit of monetary policy in the years ahead.

Table 3 shows the scope for QE in the Asia 15 economies. Among these economies, only Japan is currently engaged in QE, as reflected in the very large size of the BOJ's balance sheet. Many other Asian economies have large central bank balance sheets, primarily reflecting large stockpiles of foreign exchange reserves. We discuss exchange rate and intervention policy in the final section below.

All of these economies have at least some scope for central banks to conduct QE through purchases of government bonds. Three advanced economies (the euro area, Japan, and the United Kingdom) have also engaged in subsidized lending to the banking system. The Bank of England estimates that its Funding for Lending scheme has had a macroeconomic impact equivalent to a reduction in the policy rate of 0.75 to 1.50 percent (Bank of England 2014). The column labeled Broad Money in table 3 gives an approximation to the size of the domestic banking system through which subsidized central bank credit could operate.

Perhaps the most untapped channel for QE is equity purchases. The BOJ is buying about 1 percent of domestic equities per year, but this pace could be increased considerably. In some economies, equities represent a much larger potential market for central banks than government bonds.

A vast literature has arisen that documents the powerful effects of QE on long-term bond yields in the euro area, Japan, the United Kingdom and the United States (Casiraghi et al. 2016; Gagnon 2016; and Iwata and Fueda-Samikawa 2013). Though more difficult to prove, there is evidence that QE has stimulated economic activity and inflation. The Federal Reserve purchased long-term bonds equivalent to nearly 25 percent of GDP in successive rounds from 2008 through 2014. Staff estimate that these purchases had a macroeconomic effect roughly equal to that of a 250 basis point cut in the federal funds rate (Engen et al. 2015). Wu and Xia (2015) estimate a shadow federal funds rate to capture the macroeconomic impact of QE. They find that as of 2014, QE had reduced the shadow federal funds rate by 200 to 300 basis points. A similar estimate by Lombardi and Zhu (2014) places more weight on the Federal Reserve's balance sheet and implies a shadow federal funds rate of minus 400 basis points by 2011.

In some circumstances, however, governance considerations may in practice limit the large-scale use of the central bank's balance sheet. This can be the case in jurisdictions where full

instrument independence of the central bank is not securely established. Central banks must avoid the traps of fiscal and financial dominance; they need to be sure they are free to decide to sell the assets they have purchased if monetary policy so requires. Governments with large debts to refinance may resist higher bond yields. Whilst no central bank will want to provoke financial market volatility, worries about destabilizing bond or equity markets should not prevent central banks from gradually tightening monetary policy when inflation is expected to remain above their inflation target. The warning of Shirakawa (2014) that markets must not be misled into believing the policy regime has become a "put-option type of monetary policy" is well-taken.

V. Should Risks to Financial Stability Constrain Monetary Policy?[13]

Some central banks feel in a quandary. They worry that a prolonged period of very low interest rates could create risks for financial stability -- a reasonable worry since monetary policy works in part by changing financial risk exposures. Lower interest rates reduce the debt service burdens of borrowers, and may help keep them solvent. And lower rates typically increase asset prices, raising the value of collateral held by firms and households making them seem better credit risks in the eyes of potential lenders. Debt/income ratios can be expected to rise if the decline in interest rates persists, as suggested by some recent research (Laubach and Williams 2015; and Rachel and Smith 2015). Higher debt and higher asset prices can be regarded as natural equilibrating mechanisms to a move to a low interest rate environment. The worries begin if the long-run equilibrium or natural rate of interest is actually much higher than most assume at present. In addition, market stresses might at some point lead to a sharp rise in market rates that hits borrowers hard and lands bond investors with heavy losses. No one can know how such worries might materialize. Hence we argue that regulatory policy needs to be prepared for such shocks.

But we also argue that keeping policy interest rates higher than warranted by macroeconomic conditions would not solve this quandary. This is because a prolonged period of sub-par growth and high unemployment also creates financial stability risks. Such risks would be all the greater if prices are falling. Sometimes, then, a central bank has to choose: should it keep the policy rate higher than that needed on macroeconomic grounds in order to counter financial stability risks? This is not a new debate. Dennis Robertson (1928, 1966) answered this question with a clear "no" when he took the (young) Federal Reserve to task in 1928 for focusing its interest rate policy on limiting speculative lending of commercial banks. At that time, the Fed was guided by what it called the Principle of Productive Credit. Underlining the danger at that time of an undesirable fall in the general level of prices, Robertson proposed instead what he termed the Principle of Price Stabilization, "the stabilization of the price level as the sole and sufficient objective of (central) banking policy".

Economic historians may debate whether the Fed's interest rate hikes in the late 1920s were helpful or harmful. But the Fed's acquiescence in the massive collapse of the money supply and

[13] This section draws on Turner (2017).

a 25 percent decline in the price level after the 1929 crash turned an ordinary recession into the Great Depression (Friedman and Schwartz 1963).

As the Head of Economic Research at the Reserve Bank of Australia (RBA) has documented, there is little historical evidence that low interest rate environments are inherently unstable – either in creating macroeconomic instability or in destabilizing the financial system (Simon 2015). He concluded that low interest rates were--given weak global demand--entirely appropriate. In any event, low interest rates have proved to be a poor indicator of future problems.

The main common-sense argument for not allowing financial stability worries to override the macroeconomic considerations driving monetary policy is that interest rates high enough to counter some potential financial threat would cripple the rest of the economy. For instance, households who expect house prices to rise by 10 percent in the next six months would not be much discouraged by a 2 percentage point rise in the policy rate, which would be large by monetary policy standards. In addition, expectations which determine asset prices or lending expansions are not as stable or predictable functions of policy variables as are macroeconomic variables (BIS 1998). Empirical studies have supported these practical conclusions. The most general treatment to date uses several alternative specifications to show that the marginal cost of keeping the policy rate high and accepting higher unemployment outweighs any marginal benefit from the lower probability of a crisis (Svensson 2016).

Recent history fully supports this conclusion. From mid-2004 to mid-2006, a substantial rise in policy rates worldwide, which bond markets expected to be sustained, actually went together with increased risk-taking in the global financial system on all the standard metrics (Turner 2010). Trichet (2008) reminded *Financial Times* readers that he, in his press conferences as Chairman of the bimonthly global economy meetings of central bank governors at the Bank for International Settlements (BIS), had repeatedly during 2006 and early 2007 relayed to market participants the concerns of the governors about over-extended financial markets. He urged the financial industry to prepare for a significant correction. He told them that central banks had prepared the ground by raising interest rates substantially as economies neared full employment. But banks and markets remained entirely complacent.

Is there a historical counterfactual which would throw light on what would have happened had short-term rates been higher before 2004? The argument is sometimes heard that the Fed's policy of keeping the federal funds rate below 2 percent during 2002 and 2003 sowed the seeds of the GFC (although, given the long lags implied, the logic of such a position is not obvious). While not a strict counterfactual, one international comparison between the United Kingdom and Canada is very telling. The Bank of England, worried about strong domestic demand as well as continued rises in house prices and expecting a return of core inflation to around 2 percent from a lower level, did not follow the sharp cuts in the federal funds rate in 2001. A renewed tightening began from late-2003 taking Bank rate to 4¾ percent by mid-2004 – even though core inflation was below 1½ percent during almost all of 2003 and 2004. Tighter monetary

policy did not prevent the build-up of financial imbalances in the United Kingdom. And this policy did contribute to an overvalued currency, which created its own financial risks.

The Bank of Canada, by contrast, cut interest rates aggressively and in effect followed the federal funds rate down. But this did not induce Canadian banks to become over-extended because of much stricter regulation (notably the existence of a leverage ratio and limits to banks' off-balance sheet exposures to securitized products) and because a less contestable domestic banking market allowed fatter margins. Canada made the right choice of better regulation and easy monetary policy; the United Kingdom chose lax regulation and tight monetary policy. In the event, Canada weathered the GFC much better than the United Kingdom, despite its closer financial and economic links to United States, which was at the center of the GFC.

The major policy shortcomings that aggravated the 2008/09 financial crisis were not related to monetary policy. They were rather the failures of international banking regulation (notably the lack of realistic capital requirements on securitized assets held on their balance sheets and on credit commitments given to off-balance sheet vehicles) and of domestic supervision to address the new risks that innovation in the financial industry had created (Ramaswamy 2017). Faced with a lack of international consensus about innovations that were difficult to understand, regulators in advanced economies too readily gave the benefit of the doubt to markets and to the major international banks (Reddy 2013).

As noted in another paper for this conference, the BIS has challenged the Svensson analysis. In its 2016 *Annual Report*, the BIS put forward an alternative path for the federal funds rate from 2002 (BIS 2016). The new policy rule guiding this path was a Taylor rule augmented by a financial cycle proxy. Had the Federal Reserve followed this rule, the BIS argues, the financial crisis would have been avoided and there would have been a gain of about 1 percent a year in real US GDP over a decade or so, or 12 percent cumulatively.

However, the methodology underlying this calculation raises some questions. The federal funds rate implied by the financial cycle-augmented Taylor rule rises by much less than the actual funds rate over the 2003-06 period.[14] As noted above, a 4.25 percentage points rise in the funds rate failed to curb financial market risk-taking – much to the chagrin of Trichet and the other governors. Why then would a more modest rise started a little earlier have worked? A second problem is that no account is taken of the policy stimulus implied by QE after 2008 so the BIS exercise exaggerates the harm associated with the zero bound. It is in any event implausible that a new monetary policy rule would have significantly reined in the housing bubble and added so much to US GDP. We are skeptical that a Taylor rule augmented by any financial cycle proxy would be a useful guide to policy. As Yellen (2016) put it shortly after the

[14] The financial cycle-augmented Taylor rule in the BIS report has the federal funds rate at 2.9 percent by the second quarter of 2004 (compared with the actual 1.1 percent) and rising to a peak of only 3.5 percent in mid-2005 (the actual peak was 5.25 percent reached in 2016).

publication of the BIS report, “there is no simple rule that can prescribe, even in a general sense, how monetary policy should adjust to shifts in the outlook for financial stability”.

The implication from this new rule for monetary policy that was underlined by the BIS in June 2017 was that central banks should “tolerate longer periods of inflation below target, and tighten monetary policy if demand is strong, even if inflation is weak, so as not to fall behind the curve with respect to the financial cycle” (*Financial Times* 2017). Certainly, strong demand growth especially when the economy is near full employment justifies a tightening in monetary policy. But we would not agree that central banks should keep interest rates up in the face of prolonged periods of inflation below their target. Such a policy would run counter to the inflation-targeting mandates of many central banks, and would aggravate the risks of recession.

Almost everywhere, the post-crisis policy response focused primarily on tightening regulation and developing new macroprudential tools. Monetary policy was progressively eased to counter a deep and prolonged weakness in aggregate demand. Although such a recession was perhaps inevitable given the severity of the global financial crisis, its persistence was a surprise. Few (if any) expected low interest rates to be maintained for so long. The United States both applied regulatory tightening (notably forcing the banks to re-capitalize) more rigorously and uniformly and eased monetary policy more promptly than was the case in the euro area. This difference, as well as the fragmented policy response to the euro area’s existential crisis, likely explains the comparative success of the United States is ending its recession.

Before discussing the regulatory implications of low interest rates, one link with fiscal policy should be mentioned. One of the effects of expansionary monetary policy is to increase private sector debt. Expansionary fiscal policy would instead increase public sector debt. Whether the public sector or the private sector issues debt will influence the sustainability of aggregate debt/income ratios and this will have a bearing on the desirable monetary/fiscal mix in macroeconomic policy aimed at full employment (Poloz 2016). Greater reliance on fiscal policy rather than monetary policy to achieve macroeconomic goals might reduce financial stability risks. We do not address this question.

The implications of unusually low interest rates globally for the balance sheets of households, companies and financial institutions are going to be much larger than in the past because rates have been low for so long. Those responsible for prudential regulation need to pay particular attention to two important classes of risk. The first are the risk associated with borrowers becoming more highly leveraged as household and corporate debt-to-income ratios have risen to new highs in many countries. The second set of risks is the interest rate risks on the balance sheets of financial intermediaries. Near-zero or negative interest rates on shorter maturities have induced banks and other investors to seek yield by lengthening the maturity of the bonds they hold as assets. The profitability of interest rate carry-trades for many years has led many financial firms to lengthen the maturity of their debt instruments, and this has lowered long-term rates. Falling long-term interest rates for some years have given financial firms holding bonds on the asset side of their balance sheets large capital gains.

At the same time, this lengthening in duration has made the market value of portfolios of debt securities more sensitive to changes in benchmark long-term rates. Interest rate risk exposures have therefore risen. Turner (2014) argued that, even in normal times, regulatory and accounting rules do not treat interest rate risk well.[15] Low interest rates mean that those responsible for the supervision of banks and institutional investors need to take a hard look at how their current rules encourage greater interest rate risk exposures. At the very least, they need to redouble efforts to ensure that interest rate risk exposures are better managed than they are at present.

Interest rate developments should also influence the design of macroprudential instruments. Consider the evolution of rules on household property mortgages. Loan-to-value (LTV) ratios have been widely imposed, and have had much success in ensuring the balance sheets of lending institutions remain resilient in the face of property price declines. But such rules may not protect households from borrowing too much when interest rates are unusually low: a low debt service ratio today does not mean households will be able to service their mortgage when interest rates rise. One solution is to impose debt-to-income (DTI) ratios. After its successful use of LTV ratios, for example, the Reserve Bank of New Zealand (RBNZ) recently proposed that it be given powers to use DTI ratios. It argues that such ratios would help to constrain the credit/asset price cycle in a manner most other macroprudential ratios would not (RBNZ 2017).

So our answer to the question of this section is: "No, financial stability considerations should not in general constrain monetary policy. But prudential policies may need to be adapted to curb risks created by higher levels of debt and by the maturity mismatches/interest rate exposures associated with a long period of very low rates." A possible rejoinder is that this answer amounts to advocating that one arm of policy (regulation) undo the inevitable consequences of another arm of policy (monetary expansion). There are two reasons why this rejoinder is not convincing. The first is that expansionary monetary policy can also improve financial stability (higher incomes from stronger growth lowers debt/income ratios of many borrowers, lower interest charges help liquidity-constrained but viable debtors avoid default, encouraging investors to buy risky assets that are typically undervalued in a recession and so on). The second is that prudential policy has to take account of unusual interest rate configurations -- whether caused by domestic monetary policy or not. There will be many circumstances when the central bank will want to ease monetary policy but tighten

[15] Three points by way of brief summary. The first is that the spread of fair value accounting requiring pension firms to revalue assets and liabilities as market interest rates change encourage "liability-driven" strategies. For instance, IAS 9 requires that defined-benefit pension liabilities be discounted by a bond yield. Hence a fall in the bond yield can lead to accounting losses and lead firms to protect themselves by buying more very long-term bonds. Such purchases can drive yields even lower in effect magnifying the initial interest rate shock. The second is that the European Solvency II directive, in an effort to reduce credit risks, pushes insurance companies to hold fewer equities or corporate bonds and more government bonds. To try to maintain yields on their assets as they reduce credit risk exposures, firms tend to increase the duration of their government bond holdings. Such substitution of interest rate risk for credit risk on their financial assets can lead to destabilising market dynamics and inferior investment choices. The third major shortcoming is the lack of a capital charge under Basel III for interest rate risk from bonds held in the banking book. This has induced banks in some jurisdictions (especially those where the government depends heavily on their banks to hold government bonds) to build up large interest risk exposures.

macroprudential policies. The recent policies of the RBNZ illustrate this well. As the Governor noted, the introduction of macroprudential speed limits on high loan-to-value lending for mortgages, "moderated excesses in the housing market, thereby enabling the Bank to delay the tightening of interest rates, and reducing the incentive for further capital inflows into the New Zealand dollar" (Wheeler 2014). It deserves emphasis that there is absolutely no logical presumption that macroprudential tightening measures need to be complemented by monetary tightening.

This general policy orientation does not of course mean that central banks can ignore large increases in asset prices fuelled by debt when they set monetary policy because such developments can have macroeconomic effects that models used by central banks in forecasting may not fully capture. The best illustration of this is the Reserve Bank of Australia's (RBA) response to the Australian real estate boom in the early 2000s – which often hailed as an example of "leaning against the wind". Financial deregulation and innovation (including the securitization of mortgages) had made it much easier and cheaper to get a mortgage. A reduction of the tax on capital gains from property further supported the boom. Over a period of five years, house prices doubled and debt-to-income ratios followed a similar trend. From mid-2002, the RBA began to increase its policy rate. How did the Governor, who was worried about the risks coming from a debt-driven boom in house prices, justify the decision to raise rates? His statement read, "To persist with a strongly expansionary policy setting would risk amplifying inflation pressures and, over time, could fuel other imbalances such as the current overheating in the housing market, potentially jeopardizing the economy's continued expansion" (Macfarlane 2002). He focused on the threat to inflation. He did not say that rates were going up to preserve financial stability. And the economy did indeed continue to expand.

VI. Exchange Rate Policy

If Asian economies were suffering a loss of external demand, it might be argued that officials should seek a more competitive exchange rate by selling domestic currency for foreign currencies. However, for those economies experiencing the most pronounced growth slowdowns (Korea, Japan, Thailand, Hong Kong, Singapore, and Taiwan) the cause is domestic not external. All of these economies have current account surpluses, and in all but Hong Kong, these surpluses have been rising in recent years. (See figure 14.) Thus, the external sector has on net been supporting growth in most of the Asian economies experiencing slower growth. Among the large emerging Asian economies, only India and Indonesia have current account deficits, and in both cases the deficit is quite modest at around 2 percent of GDP.

Figure 15 shows that many Asian economies have piled up unprecedented levels of foreign exchange reserves and paid down official external debts in some cases. In many cases, official foreign assets far exceed reasonable precautionary needs (Bergsten and Gagnon 2017). Moreover, combatting currency mismatches is at least as important as accumulating reserves for the purpose of preventing future balance of payment crises (Gagnon 2013). Thus, for most large Asian economies, continued accumulation of foreign exchange reserves is not justified by either macroeconomic or precautionary needs. The IMF estimates that the aggregate saving

ratio of developing Asia has exceeded 40 percent of GDP for many years – far above that prevailing elsewhere. In such circumstances and, given the chronic shortfall of aggregate demand at the global level since the GFC, excess reserve accumulation that supports a current account surplus exerts a powerful negative externality on the rest of the world.

In some cases, the stock of foreign exchange reserves may fall as officials seek to prevent unwanted currency depreciation. For example, China's reserves fell by roughly $1 trillion over the past three years. The central bank may want to prevent a credit-depressing shrinkage of its balance sheet. In the case of China, a rise in loans to domestic banks offset the decline in foreign currency assets on the central bank's balance sheet.

VII. Conclusion

Growth in several Asian economies remains disappointing, and there are significant downside risks. With inflation declining to very low levels, central banks in Asia should be ready to use the policy tools at their disposal to sustain aggregate demand to meet medium-term inflation targets. Indeed, for Thailand and Korea at least, conditions already support further monetary ease.

Financial stability worries do not in general justify keeping the policy rate higher than warranted by macroeconomic conditions. Indeed such a policy would be fraught with risks: for instance, Brunnermeier and Schnabel (2016) pointed out, when discussing the Swedish Riksbank's decision to raise rates in 2010 to counter a property price bubble, that increasing rates when banks are vulnerable and leverage in the economy high might not be the best option. Top of the policy agenda should be measures to adapt both regulatory and macroprudential policies and the focus of supervision on the new (or accentuated) financial risks created by a very long period of exceptionally low interest rates, long as well as short.

Although some of the channels of monetary policy transmission have been weakened by globalization, Asian central banks have not lost their monetary autonomy (Santiprabhob 2017). The volatility of capital flows and vulnerability of domestic financial conditions to sudden shifts in investor risk preferences create difficult monetary policy dilemmas. As Obstfeld (2015) put it, "financial globalization has worsened the trade-offs monetary policy faces in navigating between multiple domestic objectives." The most reliable compass remains flexible inflation targeting. Even if the policy rate gets stuck at the zero lower bound, central banks still have tools to keep inflation within their policy mandate. In particular, they have the scope to expand their holdings of domestic assets (financial securities and loans to banks).

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Table 1. Phillips Curves Regressions on US GDP Deflator
Inflation – Expected Inflation = α + β Gap + γ Gap*(Inflation Dummy)

Expectations Measure	Survey	Survey	Lag	Lag	Lag
Unemp Gap	0.16		0.09	0.15	
	(0.11)		(0.11)	(0.09)	
Cap Util		0.23***			0.25***
		(0.08)			(0.06)
Unemp Gap (Inf>3)	1.03***		0.80***	1.00***	
	(0.21)		(0.18)	(0.14)	
Cap Util (Inf>3)		0.00			-0.01**
		(0.01)			(0.00)
Constant	0.37	-18.09***	0.08	0.25	-20.08***
	(0.29)	(6.18)	(0.18)	(0.17)	(4.49)
R-squared	0.39	0.22	0.27	0.56	0.37
Observations	180	180	269	197	197
Sample	72Q2-17Q1	72Q2-17Q1	50Q1-17Q1	68Q1-17Q1	68Q1-17Q1

***, **, and * denote 1, 5, and 10 percent significance levels, respectively. Newey-West standard errors are in parentheses.

Sources: Haver Analytics and authors' calculations. See text for description of variables.

Table 2. A Central Bank Balance Sheet

ASSETS	**LIABILITIES**
Foreign assets	Cash
Government bills	Required bank reserves
Government bonds	Excess bank reserves
Loans to domestic banks	Government deposits
Other local financial assets	Equity

Table 3. Scope for Quantitative Easing, December 2016
(percent of 2016Q4 GDP, seasonally adjusted annual rate)

	Central Bank Liabilities	General Govt. Gross Debt	Broad Money[1]	Equity Market Capitalization
Australia	10	44	112	101
Bangladesh[2]	n.a.	33	55	16
China	39	46	202	66
Hong Kong[3]	65	0	247	560
India[4]	21	70	82	70
Indonesia	13	28	38	45
Japan	80	239	237	104
Korea	28	39	201	92
Malaysia	35	56	128	130
New Zealand[5]	10	30	101	n.a.
Philippines	30	34	62	80
Singapore	37	112	136	220
Taiwan	87	35	238	157
Thailand	46	42	124	103
Vietnam[2]	n.a.	62	n.a.	3

1. M3 where available, otherwise M2.
2. Based on 2016 annual GDP.
3. Data exclude assets denominated in foreign currency and shares of mainland companies.
4. Broad money based on April 2017 to avoid effects of demonetization in late 2016.
5. Central government debt.
Sources: Haver Analytics and Hong Kong Monetary Authority.

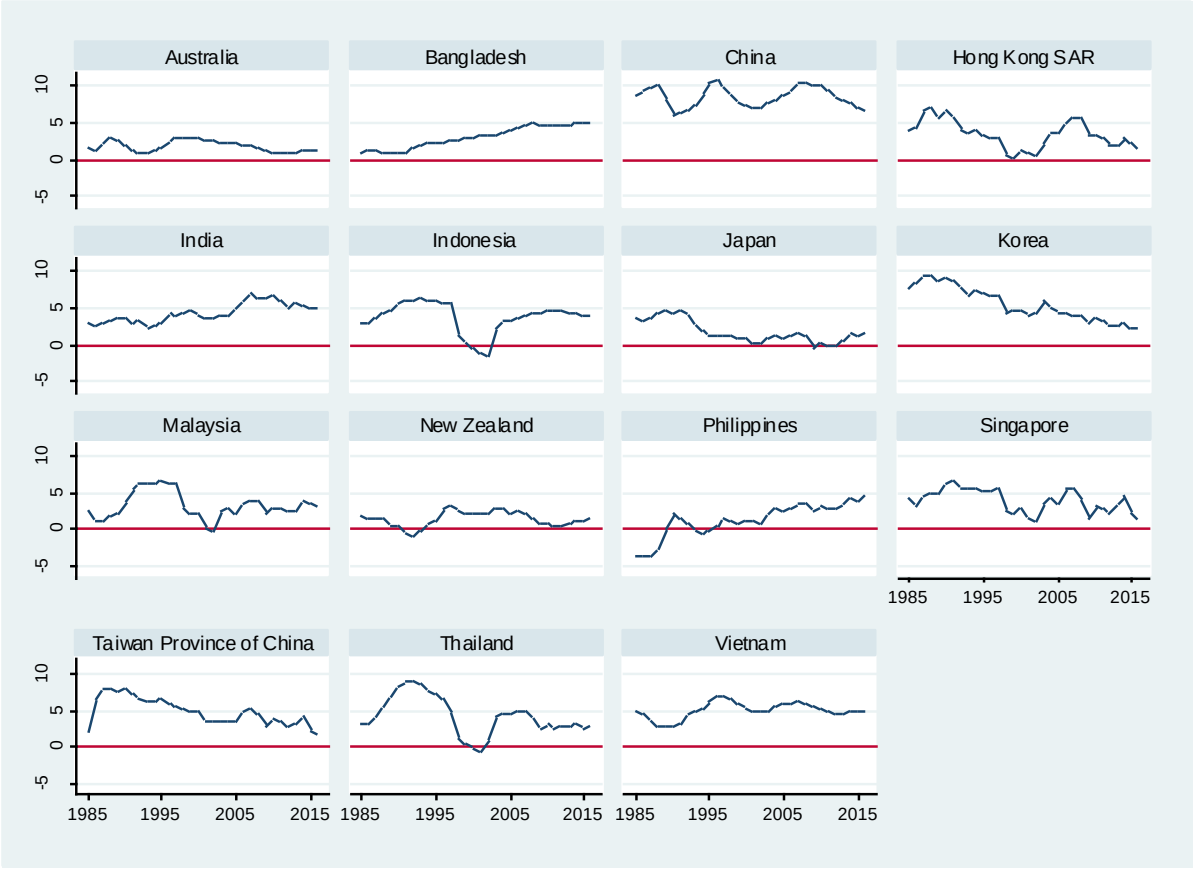

Figure 1. Growth Rate of Real Per Capita GDP, 5-year moving average, percent
Source: IMF World Economic Outlook Database.

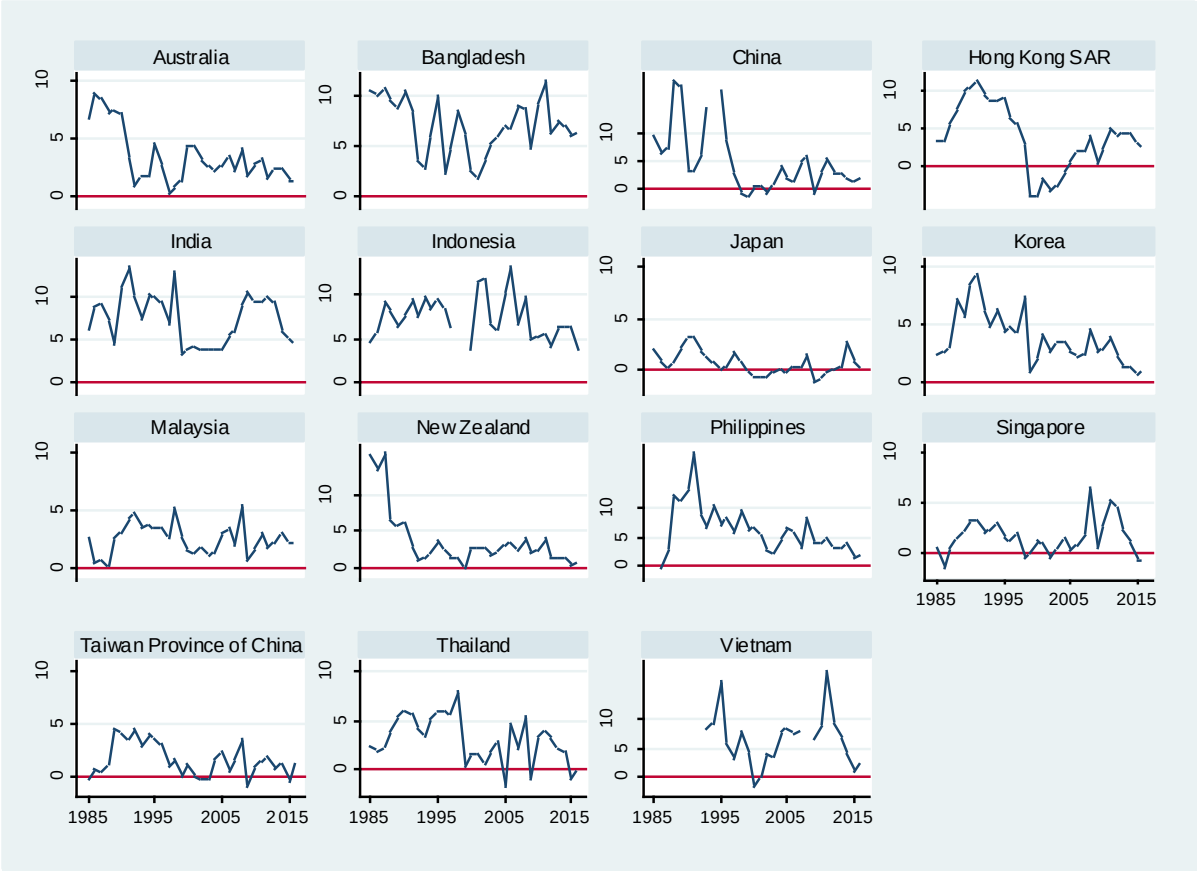

Figure 2. CPI Inflation Rates in Asia, percent per year
Note: Observations above 20 percent have been dropped.
Source: IMF World Economic Outlook database.

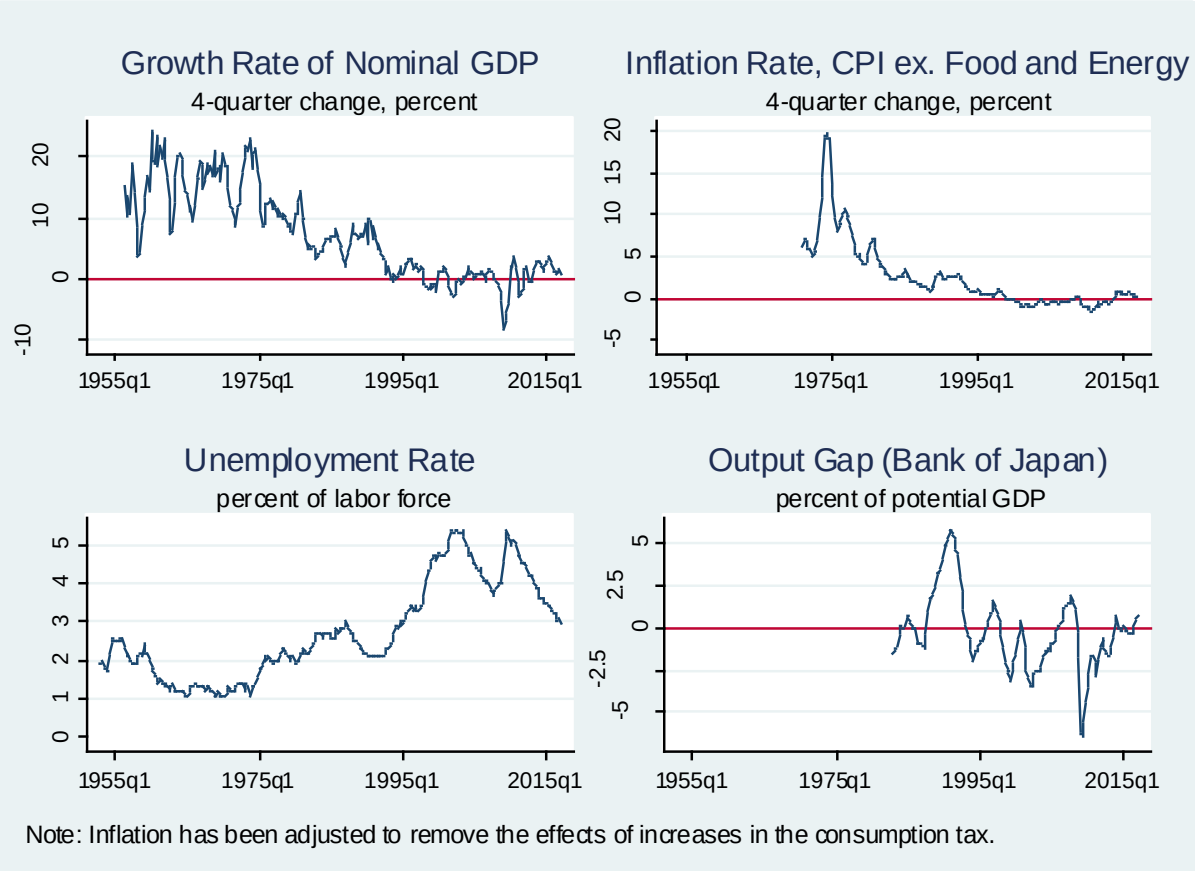

Figure 3. Macroeconomic Developments in Japan
Sources: Bank of Japan, Haver Analytics, and authors' calculations.

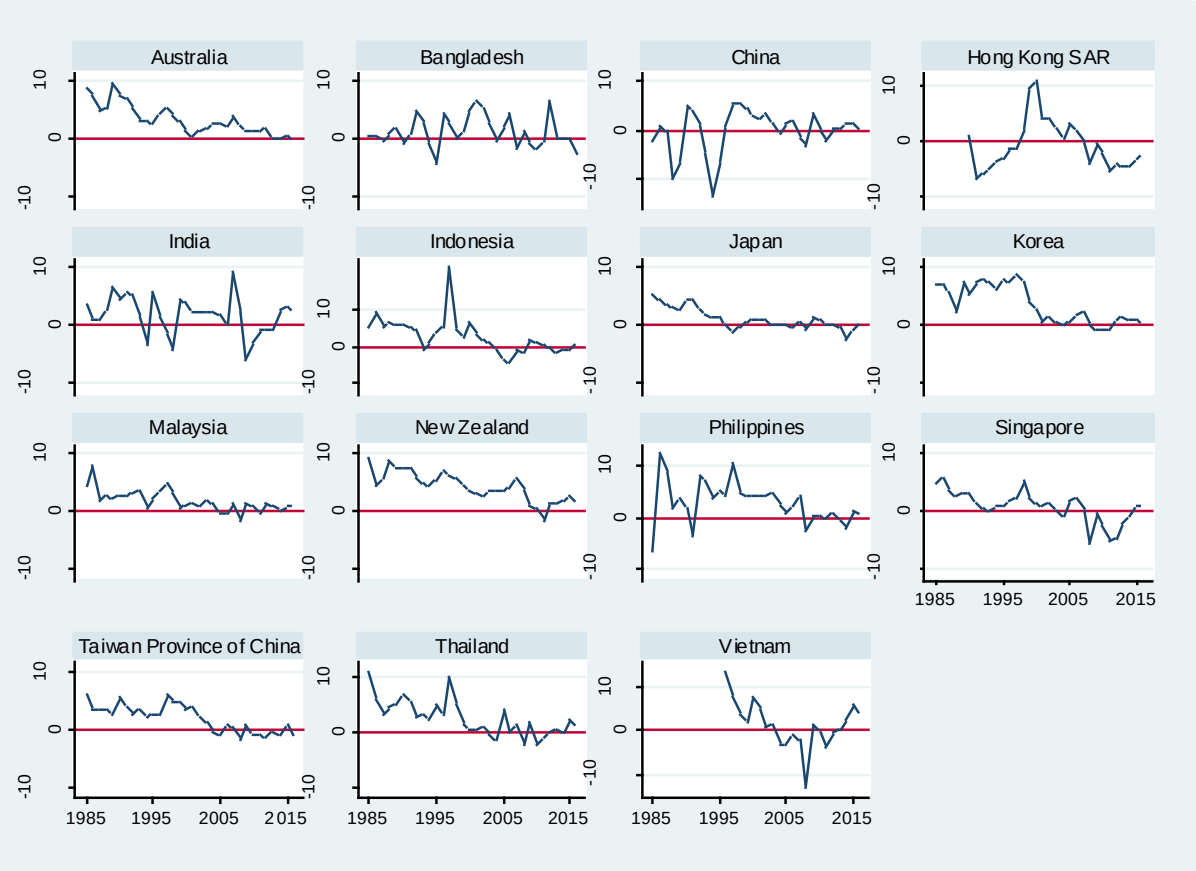

Figure 4. Real Short-term Interest Rates in Asia, percent
Sources: Haver Analytics and IMF International Financial Statistics and World Economic Outlook databases. Real interest rate is 3-month Treasury bill rate (or closest equivalent) minus current CPI inflation rate.

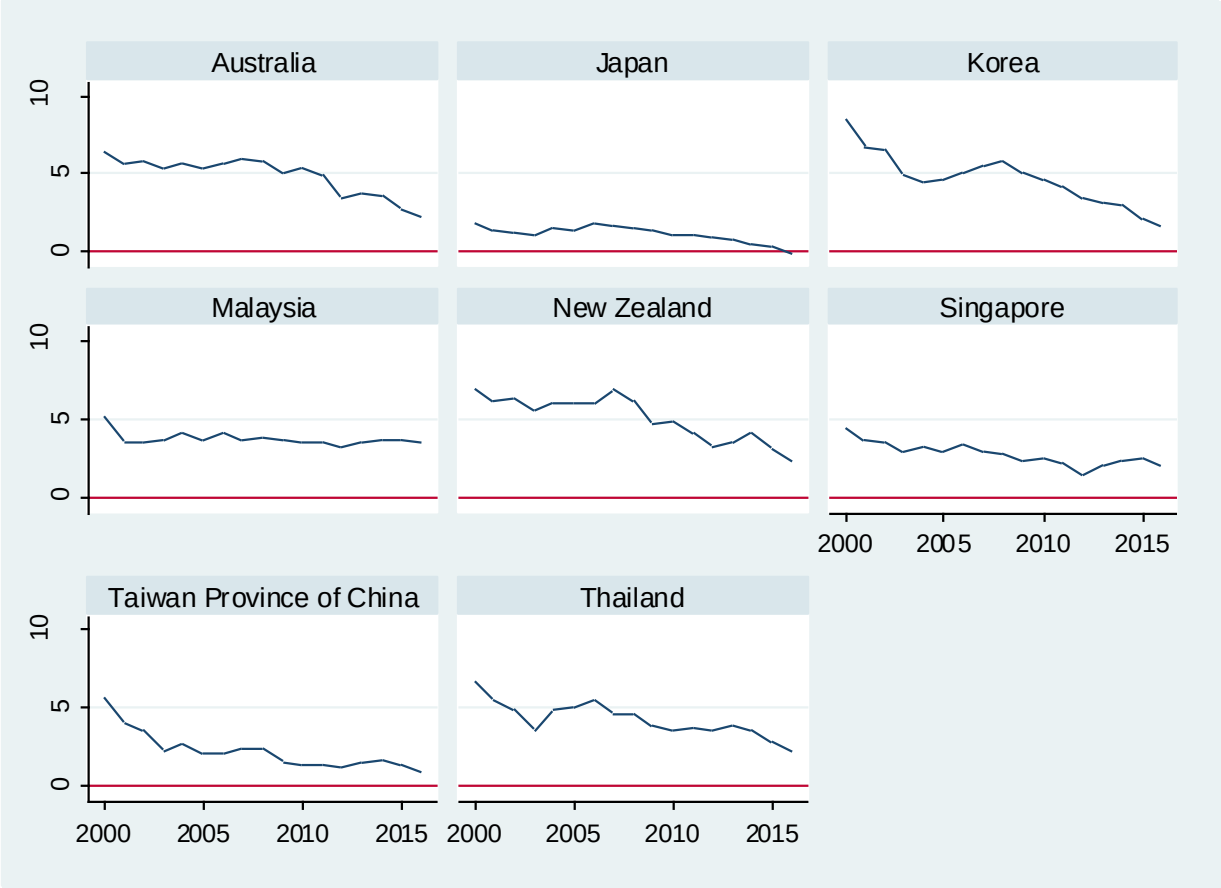

Figure 5. 10-year Bond Yields in Asia, percent
Sources: Haver Analytics and IMF International Financial Statistics and World Economic Outlook databases.

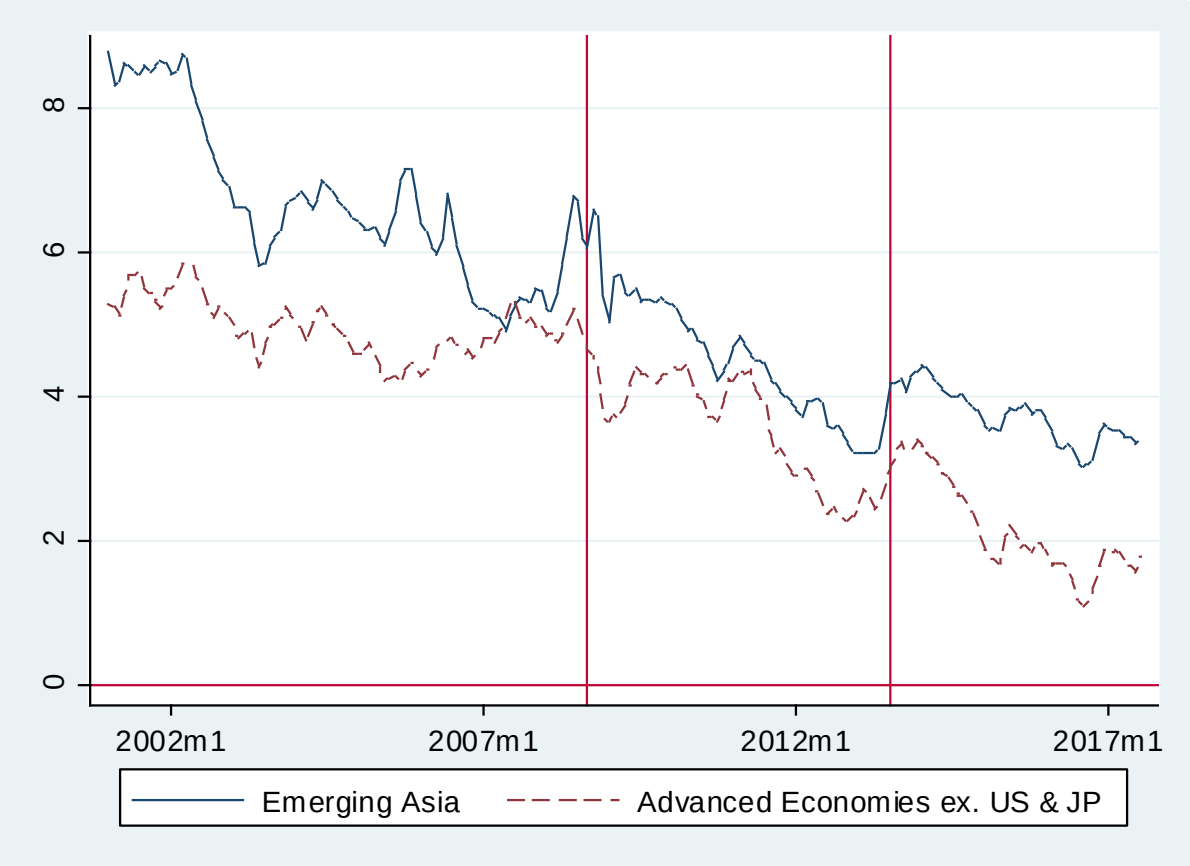

Figure 6. Bond Yields: Emerging Asia and Selected Advanced Economies, Jan. 2001 through July 2017
Note: Vertical lines denote the collapse of Lehman Brothers in September 2008 and the taper tantrum in July 2013. Emerging Asia is unweighted average of Indonesia, Korea, Malaysia, Philippines, Taiwan, and Thailand. Advanced economies is unweighted average of Australia, Canada, euro area, New Zealand, Sweden, and United Kingdom.
Sources: BIS and Haver Analytics.

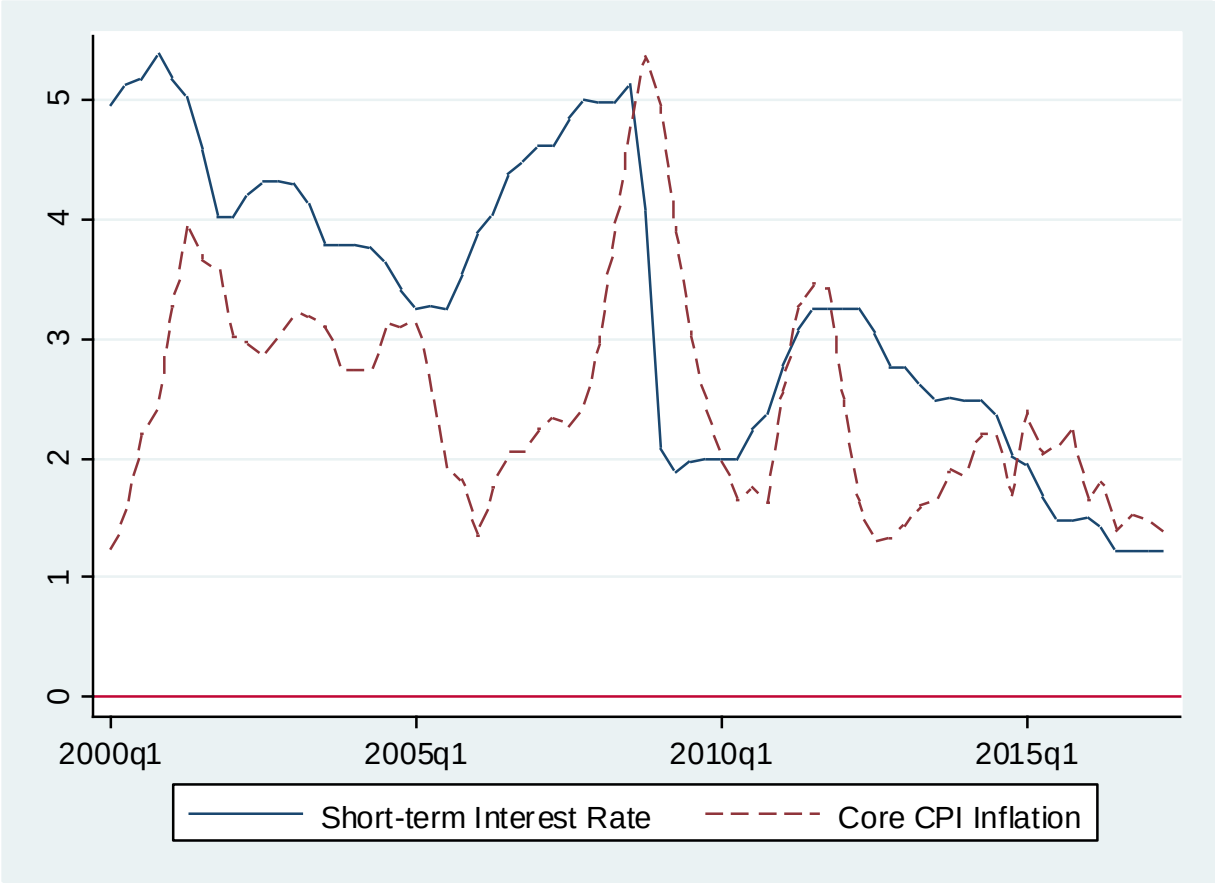

Figure 7. Korean Monetary Policy Since the Asian Financial Crisis, 2000Q1-2017Q2
Source: Haver Analytics. Interest rate is the call money rate. Inflation is the 4-quarter change in the CPI excluding agriculture and oil.

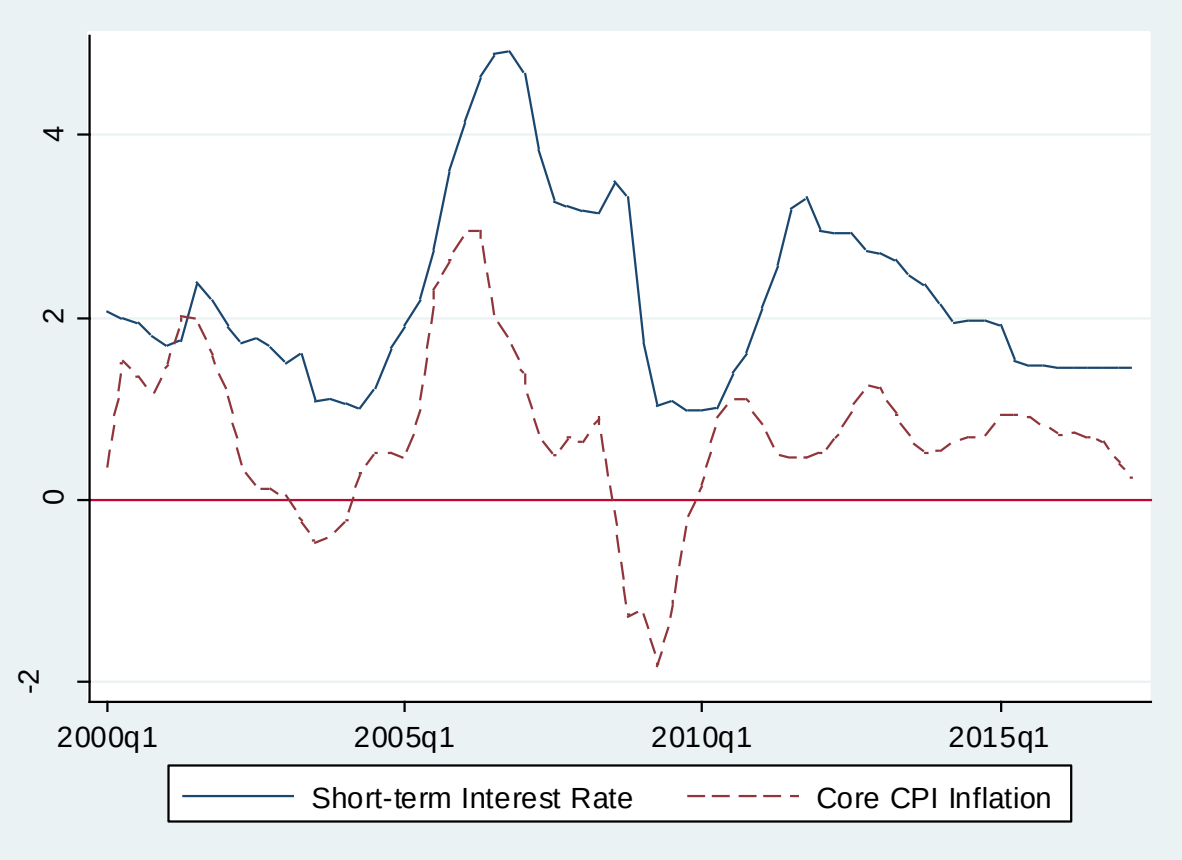

Figure 8. Thai Monetary Policy Since the Asian Financial Crisis, 2000Q1-2017Q2
Source: Haver Analytics. Interest rate is the call money rate. Inflation is the 4-quarter change in the CPI excluding food and energy.

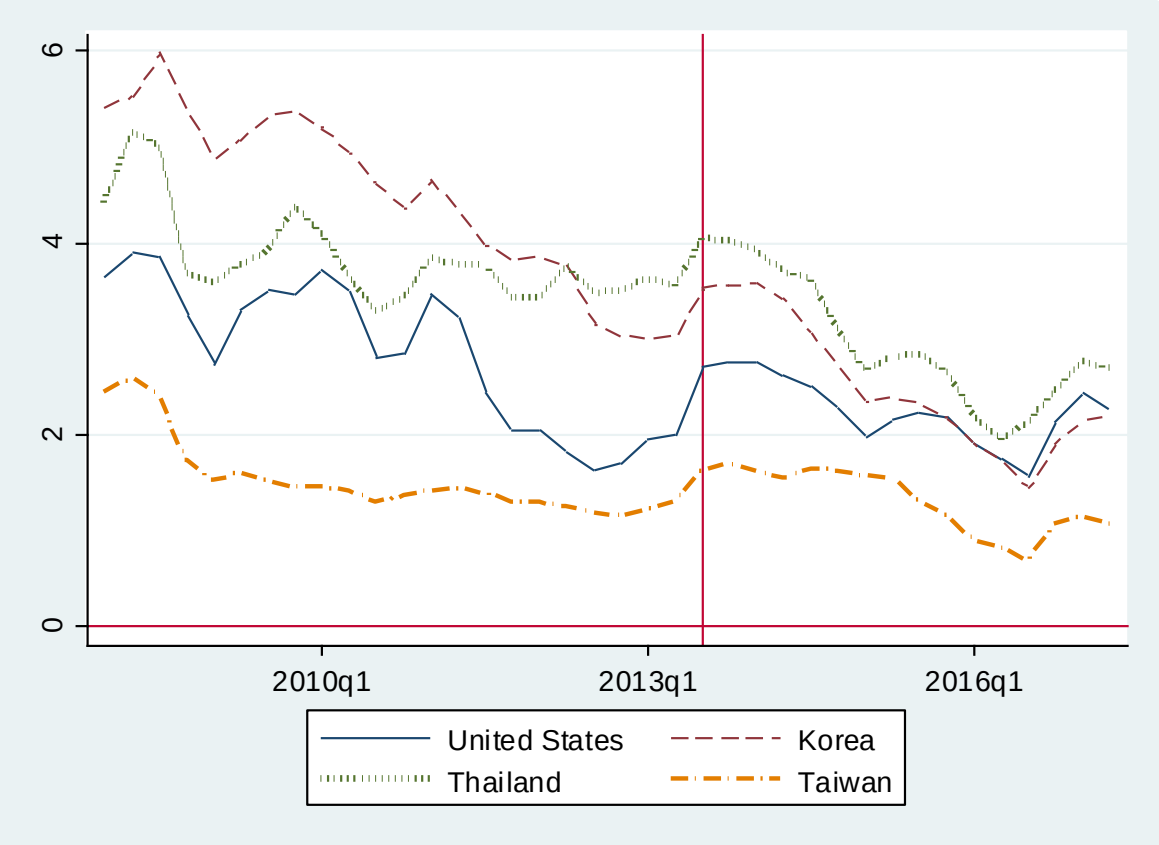

Figure 9. US and Asian bond yields and the Taper Tantrum, 2008q1-2017q2
Note: The vertical line marks the taper tantrum of 2013q3.
Source: Haver Analytics.

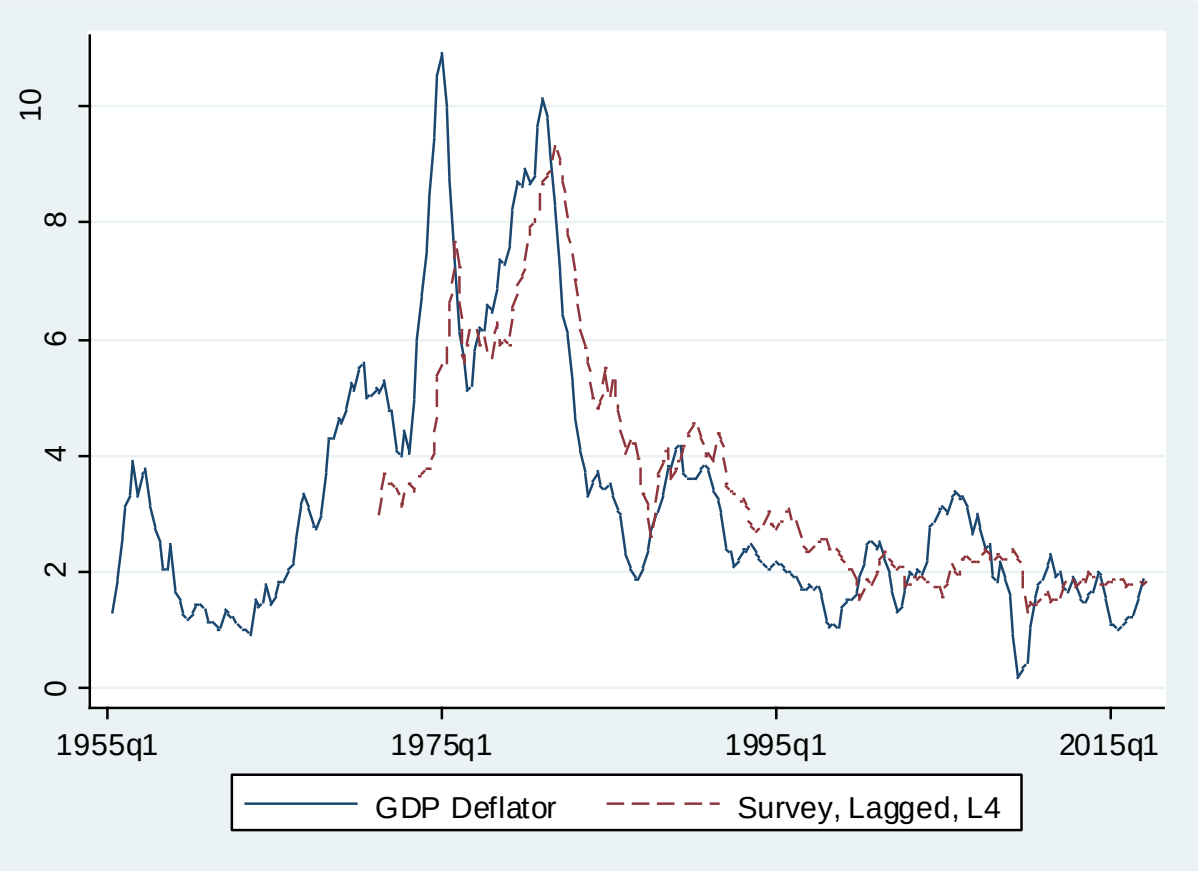

Figure 10. US GDP Inflation Rate and Professional Forecaster Survey, 1955Q1-2017Q1
Source: Haver Analytics. Inflation rate is 4-quarter percent change. Survey is 1-year ahead forecast of GDP inflation.

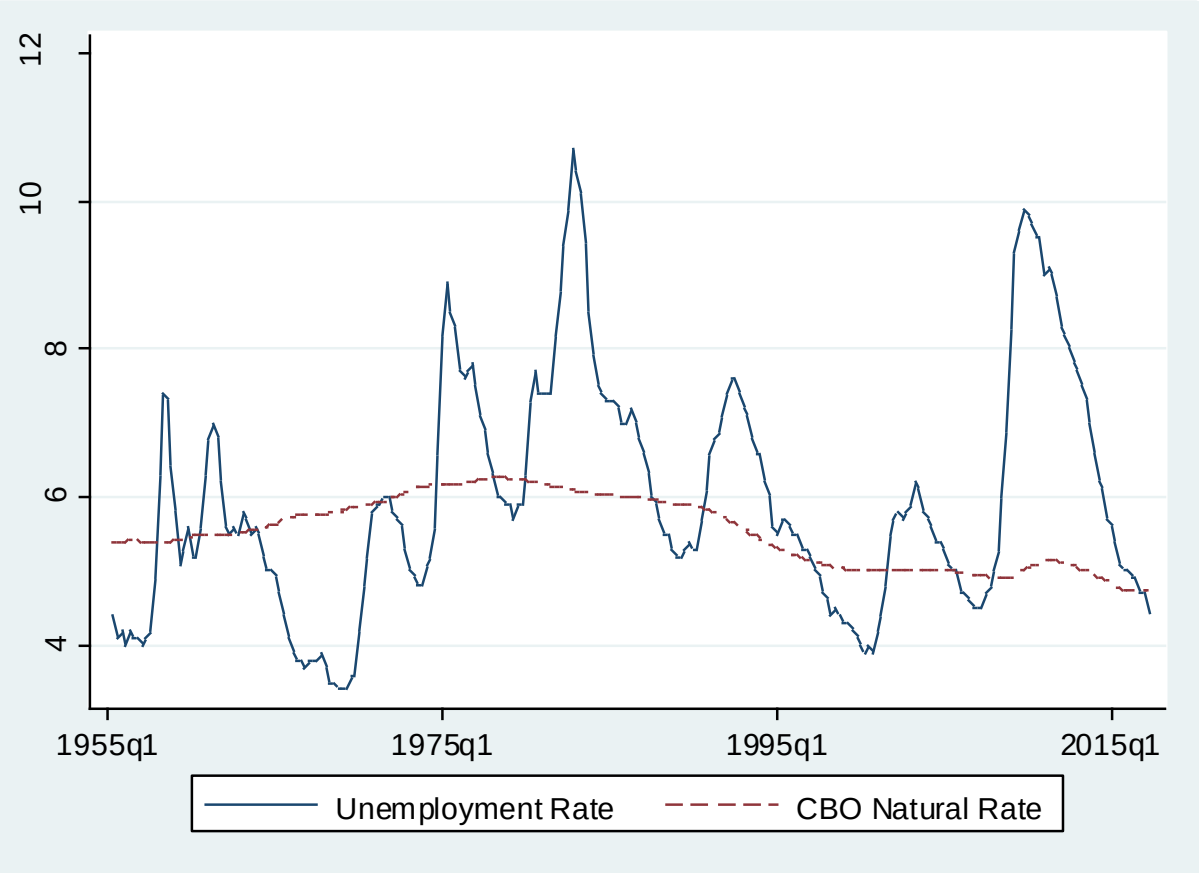

Figure 11. US Unemployment Rate, 1955Q1-2017Q1
Source: Haver Analytics.

Figure 12. US Phillips Curves for GDP Inflation and Unemployment Gap, 1955Q1-2017Q1
Source: Haver Analytics and authors' calculations.

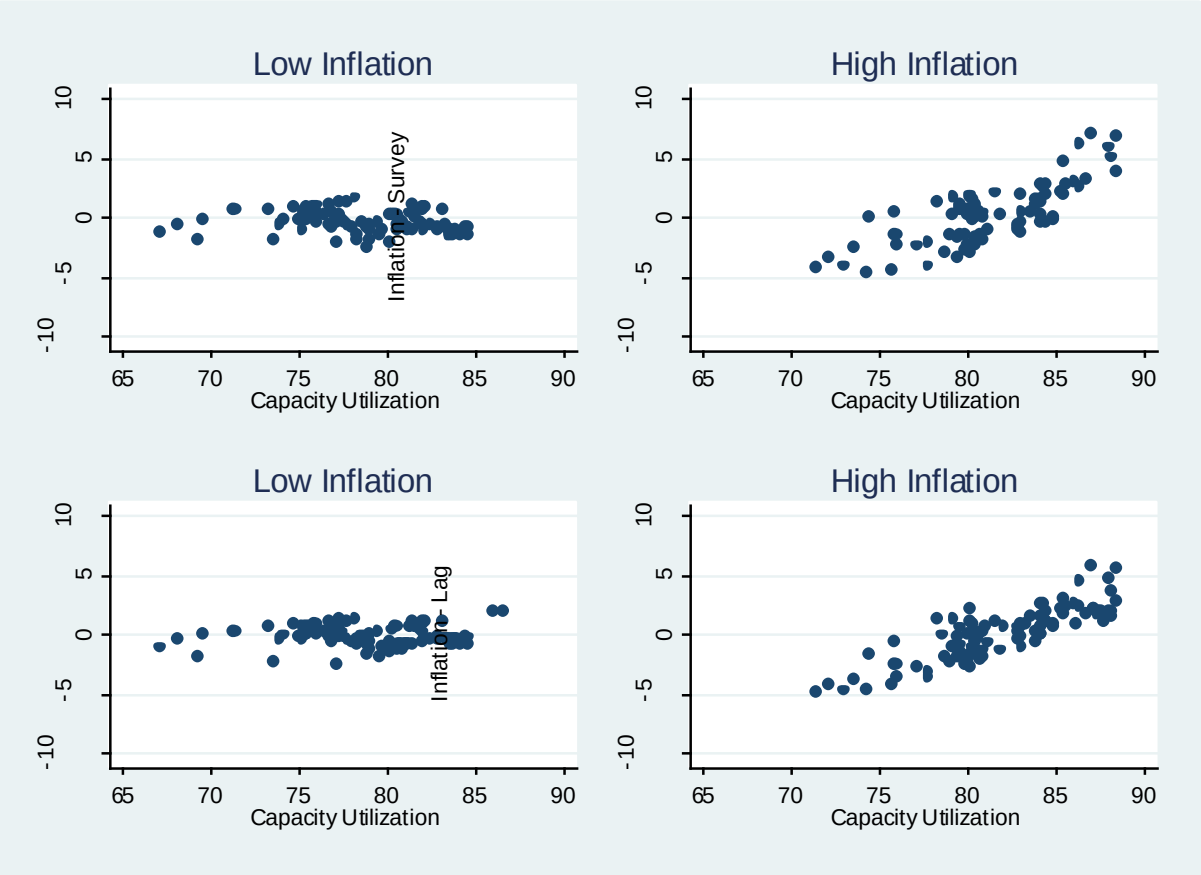

Figure 13. US Phillips Curves for GDP Inflation and Capacity Utilization, 1968Q1-2017Q1
Source: Haver Analytics and authors' calculations.

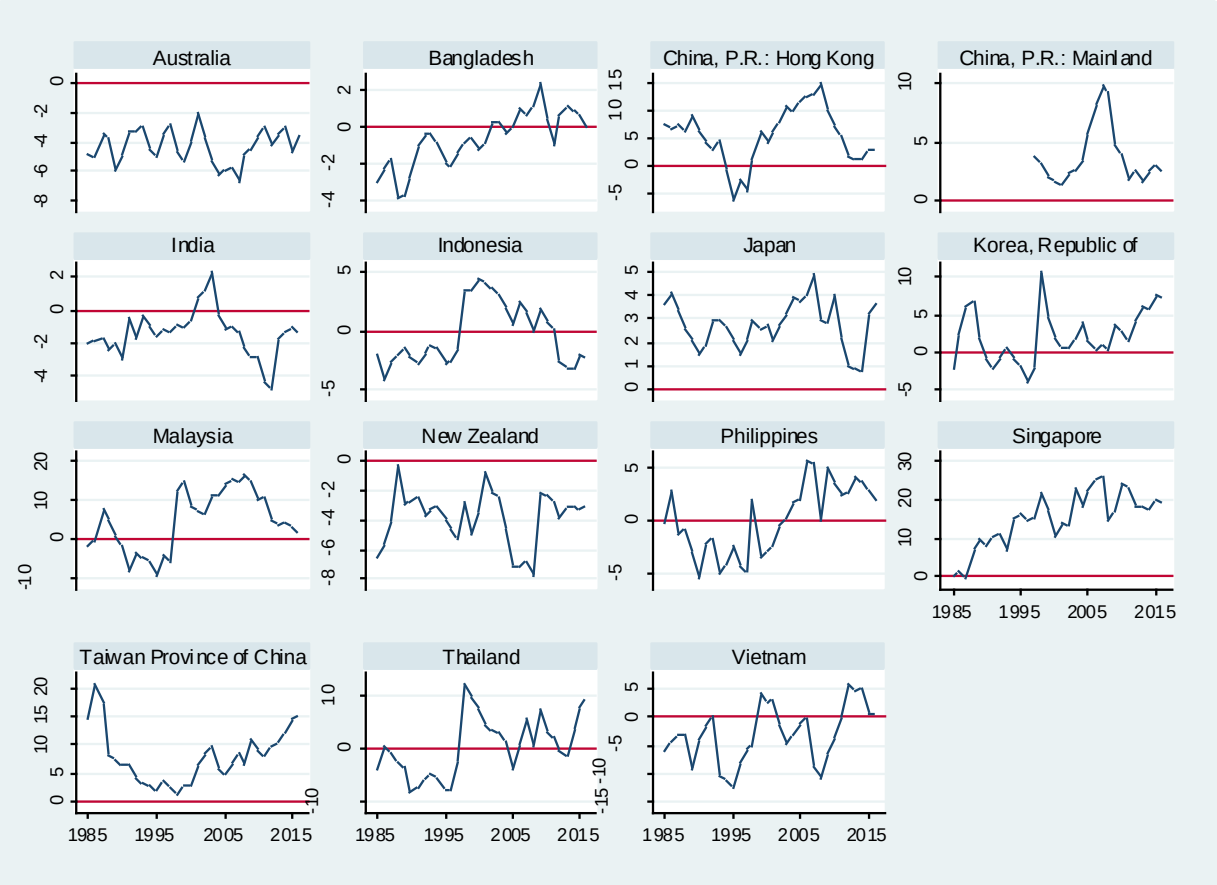

Figure 14. Current Account Balances in Asia, 1985-2016, percent of GDP
Source: IMF World Economic Outlook database.

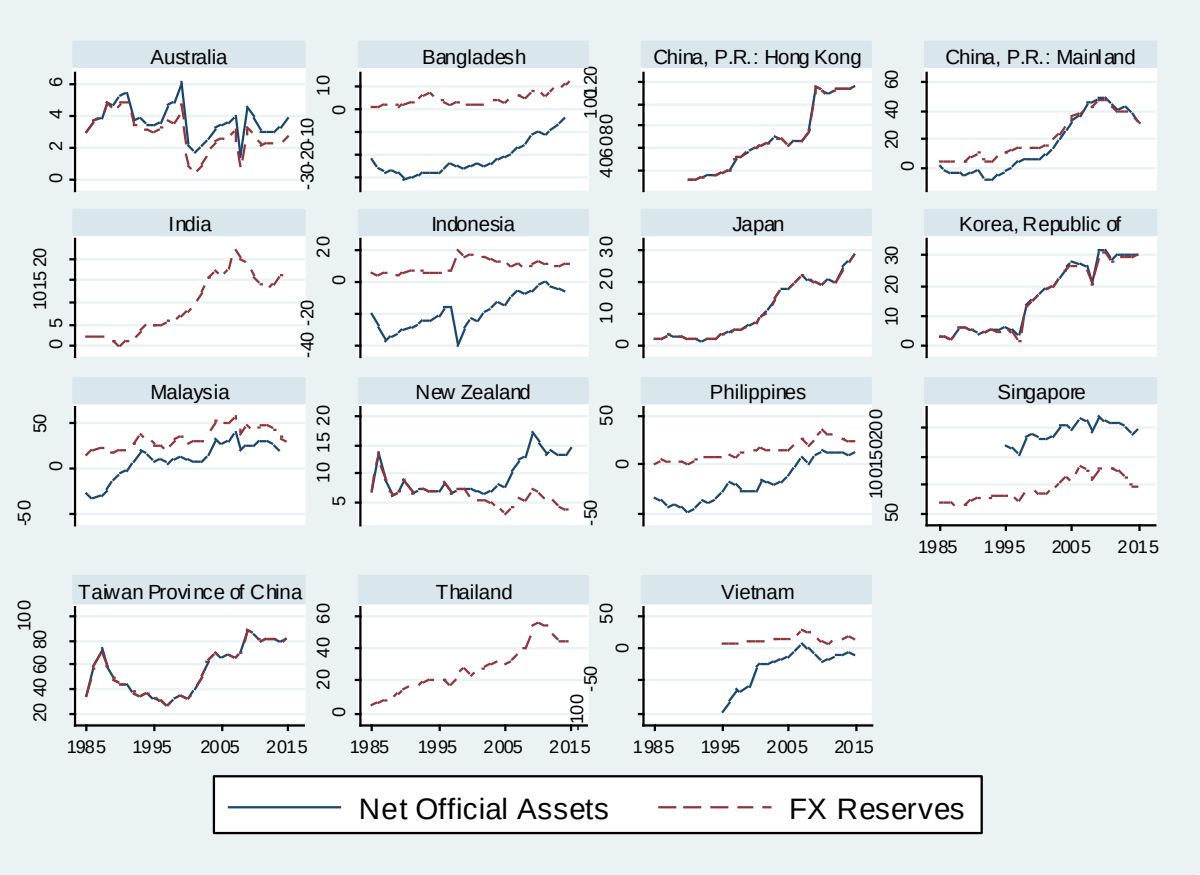

Figure 15. Foreign Exchange Reserves and Net Official Assets in Asia, 1985-2016, percent of GDP
Note: Net official assets are foreign exchange reserves plus other official assets (including sovereign wealth funds) minus official borrowing in foreign currencies.
Source: Bergsten and Gagnon (2017).