International Monetary Policy Coordination: Past, Present and Future

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Abstract This paper examines two explanations for the recent spate of complaints about cross-border monetary policy spillovers and calls for international monetary policy coordination, a development that contrasts sharply with the monetary system in the 1980s, 1990s and until recently. The first explanation holds that deviations from rules-based policy at several central banks created incentives for other central banks to deviate from such policies. The second explanation either does not see deviations from rules or finds such deviations benign; it characterizes recent unusual monetary policies as appropriate, explains the complaints as an adjustment to optimal policies, and downplays concerns about interest rate differentials and capital controls. Going forward the goal should be an expanded rules-based system similar to the 1980s and 1990s which would operate near an international cooperative equilibrium. International monetary policy coordination—at least formal discussions of rules-based policies and the issues reviewed here—would help the world get to this desirable situation.

As with most forecasting endeavors, predicting the likely course of international monetary policy coordination requires examining recent trends and then determining the state of play today.[2] Empirical research beginning in the early 1980s predicted that the gains from international coordination of monetary policy would be quantitatively small compared to the gains achieved from each central bank simply following a monetary policy which optimized its own country's economic performance.[3] This was the implication of empirically estimated multi-country monetary models that assumed market-determined flexible exchange rates,

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[2] Although international regulatory and prudential issues—including lender-of-last-resort and failure resolution of large financial firms—are a significant issue for central bank coordination, I focus here on monetary policy coordination. Thus, issues like swaps between central banks, while demonstrating significant coordination during the panic of 2008 and raising additional issues for the future, are not discussed here. I also do not consider coordination between fiscal policy and monetary policy.
[3] See, for example, the studies by Oudiz and Sachs (1984), Taylor (1985, 1993), and Obstfeld and Rogoff (2002) which all built on the earlier theoretical work of Hamada (1976).

international capital mobility, no arbitrage on the term structure of interest rates, rational expectations, and price and wage rigidities which formed the basis for monetary policy effectiveness. If each central bank in a flexible exchange rate system followed a monetary policy rule which was optimal for its own country's price stability and output stability, then the models showed that there would be little additional gain from the central banks' jointly optimizing policies.

These predictions turned out to be pretty close to actual monetary policy outcomes in the developed countries during the Great Moderation period—the 1980s, 1990s, and until recently. As central banks moved toward more transparent rules-based monetary policies—including through inflation-targeting or flexible inflation targeting—and focused on domestic price and output stability, economic performance improved dramatically, especially compared with the 1970s. By choosing policies which worked well domestically with relatively little concern about spillover effects, central banks contributed—in "invisible hand" like fashion—to better global economic conditions. Toward the later part of this period, central banks in many emerging market countries also moved toward more rule-like policies with long-run price stability goals. As they did so, they began contributing positively to overall global monetary stability.

The situation was like a Nash equilibrium in which each country choose its own good monetary policies taking as given that other countries would do much the same under a basic understanding that the outcome would be nearly as good as if they coordinated their policy choices in a cooperative fashion. Attempts to coordinate formally policy choices across countries would likely have added little to macroeconomic stability during the Great Moderation,

much as the monetary models implied. The international monetary system was operating *near an internationally cooperative equilibrium* (NICE).[4]

But during the past decade—especially since the end of the Great Moderation—international monetary coordination and spillover effects have again become a major policy issue. Policy makers in emerging market countries such as Brazil have been complaining about adverse spillover of monetary policy in the developed countries on their currencies and thus on their own economies.[5] Policy makers in developed countries including Japan have pointed to the adverse exchange rate effects of monetary policies in other developed countries and raised concerns about currency wars and competitive devaluations. Many central banks—not only in Brazil and Japan but also in Australia, South Korea, Poland, India, Israel and Hungary—have recently taken actions "to prevent their currencies from rising and hurting exports"[6] in apparent response to actions of other central banks and perceived monetary policy spillovers. The Bank for International Settlements (BIS) has been calling for a consideration of these spillovers as well as some kind of international monetary policy coordination.[7] And reflecting the intensity of the debate over spillovers and policy coordination, the G7 Central Bank Governors and Finance Ministers recently issued a special joint statement that "monetary policies have been and will remain oriented towards meeting our respective domestic objectives using domestic instruments."[8]

What caused the recent departure from the NICE monetary system? Broadly speaking there are two explanations. The first is that monetary policy deviated from the optimal rule-like

[4] Mervyn King (2003) used the acronym NICE to refer to the "non-inflationary consistently expansionary" period otherwise known as the Great Moderation. One could say that the NICE *system* helped the world economy stay together during the NICE *period*.
[5] Winter and Bohan (2012)
[6] Mead and Hilsenrath (2013)
[7] Caruana (2012a, 2012b)
[8] Statement by G7 Finance Ministers and Central Bank Governors, February 12, 2013

policies which were a prerequisite for the result that the gains from international coordination were relatively small; the theory was not wrong, but rather the policy assumptions that went into the theory no longer held.[9] Empirical research shows such deviations in the United States and some other countries starting about a decade ago when interest rates were held very low.[10] Indeed, there has been a "Global Great Deviation" to use the terminology of Hofmann and Bogdanova (2012), who also show that the deviation is continuing to the present—especially when the unconventional central bank interventions and large-scale balance sheet operations are included. According to this explanation the responses of central banks to the deviations of policy of other central banks causes them to deviate from the optimal policy that would otherwise be appropriate based on their own domestic considerations.

The second explanation is that the complaints about spillovers and calls for coordination by some countries are part of a process by which some central banks are adapting their policies to better suit their own domestic situation.[11] This explanation applies more to the countries within the G7 than to the international monetary system as a whole. For example, according to this explanation, the Bank of Japan's recent actions represent a move toward a policy more appropriate to Japan rather than a response to the adverse spillover of the exchange rate effects of the easier policy in other G7 countries.[12] In contrast, according to the first explanation, the Bank of Japan's recent actions are a response to an adverse exchange rate spillover from other central banks in the G7 countries—the Federal Reserve, the Bank of England and the European Central Bank.

[9] Taylor (2013)
[10] See Ahrend (2010) Kahn (2010) and Taylor (2007).
[11] Bernanke (2013)
[12] In addition to its new quantitative easing policy, the Bank of Japan announced that it was raising its inflation target to 2 percent. To the extent that this was target because closer to the target of the Fed and the ECB, it could be characterized as monetary coordination or cooperation.

The purpose of this paper is to examine these recent views and developments with the aim of assessing where international monetary policy coordination policy should go in the decade ahead. I start with a very simple two-country monetary model that defines and explains the basic principle that the gains from international monetary policy coordination are quantitatively small if policy is optimal in each country. Second, I review empirical evidence—using larger-scale estimated multi-country monetary models—on the size of spillovers of monetary policy which is needed to discriminate between the different explanations of recent trends. Third, I discuss the view that holds that recent trends can be explained by a deviation from rules-based policies in some countries. Fourth, I examine the alternative view and consider evidence that helps to discriminate between the two views.

1. Basic Principles: A Simple Two-Country Model

To illustrate why and in what sense the relative gains from international coordination of monetary policy are small relative to getting the policy right domestically, consider a simple two-country monetary model with

- perfect capital mobility
- a flexible exchange rate
- staggered wage setting in each country
- domestic prices in each country affected by both domestic wages and the price of foreign inputs to production
- output in each country influenced by
    - the real interest rate
    - the real exchange rate

    - foreign demand for exports
- demand for real money balances in each country determined by real income and the nominal interest rate
- a monetary policy in each country that is focused on a simple policy rule in which the short term interest rate is adjusted according to the movements in the average price level relative to a target.

Effectively this is a new-Keynesian, two-country, Mundell-Fleming framework with sticky (not fixed) prices and rational expectations in which the central banks follow an interest rate rule. A list of the model equations and variables is found in the appendix. To create a meaningful policy problem, I also assume that there are serially uncorrelated shocks to the wage equations in both countries. This creates a policy tradeoff between price stability and output stability. I also assume that monetary policy is optimal or efficient in that it effectively offsets other shocks to the economy. For this reason I abstract from other shocks to the economy in the simple model.

In such a model, the problem for the central bank is to decide how accommodative to be to price changes. Let *a* be the response coefficient of the real interest rate to percentage changes in the price level. If the central bank chooses to have a higher rather than a lower response coefficient (a higher *a*), then there will be more price stability but less output stability. For example, for the parameter values in the appendix, when the interest rate reaction coefficient increases from .2 to .6 the standard deviation of the price level falls from .423 to .188 or by .235 and the standard deviation of output (percent deviation from potential) rises from .111 to .147 or by .036. Conversely, if the central bank chooses to react less to price changes (a lower *a*), then there will be less price stability but more output stability.

The sense in which the gains from international policy coordination are small is that the central bank's choice of a policy rule—in this case the decisions to be more or less accommodative—has relatively little impact on output and price stability in the other country. For example, if the policy reaction coefficient was .2 rather than .6 in Country 1, then according to this simple model the standard deviation of the price level and the standard deviation of output in Country 2 would be only .007 and .003 higher, respectively, when the reaction coefficient is .6 in Country 2. When the reaction coefficient in Country 2 is .2, then these standard deviations would be .002 and .001 lower when Country 1 used a .2 rather than a .6 reaction coefficient. So the impact on price and output stability in Country 2 is only a very small fraction ($1/100^{th}$ or $1/30^{th}$) of the impact on Country1.

Figure 1 illustrates the idea. It shows the tradeoff between output and price stability in Country 1, on the left, and Country 2, on the right. Measures of the size of output fluctuations and aggregate price fluctuations are on the vertical and horizontal axes, respectively. The tradeoff curve is like a frontier. Points on the curve represent optimal policy. Monetary policy cannot take the economy to infeasible positions to the left of below the curve. But suboptimal monetary policy—due to policy errors, reacting to the wrong variables, etc.—can take the economy to inefficient higher variability points above and to the right of the curve. Along the curve, lower price variability can only be achieved with greater output variability corresponding to different values of the reaction coefficient. This kind of curve is implied by the simple model discussed here, but it is quite general and has been used in many different monetary policy studies going back originally to the 1970s and continuing today[13]

The shape and the position of the tradeoff curve depend on the parameters of the model and the size of the shocks. An increase in the variance of the shock to the wage equation in one

[13] See Taylor (1979) and King(2012)

country, for example, will move that country's curve out and to the right. A reduction in the size of the response of wages to the state of the economy—effectively more price-wage stickiness—will also result in a shift in the tradeoff curve in the northeast direction.

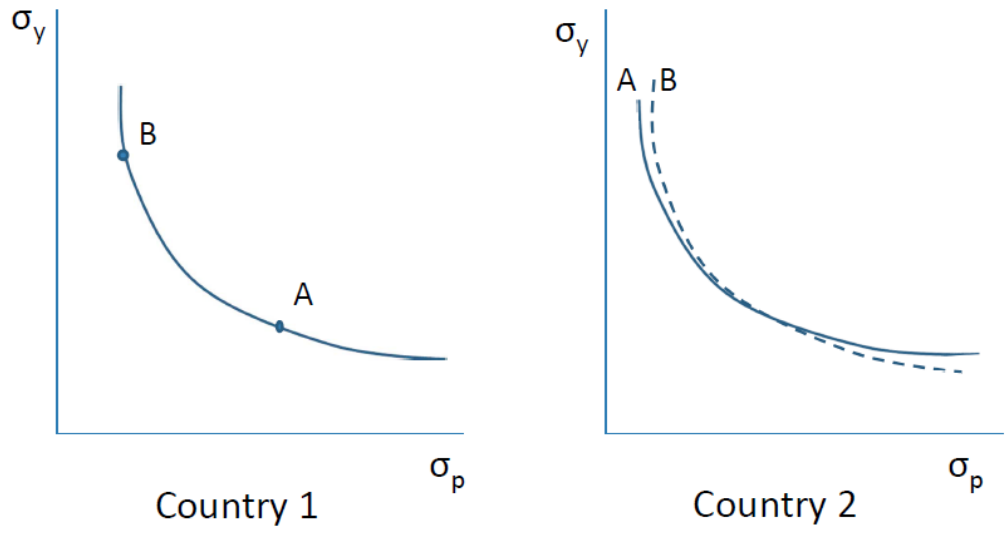

Figure 1: Illustration of the NICE System. If Country 1 chooses a different Optimal Policy B rather than Optimal Policy A, then the policy frontier in Country 2 shifts from Curve A to Curve B, or by a very small amount. This result also holds in reverse if Country 2 changes its policy. Thus there is little to be gained from formal coordination, once the optimal policy has been chosen and each country is on its own tradeoff curve.

Points A and B, which are on the tradeoff curve for Country 1, represent two alternative choices for optimal policy, reflecting different weights on the macroeconomic objective function for Country 1. They show how a more accommodative policy, such as at point A, results in a relatively small variance of output and a relatively large variance of the price level compared with point B. The two different tradeoff curves for Country 2 show the effect on Country 2 of a change in policy in Country 1 from A to B. The important point is that the tradeoff curve for Country 2 is virtually the same regardless of which of the optimal policies are chosen by Country

1. (Curve B is drawn with a slight twist relative to Curve A as in the simple model, but that is not a general result). Note that the same type of diagram would show that a change in policy in Country 2 would have little change in Country 1.

It is in this sense that there is little to be gained from international policy coordination or cooperation in which Country 2 might want to coordinate its own policy rule with Country 1. In game theory terminology, macroeconomic performance under a Nash non-cooperative monetary policy is nearly as good as under the optimal cooperative monetary policy, and far superior to a policy which is suboptimal on purely domestic grounds. Of course, if the model were such that the Country 2 curve shifted by a lot with a change from one optimal policy to another optimal policy in Country 1, and vice versa, then the cooperative monetary policy might be worth pursuing even if the policies were optimal from a domestic point of view.

It should be emphasized that this result follows from a range of empirically estimated or calibrated international monetary models in the Mundell-Fleming New-Keynesian class, and not only from the simple two country example here.[14] To be sure, the result does not imply that there are small gains from coordinating fiscal and monetary policy, an issue that has been raised by Eichengreen (2013) in the current context.[15]

Part of the reason for this result is that the cross-border impacts of conventional changes in monetary policy—whether positive or negative—tend to be small in these models because the various channels with opposite effects nearly cancel each other out. To see this, again consider the simple two-country model. Figure 2 illustrates this for this model with the parameters in the appendix. It shows the impact of an unanticipated permanent increase in the money supply in

[14] The small spillover effect of changes in policy rules on other countries was shown to hold in a seven-country fully empirically estimated model in Taylor (1993).

[15] Eichengreen (2013) recommends that emerging market countries tighten demand conditions with fiscal policy if they are constrained by international conditions to have a monetary policy which is too easy. This requires that fiscal policy can be adjusted in this way and that it has the correct effect.

Country 1, the classic canonical shock considered in original old Keynesian Mundell-Fleming models with fixed prices and static expectations. On the vertical axis of each panel in Figure 2 is the percentage deviation from baseline. On the horizontal axis are quarterly time periods. Starting from the baseline, the money supply increases in the first quarter of year 1 and the impacts on the other variables for that quarter and the ensuing quarters are shown in each panel.

The top panel shows the impact on output (y) in Country 1 and on output (y_f) in country 2, while the middle panel shows the effect on the price level and the lowest panel shows the effect on the exchange rate. Clearly the impact on output in Country 2 of this shock is small compared to the effect in Country 1. In contrast to the classic Mundell-Fleming model the foreign output impact can be positive because the foreign price level falls slightly (as shown in the middle panel of Figure 2) enabling real money balances to rise and thus the interest rate to fall without lowering output as would occur with a standard money demand equation with fixed prices. (The foreign price level falls because of the exchange rate impact on pricing decisions.)

The exchange rate depreciates sharply on impact. As is true for a wide variety of open economy monetary models with rational expectations and capital mobility, arbitrage forces the rate of return in different currencies to align. Thus, a reduced interest rate in Country 1 will tend to cause a depreciation of currency 1 and a corresponding expected appreciation of currency 2 which compensates for the lower interest rate in Country 1. This depreciation effect on currency 1 is, of course, an appreciation in the other country's currency. In this model there is only a small amount of such overshooting, but the real exchange rate still depreciates because prices are sticky. The appreciation of the currency of Country 2 has a negative impact on output in Country 2 but that is apparently just offset by the impact of higher demand from Country 1 on exports from Country 2.

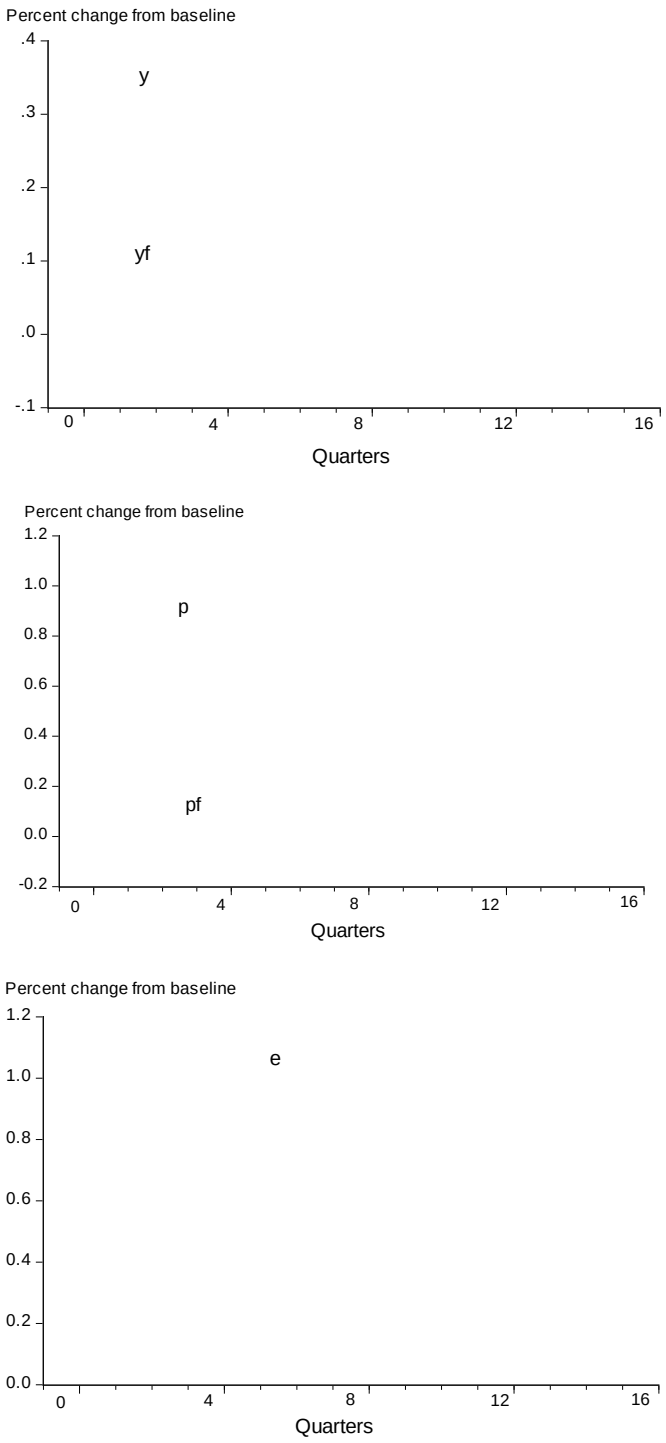

Figure 2: Small International Monetary Spillovers in a Two-Country Model. Simulation of an unanticipated permanent 1% increase in the money supply in one country in two-country model, showing impact on output and price level relative to the baseline in Country 1 (y and p) and in Country 2 (y_f and p_f), and the exchange rate (e).

2. Empirical Foundations Using Estimated Multi-Country Models

Although a simple model is useful for understanding the basic principles of monetary policy coordination, in order to establish the gains from coordination and consider alternative views of the current situation, more realistic and empirically based assessments of the cross border impacts of changes in policy are necessary. Because of the importance of recent policy statements and actions in Japan and emerging market countries, it is particularly useful to have empirical results for policy spillovers in those countries. Hence, I consider the spillover effects in a multi-country model (TMCM) which includes the United States, Japan and the other G7 countries, described in Taylor (1993)[16] and in an IMF global model (GPM6), which includes the United States and Japan but also emerging market countries in Latin American and Asia. GPM6 is described by Carabenciov, Freedman, Garcia-Saltos, Laxton, Kamenik, Manchev (2013). [17] Calculations by Taylor and Wieland (2012) show that the TMCM has effects in the United States of monetary shocks that are very similar to the new Keynesian models of Christiano, Eichenbaum and Evans (2005) and Smets and Wouters (2007), but has the advantages of including the impact on Japan.

Figure 3 and Figure 4 show the impact of monetary policy in the two models for several key variables and a selection of countries or regions.[18] In Figure 3 the impacts on the United States and Japan are compared while in Figure 4 the impact on the United States is compared with Japan as well as with the Latin American countries (LA 6, which include Brazil, Chile, Colombia, Mexico and Peru) and emerging Asia countries (EA6, which include China, India, South Korea, Indonesia, Taiwan, Thailand, Malaysia, Hong Kong, Philippines and Singapore).

[16] I use the version of this model in a database constructed and maintained by Volker Wieland; see Wieland et al (2012).
[17] I am grateful to Roberto Garcia-Saltos for running these simulations in the IMF model.
[18] Some of these results are preliminary and are still being cross-checked and verified

In each case the monetary impulse is a shock to the monetary policy rule in the United States. Note in interpreting the graphs that the shocks are of different sizes in the two models. In Figure 3 the shock initially causes the interest rate to fall by about .8 percentage points and then slowly move back up with the interest rate back to the starting point in about 5 quarters.[19] In Figure 4, the shock initially causes the interest rate to fall by about .2 percentage points and then the dynamics of the policy rule leads to a gradual rise in the interest rate back to its starting point in about 5 quarters. In both simulations the interest rate overshoots before returning to normal due to the response of the policy rule to the economy after the shock.

The findings correspond to the simple two country model in some respects. First note the strong impact of a change in short term interest rates in the United States on U.S. output in both Figure 3 and Figure 4: the percentage change in output for a percentage point change in the interest rate is about -0.5 in Figure 3 and -0.25 in Figure 4.

Simulating other estimated multi-country models, shows impacts in this same general range. For example, similar simulations of the Fed's SIGMA model vintage 2008 and the ECB's New Area Wide Model (NAWM) also vintage 2008—two other models in the Volker Wieland et al (2009) model data base—show, respectively, impact effects on output of -.19 and -.28 percent for each percentage point change in the short term policy interest rate.

Also as in the simple two-country model, an important transmission channel of this output effect is the exchange rate: The simulations show that the dollar depreciates by 1.4 percent for each percentage point decrease in the U.S interest rate in the TMCM and by 1.0 percent in GPM6 (not shown in the Figure 4).

[19] In this case a serially correlated shock is added to a Taylor rule for the policy rate.

In both models the impact on output in Japan is the same sign as in the United States but much smaller in size. For example, Japan's output changes by only about $1/20^{th}$ of the U.S. output change in both models, even smaller than in the two country model.

However, according to the GPM6 model, which incorporates emerging market countries, there is an important difference when it comes to Latin American and the Asian emerging market countries: the impact effect on output is the reverse sign as the output effect in United States and larger in magnitude than the spillover in the case of Japan. For each percentage point monetary policy-induced change in output in the United States, output changes by .25 percentage points in the opposite direction in the Latin American countries and .13 percentage points in the opposite direction on the emerging Asian countries. As described by the authors of the IMF's GPM6 model this occurs in these countries because "the exchange rate channel is stronger than the direct output gap effect." [20]

[20] Carabenciov et al (2013), p 36.

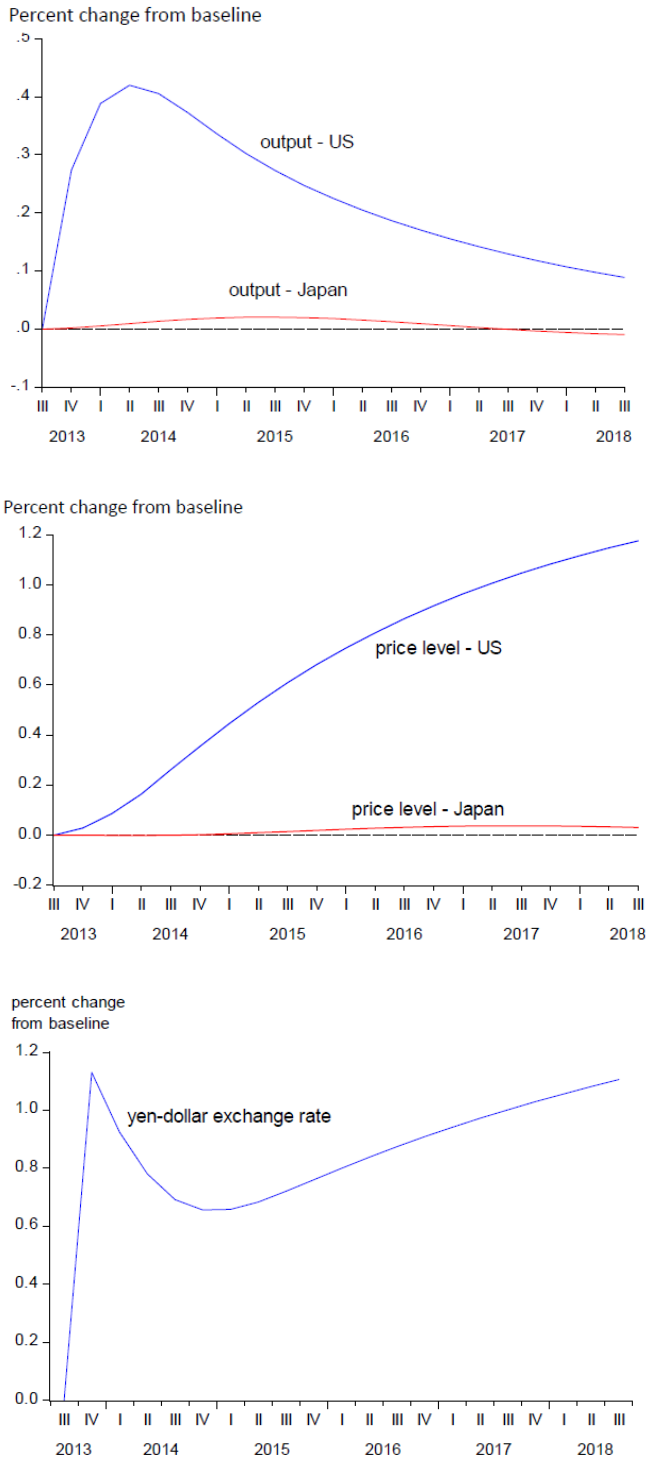

Figure 3: Impulse Response Functions from TMCM. The figure shows the response of output, prices, and the exchange rate in the US and Japan to a cut in the U.S. policy interest rate caused by a one percent reduction in the residual to the policy rule phased out at rate 0.9.

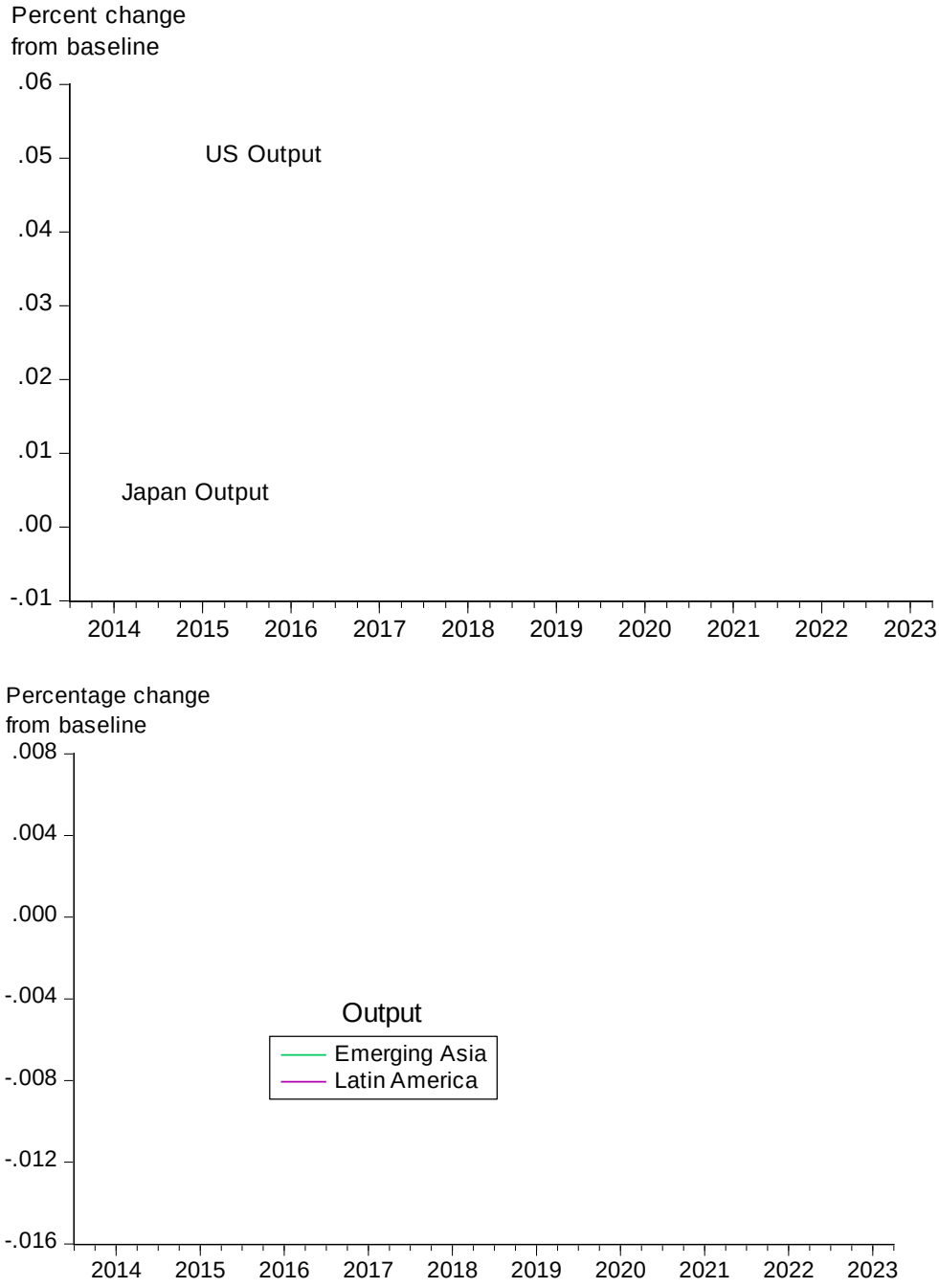

Figure 4: Impulse Response Functions from the GPM6 Impact from a positive shock to US interest rate rule of 0.2 percentage points. (I thank Roberto Garcia-Saltos for running the simulations which correspond to those with the opposite sign in Carabenciov et al (2013), p 69)**.**

3. Breakdown of the NICE System

The tradeoff curves introduced in Figure 1 can be used to illustrate how deviations from optimal policy can lead to a breakdown in the international policy equilibrium. This is shown in Figure 5. Suppose Country 1 deviates from its optimal monetary policy rule and moves in the direction of an inefficient policy as shown by point C in Figure 5. The impact in Country 2 will most likely be large for two separate, but not mutually exclusive, reasons.

First, the tradeoff curve in Country 2 would likely shift out. The instability caused by the change in policy in Country 1 could spill over to Country 2, for example, in the form of more volatile export demand, as was demonstrated vividly in the financial panic in late 2008, or simply in more volatile exchange rates or commodity prices. Bordo and Lane (2012) have shown that policy deviations can have a variety of adverse effects on economic performance which can be transmitted globally. These shocks would be very hard for even the best monetary policy to fully counteract. Figure 5 shows this shift in the tradeoff curve in Country 2; the original curve—either A or B—moves out to the curve with the long dashed lines. Hence Country 2 is forced to the point C, or perhaps to another point on the new less-favorable tradeoff.

Second, the change to a less efficient monetary policy in Country 1 might bring about a change to a less efficient monetary policy in Country 2. For example, if the policy change in Country 1 is to bring about an excessively easy policy with very low interest rates, then the policy makers in Country 2 may be concerned about exchange rate appreciation and thus keep their interest rate too low too—deviating from their policy rule—which could cause an increase in price volatility and output instability. The central bank might do this even if there was an offsetting effect from higher export demand from higher output in Country 1. They might

perceive that offsetting effect to be too low or too delayed or they may be concerned about the hit to certain export sectors.

Of course it is possible that both international effects of the change in policy in Country 1 occur at the same time, in which case the outcome could be point D in the right hand panel of Figure 5.

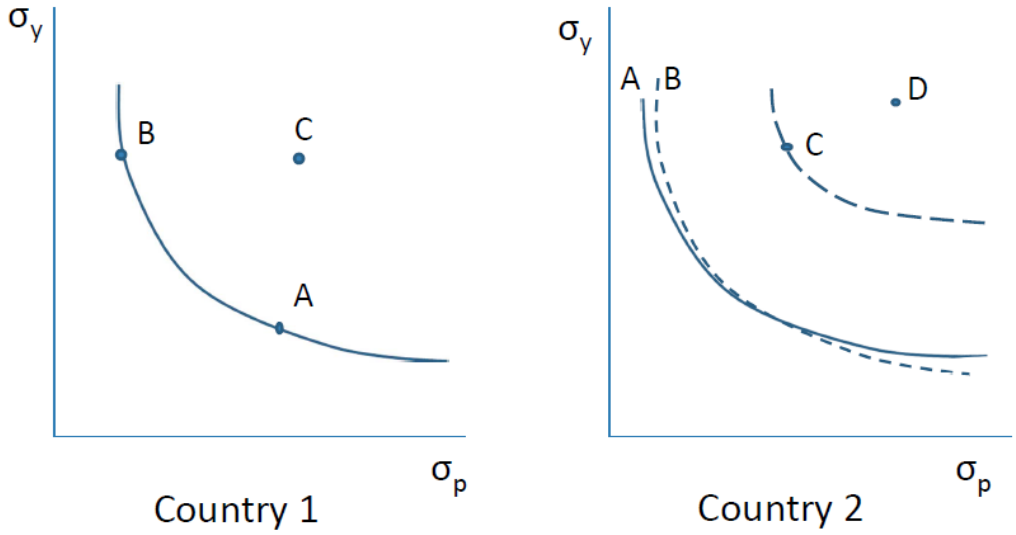

Figure 5: Illustration of a Breakdown in the NICE System. In contrast to Figure 1, if Country 1 deviates from an optimal policy and moves to point C, then the impact on Country 2 can be quite large, either because it causes Country 2 to choose a suboptimal policy C with no change in the tradeoff, or because the tradeoff shifts out to the curve with the long dashes in the chart on the right. If the tradeoff shifts and policy becomes suboptimal, then an outcome such as point D would result.

There are a number of reasons why an unusually low interest rate at one central bank puts pressures on central banks in other countries to also choose unusually low interest rates. As the simple and more complex models above show very clearly, a reduction in policy interest rates abroad causes the exchange rate to appreciate. Even though there may be countervailing effects

of the low foreign interest rates because economic output abroad is stimulated (the trade effect in the model simulations), this effect may occur with a lag in practice and is less visible than the exchange rate appreciation. Moreover, for some countries, such as the emerging market countries in Latin America and Asia, the exchange rate effect dominates according to the empirical model simulations. There is not enough empirical evidence to support simply relaxing and hoping that stronger growth in the developed world will offset the appreciation as some have suggested. Moreover, in recent years the stronger growth abroad has not materialized. Hence, many central banks will tend to resist large appreciations of their currency, and one way to do so is to cut their own policy rate. This will reduce the difference between the foreign interest rate and the domestic interest rate and will thus mitigate the appreciation of their exchange rate.

Another concern of some central banks is that very low interest rates at the major central banks can increase risk-taking in their countries, as shown by Bruno and Shin (2012), and one way to combat this is to lower the policy interest rate. Firms abroad are able to borrow in dollars to finance investment projects even though the returns on these projects are denominated in local currency. The loans made to the firms by banks to fund these projects are subject to default in the event that the project earns less than the loan, including interest payments.

In the Bruno-Shin model, banks that lend to these firms take account of this default risk by using a "value at risk" approach. Accordingly, banks increase the size of the loans on the project up to the point where the amount that must be paid back (including interest) yields a probability of the bank's insolvency that just equals a given value. The amount that must be paid back is increasing in both the interest rate and the size of the loan; thus the lower the interest rate is, the larger the loan can be for a given value at risk. A reduction in the interest rate increases lending and encourages more risk taking on the part of these firms. This initial effect is amplified

because the exchange rate appreciates with a lower foreign interest rate, and the appreciation reduces the likelihood of default because local currency then converts into more dollars to pay back the loan. This enables the banks to lend more, which in turn causes the exchange rate to appreciate further. The process converges, but the eventual impact is larger than the initial impact. Bruno and Shin (2012) provide empirical evidence of this risk taking using the VIX.

In such a circumstance, a central bank can mitigate the increase in foreign lending by keeping its own interest rate lower than it otherwise would for domestic stability purposes. This reduces the incentive to borrow abroad and the associated risk. In the end, an extra low interest rate policy in one country leads to a similar deviation in other countries.[21]

There are other reasons that policy deviations in one country can cause policy deviations in other countries. The debate about rules versus discretion is by no means settled and the case for discretion rather than rules-based policies might become more popular among central bankers or their staffs, affecting actual policy. This is natural in the aftermath of a financial crisis when the "rule-book" is often thrown away. Another reason for policy contagion is that governments in one country may become more aggressive in challenging central bank independence if other central banks appear to be losing their independence.

In any case, there is considerable empirical evidence of the impact of foreign interest rates on central bank decisions. Perhaps the best evidence comes from reports from central banks themselves. Consider the Norges Bank which provides a great deal of detail about its decisions and the rationale for them.[22] In 2010, the Norges Bank explicitly reported that it lowered its

[21] Andy Filardo reports, in personal correspondence, that concerns about exchange rates were more prevalent in emerging market Asian central banks than concerns about the Bruno-Shin capital inflows, with the possible exception of South Korea.

[22] For more information on monetary policy in Norway during these periods see various monetary policy reports and summaries by Røisland (2010), the OECD Survey (2010), and Taylor (2013).

policy interest rate, and its intentions for future settings of its policy rate, because interest rates were lower abroad.

Deviations from central banks' own reaction functions or monetary policy rules are a good way to show these policy spillovers from one central bank to another. The Norges Bank also provides reports on the details of its own policy rules, and there was a large deviation in 2010. The actual policy rate, at about 2%, was much lower than the rate implied by its domestic monetary policy rule, which called for a policy rate of about 4%. This deviation was almost entirely due to the very low interest rate abroad, according to the Norges Bank. It reported that a policy rule with external interest rates included came much closer to describing the actual decisions than the policy rules without external interest rates.

The recent case of the Bank of Japan's move toward quantitative easing and large-scale asset purchases provides another example. Following the financial crisis and into recovery, the yen significantly appreciated against the dollar as the Fed repeatedly extended its zero interest rate policy and its large scale asset purchases. Concerned about the adverse economic effects of the currency appreciation, the new government of Japan urged the Bank of Japan to ease up on policy and implement its own massive quantitative easing, and, with a new Governor at the Bank of Japan, this is exactly what happened. As a result of this change in policy the yen has fully reversed its course and has returned to the exchange rate just before the panic of 2008. In this way the policy of one central bank appeared to affect the policy of another central bank.[23]

There is also econometric evidence of the spread of central bank policies based on the statistical correlations between policy interest rates in different countries. Using panel data from 12 central banks (Australia, Canada, South Korea, the United Kingdom, Norway, New Zealand,

[23] I will return to the case of Japan when considering alternative views of current monetary policy coordination in the next section.

Denmark, Israel, Brazil, the Eurozone, China, and Indonesia), Gray (2012) estimated policy rate reaction functions in which the U.S. federal funds rate or other measures of foreign interest rates entered on the right hand side as deviations from their respective policy rates. He found that the average reaction coefficient on the foreign rate was large and significant.

There is also evidence that shifts in monetary policy in the form of quantitative easing have an impact on monetary policy decisions abroad. Chen, Filardo, He and Zhu (2012) examine the impact of various types of quantitative easing in the United States, the United Kingdom, the ECB and Japan on monetary conditions in emerging market countries and in other advanced economies. They find that "the announcement of QE measures in one economy contributed to easier global liquidity conditions.''

The Possible Amplification of Policy Spillovers

The policy deviations implied by these estimates can be amplified as central banks follow each other. In the case of interest rate rules, the amplification can be illustrated with a very simple diagram describing the inter-relations between the decisions of two central banks.[24] Suppose i is the policy interest rate in one central bank and i_f is the policy interest rate in the other country. Assume, for the reasons given above, that both central banks deviate from their own policy rule by an amount that depends on interest rate settings at the central bank in the other country. Thus the central banks follow each other.

Figure 6 shows an example of two reaction functions in which the first central bank has a response coefficient of .5 on the second central bank's policy interest rate and the second central bank has a response coefficient of 1 on the first central bank's interest rate. Suppose the first

[24] A similar argument can be made if the policy instrument is the money supply or the monetary base, though the same simple diagram will not apply.

central bank cuts its interest rate *i* by 1 percentage point below its normal policy rule setting. Then, the second central bank will also reduce its policy rate i_f by 1 percentage point, which causes the first central bank to cut its interest rate by another .5 percentage point leading to another cut at the second central bank, and so on. In this example the end result is a 2 percentage point rate cut once the iterative process settles down. The initial deviation from the policy rule of 1 percentage point by the first central bank, ends up, after amplification, reducing the policy rates in both countries by 2 percentage points.

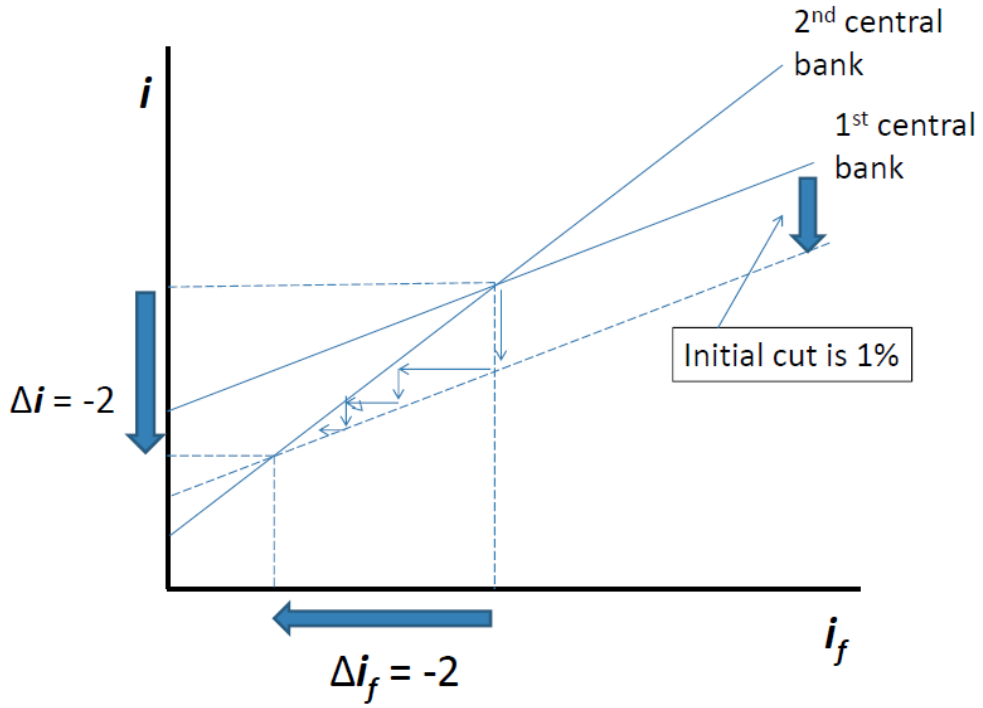

Figure 6: Illustration of Amplification of Monetary Policy Spillover: Central banks react to each other's interest rate changes creating a dynamic adjustment process and a new equilibrium with an interest rate change of 2% much larger than the 1% initial change.

Capital Controls

Concerned about the ramification of deviating from their optimal monetary policy, some central banks have looked for other ways to deal with the problems caused by unusually low

interest rates at foreign central banks. Two alternatives have been discussed and used widely: capital controls and currency market intervention. Capital controls which limit the inflow of capital are aimed at containing the demand for local currency and its appreciation, but also to mitigate risky borrowing.

However, capital controls create market distortions and may lead to instability as borrowers and lenders try to circumvent them and policy makers seek even more controls to prevent the circumventions. Indeed, capital controls are another reason why the output and price stability frontier will shift adversely. Capital controls also conflict with the goal of a more integrated global economy and higher long-term economic growth.

Currency Intervention and Gross Capital Flows

Of course, currency intervention is another way to prevent unwanted appreciation of a currency either as an alternative to lower interest rates or as a supplement. For example, as part of its announcement that it would lower interest rates on May 13 of this year to contain currency appreciation, the Bank of Israel reported that it would sell its own currency and buy $2.1 billion of foreign currency.

However, currency interventions can have adverse side effects even if they prevent appreciation for a while. Currency intervention obviously creates an accumulation of international reserves which must be invested somewhere. In the case where the low policy interest rates is set in the United States, the gross outflow of loans due to the low policy rates is accompanied by a gross inflow of funds from central banks into dollar denominated assets, such

as U.S. Treasury or mortgage-backed securities which affects prices and yields on these securities.[25]

Borio and Disyatat (2011) and Beckworth and Crowe (2012) analyzed the possible adverse effects of these flows during the period of the low federal funds rate in the United States in 2003-2005. They show that the inflow of funds from abroad into U.S. mortgage backed securities helped keep mortgage rates low, worsening the housing boom leading up to the financial crisis. In this case the policy deviation not only had an effect on the policy tradeoffs abroad, it fed back on the policy tradeoff in the United States.

4. Alternative Views

There are of course other views. In general, they stem from the premise that the monetary policies currently undertaken by the central banks of the G7 countries—and in the last few months the Bank of Japan included—are appropriate for the current situation. While the policy may not be consistent with rules followed under the NICE system and the NICE period, they are by no means suboptimal according to this view. As Janet Yellen (2012) put it recently,[26]

> Many studies have shown that, in normal times, when the economy is buffeted by typical shocks—not the extraordinary shock resulting from the financial crisis—simple rules can come pretty close to approximating optimal policies. …why shouldn't the FOMC adopt such a rule as a guidepost to policy? The answer is that times are by no means normal now, and the simple rules that perform well under ordinary circumstances just won't perform well with persistently strong headwinds restraining recovery and with the federal funds rate constrained by the zero bound.

[25] Obstfeld (2012) stresses the growing importance of these gross capital outflows and inflows in comparison with net flows and the current account.
[26] Yellen (2012) pp. 17-18

How does one reconcile this view with the recent complaints about policy spillovers and the renewed interest in policy coordination?

A starting point is an alternative interpretation of Figure 5. Rather than monetary policy in Country 1 moving off the tradeoff curve to the inefficient point C, the supposition is that the tradeoff curve itself shifted in an adverse direction. Mervyn King (2012), for example, has explicitly made this argument using the concept of a stability tradeoff curve.

A replica of tradeoff curve between output stability and price stability used in King's paper is shown in Figure 7, which also shows how the curve shifted out from the standard Taylor curve to what he calls the new Minsky-Taylor curve. The specific idea, which Hyman Minsky and others warned about, is that stability breeds instability, largely through complacency of investors who, thinking that stability conditions will continue, take too much risk and thereby increase instability. But more generally, the view is that performance deteriorated not because policy moved to inefficient points like Q, or P, in Figure 7 (or point C in Figure 5), but rather because the structure of the economy changed and the tradeoff curve shifted.

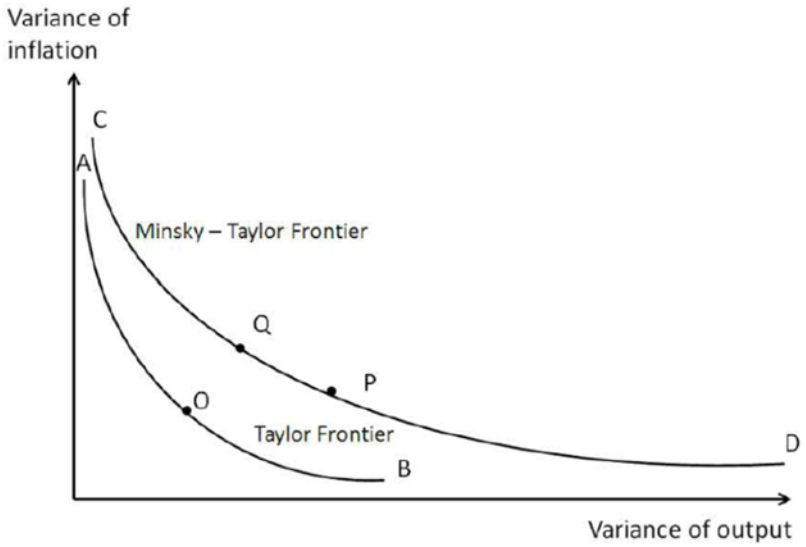

Figure 7: "The Minsky-Taylor Frontier," replica of Chart 5 from King (2012). This figure is a copy of the chart which Mervyn King used to illustrate the idea that the policy tradeoff curve shifted up and out and that monetary policy at point Q or P still represents efficient monetary policy in contrast to the point C for Country 1 in Figure 5 above. (Note that the axes are reversed in this diagram compared with Figures 1 and 5 above.)

Viewed this way, one comes to a different explanation for the current state of international monetary policy. Bernanke (2013), for example, arguing in this vein, notes that what might be seen as central banks following each other because of exchange rate concerns—either with lower interest rates as in Figure 6 or with quantitative easing—is actually a joint monetary easing which is exactly what is needed, at least within the G7, in the current economic situation. He compares recent monetary policy shifts to what happened during the Great Depression when, one after the other, countries moved off the gold standard and started what were called competitive devaluations, but he describes these as an appropriate move toward monetary ease.

To support this view, especially in contrast to the type of view put forth in the previous section, Bernanke (2013) argues that

> The benefits of monetary accommodation in the advanced economies are not created in any significant way by changes in exchange rates; they come instead from the support for domestic aggregate demand in each country or region. Moreover, because stronger growth in each economy confers beneficial spillovers to trading partners, these policies are not 'beggar-thy-neighbor' but rather are positive-sum, 'enrich-thy-neighbor' actions.

The impulse response functions in either the simple two country model or in the empirical multi-country models described above do not, however, support an enrich-thy-neighbor view. The model simulations show that, at best, the effect of stronger growth in each economy on other economies following a monetary easing barely offsets the adverse effects of the exchange rate appreciation that comes from the monetary easing from abroad. The positive overall effect is quite small in the case of Japan. In the case of the emerging market countries in Latin American and Asia the overall effect is negative-sum rather than positive-sum. The exchange rate effect dominates. This is much like the original old-Keynesian version of the Mundell-Fleming model.

From a robustness point of view, there are other reasons to be worried about the positive sum characterization. If the monetary policy action is mainly in the form of quantitative easing, the standard term structure models are not applicable and there is a great deal of debate about whether there is a positive effect on aggregate demand. Stroebel and Taylor (2012) found very little effect of large-scale purchases on mortgage rates when controlling for other risks, and the announcement effects detected by Gagnon et al (2011) likely phase out over time. And, as discussed above, the slow recovery in the United States does not seem to reflect "stronger growth in each economy" conferring "beneficial spillovers to trading partners" unless one can show that

the recovery would have been even slower without the quantitative easing in the past four years. It is little wonder that many in Japan originally focused on the exchange rate and raised the possibility of currency wars as a rationale for the recent change in monetary policy

Effectively this view explains the simultaneous occurrence of deviations from rule-based policy in different countries by the existence of a common global shock. Of course the financial crisis itself is an example of a shock, and it is natural to argue that the recent multitude of policy deviations was a common response to this shock. However, the financial crisis occurred after the policy deviations began, at least by some measures,[27] so it has a major disadvantage as common global shock that cased the policy change.[28]

The view that more easing of monetary policy—a la the Great Depression—has been needed in other countries does not apply globally because many emerging markets countries and developed economies outside the G7 emerged quickly from the crisis and have grown quite rapidly at least during part of the time since then. Many thought that higher policy rates were needed from time to time to contain inflationary pressures and commodity booms.

Here the alternative view is that if higher interest rates were appropriate for some central banks, then they should have raised their interest rates or kept them high; after all, that is the advantage of flexible exchange rates, and the adverse international ramifications would have not been so severe anyway. Bernanke (2013) puts it this way:

> It is true that interest rate differentials associated with differences in national monetary policies can promote cross-border capital flows as investors seek higher returns. But my

[27] Bernanke (2010) argues that the low federal funds rate was not really a deviation from a policy rule, in contrast to Ahrend (2010), Kahn (2010) and Taylor (2007), and was not a reason for the boom in the housing market. Rather he argues that the low long term rates were due to a savings glut—unrelated to monetary policy—by which the current account surpluses around the world caused the increased demand for U.S. mortgage securities. This is also in contrast to Borio and Disyatat (2011).

[28] Hofmann and Bogdanova (2012) find that the deviations can be explained by a change in the global equilibrium real interest rate.

> reading of recent research makes me skeptical that these policy differences are the dominant force behind capital flows to emerging market economies; differences in growth prospects across countries and swings in investor risk sentiment seem to have played a larger role.

And if the flows turn out to be severe he suggests that capital controls might be considered despite their harmful side effects, saying "Nevertheless, the International Monetary Fund has suggested that, in carefully circumscribed circumstances, capital controls may be a useful tool."

Concluding Remarks

In this paper I put forth two explanations for the recent spate of complaints and disputes about cross-border monetary policy spillovers and calls for international monetary policy coordination. This development—often expressed in terms of currency wars or threats of competitive devaluations—contrasts greatly with the situation in the international monetary system for the developed economies in the 1980s, 1990s and until recently, which was near an international cooperative equilibrium. Such a situation was a possibility predicted by research in the 1980s and reviewed here using a simple two-country model, the concept of a tradeoff between price stability and output stability, and evidence from larger-scale empirical multi-country models.

The first explanation for the current situation holds that discretionary deviations from rules-based monetary policy at several central banks created incentives or pressures on other central banks to also deviate from such policies. Reasons for the spread of these deviations—which can be documented empirically—include the desire to minimize interest rate differentials

or other measures of relative monetary conditions between countries and thereby prevent excessive exchange rate appreciation and risky capital flows.

The second explanation either does not see significant deviations from rules-based policy or does not stress such deviations as a problem. Instead, it characterizes the recent unusual monetary policy, including near-zero interest rates, pledges of near-zero interest rates in the future or quantitative easing in the G7 countries, as appropriate to the current economic situation. In some cases, such as Japan recently, it explains the complaints about spillovers and the spread of deviations from rules-based policies to other countries as the natural adjustment toward more optimal policies. In other cases, such as in many countries outside the G7 and in particular emerging market countries in Latin America and Asia, it stresses the positive benefits of the unusual G7 policies to those countries and counters complaints about spillovers and calls for coordination by downplaying concerns about the effect of interest rate differentials on capital flows or the imposition of capital controls.

The view that monetary policy in most of the G7 countries is now on track does not see the need for much international monetary policy coordination, and indeed that was the message of the G7 communique of February of this year. Such coordination might not appear to be in the interest of the United State for it suggests that U.S. monetary policy should take account of developments elsewhere to the possible detriment of the United States economy. But if a change in U.S. policy leads to better performance in other countries it will likely have positive feedback on the United States which would certainly be in the interest of the United States.

Going forward the goal should be to return to a more balanced system of rules-based monetary policies similar to what existed during the 1980s, 1990s and until recently, but now certainly including the emerging market countries. Such a system would likely operate near an

international cooperative equilibrium in which each country optimizes its economic performance without the need for formal international monetary policy coordination. But international monetary policy coordination—at least in the form of discussions of the importance of rules-based policies while sorting out and determining the accuracy of the two explanations defined here—would be quite useful in getting back to this desirable situation.

Appendix:
Simple Two-Country Model

$e = i_f + e(+1) - i$

$y = - b(1) * r + b(2) * (e + p_f - p) + b(3) * y_f$

$x = .25 * (w + w(+1) + w(+2) + w(+3)) + .25 * (y + y(+1) + y(+2) + y(+3))$

$w = .25 * (x + x(-1) + x(-2) + x(-3))$

$r = i - \pi$

$\pi = p(+1) - p$

$m = p + b(5) * y - b(4) * i$

$x_f = .25 * (w_f + w_f(+1) + w_f(+2) + w_f(+3)) + .25 * (y_f + y_f(+1) + y_f(+2) + y_f(+3))$

$w_f = .25 * (x_f + x_f(-1) + x_f(-2) + x_f(-3))$

$y_f = - b_f(1) * r_f - b_f(2) * (e + p_f - p) + b_f(3) * y$

$r_f = i_f - \pi_f$

$\pi_f = p_f(+1) - p_f$

$m_f = p_f + b_f(5) * y_f - b_f(4) * i_f$

$p = (e + p_f) * (1 - b(6)) + w * b(6)$

$p_f = (p - e) * (1 - b_f(6)) + b_f(6) * w_f$

Variables (subscript f indicates country 2)
e = exchange rate
y = real output
w = wage
x = “contract” wage
p = price level
m = money supply
i = nominal interest rate
r = real interest rate
π = inflation rate

Variables e, p, w. x, p, and m are in logs; i, r, π are in percentage points, all deviations from steady state: (+) indicates a rational expectation of a lead, (-) indicates lag

Parameters
$b(1) = b_f(1) = 1.2$, $b(2) = b_f(2) = 0.1$, $b(3) = b_f(3) = 0.1$,
$b(4) = b_f(4) = 4.0$, $b(5) = b_f(5) = 1.0$, $b(6) = b_f(6) = 0.8$

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