

Board of Governors of the Federal Reserve System

International Finance Discussion Papers

Number 1002

June 2010

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Financial Globalization and Monetary Policy

Steven B. Kamin*

Abstract: This paper reviews the available evidence and previous research on potential effects of financial globalization, that is, the international integration of financial markets. In particular, we address the questions: Has financial globalization materially increased the influence of external developments on domestic monetary conditions? And, has it reduced the influence of central banks over financial and economic conditions in their own country? We find that central banks with floating currencies retain the ability to independently determine short-term interest rates and thus influence broader financial conditions and macroeconomic performance in their economies. However, domestic financial conditions appear to have become more vulnerable to a wide range of external shocks, complicating the task of making appropriate monetary policy decisions. Moreover, the financial crisis has highlighted the importance of cross-border channels for the transmission of liquidity and credit shocks. With financial transactions increasingly being undertaken in vehicle currencies such as dollars and euros, the liquidity provision and the lender-of-last resort functions of many central banks are being challenged. Accordingly, international arrangements for liquidity provision may become increasingly important in the future.

Keywords: Globalization, monetary policy, interest rates

JEL classifications: E43, E44, E50, F40

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I. Introduction

The past decade has witnessed continued strong progress toward economic globalization, that is, the international integration of markets for goods, labor, and capital. As movements in economic and financial conditions around the globe appear to be becoming ever more tightly linked, questions are being posed as to whether individual central banks are losing their ability to independently secure stable prices and sustainable economic growth in their national economies.

Economic theory has long recognized the interdependence of national economies. The Mundell-Fleming models of open economies developed in the 1960s and 1970s, as well as the microfoundations-based New Keynesian models that succeeded them, amply described the effects that shocks to one economy may have on its trading partners. But it had generally been understood that the lessons of these models applied more to small open economies such as South Korea or Australia than to larger, more closed economies such as those of the United States, Japan, or the euro area. And this understanding had been buttressed by the view that floating exchange rates would buffer domestic financial conditions and inflation performance from outside influences.

In recent years, however, doubt has been cast on the ability of monetary policy even in the world's largest economies to independently control their destinies. *Business Week* noted "Globalization makes it harder than ever to find the right level of interest rates to foster solid economic growth while keeping inflation at bay. Globalization and its impact on monetary policy is not just about how worldwide competition suppresses prices of U.S. products. More and more, prices of everything from steel to corporate

bonds to even labor are determined by market forces overseas, not just those in the U.S.” (“What’s complicating Bernanke’s Balancing Act?” February 27, 2006).

Not surprisingly, monetary policymakers have taken an active interest in the extent to which globalization affects their ability to achieve their objectives. According to one Federal Reserve official, “the old models simply no longer apply in our globalized, interconnected and expanded economy... By spurring productivity and fomenting tectonic economic changes, globalization has acted as a tailwind for the Fed’s—and other central banks—efforts to hold down inflation” (Fisher, 2006).¹ These sentiments have been echoed, to greater or lesser degrees, by a wide range of monetary policymakers both in the United States and abroad.

At the broadest level, there are a numbers of ways in which globalization could complicate, and perhaps even constrain, the ability of monetary policy to achieve its goals. First, as countries become more integrated into the global economy, their financial conditions, prices, and economic activity likely become more affected by external shocks. Accordingly, monetary policymakers must respond to a wider range of developments, and may also face greater difficulties in predicting the future evolution of their economies than in the past. Second, globalization may alter the transmission channels of monetary policy. For example, with longer-term bond yields increasingly set in international markets, their responsiveness to the short-term interest rates set by the monetary authorities may decline. Or, as trade becomes more important, monetary policy may

¹ In fact, the Federal Reserve Bank of Dallas has created a Globalization and Monetary Policy Institute, which supports the study of globalization’s effects on the role of monetary policy in an open economy.

work more through exchange rates and net exports and less through its effects on domestic demand.

This paper reviews the available evidence and previous research on these two potential effects of globalization.² In particular, we address the questions: Has globalization materially increased the influence of external developments on domestic monetary conditions? And, has it reduced the influence of central banks over financial and economic conditions in their own country? For the most part, theoretical models suggest that the more open the economy to trade and capital flows, the more susceptible it will be to external influence. Therefore, we regard the question of whether globalization has, indeed, elevated the role of external factors as primarily an empirical question and, accordingly, we focus in this paper on reviewing the findings of empirical research on this topic.³

Additionally, in order both to contain the scope of the paper and keep it consistent with the general theme of this volume, we focus on the effects of financial globalization—that is, the international integration of financial markets—although certainly the effects of trade integration will also be touched upon. Accordingly, we do not address several related questions that have attracted considerable attention and research in recent years. One of these is whether globalization has boosted the influence of international factors over domestic inflation.⁴ The other, highly connected, is whether

² See, also, Montot and Vitale (2009) for a broad review of these issues.

³ Theoretical treatments of financial globalization and monetary policy include, among others, Woodford (2007) and Devereux and Sutherland (2008).

⁴ One strand of this literature debates whether foreign output gaps are becoming more important for domestic inflation. (See, among others, Borio and Filardo, 2006, Ihrig, Kamin, Linder, and Marquez, 2007, Pain, Koske, and Sollie, 2006, and Wynne and Kersting, 2007.) Another strand focuses on whether the integration of emerging Asia into the global economy has depressed inflation in advanced economies.

globalization, by introducing greater competition and price flexibility, has reduced the scope for central banks to boost output through inflation surprises and thus lowered optimal inflation rates.⁵

The plan of this article is as follows. Section II focuses on a key channel of the monetary transmission mechanism: the control of long-term interest rates. It reviews the evidence on whether globalization is causing domestic long-term rates to be more vulnerable to external shocks, and, as well, less amenable to influence by national monetary authorities. Section III addresses the instrument most directly controlled by central banks—the short-term interest rate—and considers the extent to which that control is affected by the exchange rate regime and by international financial integration. Section IV discusses how the recent financial crisis has highlighted the importance of cross-border liquidity and credit channels, posing new challenges to the traditional lender-of-last resort function of central banks. Section V concludes, attempting to make some sense of the dog’s breakfast of miscellaneous charts, musings, and research results described in the preceding pages.

II. Globalization and Long-Term Interest Rates

During normal economic conditions, monetary policy in the United States and most other advanced economies operates through control of a short-term interest rate.⁶ Movements in this short-term rate, in turn, ultimately affect economic activity and prices through its effect on a range of financial conditions, including, among others: longer-term

(See, among others, Kohn, 2006, Hooper, Spencer, and Slok, 2007, Kamin, Marazzi, and Schindler, 2006, and Pain, Koske, and Sollie 2006.)

⁵ See, among others, Rogoff (2004), Spiegel (2008), and Badinger (2009).

⁶ At present, of course, the financial crisis and associated recession have led a number of central banks to lower their policy rates to near zero and rely on unconventional measures to provide stimulus.

interest rates, the supply of bank loans, the level of equity and house prices, and exchange rates.

Of these channels, the most traditional, and perhaps most studied, has been the effect of monetary policy on longer-term interest rates, which affects both the user-cost of capital and thus investment, as well as the intertemporal balance between current and future consumption (Boivin, Kiley, and Mishkin, 2010). According to the expectations theory of the term structure, long-term interest rates represent the average of expected future short rates, which presumably are set by domestic policymakers. However, long-term rates are also generally believed to incorporate a risk premium which might indeed be vulnerable to external shocks. Were financial globalization to be causing longer term interest rates to be influenced more by international conditions and less by domestic monetary authorities, this would have important implications for the conduct of monetary policy.

Uncovered and real interest rate parity

At the core of the proposition that developments in one national bond market may spill over to other national bond markets is the uncovered interest parity (UIP) condition:

$$i_t = i_t^* + E[e_{t+1} - e_t] \quad (1)$$

i_t : domestic interest rate

i_t^* : foreign interest rate

e_t : log exchange rate, domestic currency per foreign currency

This condition specifies that when bonds denominated in different currencies are considered perfectly substitutable by investors, arbitrage will drive differentials in their nominal yields to equal the expected change in the exchange rate between their currencies. With the advent of the floating exchange rate system among the major advanced economies after the demise of the Bretton Woods system in the early 1970s, along with considerable progress toward the dismantling of controls on capital flows, the conditions for UIP to hold appeared to materialize. A huge literature emerged to test for the existence of UIP, with most of these studies finding that UIP fails: interest rate differentials do not predict subsequent exchange rate movements.⁷ However, it was unclear whether these studies were verifying the lack of international integration of financial markets, or rather merely the difficulty of properly identifying investor expectations of exchange rates.

A variant of UIP, the real interest rate parity (RIP) hypothesis, offered an alternative means of testing whether markets had become integrated. RIP assumes that trade equalizes the rate of goods price inflation between two countries, expressed in a common currency:⁸

$$\pi_t = \pi_t^* + \Delta e_t \quad (2)$$

Assuming that actual exchange rate movements equal exchange rate expectations plus an error term, (2) can be substituted into (1) and, defining the real interest rate $r = i - \pi$, the RIP condition results:

$$r_t = r_t^* + \varepsilon_t \quad (3)$$

⁷ See, among others, Engel (1996) for a review of the enormous body of research on this topic.

⁸ This would be equivalent to full passthrough of changes in the exchange rate into goods prices.

As with UIP, a voluminous literature emerged to test RIP.⁹ A range of techniques were applied, mainly to short-term interest rates but also to long rates, including regressions of estimated domestic real interest rates on foreign rates, tests of the stationarity of estimated real interest rate differentials, and cointegration analysis of interest and inflation rates. By and large, these studies documented significant co-movement of real interest rates across countries, although results regarding whether these co-movements reached the full (one-for-one) extent predicted by RIP have been mixed. Consistent with the advance of financial globalization, a number of studies have found that the strength of evidence in support of RIP has risen over time (Obsfeld and Taylor, 2002, Goldberg, Lothian, and Okunev 2003).

All this said, findings of increased international financial integration through stronger UIP or RIP relationships do not necessarily imply increased co-movements of nominal bond yields, nor at time horizons relevant to monetary policymakers. Even if RIP holds, changes in domestic interest rates could lead to changes in exchange rate depreciation and inflation without any movement in nominal foreign interest rates. Moreover, evidence of mean-reverting behavior of real interest rate differentials, as implied by RIP, provides little guidance as to how quickly and to what extent shocks to interest rates in one country spill over internationally.

A rough cut at the data on nominal bond yield spillovers

Chart 1 plots monthly values of 10-year nominal government bond yields over the past several years for the United States, Germany, Japan, Canada, and the United

⁹ See, among others, Cumby and Mishkin (1986), Goodwin and Grennes (1994), Chinn and Frankel (1995, 2004), Jorion (1996), Awad and Goodwin (1998), Breedon, Henry, and Williams (1999), Obsfeld and Taylor (2002), Goldberg, Lothian, and Okunev (2003), Ferreira and Leon-Ledesma (2007), and Bayoumi and Swiston (2007) .

Kingdom. Not only do these yields (excepting Japan) exhibit similar broad swings over time, but they also display considerable co-movement on a month-to-month basis, suggesting considerable integration of the markets for these different securities. As shown in Chart 2, correlations between bond yields in the United States and those in the other countries have generally been high, but have risen substantially further in recent years. The *prima facie* interpretation of this trend, and consistent with some of the studies of RIP noted above, would be that financial integration has increased, thus boosting the importance of cross-border spillovers in the determination of bond yields.

An alternative explanation, and one not generally addressed in the RIP literature, is that business cycle conditions among the major economies have become more correlated, perhaps reflecting increases in trade integration, and this has resulted in greater co-movement among yields. Charts 3 and 4 describe the evolution of correlations in 12-month changes in industrial production and inflation among these countries over the past several decades. Correlations of industrial production growth appear to be higher after 2000 than in the previous few decades, but in light of the volatility of these correlations, this rise does not seem noteworthy. Correlations of CPI inflation show even less tendency to rise over the period.¹⁰

These patterns are consistent with a number of studies that find only mixed evidence of an increase in the international synchronization of business cycles over the past several decades (Doyle and Faust, 2005, Helbling et.al., 2007, Kose, Otrok, and Prasad, 2008). Moreover, even if it were clearer that the business cycles in different

¹⁰ Analysis of time trends in the inflation correlations identified no consistent trends across the various country pairs. Additionally, correlations of core rather than headline CPI inflation rates also showed no consistent tendency to rise.

economies had become more synchronized, it does not follow that this increased synchronization explains the rise in bond-yield correlations. A number of studies suggest that financial integration and financial spillovers are an important source of macroeconomic spillovers, suggesting that greater business cycle correlations could be the result, rather than the cause, of greater bond market correlations (Imbs, 2004, Bayoumi and Swiston, 2007). All told, the *prima facie* evidence suggests that the rise in bond-yield correlations does not appear to merely be an artifact of higher real-side correlations, but rather seems likely to reflect greater financial integration as well.

Recent research documenting financial spillovers

To disentangle the factors genuinely responsible for the increased co-movement of bond yields over time, however, it is necessary to drill down below simple correlations and make some attempt to distinguish initial shocks from subsequent outcomes. Analysts have used different approaches to identifying financial market shocks and estimating their spillovers to other countries. All told, recent studies are consistent in documenting the existence of significant spillovers between national bond markets, but provide at best weak evidence that these spillovers have increased over time as globalization has progressed.

One strand of research focuses directly on the time-series behavior of interest rates to identify evidence of spillovers. Estimating some combination of cointegration, VAR, and error-correction models, Awad and Goodwin (1998), Bremnes, Gjerde, and Sættem (2001), Chinn and Frankel (2004), Ehrmann, Fratzscher, and Rigobon (2005), and Bayoumi and Swiston (2007) all find evidence of significant cross-border spillovers in bond yields among the United States and other advanced economies during the floating

currency period. Few of these studies assess whether the strength of such linkages has changed over time, but one that does--Ehrmann, Fratzscher, and Rigobon (2005)—finds that, consistent with the effects of increasing globalization, impacts of shocks to U.S. rates on euro area rates (and vice-versa) appear to have grown larger.

Another strand of research involves VAR analyses centered on the U.S. economy, but encompassing foreign factors as well. Kim (2001) starts with a VAR model of the U.S. economy involving standard macroeconomic variables including output, prices, and the federal funds rate, and then examines the effects of including various external variables. He finds that U.S. monetary policy shocks have little effect on foreign (G6) short-term interest rates, but do exert significant effects on foreign long yields and thus output. Boivin and Giannoni (2008) estimate a factor-augmented VAR (FAVAR) model of the U.S. economy over the period 1984-2005. They find that a sizeable fraction of the variance of U.S. macro variables, including the federal funds rate and long-term yields, is explained by foreign developments. However, for the most part, they find little evidence that foreign factors have become more influential for U.S. variables over time, although there is some indication of such increased importance for long-term bond yields, consistent with Chart 2.

As is well known, it is very difficult to achieve robust identification of shocks in a VAR framework. An alternative approach to identifying shocks uses the difference between actual macroeconomic announcements and expectations shortly before the announcements. Hausmann and Wongswan (2006) show that surprises in U.S. FOMC announcements during 1994-2005 have significant effects on foreign equity prices as well as short- and long-term interest rates. Ammer, Vega, and Wongswan (2008) find

that not only do U.S. FOMC surprises affect foreign equity prices—and to a greater extent than for U.S. equities—but the effect is larger, the greater the response of foreign interest rates to the FOMC announcement.

While Hausmann and Wongswan (2006) and Ammer, Vega, and Wongswan (2008) do not examine trends over time in the effects of cross-border spillovers, a number of other studies do, but with conflicting findings. Faust, Rogers, Wang, and Wright (2007) find that surprises in U.S. macro announcements affect both short- and longer-term interest rates in Europe, but find little evidence that these effects have grown stronger over the 1987-2002 period. Conversely, Ehrmann and Fratzscher (2005) document that the effect of U.S. macro announcements on euro area interest rates rose from before to after 1998.

Identifying globalization effects cross-sectionally

The plethora of studies reviewed above document the existence of significant cross-border spillovers in financial markets that affect the determination of long-term bond yields, but the evidence that these spillovers are growing over time, along with financial globalization, is at best mixed. There are a number of potential explanations for the failure to find an upward trend in the effects of globalization. First, many of the studies focus on the United States and Europe, and it is possible that financial markets in these economies were already reasonably well-integrated several decades ago, making the effects of further globalization less evident. Second, and related, most of the studies focus on changes within the reasonably short period of the 1980s through the present, and evidence of trends over this period may have been swamped by idiosyncratic events. Finally, financial markets have been affected by other significant trends in recent decades

which may have obscured the effects of globalization. Perhaps most importantly, many observers have pointed out that with reductions in inflation and greater anchoring of inflation expectations in recent years, the responses of nominal bond yields to shocks should become smaller (Boivin, Kiley, and Mishkin, 2010). This could offset any increased responsiveness of bond yields to foreign developments owing to globalization, rendering tests of the globalization hypothesis inconclusive.

Given the difficulties of identifying growing effects of globalization over time, a more fruitful line of enquiry may be to examine the cross-sectional relationship between monetary transmission and financial integration. Ehrmann and Fratzscher (2006) find that stock prices in foreign countries react more to U.S. FOMC announcements, the greater their financial openness. Shambaugh (2004) finds that domestic interest rates respond more readily to changes in foreign interest rates when the capital account is liberalized, but Miniane and Rogers (2003) find no evidence that interest rates in countries with more open capital accounts respond more to U.S. monetary policy shocks. Forbes and Chinn (2004) find that the response of bond yields in smaller economies to those of the world's largest economies depends more on trade than financial linkages, whereas Hausman and Wongswan (2006) find both types of linkages are important to the response of bond yields to U.S. monetary shocks. Clearly, the cross-sectional evidence on this point is also mixed, and more research is merited.

Which way do the spillovers run?

The literature surveyed above makes clear that cross-border influences on bond yields have been important, even if they have not necessarily grown over time. Given the size of the U.S. economy and the depth and breadth of its financial markets, it is plausible

that shocks to U.S. monetary policy and financial conditions might affect foreign markets more than shocks abroad might affect U.S. markets. Indeed, much previous research supports this view. Analyses of time series by Awad and Goodwin (1998), Bremnes, Gjerde, and Sættem (2001), Bayoumi and Swiston (2007) all find that movements in U.S. interest rates affect those in other advanced economies more than vice-versa. Chinn and Frankel (2004) estimate error-correction models suggesting a clear line of causation from U.S. to European short-term rates, although the behavior of long-term interest rates is more symmetric. The Ehrmann, Fratzscher, and Rigobon (2005) VAR-based study cited above finds that euro-area financial shocks induce larger effects on U.S. bond yields than the reverse, but U.S. shocks explain more of the variance of euro area interest rates than vice-versa.

Similar conclusions emerge from studies of announcement effects. Goldberg and Leonard (2003) find that U.S. news significantly affects both U.S. and German yields, whereas German and euro area announcement surprises have little effect on U.S. yields and, for that matter, not all that consistent an effect on German yields, either. They cite as possible explanations either the leading role of the United States in the world economy, or that fact that U.S. data tended to be released more quickly than that in the euro area. Ehrmann and Fratzscher (2005), in the study cited above, also find that U.S. news affected euro area yields but not vice-versa. They go on to show that U.S. macro announcements tend to help predict euro area macro announcements, whereas the reverse is not true. Their finding would seem to support either of the explanations for the asymmetry in announcement effects suggested by Goldberg and Leonard (2003): U.S. business cycle events tend to lead euro-area events, or the U.S. data come out earlier.

Spillovers in action: the “conundrum”

Although the research reviewed above suggests that many of the cross-border spillovers in bond markets tend to originate in the United States, one of the most important such spillovers in recent years appears to have originated abroad. In 2004–2006, U.S. bond yields attracted considerable attention by remaining relatively contained even as the federal funds rate was raised from 1 percent to an eventual level of 5¼ percent. (See chart 5.) Greenspan (2005) famously referred to this development as a “conundrum”, and various studies indicated that bond yields, both in the United States and abroad, fell below levels that were consistent with standard macro fundamentals such as inflation, GDP growth, and fiscal balances (Rudebusch, Swanson, and Wu, 2006; Gruber and Kamin, 2009). Many observers came to attribute the weakness of long-term bond yields to heavy purchases of securities by emerging market economies running current account surpluses, particularly emerging Asia and the oil exporters (Bernanke, 2005, 2007b).

Bernanke (2007a) cites the effect of these inflows in suppressing bond yields as an example of how the increasing integration of financial markets may create additional challenges for monetary policymakers. Indeed, events such as the conundrum pose important dilemmas for policy. Confronted with declines in bond yields that are not readily explained by domestic developments, the central bank must decide whether to offset the lower bond yields’ stimulatory effect on spending by raising short-term rates or, to the extent that the declines represent reductions in inflation expectations on the part of global investors, reduce short-rates in order to keep *ex ante* real interest rates from rising.

In practice, it has not been possible to fully separate out the effect of capital inflows from other factors that might also have suppressed bond yields in the United States and abroad, including declines in risk premia (perhaps, at least initially, associated with the “great moderation”) and enhanced demands for long-term assets by pension funds and other institutional investors. Evidence that capital inflows have depressed yields is mixed, but on balance seems to support that view.

Bernanke, Reinhart, and Sack (2004) find that Treasury yields declined significantly during intervals around Japanese interventions to purchase dollars in the 2000-2004 period. Warnock and Warnock (2006) estimate regressions over 1984-2005 of U.S. 10-year bond yields on a number of standard macroeconomic variables such as expected inflation and output, as well as foreign official purchases of U.S. Treasury and agency bonds; they find that foreign purchases significantly lowered U.S. Treasury yields, and by some 90 basis points in 2005. Conversely, Rudebusch, Swanson, and Wu (2006) estimate term structure models of Treasury yields and find that foreign official holdings have no explanatory power. Beltran, Kretchmer, Marquez, and Thomas (2010) revisit both of these last two exercises and find that the estimation results are very sensitive to small changes in variable definitions and econometric specification. They conclude that foreign official inflows likely have pushed down Treasury yields, but much uncertainty remains.

Is financial globalization reducing central bank influence over bond yields?

As financial markets become more integrated internationally, it is possible that long-term bond yields may become subject not only to greater influence from foreign financial shocks, but perhaps also to less influence from domestic monetary policy

actions. Long-term bond yields are conventionally decomposed into two components: (1) the expected future path of short-term interest rates, and (2) a risk premium that could respond to any number of factors, including investor appetite for risk and relative supplies of bonds and alternative assets. As long as central banks retain control over short-term rates (a topic to which we shall return below), they retain the ability to influence long rates. But by exposing economies to a greater array of both real and nominal external shocks, globalization could make the path of short-term rates more uncertain and thus hamper the central bank's ability to influence those expectations. Moreover, as financial markets grow more integrated and bonds from different countries are perceived to be more substitutable, the ability of central banks to influence the risk premia embedded in bond yields by altering relative quantities of money, bonds, and other assets may diminish.

Chart 6 shows that for all five of the economies shown, the correlation between 10-year bond yields and three-month LIBOR rates has declined in the past few decades. Taken together with the evidence shown in Chart 2, this might suggest that not only is the integration of global financial markets increasing the effect of foreign factors in the determination of long yields, but it is reducing the effect of domestic monetary policy in this respect.

However, Chart 7 presents evidence to the contrary. It shows the β_2 coefficient in rolling regressions of the equation:

$$\Delta 10\text{-year bond yield} = \beta_1 + \beta_2 * \Delta 3\text{-month LIBOR} + \varepsilon$$

The estimated equation is obviously not a structural relationship, as both variables are endogenous, but it is notable that the β_2 coefficient shows no secular tendency to decline for any of the five countries shown. At the same time, the R^2 for this equation (not shown) does tend to fall over time, consistent with the reduced correlations shown in Chart 6. Taking these results at face value, it appears that monetary policy retains its ability to affect the long rate through variations in the short rate, but that the share of fluctuations in the long rate explained by the short rate has declined.

There is very limited research available on this topic, and what little there is has produced decidedly mixed results. Ehrmann and Fratzscher (2005) show that the response of German 1-year interbank interest rates to ECB announcement surprises in the 1999-2003 period exceeded their reaction to Bundesbank surprises in the 1993-98 period. However, they show that the response of U.S. interbank rates to Federal Reserve surprises actually declined. And Faust, Rogers, Wang, and Wright (2007) find little change in the effect of FOMC announcement surprises on U.S. bond yields over the 1987-2002 period.

The results of VAR-style analyses are similarly inconclusive. Boivin, Giannoni, and Mojon (2008) estimate a FAVAR model of the euro-area economy over the period 1988-2007 and look for changes in the model with the introduction of the euro after 1998. They find that in the later period, shocks to short-term interest rates led to smaller effects on longer-term interest rates and real GDP but larger effects on exchange rates and trade. These results seem quite consistent with the results of globalization, but, of course, the euro-area economy likely was evolving in many ways as it adjusted to the advent of the single currency.

Conversely, Boivin, Kiley, and Mishkin (2010) survey a range of VAR models estimated on U.S. data and find little compelling evidence of changes in the effect of U.S. monetary policy on U.S. economic activity over time, although effects on some expenditure categories and on inflation have demonstrated some instability. However, using a combination of empirical methods, they document that U.S. monetary policy has become more active in responding to variations in inflation and, consistent with this, inflation expectations have become less responsive to monetary policy shocks. (See, also, Mishkin, 2007, and Roberts, 2006.) In consequence, longer term nominal bond yields might be expected to show less response to a wide array of shocks, providing an alternative explanation to globalization for any observed reduction in the correlation of policy rates and bond yields. Thus, ironically, the more successful is monetary policy at stabilizing inflation, the less effective may monetary policy actions appear to be at influencing financial conditions.

III. Exchange Rate Regimes and Short-term Interest Rates

It is a matter of long-standing theory and conventional wisdom that even if globalization puts longer-term interest rates at the mercy of global factors, in a floating exchange rate regime, central banks retain the ability to control short-term interest rates in their own currencies.¹¹ Chart 8 plots 36-month rolling correlations in 3-month LIBOR rates for the United States and major foreign industrial economies. Interesting, these correlations have risen over time, especially for the U.S./Germany and U.S./U.K. pairs, even though all of the currencies involved are wholly or predominantly floating.

¹¹ This view is associated with the more general proposition labeled “the impossible trinity”: policymakers cannot simultaneously choose monetary policy independence, fixed exchange rates, and open capital markets. See Aizenman (2010) in this volume and Aizenman, Chinn, and Ito (2008).

One possible explanation for the increase is that business cycles among the major industrial economies have become more synchronized. However, as we showed in Charts 3 and 4 above, the evidence for increased synchronization is mixed, at best. Below, we explore several dimensions of the nexus between exchange rate regimes, domestic and foreign interest rates.

Do floating currencies insulate short rates from external shocks?

Some previous research suggests that floating exchange rates might not provide perfect insulation for the conduct of domestic monetary policy. To begin with, a number of the time-series studies cited above on interest rate spillovers among advanced economies during the floating-rate period find evidence of such spillovers for short-term interest rates as well as long, including Awad and Goodwin (1998), Bremnes, Gjerde, and Sættem (2001), Chinn and Frankel (2004), and Ehrmann, Fratzscher, and Rigobon (2005). Additionally, Ehrmann and Fratzscher (2003) document that U.S. FOMC announcements significantly affected European short rates, and somewhat more strongly during 1999-2002 than 1993-98.

Several other studies explicitly compare the reaction to external monetary shocks of interest rates in fixed- and floating-currency regimes. Frankel, Schmukler, and Servén (2004) analyze the response of 90-day interest rates in a broad range of developing and advanced economies to foreign (usually U.S.) rates. They find that during the 1990s, domestic interest rates in most of the countries in their sample, both with pegged and floating exchange rates, exhibited significant correlations with foreign interest rates, although the response of rates in floating currency regimes to changes in foreign rates

tended to be slower.¹² Miniane and Rogers (2003) find that, controlling for characteristics such as capital controls, extent of dollarization, and trade links with the United States, the currency regime makes little difference to how short-term interest rates respond to U.S. monetary shocks.

Erceg, Guerrieri, and Kamin (2009) show that, for the 2000-2007 period, obvious floaters such as Canada and the euro area exhibited higher correlations of their short-term interest rates with those of the United States than many countries that intervene more regularly in foreign exchange markets, including several in emerging Asia; chart 9 reproduces their finding, with emerging Asian economies highlighted in red. Of course, this might reflect that Canada and the euro area have business cycles that are more closely correlated with those of the United States than many of the Asian economies. To explore this possibility, Chart 10 compares correlations in short-term interest rates between the United States and other countries (the y-axis) with correlations of their business cycles with the United States (the x-axis).¹³ Canada and the euro area have interest rate correlations that are well above the trend line, whereas the evidence on the Asian economies is mixed, albeit leaning toward relatively high correlations. Thus, the linkage between currency regime and interest rate correlations seems loose.

However, other studies using different methodologies and classifications of exchange rate regimes find that flexible exchanges do help to insulate domestic short-term rates from foreign rates. Canova (2005) estimates a VAR for the U.S. and Latin American economies and finds that shocks to U.S. monetary policy, while affecting

¹² Notably, Japan and Germany proved to be exceptions, exhibiting little responsiveness to U.S. interest rates.

¹³ As described in more detail in a footnote to the chart itself, business cycle conditions are measured as a weighted average of inflation and output gaps.

interest rates in both fixed- and floating-currency Latin American economies, exert a greater effect in the former. Hausman and Wongswan (2006) show that surprises in U.S. FOMC announcements affect both short- and long-term interest rates in other countries by more, the more rigid their exchange rate regime. Aizenman, Chinn, and Ito (2008) find that lower correlations of domestic and foreign interest rates are associated with greater exchange rate flexibility and/or less open capital markets. Shambaugh (2004) performs an analysis similar to Frankel, Schmukler, and Servén (2004), but focuses on changes rather than levels of interest rates and utilizes somewhat different classification schemes for currency regimes. He finds strong evidence that short-term interest rates in pegged regimes are more responsive to foreign rates than those in floating regimes. However, he also finds that even among floaters, short rates are generally quite responsive to foreign rates, and especially in economies with open capital accounts.

All told, our reading of the data and recent research suggests that, even if floating exchange rates preserve a central bank's technical capacity to control short-term interest rates and reduce the responsiveness of those rates to external factors, in practice most central banks have found it desirable to respond to changes in global financial conditions. In particular, as Shambaugh (2004) notes, domestic policymakers may be responding to the changes in exchange rates caused by changes in foreign interest rates. This does not necessarily reflect a "fear of floating" engendered by the exposure of domestic balance sheets to currency movements, as espoused by Calvo and Reinhart (2002) or Hausmann, Panizza, and Stein (2001). Even advanced economies with little such balance sheet exposure (such as the United States) may find that changes in foreign interest rates lead to changes in exchange rates and knock-on effects on domestic economic activity and

inflation which require a domestic monetary policy response. If globalization boosts either the sensitivity of exchange rates to interest rate differentials, or the sensitivity of inflation and output to exchange rates, this could result in increased responsiveness of domestic short-term interest rates to foreign rates, perhaps explaining the growing correlations among short rates shown in Chart 8.

Finally, through the adoption (formally or informally) of inflation targeting and other elements of what are regarded as good practices in central banking, it is likely that that monetary policies in many economies have become more similar in their response to shocks. This, by itself, might generate higher correlations of short-term interest rates (and by extension longer-term yields), even if international business cycle correlations remain unchanged, or even if the effect of interest rates on exchange rates, output and inflation remains unchanged.¹⁴

Are exchange rates becoming more responsive to monetary policies?

As noted above, the UIP condition linking interest rate differentials and expected future exchange rates assumes open capital accounts and perfect substitutability of assets denominated in different currencies. Conversely, when capital accounts are closed and/or assets highly unsubstitutable, interest rate differentials are expected to have little or no direct impact on exchange rates. Accordingly, it is plausible that as financial globalization proceeds, currency values may become more responsive to interest rate differentials, thereby reinforcing the exchange-rate channel of monetary policy transmission (Mishkin, 2008). As noted above, such a trend could also help explain a

¹⁴ Of course, this would depend on a number of considerations, such as whether or not it was common shocks generating the business cycle correlations.

greater responsiveness of domestic monetary policy to movements in foreign short rates.¹⁵

In practice, there is little support for the hypothesis that financial globalization has increased the responsiveness of exchange rates to monetary policy. Chart 11 presents correlations between short-term interest rate differentials and exchange rates for pairs of major industrial economies. These correlations do not seem to be significantly different from zero, and only hint at some increase over time for several countries. However, it may be that the effects of interest rate changes on exchange rates are being swamped by numerous other developments. Additionally, these correlations may conflate the effects of shocks to monetary policy with those of shocks to asset preferences: an increase in demand for yen that caused its value to rise, for example, might prompt the Bank of Japan to lower policy rates in response.

Previous research on this topic has addressed this identification problem in a number of ways, and generally shows that monetary shocks do affect exchange rates, but there is little evidence this effect has grown over time. Eichenbaum and Evans (1995) estimate a VAR for the U.S. economy and find that expansionary shocks to U.S. monetary policy are indeed associated with both declines in U.S.-foreign interest rate differentials and depreciations of the dollar against several major industrial-country currencies. Anderson, Bollerslev, Diebold, and Vega (2003) and Faust, Rogers, Wang, and Wright (2007) both examine the effect of FOMC federal-funds rate announcement surprises and confirm that these significantly affect the dollar. But the latter study, which

¹⁵ However, a greater correlation of short-rates in this circumstance is not assured. For a country facing an unwanted change in its exchange rate, the heightened responsiveness of exchange rates to interest rate differentials would also mean that a smaller monetary policy response was required to return the exchange rate to its original level.

examines the stability of this relationship, finds no evidence that the size of this effect changed over the 1987-2002 estimation period. Similarly, Fatum and Schnolnick (2006) document a significant effect of fed funds futures on dollar exchange rates during the 1989-2001 period and find no evidence of parameter instability. Finally, in their FAVAR analysis of the U.S. economy, Boivin and Giannoni (2008) find little change in the effect of U.S. monetary shocks on the dollar.

Are exchange rates exerting greater effects on macroeconomic performance?

Above, we speculated that increased correlations of short-term interest rates among the major industrial countries might reflect, among other factors, the role of globalization in boosting the effect of exchange rates on macroeconomic performance. In consequence, exchange rate changes induced by monetary policy shocks in one country would be more likely to elicit monetary policy responses in another country.

Mishkin (2007) argues that greater openness to trade should boost the role of the exchange rate as a transmission channel of monetary policy:

The larger the share of imports and exports in the economy, the greater the change in net exports—and, hence, in the contribution of net exports to gross domestic product (GDP) growth—for a given change in the exchange rate. In addition, the larger the share of imports in the economy, the larger should be the effect on overall CPI inflation of a given change in import prices when the exchange rate changes. (page 10)

Erceg, Gust, and Lopez-Salido (2010) use a number of calibrated New Keynesian DSGE models to analyze the effect of shocks in open economies, and they confirm Mishkin's central hypothesis: economic openness increases the role of the exchange rate and net exports in the monetary transmission process while reducing that of exclusively domestic transmission factors. Cwik, Muller, and Wolters (2008) calibrate a New

Keynesian DSGE model to match the performance of the U.S. economy as captured in an estimated VAR model. They also find that, all else equal, greater openness to trade would increase the effect of exchange rate changes on macroeconomic performance.

However, Cwik, Muller, and Wolters (2008) show that this effect is attenuated if the pass-through of changes in exchange rates into changes in import prices is limited—the more limited the pass-through, the less that prices of imports in domestic currency respond to exchange rates, and thus the smaller the changes in quantities of exports and imports. Gust and Sheets (2007) also use an open-economy DSGE model to make this finding.

Insofar as considerable research points to rates of exchange rate passthrough having fallen in many countries in recent decades—see, among others, Marazzi, Sheets, and Vigfusson, 2005, Campa and Goldberg, 2005, and Ihrig, Marazzi, and Rothenberg, 2006)—this suggests that even as trade globalization may have been bolstering the exchange rate channel of monetary policy transmission, the decline in exchange rate passthrough may have been acting to reduce it (Mishkin, 2007). Consistent with this, di Mauro, Ruffer, and Burda (2008), in their VAR analysis of the euro area, find a decline in exchange rate passthrough to imports and consumer prices, as well as some evidence that trade (especially in goods) has become less responsive to exchange rates. In fact, Gust, Leduc, and Vigfusson (2006) develop a theoretical model to argue that the simultaneous occurrence of increases in trade openness and declines in passthrough may be no coincidence: increases in trade introduce more foreign competitors into the domestic market, leading to more variable markups over cost and less passthrough of exchange-rate changes into import prices.

Finally, another channel through which globalization might affect the exchange rate channel of monetary transmission might be valuation effects associated with cross-border assets and liabilities. Presumably, as these positions have grown, the valuation and wealth effects associated with exchange rate changes should have grown as well (Lane and Milesi-Ferretti, 2005, Tille, 2008). In practice, however, it is difficult to identify this evolution.

IV. The Financial Crisis, Liquidity, and the Credit Channel

Reinforcement of old lessons

The international financial crisis that began in the summer of 2007 has served to reinforce many of the lessons of financial globalization described above. Most of all, it underscored how the global integration of financial markets poses heightened challenges to national central banks as they confront shocks originating beyond their borders. Although the United States, United Kingdom, and several other economies clearly experienced their own housing-booms-turned-bust, the crisis eventually engulfed nearly all economies, often in ways that were not always clearly related to their own financial vulnerabilities or exposure to U.S. subprime assets. (See, among others, Ehrman, Fratzscher, and Mehl, 2009, Eichengreen et.al., 2009, Kamin and Pounder, 2009; and Rose and Spiegel, 2009.)

Second, and as a related point, the crisis has highlighted the extent to which markets for long-term securities are globally integrated. As the crisis deepened in late 2008, the United States experienced a surge in capital inflows to purchase U.S. Treasuries as investors sought a safe haven from the financial turbulence (Bertaut and Pounder, 2009). This led to an extraordinary decline in U.S. Treasury yields in late 2008, with

sovereign yields in other major industrial economies declining to a lesser extent. (See chart 1.) Subsequently, as the crisis eased, government bond yields through the world moved back up more or less in unison.

Finally, the crisis highlighted the extent to which correlations in short-term interest rates among economies have risen as well. The early phase of the crisis saw some divergence in policies, as the United States and then United Kingdom started cutting rates while other countries saw further increases. However, by late in 2008, the contractionary effects of the financial crisis and disinflationary effects of the related collapse in oil prices led to cuts in central bank policy rates around the world, and in some countries to unconventional policies to provide further monetary stimulus.

International dimensions of liquidity and credit

The discussions of monetary policy presented above assumed that credit is freely accessed and extended at a given rate (or term structure of rates) of interest. However, the broad and growing literature on the credit channel of monetary policy highlights that informational asymmetries and contract enforcement costs can elevate a firm's financing costs relative to the safe (for example, government) rate of interest, so that changes in the "external finance premium" can lead to effects on economic activity beyond that induced by changes in the general interest rate (Bernanke and Gertler, 1995). In this environment, borrowing and spending depend crucially on the level of liquidity—that is, the ability to readily transact in assets without inducing large changes in asset values—in money markets and, related, the liquidity positions of financial institutions (Warsh, 2007). Kashyap and Stein (2000) show that U.S. banks with less liquid balance sheets are more constrained in their lending and more responsive to monetary policy.

Even before the advent of the financial crisis, it was becoming evident that globalization might be altering the evolution of liquidity and credit conditions. Cetorelli and Goldberg (2009) apply the Kashyap and Stein (2000) approach to U.S. banks during the 1980-2006 period, distinguishing between domestically oriented and globally active banks. They find the lending activities of the global banks to be less affected by U.S. monetary policy shocks, as these banks shift funds between themselves and foreign affiliates in response to changing liquidity needs in the United States and abroad; as a result, lending activities of foreign affiliates are also affected by U.S. monetary conditions. This international spillover through the credit channel is also identified by Correa and Murray (2009), who find that U.S. monetary policy actions significantly affect the cross-border lending of U.S. banks, and that this effect is stronger for banks with foreign offices. Although neither study examines changes over time, it is plausible that as banks have become more internationally active, these international spillovers have become more pronounced. Chart 12, reproduced from Cetorelli and Goldberg (2009), provides some evidence of the increased globalization of banking.

With the recent financial crisis, the prominence of liquidity and credit channels ratcheted further upward as money and interbank markets around the world seized up. Chart 13 shows that spreads of dollar Libor over overnight index swap (OIS) rates, a measure of the premium banks were charging each other over expected policy interest rates, surged starting in August 2007. Much of the heightened demand for funding in dollars appeared to be coming not so much from U.S. banks but from foreign banks and other institutions, and these heightened demands spilled over into Libor rates in other currencies as well. Dollar funding pressures were also associated with a deterioration of

functionality in the foreign exchange swap market and deviations from covered interest parity, as discussed by Coffey, Hrung, Nguyen, and Sarkar (2009) and Bowman and Covitz (2008).

As illustrated in Chart 14, the large need for dollar funding by foreign institutions reflected the fact that foreign banks had substantially increased their cross-border dollar liabilities in recent years, in part to finance their purchases of U.S. assets (McGuire and von Peter, 2009). After credit markets seized up, refinancing those liabilities became quite difficult, and because they were in dollars, often with short maturities, foreign central banks had limited scope to improve funding conditions.

The dollar funding shortage not only posed challenges for financial stability abroad, but also in the United States. Foreign banks operating in the United States increasingly used their access to U.S. money markets to siphon funds abroad (Bertaut and Pounder, 2009), consistent with the identification by Goldberg and Cetorelli (2009) of significant internal markets for funds within large global banks. In turn, these activities led to significant impacts on interbank markets and the behavior of the Federal Funds rate within the United States (Bernanke, 2009).

The effects of these developments quickly spilled over beyond the money markets into the non-financial sector. Chart 15 tracks surveys of bank lending behavior in the United States, United Kingdom, and the euro area. The rise in the indexes indicates that by the fourth quarter of 2007, well before the bankruptcy of Lehman Brothers, banks had started to tighten lending to households and firms, setting the stage for the recession in the real economy that followed in 2008. Thus, at least among the advanced economies,

liquidity and credit channels were the prime vehicle for cross-border spillovers of distress in the real economy.

New challenges for central banks

Even aside from the international dimensions of the crisis, the seizure of interbank and other money markets during the past two years forced many central banks to develop a range of new facilities designed to calm markets and restore liquidity. In many ways, however, these new activities were mainly extensions of the central banks' traditional responsibility for regulating liquidity and, on occasion, acting as a lender of last resort. One of the most novel challenges posed by the crisis was the revelation that financial institutions were experiencing funding shortages in foreign currencies, mainly dollars, but also in other key currencies such as euros. These shortages, which were a direct outgrowth of the globalization of banking and asset management, could not be addressed through the central banks' standard capacity to create domestic currency, but instead "required a more internationally coordinated approach among central banks to the lender-of-last-resort function" (Bernanke, 2008).

Accordingly, the Federal Reserve and foreign central banks arranged currency swaps designed to permit the foreign central banks to lend dollars into their domestic markets. The amounts outstanding under these swaps ballooned in the fall of 2008 with the intensification of the crisis, accounting for roughly a quarter of the Federal Reserve's balance sheet at their peak. But they appear to have helped ease liquidity conditions in money markets, as evidenced by sharp decline in dollar Libor-OIS spreads shown in Chart 11, and they also apparently reduced the European banks' need to fund in the U.S. market (Bertaut and Pounder, 2009).

By early 2010, credit spreads in interbank markets around the world had largely returned to their pre-crisis levels and the central bank dollar liquidity swaps had been drawn down. But the financial crisis had made clear that future bouts of turbulence would likely be international in scope, and they would likely not be amenable to the purely domestic facilities central banks had wielded in the past.¹⁶ According to a prominent Federal Reserve official:

Our experience in recent months has underlined the global interdependencies of financial markets. Globally active banks manage their positions on an integrated basis around the world, and pressures transmitted in one market are quickly transmitted elsewhere. Central banks should consider how to adapt their facilities to help these institutions mobilize their global liquidity in stressed market conditions and apply it to where it is most needed. (Kohn, 2008).

V. Conclusion

Over the past several decades, interest rates across the global economy have come to move ever more closely with each other. Prior empirical research has not been able to conclusively tie these increased co-movements to increased financial market integration, as other trends appear to be complicating the analysis, most notably a tighter anchoring of inflation expectations that appears to be diminishing the response of yields to all sorts of shocks, domestic and external. However, taking all of the evidence and prior research into consideration, our judgment is that the trend toward heightened correlations in interest rates across countries very likely reflects financial globalization, particularly as there is little evidence that business cycles have become more internationally synchronized.

¹⁶ In fact, the liquidity swaps were reinstated with several central banks in May 2010 in response to the dollar funding pressures associated with European sovereign debt problems.

Has this globalization reduced the influence of central banks over financial and economic conditions in their own country? For the most part, probably not. All told, our reading of the research on this topic is that financial integration does not lead to the loss of control over short rates in countries with floating currencies. Moreover, there is not much evidence that globalization has made it more difficult for central banks to influence longer rates through their control of short rates.

Even so, globalization appears to be amplifying the role of international considerations in the formation of domestic monetary policy. First, it is clear that even with floating rates, the short-term rates set by monetary policymakers in many economies are responding to foreign financial conditions, and apparently to a greater extent than previously. This could be because globalization is rendering exchange rates more sensitive to interest rate differentials, and even central banks with floating currencies will need to respond to changes in exchange rates. It could also be because exchange rates are becoming a more important channel of monetary transmission. A final explanation for the increased co-movement in short rates observed across economies is that monetary policy strategies around the world are becoming more similar with the adoption of inflation targeting and other elements of good practice in central banking.

Second, in addition to short rates, long-term interest rates appear increasingly to be affected by international developments as well. This poses a challenge to central bank policymakers, who must not only understand the implications of, and formulate a response to, domestic shocks, but must also take into account a diverse array of external shocks. In a speech a few years ago, Federal Reserve Board Chairman Ben Bernanke noted that although globalization has not “materially affected the ability of the Federal

Reserve to influence financial conditions in the United States, nor has it led to significant changes in the process that determines the U.S. inflation rate...effective monetary policy making now requires taking into account a diverse set of global influences, many of which are not fully understood” (Bernanke, 2007a).

Finally, the recent crisis has both underscored the challenges of monetary policy in a globalized financial system and highlighted the importance of liquidity and credit channels as additional conduits of external shocks. The crisis has also identified an area in which the standard array of central bank tools may have become inadequate in many countries: liquidity provision and the lender-of-last resort function. With the rise in the share of financial transactions undertaken in vehicle currencies such as dollars and euros, the ability to print domestic currency may no longer suffice to address a liquidity crisis. Accordingly, international arrangements for liquidity provision may become increasingly important in the future.

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CHART 1

10-Year Government Bond Yields
(January 2000 – October 2009)

Percent

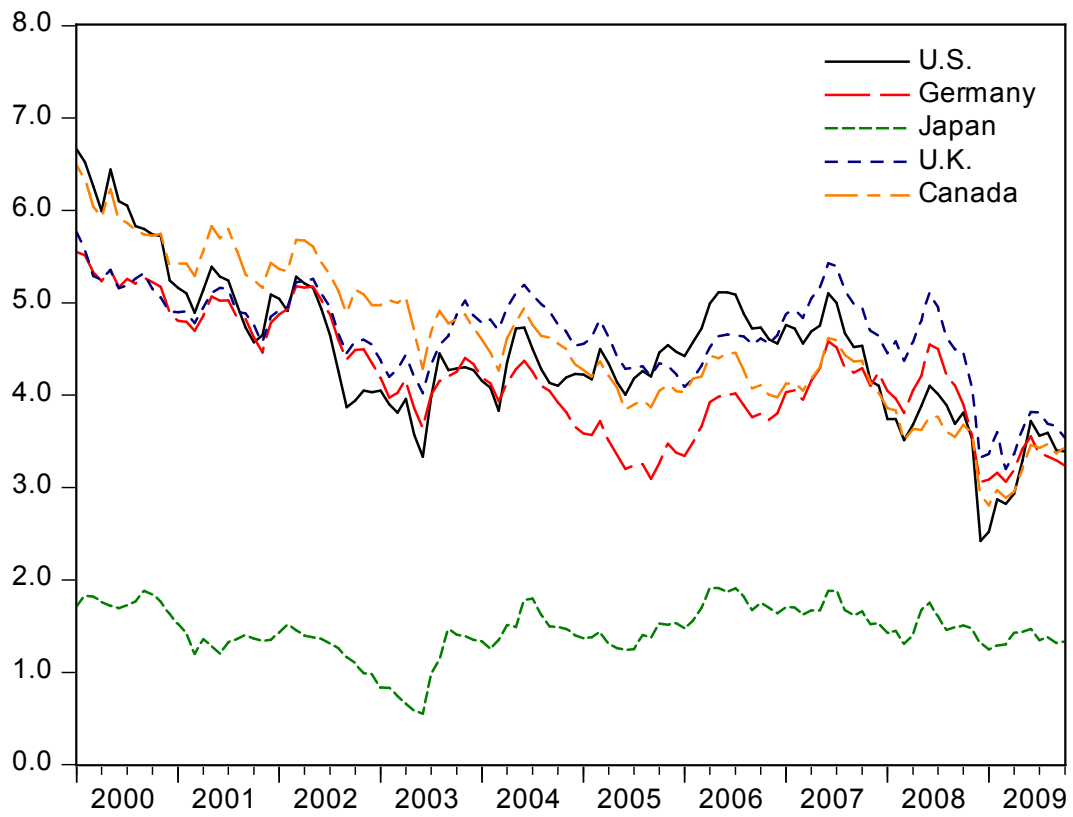
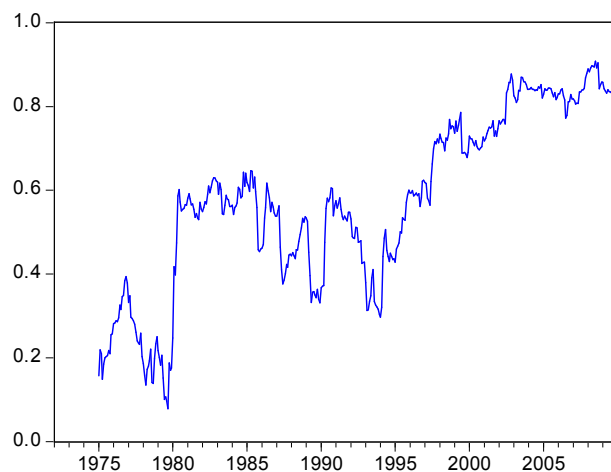


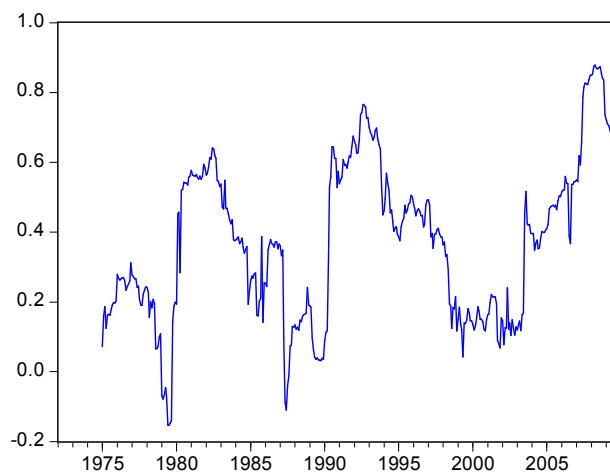
CHART 2

36-Month Rolling Correlations of Monthly Changes in 10-Year Bond Yields
(January 1975 – October 2009)

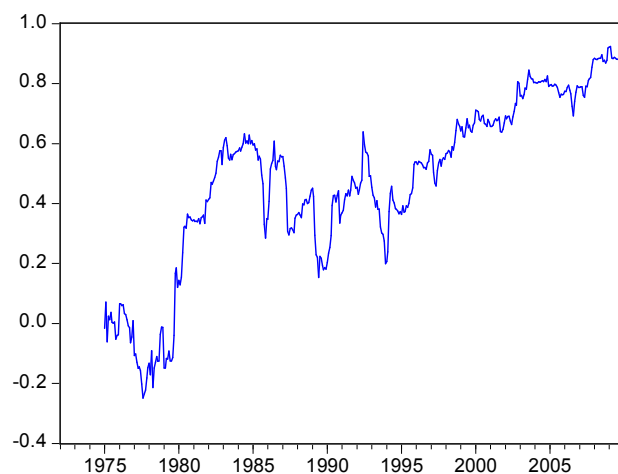
U.S. and Germany



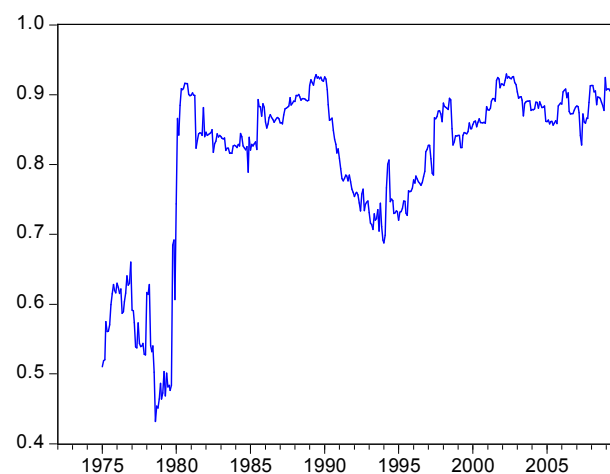
U.S. and Japan



U.S. and United Kingdom



U.S. and Canada

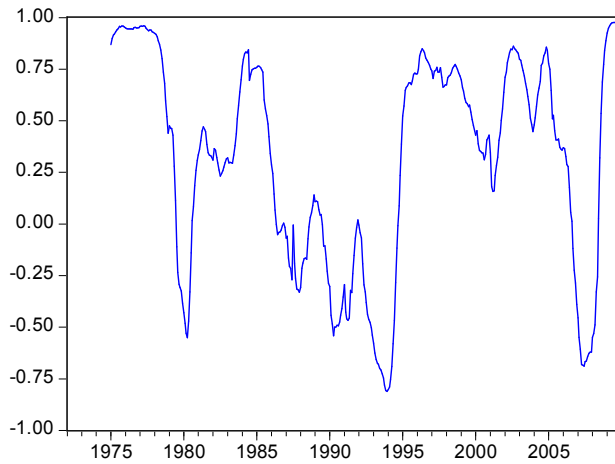


Corr. of US with	GER	JP	UK	CAN
1972.02-2009.10	0.536044	0.365700	0.370651	0.816385
1972.02-1999.12	0.485242	0.360415	0.326907	0.810991
2000.01-2007.06	0.839049	0.437042	0.789023	0.896677
2000.01-2009.10	0.832248	0.491304	0.819244	0.898305

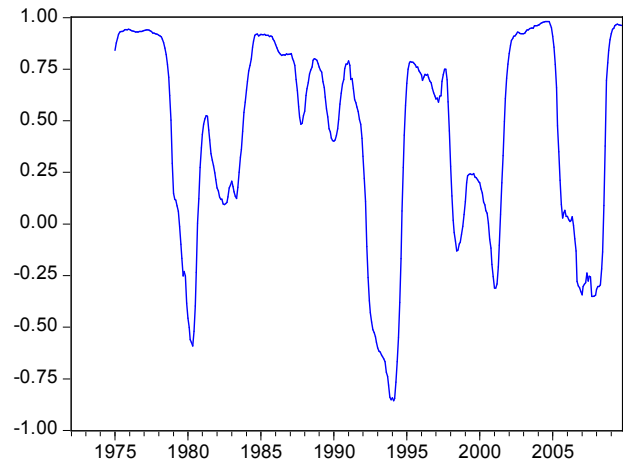
CHART 3

36-Month Rolling Correlations of 12-Mo. Percent Changes in Industrial Production
(January 1975 – October 2009)

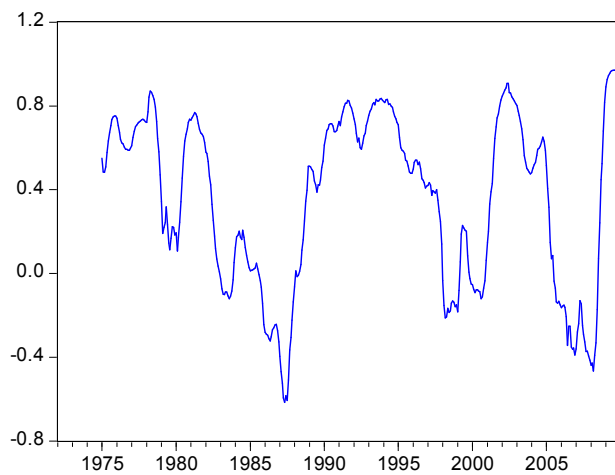
U.S. and Germany



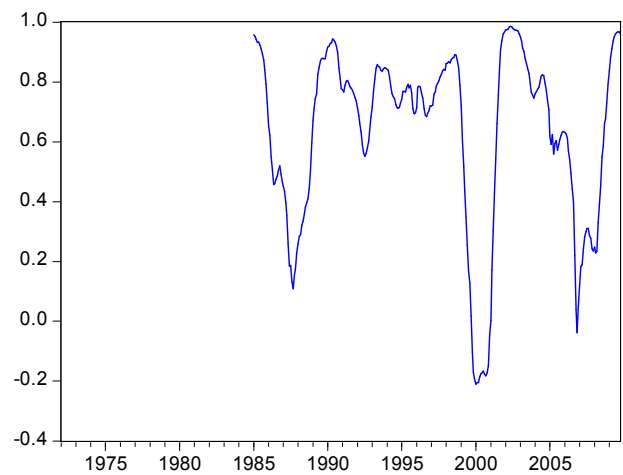
U.S. and Japan



U.S. and United Kingdom



U.S. and Canada

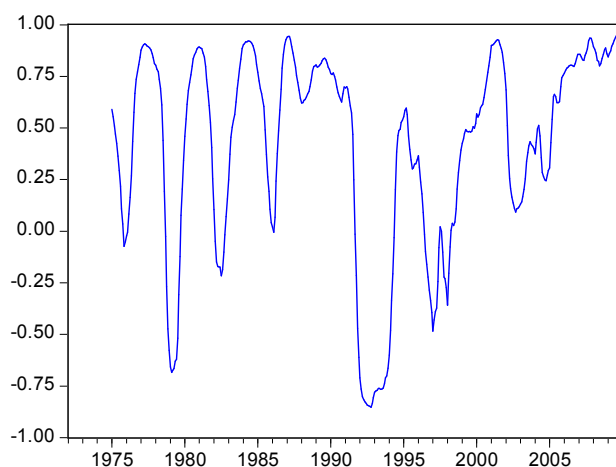


Corr. of US with	GER	JP	UK	CAN
1972.02-2009.10	0.621176	0.685977	0.611893	0.795206
1972.02-1999.12	0.504682	0.554199	0.495737	0.766698
2000.01-2007.06	0.600130	0.852044	0.572283	0.737191
2000.01-2009.10	0.894791	0.937021	0.879185	0.911223

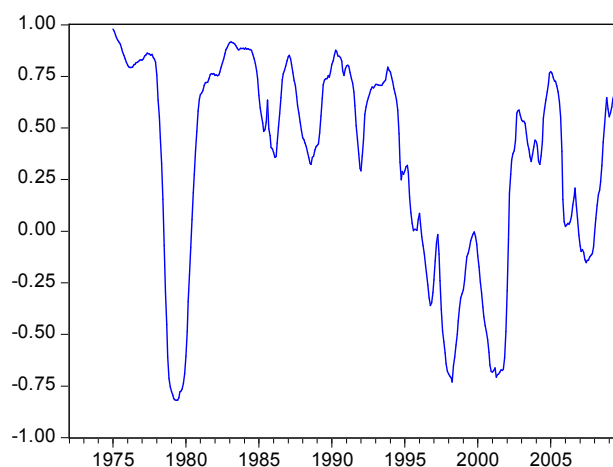
CHART 4

36-Month Rolling Correlations of 12-mo. Percent Changes in CPI
(January 1975 – October 2009)

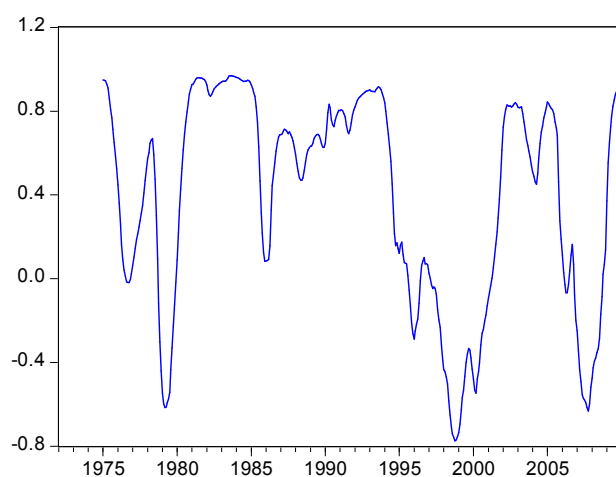
U.S. and Germany



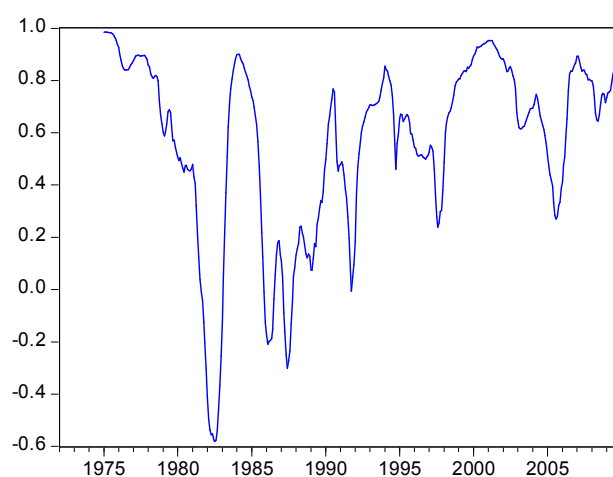
U.S. and Japan



U.S. and United Kingdom



U.S. and Canada



Corr. of US with	GER	JP	UK	CAN
1972.02-2009.10	0.676600	0.701180	0.829090	0.869729
1972.02-1999.12	0.631601	0.659523	0.804536	0.855649
2000.01-2007.06	0.420438	0.278053	0.331413	0.510371
2000.01-2009.10	0.855637	0.595278	0.792115	0.721203

CHART 5

U.S. Federal Funds Rate and 10-Year Government Bond Yield
(January 2000 – October 2009)

Percent

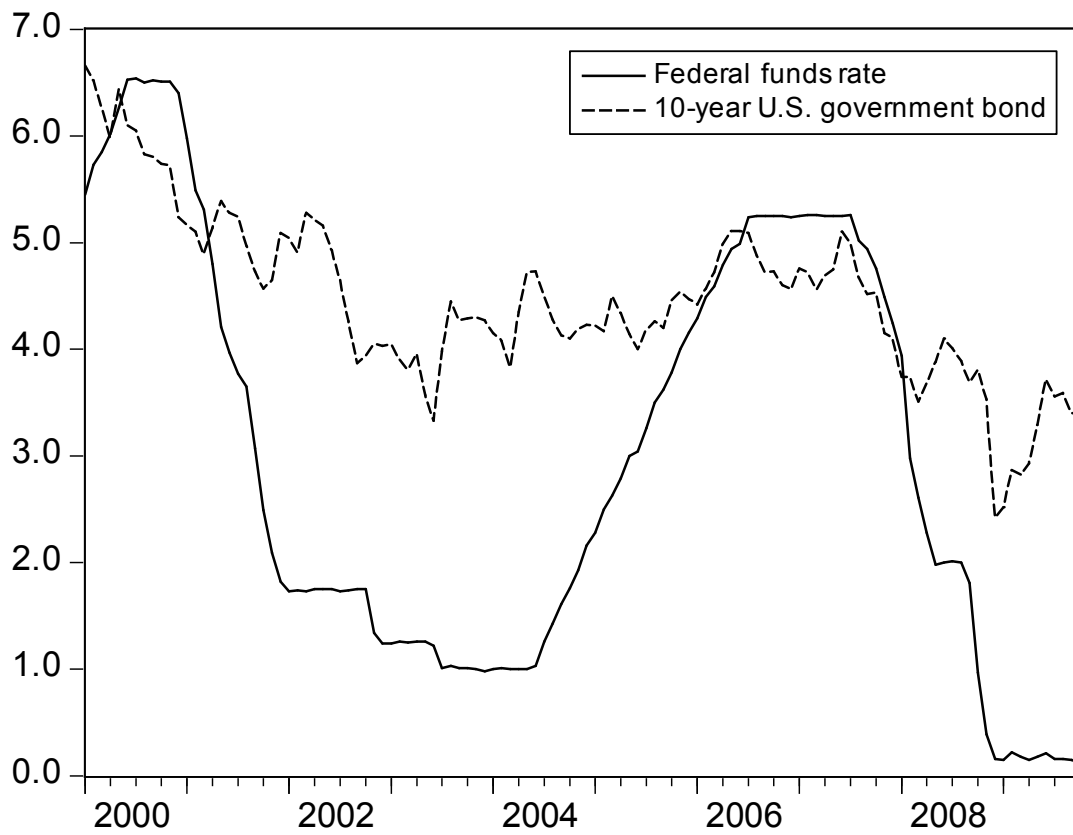
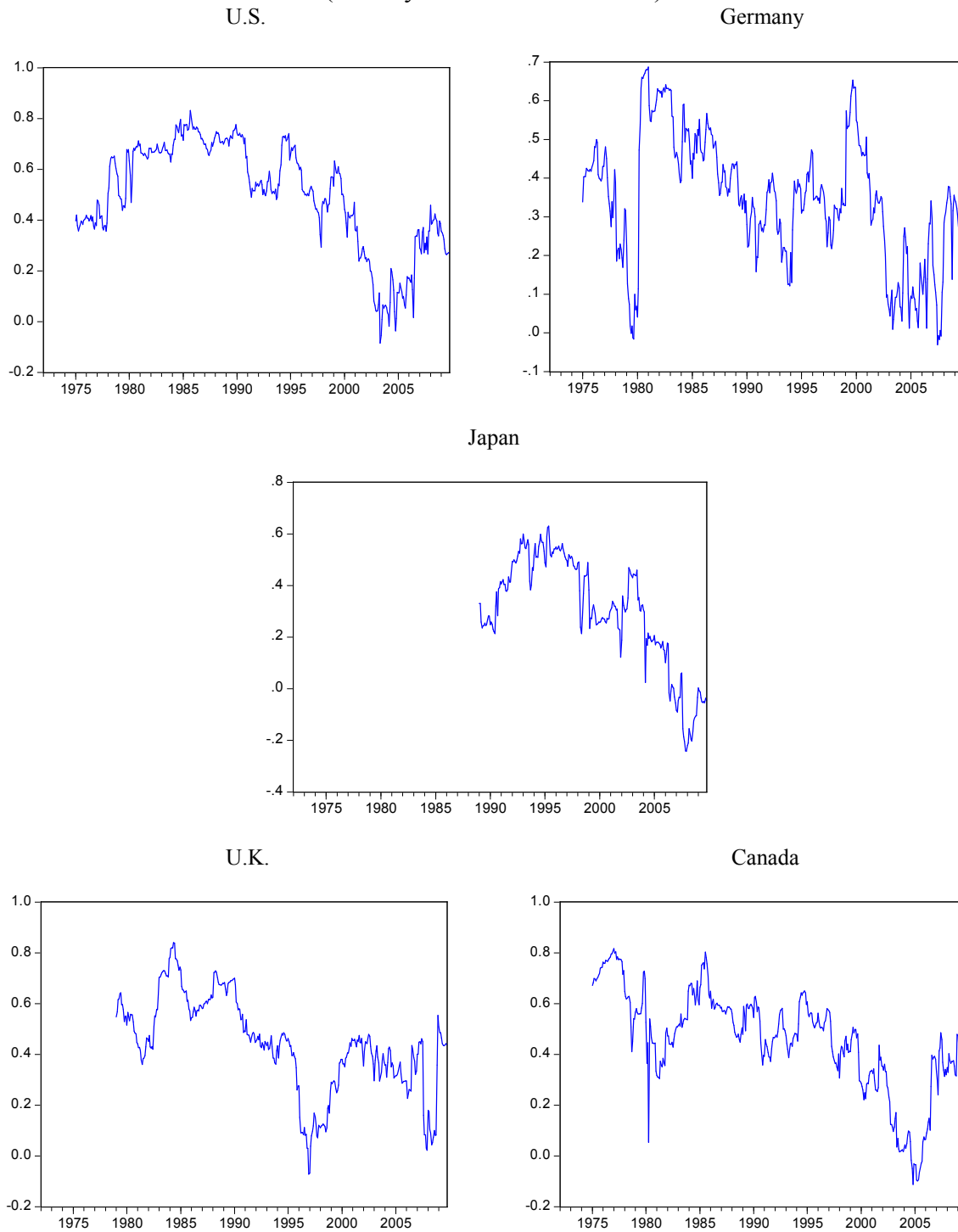


CHART 6

36-Month Rolling Correlations between Monthly Changes in 3-Month LIBOR and 10-Year Bond Yields
(January 1975 – October 2009)

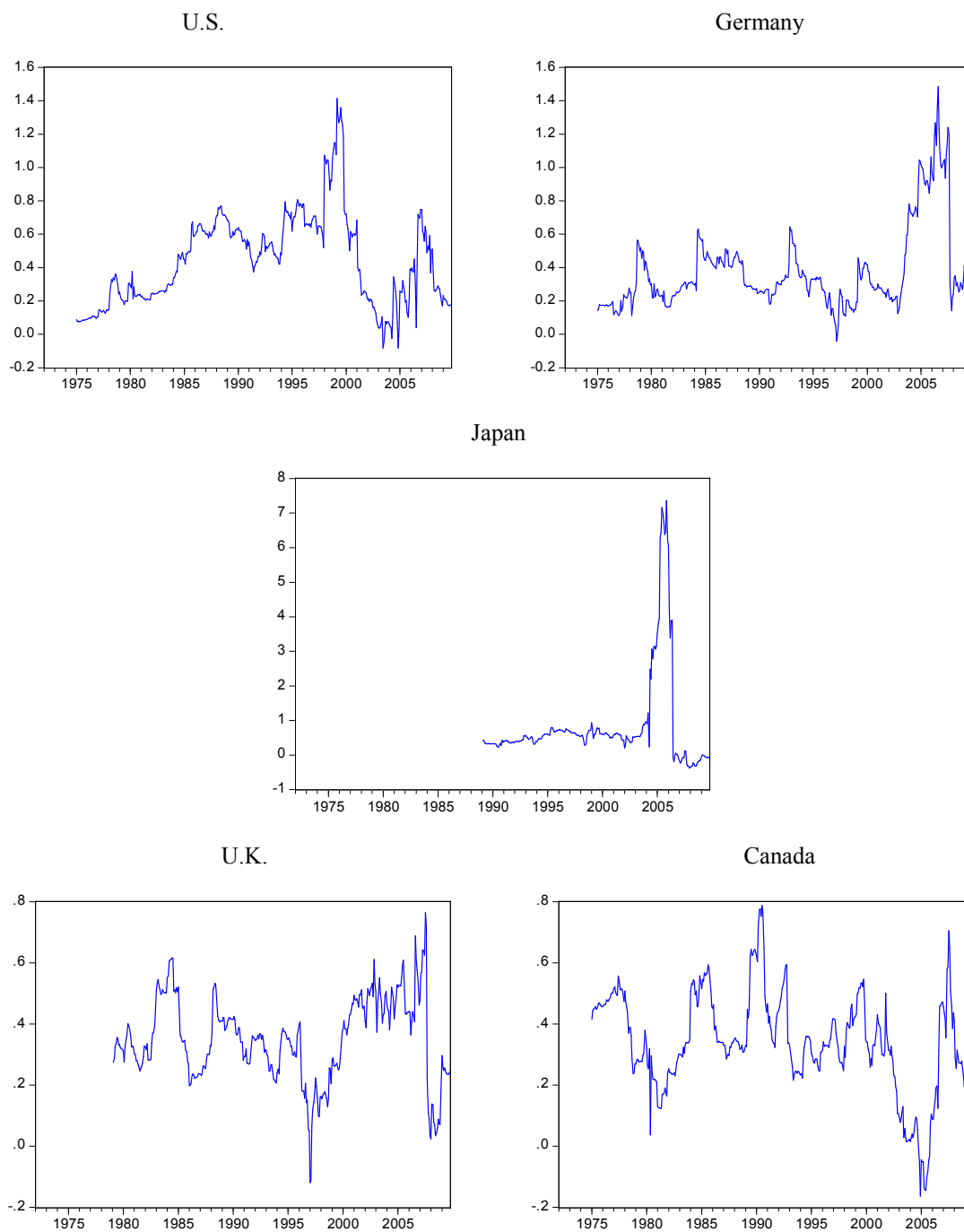


Correlations	GER	JP	UK	CAN	US
1972.02-2009.10	0.429612	0.383443	0.521488	0.509875	0.551397
1972.02-1999.12	0.446874	0.406149	0.534500	0.530538	0.59082
2001.01-2007.06	0.280401	0.192129	0.374847	0.151400	0.171072
2000.01-2009.10	0.307272	0.108181	0.375214	0.207916	0.21948

CHART 7

Estimated Coefficient β_2 in 36-Month Rolling Regressions of Monthly Changes in 10-Year Bond Yield on 3-Month LIBOR

(January 1975 – October 2009)

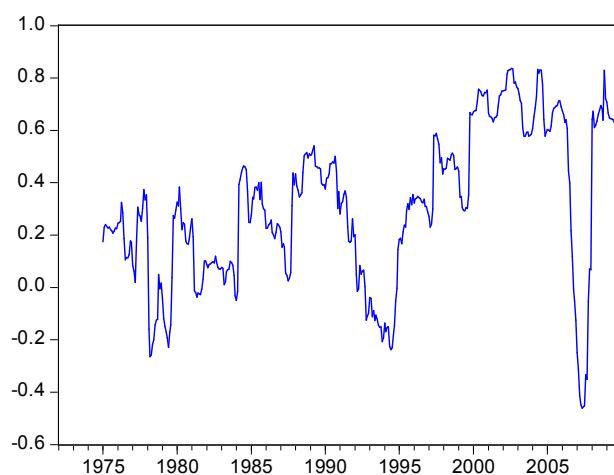
Estimated equation: $\Delta 10\text{-year bond yield} = \beta_1 + \beta_2 \cdot \Delta 3\text{-mo. LIBOR}$ 

β_2 (t-stat)	GER	JP	UK	CAN	US
72.02-09.10	0.247541 (10.10347)	0.447342 (6.984360)	0.321580 (12.26920)	0.329929 (12.58715)	0.247541 (10.10347)
72.02-99.12	0.247055 (9.115493)	0.458979 (5.709168)	0.326099 (10.67645)	0.337274 (11.42132)	0.247055 (9.115493)
00.01-07.06	0.361010 (2.740330)	0.392684 (1.836544)	0.507887 (3.792936)	0.153636 (1.436825)	0.190786 (1.628809)
00.01-09.10	0.252202 (3.477665)	0.195212 (1.172021)	0.264862 (4.359702)	0.176128 (2.289355)	0.252202 (3.477665)

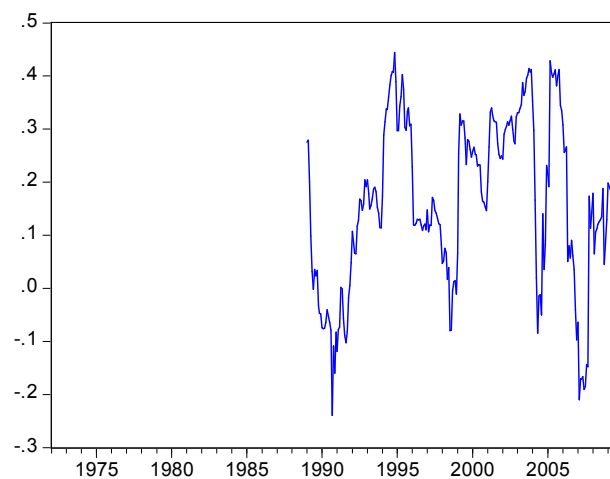
CHART 8

36-Month Rolling Correlations of Monthly Changes in 3-Month LIBOR
(January 1975 – October 2009)

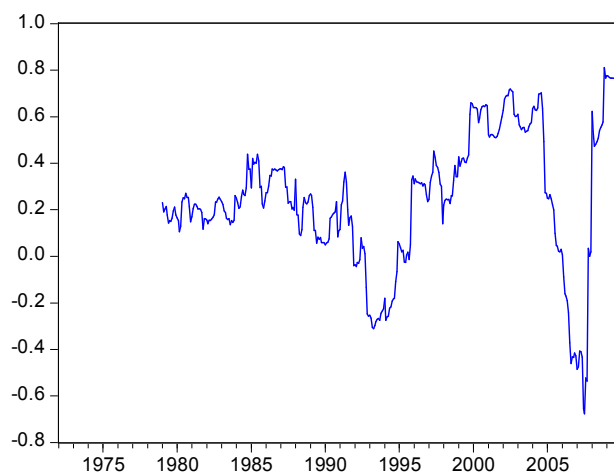
U.S. and Germany



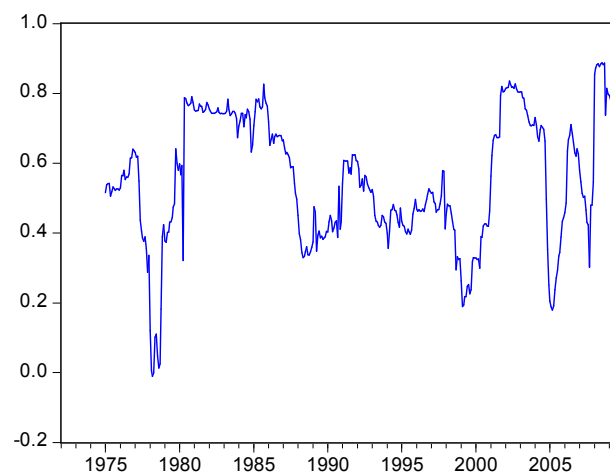
U.S. and Japan



U.S. and United Kingdom



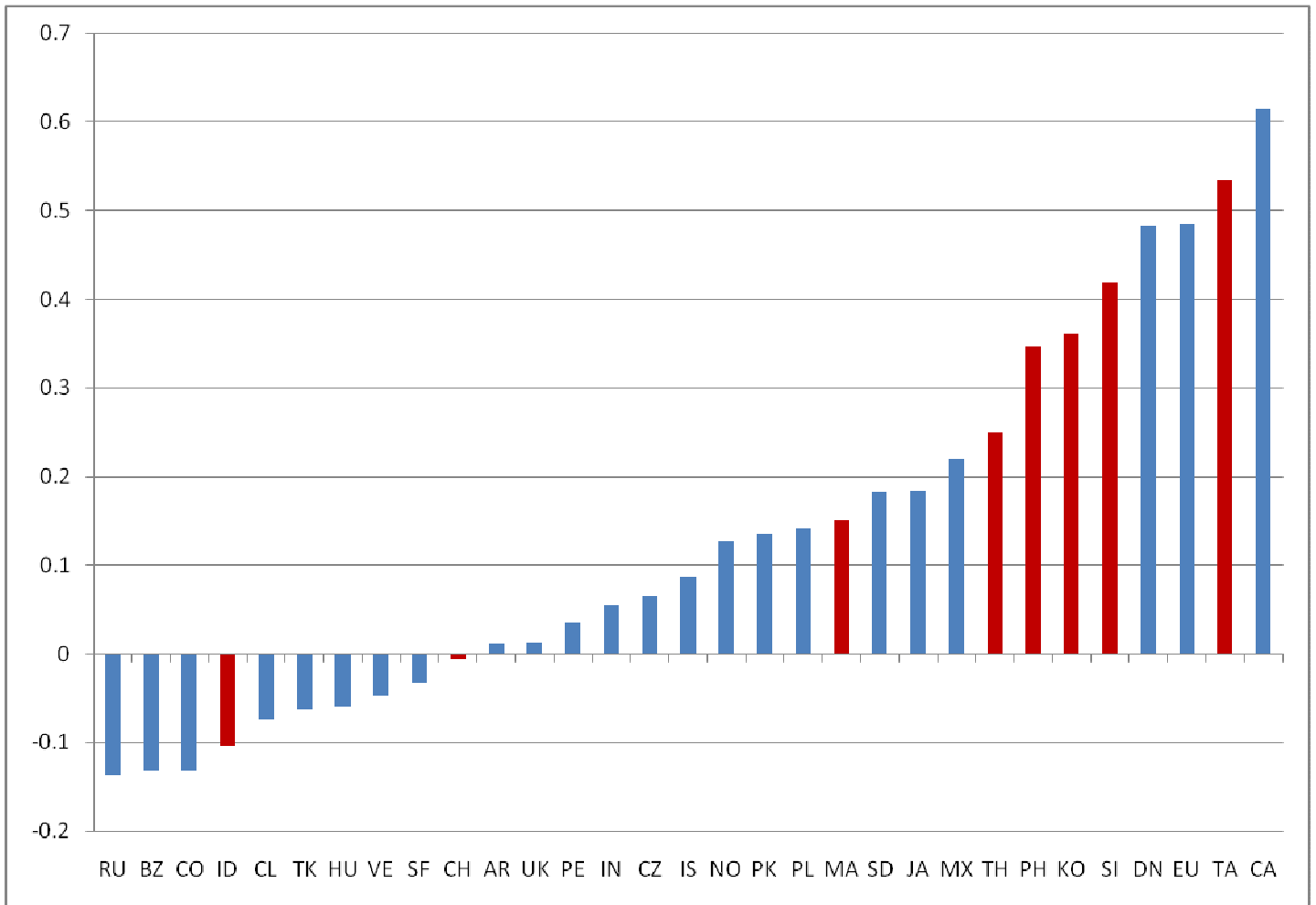
U.S. and Canada



Corr. of US with	GER	JP	UK	CAN
1972.02-2009.10	0.186883	0.132189	0.207181	0.624412
1972.02-1999.12	0.156899	0.152913	0.173828	0.617880
2001.01-2007.06	0.637578	0.273823	0.469596	0.734755
2000.01-2009.10	0.647137	0.214645	0.692383	0.740705

CHART 9

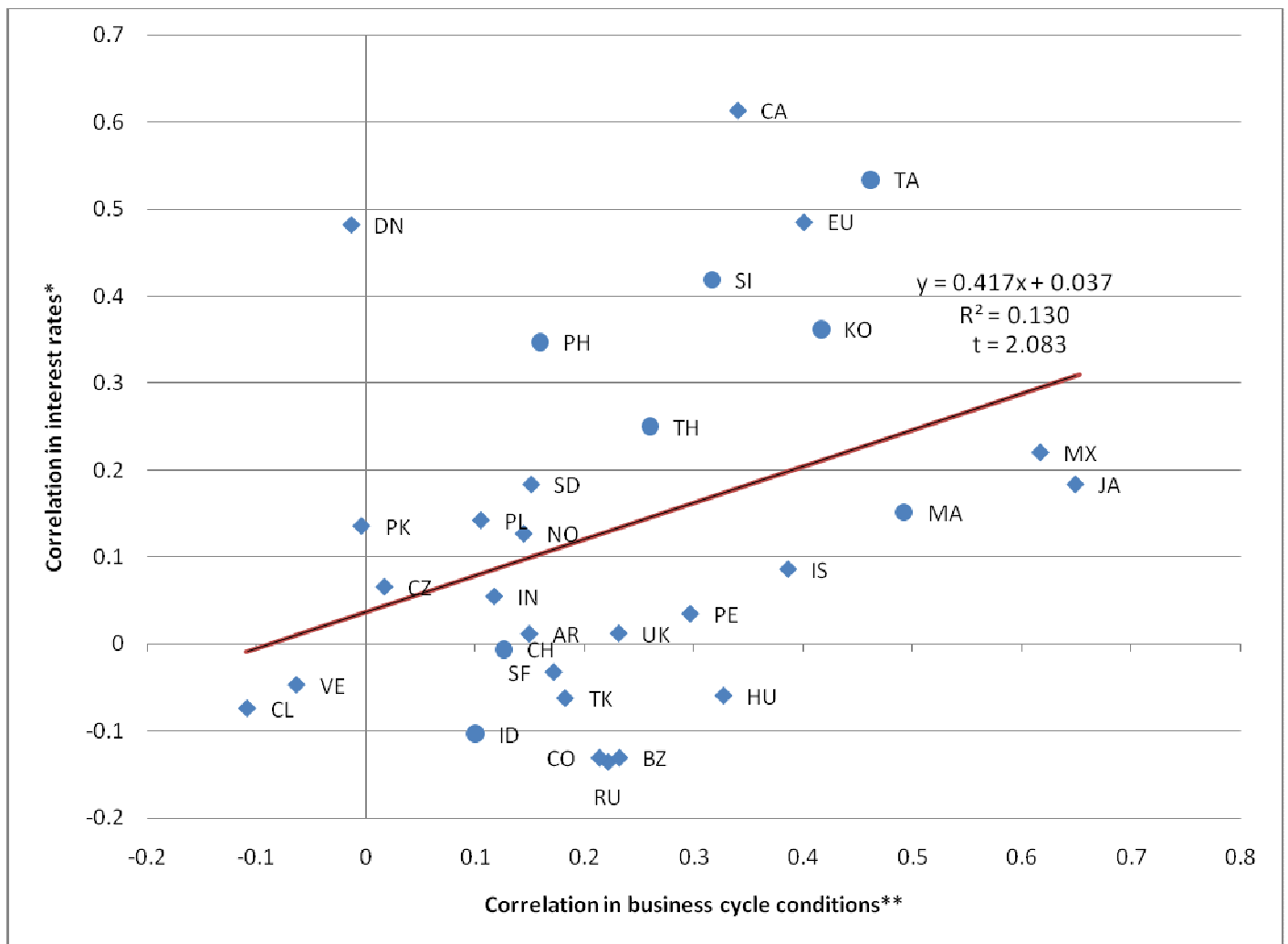
Correlation of Nominal Interest Rate Changes with U.S. Rates*



* Monthly data on policy interest rates, 2000 – 2007.

CHART 10

**Correlations of Nominal Interest Rates with U.S. vs.
Correlations of Business Cycle Conditions with U.S.**
(January 2000 – December 2007)



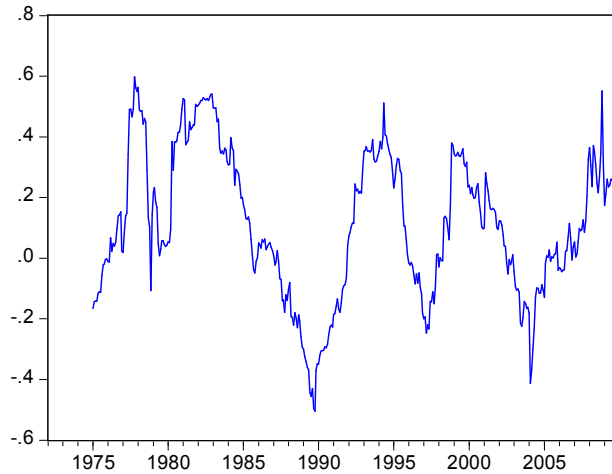
* Correlations of monthly changes in domestic rates with U.S. rates. Interest rates are 3-month money market rates.

** Correlations of monthly changes in domestic business cycle conditions with U.S. conditions. Changes in conditions are calculated as $1.5 \cdot \Delta\pi + 0.5 \cdot \Delta(\text{output gap})$, where π is 12-month inflation (for U.S., core inflation) and the output gap is the difference between industrial production and HP-filtered industrial production.

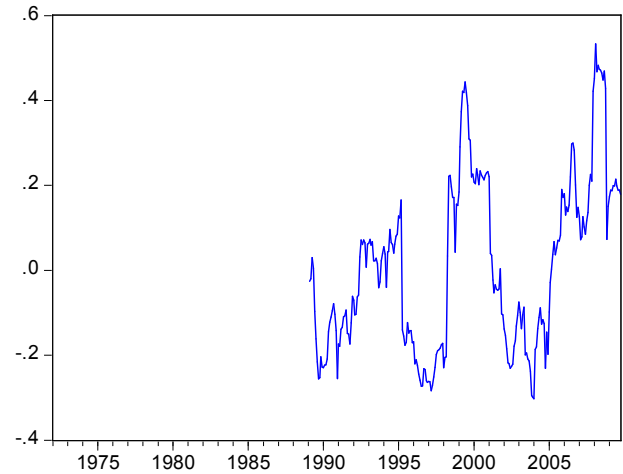
CHART 11

36-Month Rolling Correlations of Monthly Changes in 3-mo. LIBOR Differentials with Monthly Percent Changes in Exchange Rates (Foreign Currency/USD)
(January 1975 – October 2009)

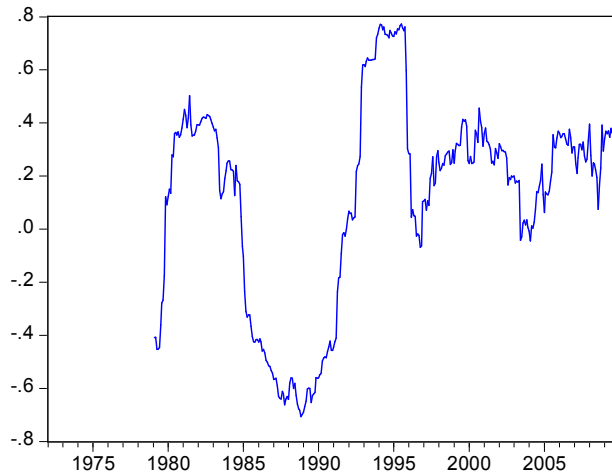
U.S. and Germany



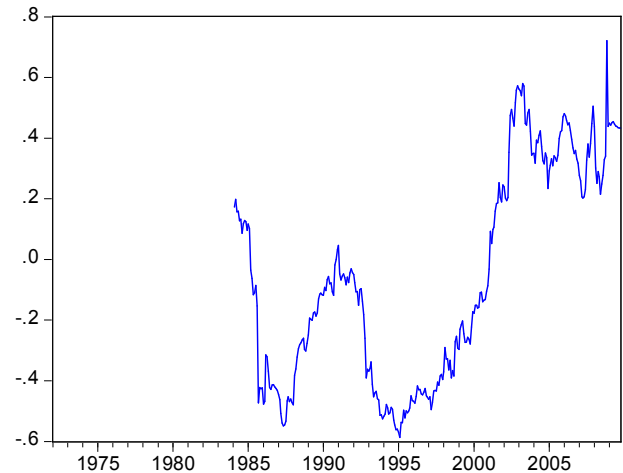
U.S. and Japan



U.S. and United Kingdom



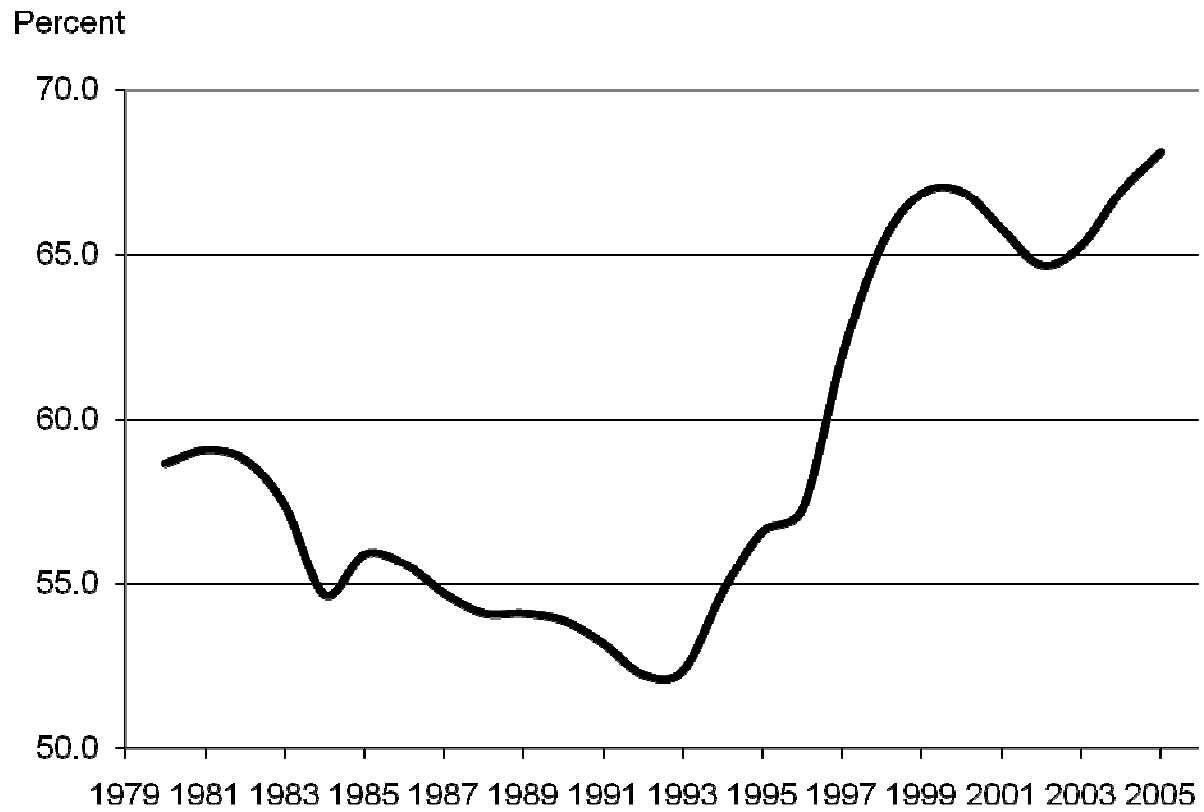
U.S. and Canada



Corr. of US with	GER	JP	UK	CAN
1972.02-2009.10	0.128459	-0.007776	0.040300	0.019661
1972.02-1999.12	0.140153	-0.053914	0.022033	-0.060083
2000.01-2007.06	-0.075727	-0.052164	0.215511	0.290582
2000.01-2009.10	0.083228	0.098478	0.270520	0.372322

CHART 12

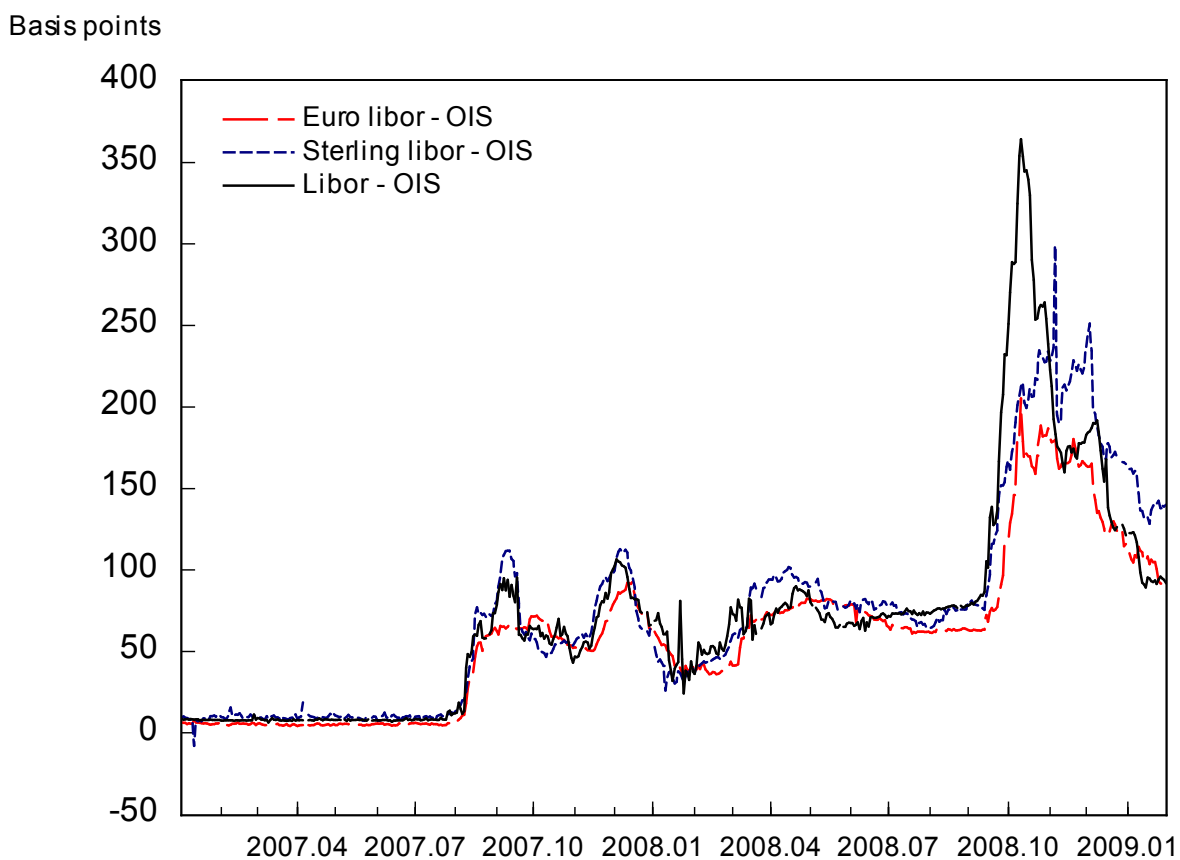
Assets of Globally-Oriented U.S. Banks as a Share of Total U.S. Bank Assets
(1980 – 2006)



Source: Cetorelli and Goldberg (2009).

CHART 13

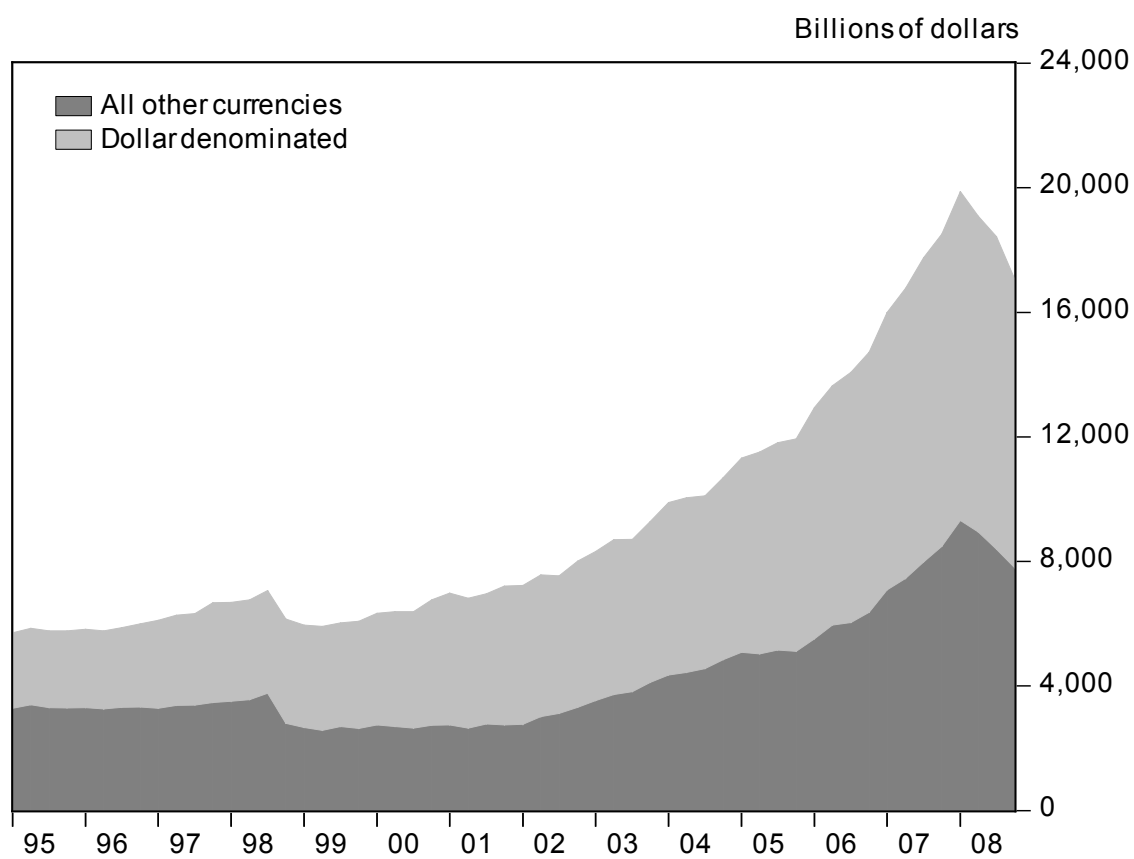
Spread of LIBOR over OIS (3-Month) Interest Rates
(2007.01.02 – 2009.01.30)



Source: Kamin and Pounder (2009)

CHART 14

Cross-Border Foreign Currency Liabilities of Non-U.S. Banks*
(1995Q1 – 2008Q4)



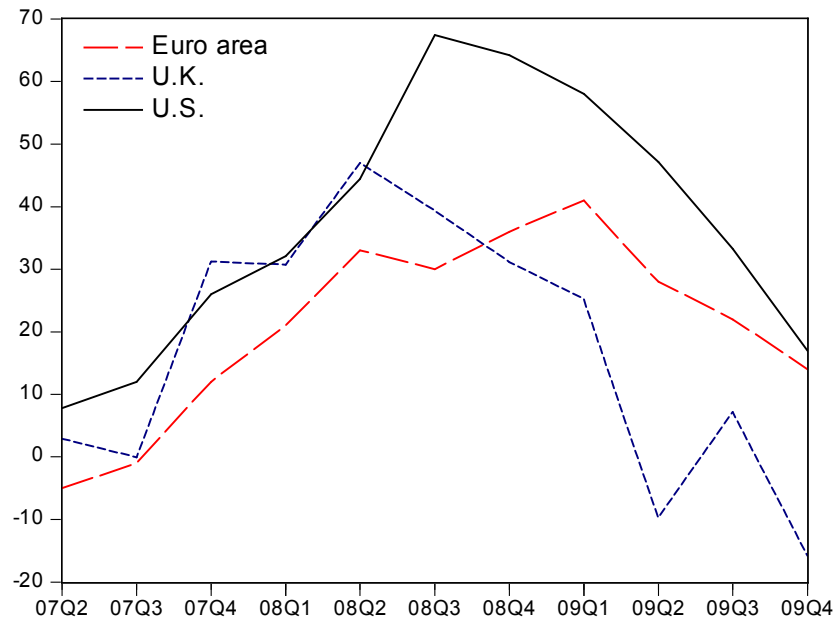
Source: Kamin and Pounder (2009)

* Excludes liabilities in an issuer's own currency.

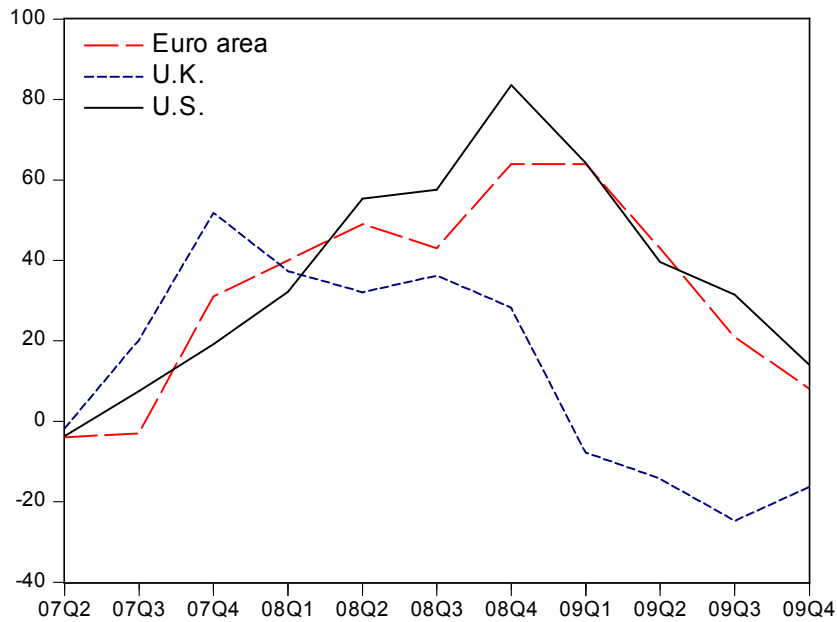
CHART 15

Survey Measures of Bank Lending Conditions*
(2007Q2 – 2009Q4)

Lending to Households



Lending to Non-Financial Corporations



* Increase indicates tighter lending conditions.

DATA SOURCES

Interest rates: 3-mo.

Germany	3-month Interbank Offered Rate {FIBOR} (%)	Haver: DENRI3@GERMANY
Japan	3-month LIBOR: Based on JPY (EOP, %)	Haver: JPRIL3ME@JAPAN
UK	3-month LIBOR (AVG, %)	Haver: UNRO3M@UK
Canada	3-month Treasury Bills (AVG, %)	Haver: CIG3MV@CANSIM
US	3-month LIBOR: Based on US\$ (%)	Haver: FLOD3@USECON

Interest rates: 10-yr.

Germany	Average yield of all public authority loans	National sources
Japan	Average yield of seven-year industrial bonds listed on Tokyo Stock Exchange	National sources
UK	Average yield on government interbank loans	National sources
Canada	Average yield of Canada issues due or callable in 10+ years	National sources
US	Market yield on U.S. Treasury securities at 10-year constant maturity, quoted on investment basis	National sources

Exchange rates

Germany	USD / Euro based on restated German Mark, using conversion rate as 1 euro = 1.95583 DM	Haver: DENXUSDV@GERMANY, DENXUSEV@GERMANY
Euro area	USD / Euro spot exchange rate	Haver: X111EXR@EUROSTAT
Japan	JPY / USD spot exchange rate	Haver: JPXRSDV@JAPAN
UK	USD / GBP spot exchange rate	Haver: UNASS@UK
Canada	CND / USD spot exchange rate	Haver: V37426@CANSIM

Industrial production

Germany	Industrial production including construction (SA/WDA, 2005=100)	Haver: DESDY@GERMANY
Euro area	Industrial production including construction (SA, 2005=100)	Haver: S025QZX2@EUROSTAT
Japan	Industrial production: Mining & Manufacturing (SA, 2005=100)	Haver: IIP052@JAPAN
UK	Industrial production: Production Industries (SA, 2005=100)	Haver: CKYW@UK
Canada	Industrial production: All Industries (SAAR, Mil.2002.C\$)	Haver: V41G1478@CANSIM
US	Industrial production Index (SA, 2002=100)	Haver: IP@USECON

CPI

Germany	Consumer Price Index (SA, 2005=100)	Haver: DESPCT@GERMANY
Euro area	Monetary Union Index: Consumer Prices (MUICP) (SA, 2005=100)	Haver: H025H@EUROSTAT
Japan	Consumer Price Index: General (NSA, 2005=100)	Haver: CIJ05@JAPAN
UK	Retail Prices Index: All Items (NSA, Jan-87=100)	Haver: CHAW@UK
Canada	CPI: All Items [V41690973] (NSA, 2002=100)	Haver: V4C90973@CANSIM
US	CPI-U: All Items (SA, 1982-84=100)	Haver: PCU@USECON

Core CPI

All countries	Consumer prices - all items non-food, non-energy: Index (2005=100)	OECD Main Economic Indicators (MEI) database
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FFR

US	Effective federal funds rate	FRED II: FEDFUNDS
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