CHAPTER ONE

Monetary Policy Independence under Flexible Exchange Rates

The Federal Reserve and Monetary Policy in Latin America—Is There Policy "Spillover"?

Sebastian Edwards

ABSTRACT

I use historical weekly data from 2000 to 2008 to analyze the way in which Federal Reserve policy actions have affected monetary policy in a group of Latin American countries: Chile, Colombia, and Mexico. I find some evidence of policy spillover during this period, in Chile and Colombia, but not in Mexico. In addition, I analyze whether changes in the slope of the yield curve in the United States have affected policy rates in these emerging markets (EMs). I also investigate the role of global financial markets' volatility and capital mobility on the extent of monetary policy "spillovers." I provide some comparisons between these Latin American countries and a group of East Asian nations during the same period. The results reported here call into question the notion that under flexible exchange rates countries exercise a fully independent monetary policy.

1. Introduction

For central bankers from around the world, the years 2013 to 2015 were years of great apprehension as they waited for the Federal Reserve to make up its mind and to begin raising policy rates. As time passed without the Fed taking action, central bank governors became increasingly anxious. The first sign of apprehension came

This paper was prepared for presentation at the Hoover Institution Monetary Policy Conference held on May 5–6, 2016. I thank John Taylor for encouragement and Ed Leamer for very helpful discussions. I am grateful to David Papell for his comments.

in June 2013 during the so-called "taper tantrum."[1] Soon afterward, a number of influential central bankers from the periphery called for the Fed to normalize monetary policy once and for all. They wanted the "waiting game" to be over and for the Fed to begin hiking interest rates. On August 30, 2015, the governor of the Reserve Bank of India, Ragu Rajan, told the *Wall Street Journal,* "[F]rom the perspective of emerging markets . . . it's preferable to have a move early on and an advertised, slow move up rather than, you know, the Fed being forced to tighten more significantly down the line."

The wait was finally over on December 17, 2015, when the Fed raised the federal funds policy target range by 25 basis points, from 0 to 0.25 to 0.25 to 0.50 percent. During the next few weeks many Latin American countries—Chile, Colombia, Mexico, and Peru, for example—followed suit, and their respective central banks raised interest rates.[2] In contrast, during that same short period most of the East Asian central banks remained "on hold." An important question in this regard is, Why do some central banks "follow" the Fed, while others act with what seems to be a greater degree of independence?

During the first few weeks of 2016, and as the world economy became more volatile and questions about China mounted, anxiety returned. In particular, many EMs' central bankers became concerned about the rapid depreciation of their currencies, a phenomenon that they associated with the expectation that the Fed would continue to hike rates during 2016. For example, in an interview published in the *Financial Times,* Agustín Casterns, the governor of the Bank of Mexico, publicly argued that the peso had weakened too much—it had "overshot"—and predicted that, eventually, it would

1. On the effects of the tapering on the EMs see, for example, Aizenman, Binici, and Hutchison (2014) and Eichengreen and Gupta (2014).

2. In most of the Latin American countries, the Fed action was seen as contributing to the depreciation of their currencies.

go through a period of significant strengthening.[3] During February 2016, the degree of apprehension among periphery central bankers increased when the Bank of Japan moved its policy rate to negative terrain. In part as a result of this action, long rates declined, and the yield curve became flatter. On February 10, 2016, the *Wall Street Journal* said, "A little more than a month after the Federal Reserve lifted its benchmark rate from near zero, rates across the market are *falling*. The yield on the 10-year US Treasury note, a benchmark for everything from corporate rates to corporate lending this week fell below 1.7%, its lowest level in a year. (Emphasis added.)"

At a policy level, an important issue is how emerging markets are likely to react when advanced countries' central banks (and, in particular, the Federal Reserve) change their monetary policy stance.[4] According to received models of international macroeconomics (i.e., the Mundell-Fleming model, in any of its versions), the answer to this question depends on the exchange rate regime. Countries with pegged exchange rates cannot pursue independent monetary policy, and any change in the advanced countries' central bank policy rates will be transmitted into domestic rates (with the proper risk adjustment). However, under flexible exchange rates countries are able to undertake independent monetary policies and don't face the "trilemma." In principle, their central bank actions would not have to follow (or even take into account) the policy position of the advanced nations, such as the United States.[5] More recently, however, some authors, including, in particular, Taylor (2007, 2013, 2015) and Edwards (2012, 2015), have argued that even under flexible exchange rates there is significant policy interconnectedness across countries. In a highly globalized setting, even when there

3. See *Financial Times,* January 17, 2016. http://www.ft.com/intl/cms/s/0/968bd686-ba02-11e5-bf7e-8a339b6f2164.html#axzz3zyDnMPnT.

4. In the recent World Economic Outlook (2015), the International Monetary Fund devotes a long discussion to this issue.

5. On the "trilemma," see, for example, Obstfeld, Shambaugh, and Taylor (2005) and Rey (2013).

are no obvious domestic reasons for raising interest rates, some central banks will follow the Fed. This phenomenon may be called policy "spillover," and could be the result of a number of factors, including the desire to protect domestic currencies from "excessive" depreciation.[6] The late Ron McKinnon captured this idea when, in May 2014, he stated at a conference held at the Hoover Institution that "there's only one country that's truly independent and can set its monetary policy. That's the United States."[7] Of course, not every comovement of policy rates should be labeled as "spillover." It is possible that two countries (the United States and a particular EM, say, Colombia) are reacting to a common shock—a large change in the international price of oil, for example. "Spillover" would happen if, after controlling by those variables that usually enter into a central bank policy reaction function—the Taylor rule variables, say—there is still evidence that the EM in question has followed the Fed.

The purpose of this paper is to use data from three Latin American countries—Chile, Colombia, and Mexico—to analyze the issue of policy "spillover" from a historical perspective. More specifically, I am interested in answering the following questions: (*a*) Have changes in the Fed policy rate historically affected the policy stance of these countries' central banks, even after controlling for other variables? (*b*) If the answer is yes, how strong has the policy pass-through been? (*c*) What is the role played by the yield curve in the policy "spillover" process? Does it make a difference if the policy rate hike is accompanied by a flattening or steepening of the global yield curve? (*d*) What has been the role of global instability in the transmission mechanism of policy interest rates? and (*e*) Has this process been affected by the degree of capital mobility in the spe-

6. This is related to "fear of floating." See, for example, Calvo and Reinhart (2000). On the effect of advanced central banks' actions on EMs, see also Ince, Molodstova, Nikolsko-Rzhevskyy, and Papell (2015), Molodstova and Papell (2009), and Nikolsko-Rzhevskyy, Molodstova, and Papell (2008).

7. I thank John B. Taylor for making the transcript of Ron McKinnon's remarks available to me.

cific countries? In order to put my findings in perspective, in the final section of the paper, I compare the results obtained for the three countries in the sample to a group of East Asian nations. Although the analysis presented here is based on historical data (2000 to 2008), the answers are particularly pertinent for the current times, as an increasing number of central banks in the emerging nations are considering the issue of whether to react to Fed policy moves.

This paper differs from previous work on the subject in several respects: (*a*) I concentrate on individual countries. This allows me to detect differences across nations. Most analyses of related subjects have relied on either pooled (panel) data for a group of countries—often pooling countries as diverse as Argentina and India—or have based their simulations on a "representative EM." (*b*) I use short-term (weekly) time series data. As a consequence, I am able to follow the granularity of the transmission from interest rates in the United States to interest rates in the EMs of interest. (*c*) As noted, I focus on the important issue of the slope of the yield curve, and I analyze how changes in the policy rate and the long rate have interacted to affect the three central banks' policy stance. (*d*) I explicitly investigate how changing conditions in the global economy—including the volatility of global financial markets—affect (if they do at all) the transmission process. (*e*) I investigate whether the degree of capital mobility affects the transmission process.[8] And (*f*) I provide an explicit comparison between a group of Latin American countries and a group of Asian nations.

2. Preliminaries

Before moving forward, a note on the sample is in order. Chile, Colombia, and Mexico are the three Latin American countries with

8. I have previously addressed some of these issues in Edwards (2011, 2012, 2015).

available weekly data for the variables of interest. In addition, they have three important characteristics in common: (*a*) they followed inflation targeting during the period under study (2000 to 2008); (*b*) they had a relatively high degree of capital mobility (more on this below); and (*c*) the three had independent central banks. In this sense, they constitute a somewhat homogenous group.

In figure 1.1, I present weekly data for the federal funds target rate from 1994 through 2008, just before it was reduced to (almost) zero and quantitative easing was enacted. Between January 2000 and September 2008, there were 40 changes in the federal funds policy (target) rate. Twenty were increases, and in 19 of them the rate hike was 25 basis points; on one occasion the Fed Funds rate was increased by 50 basis points (in the week of May 19, 2000). The other 20 policy actions correspond to cuts in the federal funds rate. In seven cases it was cut by 25 basis points; in 11 cases it was cut

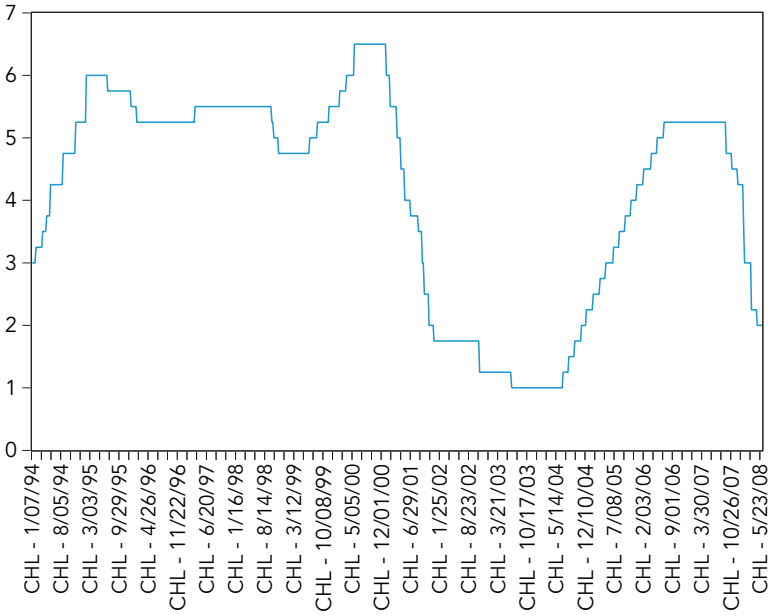

FIGURE 1.1. Federal funds target rate, 1994–2008

by 50 basis points; and on two occasions it was reduced by 75 basis points (both of them in early 2008: the week of January 25th and the week of March 21st).

In figure 1.2, I include weekly data on the policy rate for the three countries in this study: Chile, Colombia, and Mexico. As noted, the key question in this paper is the extent to which these EMs' central banks took into account the Fed's policy stance when determining their own monetary policy. In other words, with other givens, did (some of) these countries take into account Fed action when deciding on their own policies, or did they act with complete independence?

Standard tests indicate that it isn't possible to reject the null hypothesis that the policy interest rates have unit roots. For this reason in the analysis that follows, I rely on an error correction specification. This is standard in the literature on interest rate dynamics.[9] Not surprisingly, it is not possible to reject the hypothesis that the Federal Fund's rate "Granger causes" the EMs' policy rates; however, the null that these rates "cause" Fed policy actions is rejected, in every case, at conventional levels. The details of these tests are not reported here due to space considerations; they are available on request.

A brief discussion on the use of the term *spillover* is in order. As the reader may have noticed, I have used it in quotation marks. There are two reasons for this: First, central bankers usually reject—and sometimes quite strongly—the notion that their decisions are subject to direct influence from abroad. They argue that in making decisions they take into account all available informa-

9. See, for example, Frankel, Schmukler, and Serven (2004), and Edwards (2012) for analyses of the transmission of interest rate shocks. These studies are different from the current paper in a number of respects, including the fact that they concentrate on market rates and don't explore the issue of "policy spillover." Other differences are the periodicity of the data (this paper uses weekly data) and the fact that in the current work individual countries are analyzed. Rey (2013) deals with policy interdependence, as does Edwards for the case of one country only (Chile).

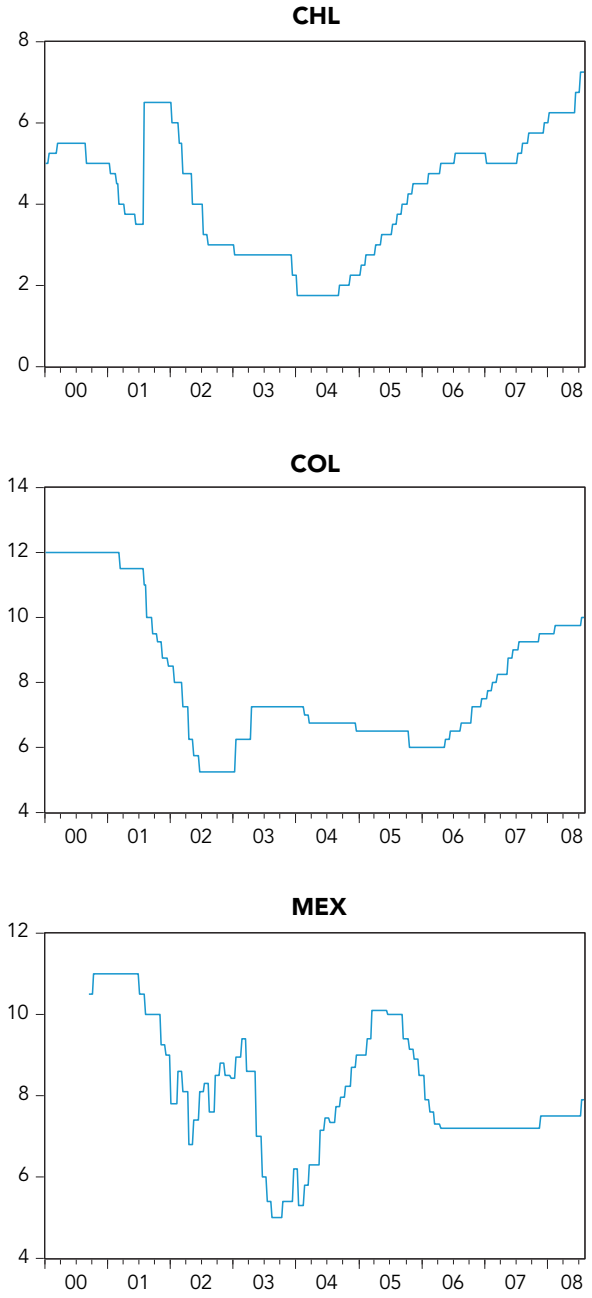

FIGURE 1.2. Monetary policy rates, selected Latin American countries, 2000–2008

tion, including global interest rates, but they point out that they don't follow, as a matter of policy, any other central bank, be it the Fed or the ECB. For example, this point has been made recently by Claro and Opazo (2014) with respect to Chile's central bank. Second, and as noted, it is possible that even if there are strong comovements in policy rates, these don't constitute "spillover" but are the reflection of both banks reacting to common shocks. In the analysis presented below, I do make an attempt to control by the type of variables that would constitute common shocks and, thus, to separate "spillover" from policy rates' comovements.[10]

3. On policy "spillover": A conceptual framework

Consider a small open economy with risk-neutral investors. Assume further, in order to simplify the exposition, that there are controls on capital outflows in the form of a tax of rate τ.[11] Then, the following condition will hold in equilibrium (one may assume without loss of generality that the tax is on capital inflows, or both on inflows and outflows; see the discussion in Edwards 2015a):

$$\frac{r_t - r_t^{\star}}{(1 + r_t^{\star})} = E_t\{\Delta e_{t+1}\} - (1 + E_t\{\Delta e_{t+1}\})\tau \qquad (1)$$

Where r_t and $r_t^{\star}$ are domestic and foreign interest rates for securities of the same maturity and equivalent credit risk and $E_t\{\Delta e_{t+1}\}$ is the expected rate of depreciation of the domestic currency. (This assumes perfect substitutability of local and foreign securities. If these are not perfect substitutes, we could multiply $r_t^{\star}$ by some

10. In previous work—and in the version of this paper presented at the conference—I have used the terms "spillover" and "contagion" interchangeably. "Contagion" is usually interpreted as being suboptimal. From a theoretical point of view, however, there are some circumstances under which taking into account a foreign country's policy rate is optimal. See, for example Clarida (2014).

11. Parts of this section draw on Edwards (2015a, b).

parameter θ). In a country with a credible fixed exchange rate, the expected rate of depreciation is always equal to zero, $E_t\{\Delta e_{t+1}\} = 0$. If, in addition, there is full capital mobility $\tau = 0$ and, thus, $r_t \approx r_t^*$. That is, under these circumstances, local interest rates (in domestic currency) will not deviate from foreign interest rates. In this case, changes in world interest rates will be transmitted in a one-to-one fashion into the local economy. It is in this sense that with (credible) pegged exchange rates there cannot be an independent monetary policy; the local central bank cannot affect the domestic rate of interest. If $\tau \geq 0$, then there will be an equilibrium wedge between domestic and international interest rates, but still the domestic monetary authorities will be unable to influence local rates over the long run. Of course, how fast the domestic rates will converge to the international rate will vary from country to country. This is, indeed, the typical case of the "trilemma" or the "impossibility of the Holy Trinity."

Under flexible rates, however, $E_t\{\Delta e_{t+1}\} \neq 0$, and local and international rates may deviate from world interest rates. Assume that there is a tightening of monetary policy in the foreign country—i.e., the Fed raises the target federal funds rate—that results in a higher r_t^*. Under pegged exchange rates this would be translated into a one-to-one increase in r_t; the pass-through coefficient is equal to one, even if $\tau \geq 0$. However, if there are flexible rates, it is possible that r_t remains at its initial level and that all of the adjustment takes place through an expected appreciation of the domestic currency, $E_t\{\Delta e_{t+1}\} < 0$. As Dornbusch (1976) showed in his celebrated "overshooting" paper, for this to happen it is necessary for the local currency to depreciate on impact by more than in the long run. Under flexible rates, then, the exchange rate will be the "shock absorber" and will tend to exhibit some degree of volatility.[12]

12. The shock absorber role of the exchange rate goes beyond monetary disturbances. Edwards and Levy-Yeyati (2005) show that countries with more flexible rates are able to accommodate better terms of trade shocks.

If central banks want to avoid "excessive" exchange rate variability, they may take into account other central banks' actions when determining their own policy rates. That is, their policy rule could include a term with other central banks' policy rates.[13] In a world with two countries, this situation is captured by the following two policy equations, where r_p is the policy rate in the domestic country, $r_p^\star$ is the policy rate in the foreign country, and the x and $x^\star$ are vectors with the traditional determinants of policy rates (the elements in standard Taylor rules, for example), such as deviations of inflation from their targets and the deviation of the rate of unemployment from the "natural" rate:

$$r_p = \alpha + \beta r_p^\star + \gamma x \tag{2}$$

$$r_p^\star = \alpha^\star + \beta^\star r_p + \gamma^\star x^\star. \tag{3}$$

In equilibrium, the monetary policy rate in each country will depend on the other country's rate.[14] For the domestic country the equilibrium policy rate is (there is an equivalent expression for the foreign country):

$$r_p = \frac{\alpha + \beta\alpha^\star}{1 - \beta\beta^\star} + \left(\frac{\gamma}{1 - \beta\beta^\star}\right) x + \left(\frac{\beta\gamma^\star}{1 - \beta\beta^\star}\right) x^\star. \tag{4}$$

Changes in the drivers of the foreign country's policy interest rate, such as $\alpha^\star$, $\beta^\star$, $\gamma^\star$, or $x^\star$, will have an effect on the domestic policy rate. This interdependence is illustrated in figure 1.3, which includes both reaction functions (2) and (3); PP is the policy function for the domestic country and P*P* is for the foreign nation.

13. In Edwards 2006, I argue that many countries include the exchange rate as part of their policy (or Taylor) rule. Taylor (2007, 2013) has argued that many central banks include other central banks' policy rates in their rules. The analysis that follows in the rest of this section owes much to Taylor's work.

14. The stability condition is $\beta\beta^\star < 1$. This means that in figure 1.3 the P*P* schedule has to be steeper than the PP schedule.

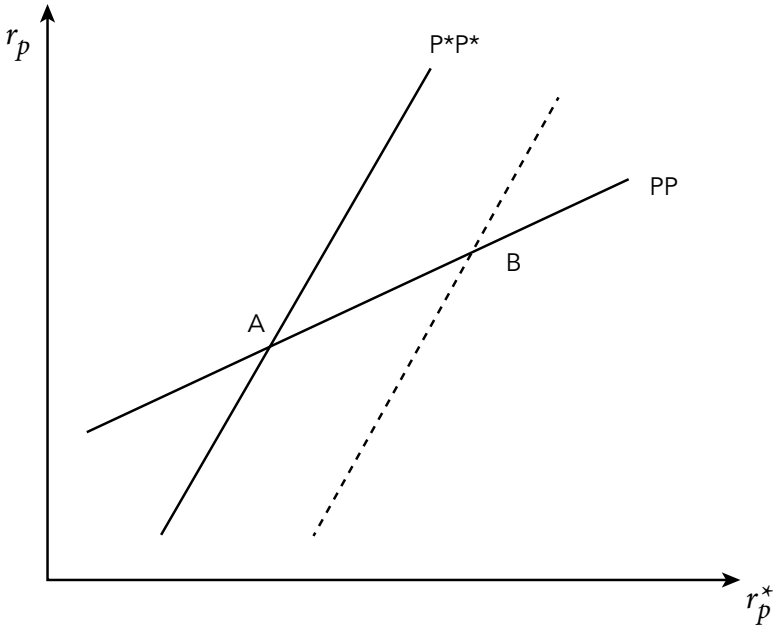

FIGURE 1.3. Policy rates equilibrium under policy "spillover" and large countries

The initial equilibrium is at point A. As may be seen, a higher x^* (say the gap between the actual and target inflation rate in the foreign country) will result in a shift to the right of P*P* and in higher equilibrium policy rates in both countries; the new equilibrium is given by B.[15] Notice that in this case the final increase in the foreign policy rate gets amplified; it is larger than what was originally planned by the foreign central bank. The extent of the effect of the foreign country's policy move on the domestic country policy rate will depend on the slopes of the two curves; these, in turn, depend on the parameters of equations (1) and (2).

Figure 1.3 is for the case when both countries take into consideration the other nation's actions. But this need not be the case.

15. The new equilibrium will be achieved through successive approximations, as in any model with reaction functions of this type, where the stability condition is met.

Indeed, if one country is large (say, the United States) and the other one is small (say, Colombia), we would expect policy "spillover" to be a one-way phenomenon. In this case, and if the foreign country is the large one, β^* in equation (2) will be zero, and the P*P* schedule will be vertical. A hike in the foreign country's policy rate will impact the domestic country rate, but there will be no feedback to the large nation and, thus, no amplifying effect.[16] As noted, the magnitude of the policy "spillover" will depend on the slope of the PP curve. The steeper this curve, the larger is policy "spillover"; if, on the contrary, the PP curve is very flat, policy "spillover" will be minimal. In the limit, when there is complete policy independence in both countries, the PP schedule is horizontal and the P*P* is vertical.

In traditional analyses $\beta = \beta^* = 0$. That is, once central banks have taken into account the direct determinants of inflation (and unemployment, if that is part of their mandate), there is no role for the foreign policy rate when determining the domestic policy stance. It is in this regard that in this paper I call a situation where β or β^* are different from zero policy "spillover." At the end of the road, the extent to which specific countries are affected by a foreign country's policy stance is an empirical matter.

Given the discussion in the introduction to this paper, and the concerns that have emerged in central banks from around the world in 2015–2016, it is possible to think that in some countries the actual policy rate would include other global variables, including the "long" rate in the world economy (r^{*L}) and the extent of uncertainty in global financial markets (μ). In this case, equation (2) would become

$$r_p = \alpha + \beta r_p^* + \gamma x + \delta r^{*L} + \theta \mu. \qquad (5)$$

16. Of course, if neither country considers the foreign central bank actions, PP will be horizontal and P*P* will be vertical.

In the sections that follow I use data from three Latin American countries to investigate whether the key coefficients in equation (5) have been different from zero, as the "spillover" analysis suggests, or whether once other variables are incorporated they are no longer relevant, as suggested by traditional analyses. To put it simply, then, the goal of this paper is to determine, using historical data, whether, once the appropriate controls are introduced into the empirical analysis, $\beta \neq 0$.[17]

4. An empirical model

In this section I report the results from the estimation of a number of equations for monetary policy rates for the three countries in the sample—Chile, Colombia, and Mexico. I assume that each central bank has a policy function of the form of equation (5) and that central banks don't necessarily adjust their policy rates instantaneously to new information, including changes in policy rates in the advanced nations. More specifically, I estimate the following error correction model that allows central banks to make adjustments at a gradual pace:

$$\Delta r_t^p = \alpha_0 + \alpha_1 FF_t + \alpha_2 \Delta r_{t-1}^p + \alpha_3 r_{t-1}^p + \sum \rho_j x_{jt} + \varepsilon_t. \quad (6)$$

In this expression, r_t^p is the policy rate in each of the three countries in period t; FF_t is the federal funds (target) interest rate; and the x_{jt} are other variables that affect the central bank policy actions, including, in particular, the long rate in the foreign country (the United States), inflationary pressures, global perceptions of coun-

17. In previous work—and in the version of this paper presented at the conference—I used the terms "spillover" and "contagion" interchangeably. "Contagion" is usually interpreted as being suboptimal. From a theoretical point of view, however, there are some circumstances under which taking into account a foreign country's policy rate or the exchange rate may be optimal. See, for example, Clarida (2014) for a discussion on optimal monetary policy in open economies.

try risk, and expectations of global inflation; that is, these variables capture what we would normally expect to be included in an expanded Taylor rule type of equation. If there is policy "spillover," the estimated α_1 would be significantly positive. The extent of long-term policy "spillover" is given by $-(\alpha_1/\alpha_3)$. If, for example, $-(\alpha_1/\alpha_3) = 1$, then there will be full importation of Fed policies into domestic policy rates. Parameter γ allows for the adjustment to a new equilibrium policy rate to be cyclical; this, however, is unlikely. In equation (6), the timing of the variables is contemporaneous. However, in the estimation and as explained below, alternative lag structures were considered.

4.1. Reduced form results

In table 1.1, I report results for a basic *bivariate* dynamic specification of equation (6) for all three countries, using least squares. The federal funds variable is entered contemporaneously. If it is included with a one-week lag, the results don't change in any significant way.[18] These preliminary estimates should be interpreted as a *reduced form* for a significantly more complex system. Indeed, these results are consistent with a number of models and hypotheses. For example, they are consistent with the case where vector x in equation (1) includes variables that indirectly depend on the foreign country's policy rate r_p^*. An example of this is when x includes domestic inflation, or its deviations from target, which, through a pass-through equation, may depend on the rate of depreciation of the domestic currency, a variable that, in turn, depends on the interest rate differential between the home and the

18. The issue of timing here is important. The three central banks under study have monthly meetings; in contrast, the Federal Open Market Committee (FOMC) meets only eight times per year. Our data refer to each week's Friday. The FOMC never holds scheduled meetings on a Friday. This means that using contemporaneous data for the federal funds rate is fine in the sense that changes to the policy precede by at least a few days the policy rate that we are considering for our EMs.

TABLE 1.1. Monetary policy rates in Latin America, 2000–2008 (least squares)

Eq Name: Method:	Chile (1.1)	Colombia (1.2)	Mexico (1.3)
FF_POLICY	0.016	0.016	0.004
	[2.384]**	[3.373]***	[0.590]
C	0.044	0.055	0.090
	[1.505]	[2.055]**	[1.589]
POL_RATE(–1)	–0.024	–0.015	–0.013
	[–2.610]***	[–3.588]***	[–1.854]*
D(POL_RATE(–1))	0.005	–0.027	0.004
	[0.100]	[–0.525]	[0.073]
Observations	390	387	403
R-squared	0.019	0.038	0.009

Note: *, **, and *** refer to significance at 10%, 5%, and 1%, respectively.

foreign countries. Another model that is consistent with the reduced forms presented in table 1.1 is one where the monetary authorities in the EMs believe that the Fed has superior knowledge and/or information about world economic conditions, including global monetary pressures and/or the evolution of commodity prices. In this case, it is possible that the EMs' central banks follow the Fed in a way similar to the way in which firms follow a "barometric price leader" in the industrial organization literature.[19] In what follows, I try to disentangle the different effects at play, and I investigate whether the federal funds rate has an independent effect even when other variables are held constant (domestic inflationary pressures, US expected inflation, and so on).

As may be seen from table 1.1, in two of the three countries the estimated coefficients for the federal funds rate are positive and significant; the exception is Mexico. This provides some preliminary evidence suggesting that during the period under study (2000–2008) there may have been some policy "spillover" from the

19. Clarida (2014) develops a model of monetary policy in an open economy where the optimal policy rule includes the exchange rate. Interestingly, the optimal rule implies moving the exchange rate in a direction that is opposite from PPP.

United States to some of these EMs. The main insights from this table may be summarized as follows: (*a*) The impact effect—first week—of a Fed action on these countries' policy rates is small. This is not surprising, as the timing of central bank meetings doesn't necessarily coincide across countries. (*b*) The coefficient for Δr^{p}_{t-1} is never significant. And (*c*) the estimated long-run effect of a change in the "spillover" effect $-(\alpha_1/\alpha_3)$ ranges from 0.66 to 1.0 in the countries where there is "spillover." The individual point estimates for these (unconditional) long-term coefficients are 0.66 for Chile, 1.00 for Colombia, and non-significantly different from zero for Mexico. In some regards the result that US policy didn't affect Mexico's central bank stance during this period is surprising, given the proximity of the two countries and the traditional dependence of Mexico's economy on US economic developments.[20]

4.2 Multivariate analysis

In this subsection I report results from multilateral estimates using both least squares and instrumental variables for the three Latin American nations. I included the following covariates x_{jt} (in addition to the dynamic terms and the federal funds target rate):[21] (*a*) Year over year inflation rate, lagged between four and six weeks. Its coefficient is expected to be positive as central banks tighten policy when domestic inflation increases. (*b*) Annualized growth, lagged between four and six weeks. This is the second term of traditional Taylor rules, and its coefficient is also expected to be positive. (*c*) A measure of expected global inflationary pressures, defined as

20. It is important to emphasize that the period under consideration is 2000–2008. Indeed, at the time of this writing (April 2016), most analysts believe that the Bank of Mexico is particularly aware of the Fed's policy when determining its own policy stance.

21. Notice that for two of the regressors weekly data are not available. This is the case for inflation and growth. In these cases, I use monthly data for the four weeks in question. I constructed monthly growth data by combining quarterly data on gross domestic product growth and monthly data on manufacturing activity.

the breakeven spread between the five-year US Treasury Securities (Treasuries) and five-year Treasury Inflation-Protected Securities (TIPS). This is entered with one period lag, and its coefficient is expected to be positive.[22] (*d*) The yield on the ten-year US Treasury note. (*e*) An indicator of country risk premium, defined as the lagged Emerging Markets Bond Index spread for Latin America. Its expected sign is not determined a priori and will depend on how central banks react to changes on perceived regional risk.

The least squares estimates are reported in table 1.2 and confirm the results from table 1.1 in the sense that during this period there is evidence of policy "spillover" in Chile and Colombia. These results are quite satisfactory. This is especially the case considering that interest rate equations are usually very difficult to estimate. As may be seen, most coefficients are significant at conventional levels and have the expected signs. The R-squared is quite low, as is usually the case for interest rate regressions in first differences. In addition to the individual countries' regression, I report pooled results. In these estimates, fixed effects were included. The most salient findings in table 1.2 may be summarized as follows:

- In every regression the coefficients of the traditional Taylor rule have the expected positive sign, and in the great majority of cases they are significant at conventional levels. In Chile the long-run coefficient of inflation in the monetary policy equation is not significantly different from one; in Colombia and Mexico it is greater than one, as suggested by the original Taylor model for the United States. Also, in Colombia and Mexico, the (long-term) coefficient of the growth term is smaller than that of the inflation term, as in most empirical Taylor rules.

22. However, it is possible to argue that once the federal funds rate is included, the coefficient of the spread between Treasuries and TIPS should be zero since the federal funds rate already incorporates market expectations of inflation of the United States.

TABLE 1.2. Monetary policy rates in Chile, Colombia, and Mexico, 2000–2008 (least squares)

Eq Name	Chile (2.1)	Colombia (2.2)	Mexico (2.3)	Pooled (2.4)	Chile (2.5)	Colombia (2.6)	Mexico (2.7)	Pooled (2.8)
FF_POLICY	0.0196	0.0456	0.0079	0.0093	0.0206	0.0469	0.0034	0.0122
	[2.0085]**	[4.2431]***	[0.6498]	[1.8590]*	[1.7156]*	[4.2860]***	[0.2133]	[1.8874]*
C	–0.5328	–0.5984	–0.4487	–0.2747	–0.5232	–0.5386	–0.4857	–0.2425
	[–3.2323]***	[–2.9346]***	[–1.9778]**	[–2.7266]***	[–2.9127]***	[–2.4059]**	[–2.0091]**	[–2.1953]**
POL_RATE(–1)	–0.0147	–0.0644	–0.0306	–0.0104	–0.0142	–0.0609	–0.0292	–0.0104
	[–1.2218]	[–5.5324]***	[–2.6834]***	[–2.2504]**	[–1.1130]	[–4.7588]***	[–2.4805]**	[–2.2497]**
D(POL_RATE(–1))	–0.0433	–0.0669	–0.0204	–0.0185	–0.0440	–0.0719	–0.0215	–0.0194
	[–0.8376]	[–1.2512]	[–0.3793]	[–0.6026]	[–0.8463]	[–1.3306]	[–0.4003]	[–0.6317]
GROWTH(–6)	0.0246	0.0153	0.0173	0.0090	0.0247	0.0137	0.0186	0.0086
	[2.7747]***	[2.3254]**	[2.1148]**	[2.2095]**	[2.7628]***	[1.9655]**	[2.1405]**	[2.0997]**
INF_YOY(–6)	0.0141	0.1043	0.0363	0.0116	0.0134	0.0996	0.0344	0.0113
	[1.2449]	[5.1164]***	[2.2374]**	[2.1245]**	[1.0645]	[4.6140]***	[2.0489]**	[2.0582]**
EMBI_LATAM(–1)	0.0196	–0.0047	0.0171	0.0075	0.0199	–0.0037	0.0162	0.0082
	[3.0001]***	[–0.8207]	[1.8373]*	[1.8684]*	[2.8769]***	[–0.6318]	[1.6918]*	[1.9904]**
TIPS_ INF_USA(–1)	0.1208	0.1128	0.1597	0.0809	0.1208	0.1211	0.1500	0.0831
	[2.5283**	[1.9791]**	[2.1605]*	[2.4940]**	[2.5237]**	[2.0716]**	[1.9450]*	[2.5494]*
UST_10YR(–1)	—	—	—	—	–0.0033	–0.0172	0.0160	–0.0104
					[–0.1368]	[–0.6505]	[0.4472]	[–0.7107]
Observations	390	331	351	1072	390	331	351	1072
R-squared	0.0590	0.1257	0.0440	0.0272	0.0590	0.1268	0.0446	0.0277
F-statistic	3.4205	6.6332	2.2548	4.2484	2.9876	5.8465	1.9933	3.7788

Note: *, **, and *** refer to significance at 10%, 5%, and 1%, respectively.

- In six of the eight regressions, the coefficient of the federal funds rate (FF-Policy) is significantly positive, indicating that during the period under study there was a pass-through Fed policy rates into policy interest rates in Chile and Colombia. These coefficients are positive and significant, even when other determinants of the monetary policy stance—including the traditional Taylor rule components—are included in the regressions. Once other covariates are included, the coefficient for the federal funds for Mexico continues to be nonsignificant (see, however, the instrumental variables results reported below). This suggests that in Chile and Colombia there was some form of "spillover" during the period under study.[23]
- The impact coefficient for the Fed's federal funds rate is significantly larger in Chile (0.0196 and 0.0206) than in Colombia (0.0456 and 0.0469). That is, during this period Chile's central bank had a tendency to react more slowly to changes in the Fed's policy stance than Colombia's did.
- The extent of long-term policy "spillover," measured by $-(\alpha_1/\alpha_3)$, is rather large in both Chile and Colombia. The point estimates for the long-run effect is greater than one for Chile—this is the case both in equations (1) and (5). For Colombia, this long-term coefficient is smaller than one: point estimates are 0.707 and 0.770 in equations (2) and (6). This means that as a consequence of a Fed policy rate hike, Chile will react more slowly but in the end will tend to implement a higher increase in its own policy rates.
- Consider a 100 basis point increase in the federal funds rate. According to the point estimates in the two first columns in table 2, after 26 weeks, the pass-through into Chile is 41 basis points (bps), on average, and 58 bps in Colombia. After 52 weeks, the transmission is 71 bps in Chile and only 69 in Colombia. After 104 weeks

23. In a recent paper Claro and Opazo (2014) argue that the Central Bank of Chile has been fully independent, and has not directly responded to Fed policy moves.

the pass-through is 103 bps in Chile; in Colombia the process is finished with a rate increase, on average 71 bps.[24]

- The coefficients of the other covariates are significant at conventional levels in almost every case. These results indicate that perceptions of higher regional risk, measured by the spread of the EMBI index for Latin America, tend to result in defensive monetary policy—that is, in higher domestic interest rates—in Chile and Mexico but not in Colombia. A higher expected inflation in the United States, measured by the implied inflationary expectations in the spread between the five-year note and five-year TIPS, also generates a tightening in the domestic monetary policy. This is an interesting result as it suggests that central bankers in Chile and Colombia react to a Fed action even when we control for the market's expectations of inflation. This suggests that, during this period, central bankers in Chile and Colombia believed that the Fed had superior information and/or knowledge than the market.
- In the last four columns in table 1.2, I present estimates of policy reaction functions that include the yield on the ten-year Treasury note as an additional regressor. The issue, as noted, is the extent to which the slope of the yield curve matters in the transmission of policy rates. More specifically, I try to answer the following question: Does it make a difference if the federal funds rate is raised and the ten-year Treasury yield is constant or if it is allowed to adjust. As may be seen, the results provide some preliminary evidence that there is no role for the long rate in the policy transmission process (see, however, the discussion below for an analysis of the possible effects of Treasuries of other tenors).

24. Most (but not all) central banks conduct policy by adjusting their policy rates by multiples of 25 bps. The estimates discussed here refer to *averages*. Thus, they need not be multiples of 25 bps.

4.3 Instrumental variables and commodity prices

In this subsection I discuss issues related to possible endogeneity, and I present a set of regressions estimated with instrumental variables. I also report the results obtained from some extensions of the analysis.

For countries such as Chile, Colombia, and Mexico, the federal funds rate, the yield on TIPS, and the yield on Treasuries are clearly exogenous to their monetary policy decisions. It is possible to argue, however, that some of the domestic variables, in particular growth, may be subject to some degree of endogeneity.[25] In order to explore this angle, I estimated instrumental variables versions of some of the equations in table 1.2. The results are presented in table 1.3 and confirm the results reported previously in the sense that during the period under study Chile and Colombia were subject to considerable policy "spillover."[26] This is not the case for Mexico. Most of the coefficients of the other covariates continue to have expected signs and are estimated with the standard level of precision. Table 1.3 also has a dynamic panel estimate; country fixed effects were included.

Notice, however, that there are some differences between the results in tables 1.2 (least squares [LS]) and 1.3 (instrumental variables [IV]) in terms of the point estimates of the coefficients of interest. In the IV estimates the impact coefficient for Chile is larger than under LS. More important, perhaps, the long-term pass-through is now significantly smaller than one; it has a point

25. It is possible for lagged growth to be endogenous. This may especially be the case in a dynamic panel, like the ones in columns (2.4) and (2.8) of table 1.2 and in the sections that follow.

26. The following instruments were used: log of lagged commodity prices (copper, coffee, metals, energy, West Texas Intermediate oil), lagged US dollar to euro rate, six periods lagged effective devaluation, lagged expected depreciation, and lagged rates for the United States at a variety of maturities.

TABLE 1.3. Monetary policy rates in Chile, Colombia, and Mexico, 2000–2008 (instrumental variables)

Eq Name	Chile (3.1)	Colombia (3.2)	Mexico (3.3)	Pooled (3.4)
FF_POLICY	0.0251	0.0342	0.0061	0.0016
	[2.3351]**	[3.3445]***	[0.5007]	[0.2608]
C	–0.2963	–0.4893	–0.5750	–0.3663
	[–1.5060]	[–2.4593]**	[–2.5843]**	[–3.4398]***
POL_RATE(–1)	–0.0343	–0.0514	–0.0317	0.0032
	[–2.1021]**	[–4.5398]***	[–2.8138]***	[0.4043]
TIPS_ INF_USA(–1)	0.1151	0.0694	0.1799	0.0585
	[2.3749]**	[1.2124]	[2.4719]**	[1.6974]*
EMBI_LATAM	0.0111	–0.0039	0.0258	0.0141
	[1.4476]	[–0.6573]	[2.6270]***	[2.8582]***
D(POL_RATE(–1))	0.0027	–0.0692	–0.0375	–0.0417
	[0.0474]	[–1.2705]	[–0.6905]	[–1.2614]
INF_YOY(–6)	0.0196	0.0870	0.0391	0.0022
	[1.7463]*	[4.4663]***	[2.3166]**	[0.2993]
GROWTH(–6)	–0.0045	0.0219	0.0321	0.0309
	[–0.2612]	[2.3886]**	[2.4868]**	[2.8406]**
Observations	378	331	351	1060
R-squared	0.0309	0.0986	0.0485	0.0017
F-statistic	2.1018	6.1147	3.1841	4.9113

Note: *, **, and *** refer to significance at 10%, 5%, and 1%, respectively.

estimate of 0.732. The long-term pass-through for Colombia is now 0.661. To summarize: the results in table 1.3 indicate that during the period under analysis the central banks in Chile and Colombia tended to follow the Federal Reserve; the pass-through coefficient was, in both countries, lower than one.

An interesting question is whether monetary policy in these countries has been historically affected by the behavior of commodity prices. In order to analyze this issue, I included in each regression the log of the detrended commodity prices of greater relevance for each of the three countries: copper for Chile, energy and coffee for Colombia, and energy for Chile. The detrending of

TABLE 1.4. Monetary policy rates and commodity prices in Chile, Colombia, and Mexico, 2000–2008 (instrumental variables)

Eq Name	Chile (4.1)	Colombia (4.2)	Mexico (4.3)
FF_POLICY	0.0250	0.0322	0.0057
	[2.3188]**	[3.1479]***	[0.4680]
C	–0.3158	–0.4560	–0.5721
	[–1.5972]*	[–2.2955]**	[–2.5676]**
POL_RATE(–1)	–0.0332	–0.0500	–0.0315
	[–2.0353]**	[–4.4307]**	[–2.7994]**
TIPS_ INF_USA(–1)	0.1171	0.0598	0.1795
	[2.4069]**	[1.0489]	[2.4628]**
EMBI_LATAM	0.0118	–0.0042	0.0255
	[1.5316]*	[–0.7035]	[2.5911]**
D(POL_RATE(–1))	0.0006	–0.0575	–0.0361
	[0.0103]	[–1.0554]	[–0.6649]
INF_YOY(–4)	0.0196	0.0841	0.0391
	[1.6357]*	[4.3230]***	[2.3180]**
GROWTH(–4)	–0.0030	0.0221	0.0319
	[–0.1753]	[2.4394]**	[2.4741]**
LOG_COPPER_W(–4)	0.1209	—	—
	[0.3886]		
LOG_ENERGY_W(–4)	0.1095	–0.4262	–0.1425
	[0.4069]	[–1.9246]*	[–0.4375]
LOG_COFFEE_W(–4)	—	0.2938	—
		[1.4902]	
Observations	378	331	351
R-squared	0.0344	0.1137	0.0493
F-statistic	1.6665	5.5445	2.7953

Note: *, **, and *** refer to significance at 10%, 5%, and 1%, respectively.

these indexes was obtained using the Hodrick-Prescott filter. The results are in table 1.4. Broadly speaking, we can say that the results obtained confirm our earlier findings regarding "spillover." There is no strong evidence that commodity prices affected monetary policy during this period. Only one of the commodity coefficients is significant at conventional levels: energy in Colombia, with a negative coefficient.

5. Extensions, refinements, and robustness

In this section I present a number of extensions to the analysis. First, I investigate whether the yield on Treasuries of shorter maturities than 10 years have had an effect in the policy "spillover" process. In particular I consider the yield on two- and five-year Treasuries. It is possible that central banks' authorities in these countries take into account rates in the middle rather than at the long end of the yield curve. Second, I investigate if the volatility conditions in global financial markets have historically had an effect on the transmission of policy rates from the Fed to the countries in the sample. Third, I investigate the extent to which the degree of capital mobility has historically affected the extent of policy "spillover." Fourth, I present a number of robustness tests.

In the analyses presented in this section, I focus on a dynamic panel for Chile and Colombia, the two nations that in the results in the previous section appeared to have been subject to some policy "spillover" during the period under study. There are a number of advantages of using a panel, including the fact that in a panel some of the covariates exhibit greater variability (this is particularly the case for the index of capital mobility).

5.1 Moving along the yield curve

The results in the preceding section for individual countries suggested that the yield on the long Treasury note (10 years) hadn't affected, historically, monetary policy in the three countries in the sample. In this subsection I investigate this issue further by incorporating the yields of other Treasury securities along the yield curve. In particular, I estimate dynamic panel regressions (with instrumental variables and fixed effects) for Chile and Peru, with the yield on the two-, five-, and ten-year Treasuries as additional

FIGURE 1.4. Spread between two-, five-, and ten-year Treasuries and federal funds rates, weekly, 2000–2008

regressors. Before proceeding further, let us look at how the spreads between the federal funds rate and these longer-term Treasury securities behaved during the period under investigation (see figure 1.4). As may be seen, the spreads (slopes of the yield curve at different points) are fairly high between mid-2001 and mid-2005; they were quite low during late 2000 and late 2007.

The results from the instrumental variables dynamic panel analysis are in table 1.5 and may be summarized as follows:

- The coefficient of the federal funds rate is always significant, confirming the existence of policy "spillovers" in the two countries that make up the panel. It is interesting to notice that the point estimate of the coefficient of the federal funds is higher in the regressions where the yield on longer-term Treasuries is incorporated. This indicates that the "spillover" effect is larger when we control for longer-term yields, and a hike in the federal funds makes the yield curve flatter.

TABLE 1.5. Monetary policy rates in Latin America and the yield curve, dynamic panel (Chile and Colombia), 2000–2008 (instrumental variables)

Eq Name	(5.1)	(5.2)	(5.3)	(5.4)
FF_POLICY	0.0141	0.0846	0.0421	0.0253
	[2.1931]**	[3.3751]***	[2.8125]***	[2.4035]**
C	–0.2987	–0.0639	–0.0976	–0.1300
	[–2.2316]**	[–0.4022]	[–0.5878]	[–0.7080]
POL_RATE(–1)	–0.0206	–0.0246	–0.0205	–0.0201
	[–2.4229]**	[–2.7927]***	[–2.3970]**	[–2.3629]**
TIPS_ INF_USA(–1)	0.0688	0.1009	0.0903	0.0811
	[1.9609]*	[2.6842]***	[2.4531]**	[2.2328]**
EMBI_LATAM	0.0083	0.0022	0.0077	0.0092
	[1.6130]*	[0.3919]	[1.4865]	[1.7716]
D(POL_RATE(–1))	–0.0338	–0.0306	–0.0306	–0.0325
	[–0.8611]	[–0.7602]	[–0.7737]	[–0.8263]
INF_YOY(–4)	0.0204	0.0101	0.0136	0.0169
	[2.6494]***	[1.6910]*	[1.6212]*	[2.0742]**
GROWTH(–6)	0.0171	–0.0044	0.0020	0.0086
	[1.6648]*	[–0.3255]	[0.1528]	[0.6823]
UST_2YR	—	–0.0935	—	—
		[–2.9143]***		
UST_5YR(–1)	—	—	–0.0573	—
			[–2.0730]**	
UST_10YR(–1)	—	—	—	–0.0402
				[–1.3436]
Observations	709	709	709	709
R-squared	0.0529	0.0082	0.0424	0.0520
F-statistic	4.1658	4.7380	4.2026	3.9069

Note: *, **, and *** refer to significance at 10%, 5%, and 1%, respectively.

- The coefficient of longer-term yields is always negative, and significantly so for the two- and five-year tenor. Moreover, the null hypothesis that the federal funds and longer Treasury yield sum up to zero cannot be rejected at conventional levels. This indicates that during the period under analysis a raise in the federal funds rate that was not accompanied by an increase in longer-term yields had a greater effect on these countries' monetary policy than a hike in the policy rate that results in a parallel shift of the midsection of the US yield curve.

5.2 Global financial conditions and monetary policy "spillover"

Has policy "spillover" worked in a similar way when the global economy is in turmoil as compared to when it is going through a tranquil period? In order to investigate this issue, I used the "TED spread," defined as the spread between the three-month London Interbank Offered Rate (LIBOR) and the effective (as opposed to policy) federal funds rate, as an indicator of market volatility. During periods of financial turbulence the TED spread increases; it declines during periods of tranquility. In figure 1.5 I present the weekly evolution of the TED spread for 2000 to 2008. During this period the mean was 0.21 (21 bps), the median was 0.18, and the standard deviation was 0.228. In the analysis I proceeded as follows: I estimated dynamic panel IV equations for two subsamples: "low volatility" (low TED spread) and "high volatility" (high TED spread). The definition of "high" and "low" was determined by the median value of the TED spread.

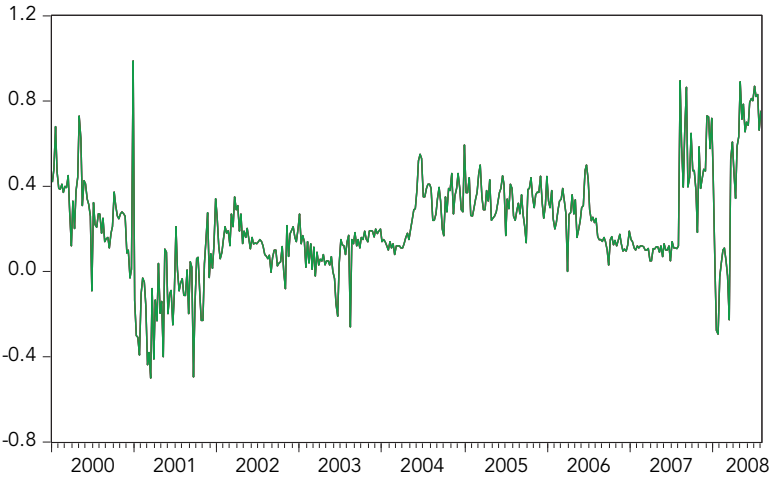

FIGURE 1.5. TED spread, weekly, 2000–2008

TABLE 1.6. Monetary policy rates in Latin America and global volatility, dynamic panel (Chile and Colombia), 2000–2008 (instrumental variables)

Eq Name	(6.1) High Ted	(6.2) High Ted	(6.3) Low Ted	(6.4) Low Ted
FF_POLICY	0.0986	0.0510	0.0165	0.0090
	[2.9686]***	[2.4409]**	[0.3983]	[0.3732]
C	–0.3545	–0.3029	–0.3113	–0.3538
	[–2.4117]**	[–1.9718]**	[–0.9305]	[–1.0117]
POL_RATE(–1)	0.0065	0.0026	–0.0170	–0.0163
	[0.4792]	[0.1810]	[–0.9142]	[–0.8863]
TIPS_INF_USA(–1)	0.0974	0.0996	0.0710	0.0675
	[2.3381]**	[2.3090]**	[1.1402]	[1.0910]
EMBI_LATAM	0.0141	0.0186	0.0101	0.0109
	[2.1733]**	[2.3505]**	[0.8774]	[0.9896]
D(POL_RATE(–1))	–0.1971	–0.1734	–0.0293	–0.0306
	[–2.9552]***	[–2.6999]***	[-0.4997]	[–0.5223]
INF_YOY(–4)	0.0059	0.0066	0.0150	0.0167
	[0.5185]	[0.5225]	[0.9771]	[1.1639]
GROWTH(–6)	0.0337	0.0268	0.0221	0.0259
	[4.1462]***	[3.0269]***	[0.6433]	[0.7682]
UST_2YR	–0.1235	—	–0.0068	—
	[–2.6501]***		[–0.1342]	
UST_5YR	—	–0.0819	—	0.0044
		[–1.9496]*		[0.1058]
Observations	301	301	382	382
R-squared	0.1151	0.1475	0.0365	0.0343
F-statistic	7.9707	7.4637	1.5386	1.5378

Note: *, **, and *** refer to significance at 10%, 5% and 1%, respectively.

The results from these regressions are in table 1.6. They indicate that "spillover" is a phenomenon that occurs during periods of higher global financial volatility. Indeed, these estimates suggest that there is no policy "spillover" during periods when global financial markets are calm. A possible explanation for this is that EMs' central bankers become particularly defensive during periods of global financial turmoil. It is during these times that they become particularly sensitive to global shocks and decide to follow the ad-

vanced countries' central banks. This notion is supported by the estimated coefficients of the EMBI variable: in the high-volatility regressions they are significantly higher than in the regressions for the complete sample, and their p-values are significantly lower; indeed, these coefficients are not significant during the low-volatility periods.

A preliminary analysis of the case of Mexico—remember that in the previous section I found no evidence of "spillover" for that country—indicates that there was indeed some response by its central bank to federal funds changes during high-volatility periods. However, in order to determine the robustness of this result, further research is required.

5.3 Policy "spillovers" and capital controls

In equation (1) I assumed that there was a tax of rate τ on capital leaving the country. Alternatively, it is possible to think that there is a tax on capital inflows of the type popularized by Chile during the 1990s.[27] If this is the case, equation (1) becomes[28]

$$r_t - r_t^{\star}(1 - t) + t = E_t\{\Delta e_{t+1}\}, \qquad (1')$$

where t is the rate of the tax on capital inflows.

As pointed out above, the three countries in this study had varying degrees of capital mobility during the period under investigation, with Chile being the most open, and Colombia being the least open, to capital movement. In addition, during the (almost) 500 weeks covered by this analysis there were some adjustments to the extent of mobility in all nations. This was especially the case with Chile, a country that in early 2001, and during the negotiation of the

27. On the Chilean tax on capital inflows, see De Gregorio, Edwards, Valdes (2000) and Edwards and Rigobón (2009).

28. See, for example, Edwards (2012).

Free Trade Agreement with the United States, opened its capital account further. In figure 1.6 I present the evolution of a comprehensive index of capital mobility. In constructing this index I took as a basis the indicator constructed by the Fraser Institute; I then used country-specific data to refine it. A higher number denotes a higher degree of capital mobility in that country in that particular year.

An interesting question, then, is whether the degree of capital mobility affects the extent of pass-through from federal funds rates into policy interest rates in emerging countries. In order to address this issue, I estimated a number of IV dynamic panel regressions similar to those reported above, with two additional regressors: an index of capital mobility and a variable in which this index interacts with the federal funds rate. The results reported in table 1.7 should be considered preliminary and subject to further research for a number of reasons, including the fact that the index of capital mobility is an aggregate summary that includes different modalities of capital controls. To understand better the role of mobility on interest rate pass-through, it is necessary to construct more detailed and granular indexes. Furthermore, in order to investigate this issue fully, a broader sample that includes countries with greater restrictions would be required.

The results in table 1.7 are interesting. Overall they tend to confirm the findings reported above: there continues to be evidence of a pass-through from federal funds rates into domestic policy rates, even after controlling for other variables. As may be seen, the capital mobility index is significant and positive when entered on its own; in this case the federal funds coefficient continues to be significant and positive. The interactive variable is negative and significant at the 10% level in all regressions. This suggests that the higher the degree of mobility, the lower the effect of a change in the policy rate. A possible reason for this is that a higher degree of capital mobility is acting as a proxy for the sophistication of domestic capital markets. It is possible that with deeper domestic

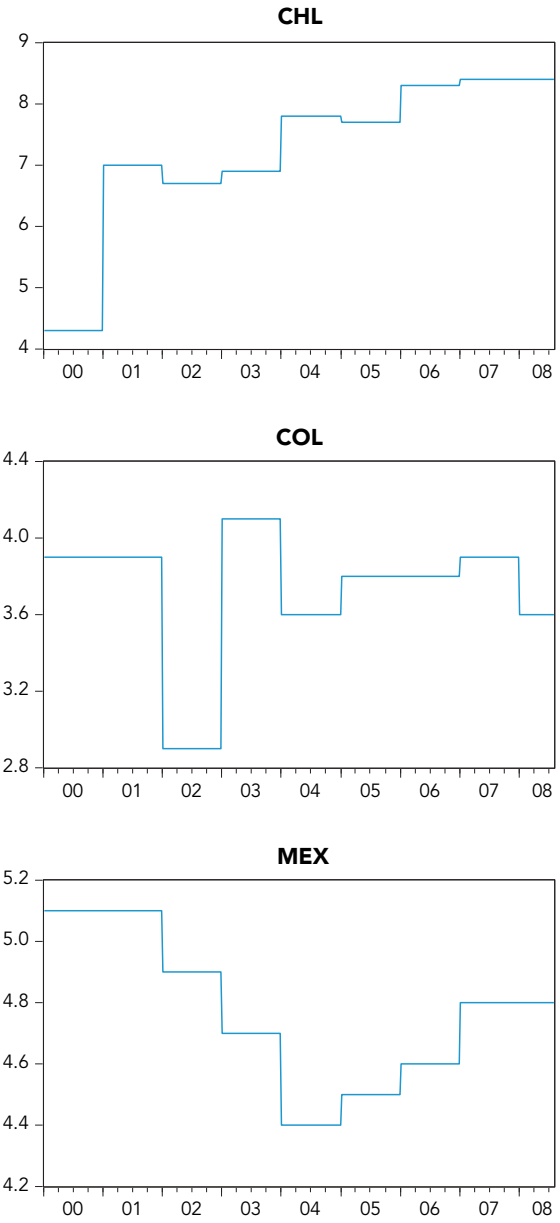

FIGURE 1.6. Capital mobility index for selected Latin American countries, 2000–2008

TABLE 1.7. Monetary policy rates in Latin America and capital mobility, dynamic panel (Chile and Colombia), 2000–2008 (instrumental variables)

Eq Name	(7.1)	(7.2)	(7.3)
FF_POLICY	0.0667	0.0759	0.0768
	[2.0288]**	[2.2010]**	[2.2153]**
FF_POLICY*			
CAP_CONT_NEW	–0.0105	–0.0120	–0.0113
	[–1.6174]*	[–1.8036]*	[–1.7841*]
C	–0.7534	–0.8726	–0.8849
	[–2.6063]***	[–2.7140]***	[–2.6975]***
POL_RATE(–1)	–0.0284	–0.0307	–0.0303
	[–3.1544]***	[–3.2514]***	[–3.2627]***
TIPS_ INF_USA(–1)	0.0194	0.0104	0.0123
	[0.4195]	[0.2216]	[0.2648]
EMBI_LATAM	0.0123	0.0124	0.0117
	[2.2361]**	[2.3016]**	[2.2101]**
D(POL_RATE(–1))	–0.0444	–0.0457	–0.0455
	[–1.1274]	[–1.1554]	[–1.1507]
INF_YOY(–4)	0.0375	0.0410	0.0393
	[2.5593]**	[2.7218]***	[2.7474]***
GROWTH(–6)	0.0228	0.0261	0.0258
	[2.1012]**	[2.2547]**	[2.2569]**
CAP_CONT_NEW	0.0805	0.0925	0.0890
	[2.1365]**	[2.3415]**	[2.3811]*
UST_2YR	0.0166	—	—
	[0.7575]		
UST_5YR	—	0.0265	—
		[1.1307]	
UST_10YR	—	—	0.0289
			[1.1355]
Observations	709	709	709
R-squared	0.0477	0.0403	0.0429
F-statistic	3.6382	3.7074	3.7081

Note: *, **, and *** refer to significance at 10%, 5%, and 1%, respectively.

financial markets a central bank could maintain a higher degree of independence. As noted, however, this is an issue that merits further analysis.

5.4 Other extensions

In order to determine the robustness of the results, I considered a number of alternative specifications, and I introduced additional regressors. Here I summarize some of the results.

Federal funds rate. I considered different lags in the federal funds rate (from contemporaneous to two-week lags). This had no discernable effect on the results. Also, the results were basically unaffected if the estimation period was altered somewhat and if the *effective* federal funds rate was used instead of the *target* rate.

Additional global financial variables. An interesting question is whether other variables related to global economic conditions enter these three countries' policy rules. I address this issue by considering two additional covariates: a stock market index for the United States (first differences of the log) and the first difference in the (log of the) euro-US dollar (USD) exchange rate. In two of the individual countries' regressions (Colombia and Mexico), the coefficient of the (one period lagged) euro-USD exchange rate is significantly positive. The inclusion of this variable, however, doesn't affect the main findings regarding policy "spillover" discussed above. The stock market covariate is not significant.

Short-term deposit rates. I also investigated the extent to which Fed policies were translated into (short-run) market interest rates. The results obtained—available on request—show that there is a significant and fairly rapid pass-through from Federal Reserve policies into three-month certificate of deposit rates in the three countries in the Latin American sample. This is the case even after controlling for expected depreciation, country risk, and global financial conditions such as the USD-euro exchange rate and com-

modity prices—for a preliminary analysis on this issue see, for example, Edwards (2012) and the literature cited there.

6. A comparison with East Asian nations

How characteristic are the Latin American countries in this study? How does their central banks' behavior compare to that of central banks in other EMs? In order to address this issue, I estimated a number of IV dynamic panel equations for a panel of three East Asian nations: Korea, Malaysia, and the Philippines. These three nations constitute a slightly more varied group than our group of Latin American countries is: Korea and the Philippines had (some degree of) currency flexibility during the period 2000–2008 while during most of the period under study Malaysia had fixed exchange rates (relative to the USD); the three East Asian nations' central banks were de facto (but not necessarily de jure) quite independent from political pressure; and Korea and the Philippines followed inflation targeting.[29]

The results for the East Asia panel are presented in table 1.8. The most important findings may be summarized as follows: (*a*) In contrast to the Latin American nations discussed above, for the East Asian nations the coefficients of the traditional Taylor rule components (inflationary pressures and domestic growth) are not significant, suggesting that during this period these countries implemented monetary policy following a criterion that differed from traditional Taylor rules. (*b*) There is, however, evidence that changes in the policy stance in the United States were transmitted, to some extent, to these East Asian nations. (*c*) But the most interesting result is that the magnitude of the monetary policy "spillover" is much smaller in East Asia than in Latin America. This becomes particularly clear when we compare the results in tables 1.5 and 1.8.

29. For indexes of central bank transparency and independence see Dincer and Eichengreen (2013).

TABLE 1.8. Monetary policy rates in East Asia, dynamic panel, 2000–2008 (instrumental variables)

Eq Name	(8.1)	(8.2)	(8.3)	(8.4)
FF_POLICY	0.0116	0.0149	0.0115	0.0114
	[4.0109]***	[2.0996]**	[3.0940]***	[3.8950]***
C	0.2523	0.2483	0.2524	0.2494
	[3.2841]***	[3.2271]***	[3.2776]***	[3.2262]***
POL_RATE(–1)	–0.0399	–0.0407	–0.0400	–0.0417
	[–4.6058]***	[–4.6363]***	[–4.5188]***	[–4.4447]***
TIPS_INF_USA(–1)	–0.0199	–0.0175	–0.0200	–0.0212
	[–1.2329]	[–1.0432]	[–1.2150]	[–1.2906]
EMBI_ASIA	0.0003	0.0006	0.0003	–0.0002
	[0.0371]	[0.0747]	[0.0340]	[–0.0220]
D(POL_RATE(–1))	–0.0020	–0.0031	–0.0019	0.0006
	[–0.0521]	[–0.0802]	[–0.0484]	[0.0163]
INF_YOY(–4)	0.0004	0.0008	0.0004	0.0004
	[0.1587]	[0.2890]	[0.1548]	[0.1549]
GROWTH(–6)	–0.0064	–0.0045	–0.0065	–0.0079
	[–1.6088]*	[–0.8470]	[–1.3051]	[–1.5894]
UST_2YR	—	–0.0053	—	—
		[–0.5097]		
UST_5YR	—	—	0.0003	—
			[0.0305]	
UST_10YR	—	—	—	0.0054
				[0.5058]
Observations	676	676	676	676
R-squared	0.0244	0.0321	0.0240	0.0180
F-statistic	3.8769	3.4716	3.4411	3.4715

Note: *, **, and *** refer to significance at 10%, 5%, and 1%, respectively.

The coefficients for the impact effect are smaller in the East Asian case. But, more important, the long-term pass-through coefficient is significantly smaller in East Asia than in Latin America. Compare, for instance, columns (5.1) and (8.1), which have the same specification. According to (5.1) the long-run pass-through in the Latin American nations is a relatively high 0.68, while it is only 0.29 in the East Asian nations. Interestingly, this historical difference in response is consistent with the behavior of EMs' central banks

during late 2015 and early 2016 that was discussed above: the Latin American countries tended to follow the Fed and raise their policy rates while the East Asian nations stayed "on hold."

7. Concluding remarks

In December 2015 the Federal Reserve raised interest rates for the first time since 2006. At the time an important question was—and continues to be—how the tightening process would affect the emerging markets. Underlying that question was a bigger issue: To what extent do emerging markets follow an independent monetary policy? In this paper I attempt to provide a (partial) answer to this question by investigating the extent to which Fed policy actions have, in the past, been passed into monetary policy interest rates in a group of Latin American nations–Chile, Colombia, and Mexico—during the period 2000–2008.

The results indicate that two of the three countries—Chile and Colombia—were subject to policy "spillovers" during this period. Even after controlling for other determinants of monetary policy stance—including the traditional Taylor rule variables—changes in the Fed policy rate were transmitted into these countries' own policy rates. Interestingly, there is no evidence for "spillovers" for Mexico.

The finding of a nonzero pass-through from the Fed to monetary policy in two of the three countries in the sample with exchange rate flexibility is important for the debate on optimal exchange rate regimes. Indeed, according to traditional models, one of the key advantages of flexibility is that the country in question can run its own monetary policy. The results in this paper question that principle by indicating that at least for two out of three countries there is a fairly high degree of policy "spillover"—there is also some evidence of "spillover" in the three East Asian countries discussed in section 6. A possible explanation for the results

reported in this paper is "fear to float" that is not captured fully by the covariates included in the analysis.[30] According to models in the Mundell-Fleming tradition, if there is less than perfect capital mobility, a hike in the global interest rate—generated by, say, Federal Reserve action—will result in an incipient external deficit and in a depreciation of the domestic currency. Indeed, it is currency adjustment what reestablishes equilibrium. If, however, there is "fear to float," the local authorities will be tempted to tighten their own monetary stance (that is, hike policy rates) as a way of avoiding the weakening of the currency. Further investigation along these lines should shed additional light onto the question of the "true" degree of monetary independence in small countries with flexible exchange rates. A particularly important point that follows from this analysis is that, to the extent that the advanced country central bank (that is, the Fed) pursues a destabilizing policy, this will be imported by the smaller nations, creating a more volatile macroeconomic environment at home.[31]

Data Sources

Interest rates: Policy rates were obtained from various issues of each country's central bank. Data on US Treasuries and federal funds rate were also obtained from *Datastream*. All the figures correspond to the Friday of that particular week.

Exchange rates: For the Latin American countries, they correspond to units of domestic currency per US dollar. Expected devaluation is constructed as the 90-day forward discount also relative to the US dollar. The euro-USD rate is defined as euros per US dollar. The source is *Datastream*.

Commodity Price Indexes: Obtained from the JP Morgan data set.

Country risk: Defined as the EMBI premium above Treasuries, measured in percentage points. The data were obtained from *Datastream*.

Inflation and growth: Individual countries' central bank bulletins.

30. Calvo and Reinhart (2000) is the classical reference on this subject.

31. For a discussion along these lines, see, for example, Taylor (2013). See also Edwards (2012) and Rey (2013).

References

Aizenman, J., M. Binici, and M. M. Hutchison. 2014. *The transmission of Federal Reserve tapering news to emerging financial markets.* National Bureau of Economic Research.

Calvo, G. A., and C. M. Reinhart. 2000. *Fear of floating* (no. w7993). National Bureau of Economic Research.

Cetorelli, N., and L. S. Goldberg. 2011. Global banks and international shock transmission: Evidence from the crisis. *IMF Economic Review* 59 (1): 41–76.

Clarida, R. H. 2014. Monetary policy in open economies: Practical perspectives for pragmatic central bankers. *Journal of Economic Dynamics & Control* Dec.: 21–29.

Claessens, S., H. Tong, and S. J. Wei. 2012. From the financial crisis to the real economy: Using firm-level data to identify transmission channels. *Journal of International Economics* 88 (2): 375–87.

Claro, S. and L. Opazo. 2014. Monetary policy independence in Chile. *BIS* paper no. 78.

De Gregorio, J., S. Edwards, and R. O. Valdes. 2000. Controls on capital inflows: Do they work? *Journal of Development Economics* 63 (1): 59–83.

Devereux, M. B., P. R. Lane, and J. Xu. 2006. Exchange rates and monetary policy in emerging market economies. *Economic Journal* 116 (511): 478–506.

Dincer, N., and B. Eichengreen. 2013. Central bank transparency and independence: Updates and new measures. Working paper.

Dornbusch, R. 1976. Expectations and exchange rate dynamics. *Journal of Political Economy,* 1161–76.

Edwards, S. 2006. *The relationship between exchange rates and inflation targeting revisited* (no. w12163). National Bureau of Economic Research.

———. 2012. The Federal Reserve, the emerging markets, and capital controls: A high-frequency empirical investigation. *Journal of Money, Credit and Banking* 44 (s2): 151–84.

———. 2015. Monetary policy independence under flexible exchange rates: An illusion? National Bureau of Economic Research working paper 20893.

Edwards, S., and E. Levy-Yeyati. 2005. Flexible exchange rates as shock absorbers. *European Economic Review* 49 (8): 2079–2105.

Edwards, S., and R. Rigobón. 2009. Capital controls on inflows, exchange rate volatility and external vulnerability. *Journal of International Economics* 78 (2): 256–67.

Eichengreen, B., and P. Gupta. 2014. Tapering talk: The impact of expectations of reduced Federal Reserve security purchases on emerging markets. World Bank Policy Research working paper 6754.

Frankel, J., S. L. Schmukler, and L. Serven. 2004. Global transmission of interest rates: Monetary independence and currency regime. *Journal of International Money and Finance* 23 (5): 701–733.

Glick, R., R. Moreno, and M. M. Spiegel. 2001. Financial crises in emerging markets (no. 2001–2007). Cambridge University Press.

Goldberg, L. S. 2009. Understanding banking sector globalization. *International Monetary Fund Staff Papers,* 171–97.

Ince, O., T. Molodtsova, A. Nikolsko-Rzhevskyy, and D. H. Papell. 2015. Taylor rule deviations and out-of-sample exchange rate predictability. Working paper.

Justiniano, A., and B. Preston. 2010. Monetary policy and uncertainty in an empirical small open-economy model. *Journal of Applied Econometrics* 25 (1): 93–128.

Miniane, J., and J. H. Rogers. 2007. Capital controls and the international transmission of US money shocks. *Journal of Money, Credit and Banking* 39 (5): 1003–35.

Molodtsova, T., and D. H. Papell. 2009. Out-of-sample exchange rate predictability with Taylor rule fundamentals. *Journal of International Economics* 77 (2): 167–80.

Molodtsova, T., A. Nikolsko-Rzhevskyy, and D. H. Papell. 2008. Taylor rules with real-time data: A tale of two countries and one exchange rate. *Journal of Monetary Economics* 55: S63–S79.

Monacelli, T. 2005. Monetary policy in a low pass–through environment. *Journal of Money, Credit and Banking,* 1047–66.

Obstfeld, M., J. C. Shambaugh, and A. M. Taylor. 2005. The trilemma in history: Tradeoffs among exchange rates, monetary policies, and capital mobility. *Review of Economics and Statistics* 87 (3): 423–38.

Rey, H. 2013. Dilemma not trilemma: The global financial cycle and monetary policy independence. Jackson Hole Economic Symposium.

Rogoff, K., S. J. Wei, and M. A. Kose. 2003. Effects of financial globalization on developing countries: Some empirical evidence (vol. 17). Washington, DC: International Monetary Fund.

Spiegel, M. M. 1995. Sterilization of capital inflows through the banking sector: Evidence from Asia. *Economic Review-Federal Reserve Bank of San Francisco* 3:17.

Taylor, J. B. 2007. Globalization and monetary policy: Missions impossible. In *International dimensions of monetary policy*, ed. M. Gertler and J. Gali, 609–624. Chicago: University of Chicago Press.

Taylor, J. B. 2013. International monetary coordination and the great deviation. *Journal of Policy Modeling* 35 (3): 463–72.

Taylor, J. B. 2015. Rethinking the international monetary system. Remarks at the Cato Institute conference, Rethinking Monetary Policy.

Tesar, L. L. 1991. Savings, investment and international capital flows. *Journal of International Economics* 31 (1): 55–78.

DISCUSSION BY DAVID PAPELL

It is a pleasure to read and discuss this interesting and well-written paper by Sebastian Edwards. There is a lot of detail in the paper that I'm not going to comment on here, so I highly recommend that you read it. The organizing principle of the paper is the impossible trinity or, equivalently, the macroeconomic policy trilemma. As first discussed by Mundell (1963), the idea of the trinity/trilemma is that, while countries would prefer to have fixed exchange rates, high capital mobility, and independent monetary policy, they can only attain two of the three objectives.

The paper considers the part of the trilemma that applies to emerging market economies with high degrees of capital mobility. Countries that do not restrict capital flows have two choices. One is to fix the exchange rate. We learned from the series of exchange rate crises in the 1990s and early 2000s that fixed exchange rates that can be changed do not work. You need a hard fix such as dollarization or a single currency that, in turn, totally dictates monetary policy. For countries that want to have monetary policy independence, the only choice is to have flexible exchange rates. A modern version is discussed by Taylor (2001), who proposes his own trinity, the possible trinity. For emerging market economies that do not choose to permanently fix their exchange rates, the only sound monetary policy is one based on a flexible exchange rate, an inflation target, and a policy rule.

The results of the paper can be considered in the context of the following policy rule:

$$r_p = \alpha + \beta r_p^{\star} + \gamma x \tag{1}$$

where r_p is the policy rate for the emerging market country, $r_p^{\star}$ is the policy (federal funds) rate for the United States, and x are the variables, such as inflation and the output gap, that enter a standard

Taylor (1993) rule. The coefficient α is determined by the inflation target, the equilibrium real interest rate, and the coefficient on inflation. Monetary policy independence is defined by the coefficient β being equal to zero so that the US federal funds rate does not affect the emerging market country's policy rate.

Edwards first estimates Taylor rules for three Latin American countries. The US federal funds rate is significant for Chile and Colombia, but not significant for Mexico. The long-term coefficients are substantial, and the results are robust to many controls. He then estimates Taylor rules for a panel of East Asian countries. While the results are also significant, they are not as large. The conclusion is that flexible exchange rates do not provide monetary policy independence.

What does monetary policy independence mean? From the perspective of this paper, it means that if a country has a policy rule, it should only have domestic variables in its rule, which would be contradicted by having either the US federal funds rate or the real exchange rate in the Taylor rule. This perspective receives support from Taylor (1999), who argues that, based on simulations of macroeconomic models, there is only a weak case for having an exchange rate in a policy rule. It also receives support from Clarida (2014), who shows that optimal policy in a two-country model would have a Taylor-type rule, where each country pays attention only to its own variables.

But there is another perspective. Why does monetary policy independence mean that a country cannot be concerned about the value of its exchange rate? In Mundell (1963) the central bank can still intervene in the foreign exchange market under flexible exchange rates; it just can't announce an exchange rate that it is going to defend. In Taylor's 2001 paper on advice for emerging market economies, flexible exchange rate policy doesn't mean that the exchange rate plays no important role in interest rate decisions or in a policy rule. Clarida, Gali, and Gertler (1998) found significant

coefficients on either the federal funds rate or the real dollar exchange rate in Taylor rules for Germany and Japan, and there are many subsequent examples.

Suppose that all countries include foreign interest rates in their Taylor rules. Why is this a matter for concern? The basis for the concern comes from Taylor (2009). Suppose you have two countries, each of which responds to the other country's interest rate. In addition to equation (1), there would also be a policy rule for the foreign country:

$$r_p^* = \alpha^* + \beta^* r_p + \gamma^* x^* \tag{2}$$

where x^* are the variables that enter the foreign country's Taylor rule. Substituting equation (1) into equation (2), and vice versa, produces the following reaction functions:

$$r_p = \frac{\alpha + \beta\alpha^*}{1 - \beta\beta^*} + \left(\frac{\gamma}{1 - \beta\beta^*}\right) x + \left(\frac{\beta\gamma^*}{1 - \beta\beta^*}\right) x^* \tag{3}$$

$$r_p^* = \frac{\alpha^* + \beta^*\alpha}{1 - \beta\beta^*} + \left(\frac{\gamma^*}{1 - \beta\beta^*}\right) x^* + \left(\frac{\beta^*\gamma}{1 - \beta\beta^*}\right) x. \tag{4}$$

Assume that β and β^* are both between zero and one, so that each country raises its policy rate when the other country's policy rate increases, but less than point-for-point. Then $0 < \beta\beta^* < 1$ so that $1 - \beta\beta^* < 1$. The important characteristic of the reaction function is that the term that multiplies domestic variables is magnified for both countries. For the domestic country with a policy rule defined by equation (1), the coefficient γ is the desired response to the domestic variables x in the Taylor rule. Since $1 - \beta\beta^* < 1$, the actual response in equation (3) is larger than the desired response in equation (1). The same argument applies to the foreign country in equations (2) and (4). Because each country responds to the other country's interest rate, the policy responses are magnified.

The problem with this analysis, however, is that equations (1) and (2) can't possibly be the correct model for thinking about Latin American or Asian countries. When I think about the future path of the US federal funds rate, one thing that doesn't come to mind is what the interest rates in Chile, Colombia, or Mexico are going to be. Consider an alternative model, which is also discussed in Taylor (2009). What happens if the emerging market country responds to the US federal funds rate, but the United States doesn't respond to the emerging market country's policy rate? The policy rule for the emerging market country is still described by equation (1), but the policy rule for the United States is the standard Taylor rule:

$$r_p^* = \alpha^* + \gamma^* x^*. \tag{5}$$

Substitute equation (5) into equation (1):

$$r_p = \alpha + \beta(\alpha^* + \gamma^* x^*) + \gamma x. \tag{6}$$

The emerging market country responds to the US interest rate, which means that it responds to US macro variables, but there is no magnification effect. While concern about the exchange rate will affect monetary policy independence in the sense that it causes emerging market economies to respond to US variables, it does not affect monetary policy independence in the sense that it does not cause them to increase the policy response to their own inflation rates and output gaps.

In the context of flexible exchange rates and high capital mobility, I am not convinced that a policy response to the US federal funds rate based on concern about the exchange rate or capital flows is as important a problem as is represented by the paper because, since there is no magnification, emerging market economies do not have to increase the response to their own variables.

This assumes that the Fed follows its own policy rule. But what happens if the Fed deviates from its rule? While Sebastian talks about this at the end of the paper, saying it will create a more volatile macroeconomic environment, the paper is about "spillover" or contagion between policies. What I think is potentially more important is "spillover" or contagion between policy rule deviations. If the Fed deviates from its policy rule, does this create pressure on other countries to deviate from their policy rules? This is not an easy question to answer for developed economies, and I am doubtful that it can be answered with the span of data available for emerging market economies. But the question is worth asking. If flexible exchange rates do not insulate countries from US policy rule deviations, then monetary policy independence would truly be a mirage.

References

Clarida, R. 2014. Monetary policy in open economies: Practical perspectives for pragmatic central bankers. *Journal of Economic Dynamics and Control* 49: 21–30.

Clarida, R., J. Gali, and M. Gertler. 1998. Monetary policy rules in practice: Some international evidence. *European Economic Review* 42: 1033–67.

Mundell, R. 1963. Capital mobility and stabilization policy under fixed and flexible exchange rates." *Canadian Journal of Economics* 29: 475–85.

Taylor, J. B. 1993. Discretion versus policy rules in practice. *Carnegie-Rochester Conference Series on Public Policy* 39: 195–214.

Taylor, J. B. 1999. The robustness and efficiency of monetary policy rules as guidelines for interest rate setting by the European Central Bank. *Journal of Monetary Economics* 43: 655–79.

Taylor, J. B. 2001. Using monetary policy rules in emerging market economies. In *Stabilization and monetary policy: The international experience.* Proceedings of a conference at the Central Bank of Mexico.

Taylor, J. B. 2009. Globalization and monetary policy: Missions impossible. In *The international dimensions of monetary policy,* ed. M. Gertler and J. Gali, 609–624. Chicago: University of Chicago Press.

GENERAL DISCUSSION

SEBASTIAN EDWARDS: Let me tackle two issues that David Papell raises. The first one—something that John Taylor and I have discussed over the years and that comes up every time I go to an emerging market and talk to central bankers either as an advisor or just in a conversation—is about what to do with the exchange rate in respect to monetary policy. So the exchange rate, even in the most simple Taylor rule, is already indirectly in the monetary policy, because, of course, what happens to the exchange rate affects inflation through some pass-through mechanism. It doesn't have to be one-to-one. And the pass-through, as John Taylor has documented, has been declining around the world in the last 30 years. But, of course, every time Argentina devalues its currency, and the exchange rate just went from nine pesos to 14 or 15 pesos to the dollar, domestic inflation in Argentina goes up, because they are wired for a number of historical reasons to react to changes in the exchange rate. So the question is, Should the exchange rates play a role over and above this indirect role in monetary policy, or should we allow the exchange rates to do whatever it has to do and react as a shock absorber to different shocks in the world economy? That's a big, big question, and I don't think we have time to solve it during my two minutes here. But the point that I want to make is that even in any of these models, exchange rates already are there once you have local inflation.

The second point I want to raise—and I will just leave it open—is, Why should we worry about this monetary policy "spillover"? Is this a concern? There are two different approaches to this at least. One is the welfare approach. The United States does not take into account what Colombia does. Many of you guys are or have been in the FOMC. I'm sure that you've never

spent even one millisecond talking about Colombia. And you haven't spent any time talking about what Chile does, a well-behaved country that is not about to go belly up, and even if it did, it is so small that no one would worry. And so in this case, as I point out in the paper, there is a one-way amplification effect, that only concerns the developing countries.

So why worry? One question is whether there are negative welfare implications by the way these central banks are behaving. And a related one is whether we should worry that, even if they are doing the right thing, because the exchange rate does truly belong in the augmented Taylor rule in order to minimize the volatility of nominal GDP, that is not what they are saying. And I think that it is important, and we should worry, because they are saying that they do something that they don't appear to be doing. And I think that for the markets to operate properly, the understanding of what central banks are doing is important, and we should match to some extent—and this has to do with, of course, transparency and communications—what central banks say with what they do. And what I think I'm doing here is unveiling the fact that indeed they say one thing while they do another thing. Now why would they say, "We don't pay attention to what the Fed does"? It's beyond me. There's no loss in dignity or honorability by saying, "Yeah, we look at what the Fed does." It's a big country, and it's very important.

HAROLD UHLIG: I have two questions. One is a conceptual one, the other is an econometric one. The conceptual one is this notion of independence here. So let me start with an analogy. When I was a child, my parents didn't really allow me to get drunk on weekends. And now that I'm an adult and independent from my parents, I still try not to get drunk on weekends. But it's not because I'm dependent on somebody else. It's because it's a good idea not to do that. And so you wonder if the central banks in these countries do what they do because it's a good idea or be-

cause they are dependent in some ways. The very essence of the Taylor rule in some ways is that central banks don't set interest rates arbitrarily. They set them according to economic circumstances, and maybe that's all that they're doing, and we just have to wrap our mind around why they're doing what they're doing. So I think the welfare question, to answer whether there's a lack of independence, is really at the heart of the whole discussion, and bringing that out more in the paper maybe would be nice, some theory.

The other one is the econometric question. It looks like you put the contemporaneous federal funds rate and the contemporaneous US policy stance on the right-hand side in the regression. But you have the lag policy rates in this regression. So for short horizons, it may not be all that surprising that news about monetary policy will result in news about domestic monetary policy. That's a little different from saying the stands of US monetary policy drive the stands of the monetary policy in the country. So the question is, What happens if you put in the stands of US monetary policy, say, with four lags? I notice there are a bunch of lag variables in there. But if it still shows up significantly there, you would have a much stronger case.

RICHARD CLARIDA: David Papell mentioned my 1998 paper with Gali and Gertler, and it actually addresses a couple of the issues here. So in that paper, we actually had a forward-looking Taylor rule. We were precisely interested in the issue of whether the real exchange rate enters into the Bundesbank's or the Bank of Japan's equations because it's useful in forecasting inflation, or whether it enters with an independent effect. And our generalized method of moments approach actually allowed us to test that hypothesis. And what we found is entering over and above its ability to forecast. So at least in our original work, we were directly focused on this issue of a reduced form of correlation from a forecasting role. But we found the independent role.

But the second point, I think, to Harold's observation: it's actually not hard to write down a model—as in my paper in this volume—where you can get a relationship between, say, Colombia's or Chile's interest rate and the US interest rate, because essentially there's a global dimension to the neutral policy rates. In the original Taylor formulation, the neutral rate's a constant, but you can write down models where not only is it time varying, but there's actually a global dimension to it, and then it's very easy for the foreign interest rate to enter, because it's essentially a proxy for that unobservable global factor. But nice paper.

SEBASTIAN EDWARDS: Harold Uhlig, Rich Clarida, and also David Papell raise the question of what really is independence here? And the answer is that I'm defining it in a particular way, which is very clear in the paper, which you may not agree with, but that's the way I define it. It's not fuzzy. It has to do with after estimating an augmented Taylor rule that includes some foreign or external or global variables, and I will get back in a second, once you estimate that Taylor Rule, whether the federal funds rate still plays a role. And here let me just add that I must apologize for not citing the Clarida, Gali paper, which, of course, is a very important paper on this topic. So this is the way I define independence, and that's why "contagion" or "spillover" is in quotation marks. It is a very particular way of doing it, and one can indeed write models where the foreign interest rate enters. But the question I think is what Vasco said, which is: Is it entering because it's an additional target, or is it entering because it affects the objective function of the central bank, which is to minimize the variability of nominal GDP over time?

ALLAN MELTZER: I've read Sebastian's paper. It's really very interesting. And it intrigued me that Mexico was so different. And I came up with this possible explanation, which I want to try on you. Mexico went through some really tough times up through 1994. And now it's 20 years past that, and it's followed a policy of noninflation during that period under sometimes difficult cir-

cumstances. So it has embedded in the holders of the peso the idea that Mexico will not inflate, just as holders of the dollar currently think the United States may never inflate again. Anyway, they have that strong belief, and they have more independence as a result. Whereas in Chile and certainly in Colombia, US pressure is very strong. And I end that by saying in my experience with the Bank of Japan over a very long time, I remember when Larry Summers came as the US undersecretary of the Treasury, came to Tokyo and told them, look, you're not allowed to change your exchange rate. And so it went back up. And he said you have to use fiscal policy.

SEBASTIAN EDWARDS: I think that I agree basically with what Allan said. Mexico is one of the few—not the only but one of the few—Latin American countries that had long, long, long periods of price and exchange rate stability: about 20 years of the peso when the old peso to the dollar was fixed at 12 pesos and fifty cents. That created a whole literature—most of you are too young to even remember it—the "peso problem" literature. The peso was at a discount every year for 20 years, and it never actually devalued, until it did. And when it did, it was gigantic. So I think that after the 1994–95 crisis in Mexico, that possibility became very clear. It was internalized by the market. I was a chief economist for Latin America at the World Bank, and I remember a good friend, Guillermo Ortiz, who was at the time secretary of the Treasury, sweating. This was a totally traumatic experience for Mexico. And they decided it would never happen again.

MICHAEL HUTCHISON: I'm wondering about the commodity prices in Chile. Isn't it the case that these kinds of exogenous shocks can be responded to immediately, while the lag of GDP takes some time? And officials also don't observe contemporaneous GDP and do observe commodity prices. Is it possible that you've underestimated the effect because you've left out commodity prices—Chile is an important example. Could you

include other variables which are contemporaneously observable for policy rules?

SEBASTIAN EDWARDS: Mike Hutchinson makes some important points about commodity prices, and Chris asked the question: Why do the Latin American countries behave differently from the Asian countries? I think that part of it has to do with commodity prices. So the main difference between these countries—the Latin American and the East Asian countries—is that the Latin American currencies are commodity currencies and the East Asian currencies are not commodity currencies. And the commodity markets are denominated in dollars. So the price of copper in dollars, which has a role in the Chilean economy and the Peruvian economy, or the price of oil in Mexico and Columbia is affected in the world markets when the dollar changes in the world market and the dollar changes and responds in general to interest rate differentials. So interest rates in the United States have an important effect. And it also has an effect in expectations. So maybe that's an avenue that one has to continue to look into: the role of commodities.

CHRISTOPHER CROWE: I thought the finding that US policy was more important to Latin American countries than Asian countries was interesting and very plausible. I was wondering if we could have your thoughts on the reason why that is. I also wanted to give what might be a reason, which is the suggestive evidence that I saw when I was looking at a related issue: that if you look at overall capital flows to EMs and then look at capital flows from the United States to each of those EMs, in general, they're not very highly correlated. The exception is Latin American countries, where flows from the United States really drive flows in and out of those countries, and particularly in bank flows and debt securities, which presumably are the most interest rate sensitive parts of those flows. To my mind, that sounds like a plausible rationale why this is the case. So I'd be interested in your thoughts.

VASCO CURDIA: Sebastian's paper seems to be implying that you don't input the exchange rate because it's implicitly there, because you have local inflation. Through the indirect effects, you could argue the same thing about the federal funds rate to the extent that it affects financial conditions. That is already transmitted through the economy. So the question is whether they are there because they are a separate target or because they are some sort of summary statistic for other financial conditions or global conditions, So it would be interesting if you could dig a bit further, by including both exchange rates and the federal funds rate, because one of the arguments you mention for including the federal funds rate is maybe just to defend the currency. But if that's the case, just include the currency itself in there, right, with lags and so on.

Another thing which is partially there already is to include expectations for inflation in the United States, which maybe could be used as a proxy for inflation in the world. Why don't you use, let's say, International Monetary Fund forecasts for global demand and global inflation, or try to use some sort of trade-weighted measure of all those conditions. That's what should be in all those countries in a way, right, other than for financial conditions. So that will be an interesting thing.

WILLIAM ENGLISH: I wanted to follow up on Harald Uhlig's question. It seems to me that US policy or the exchange rate may matter because they affect the outlook for inflation or the outlook for the output gap, say. And because central banks should be forward-looking, it's not a surprise that these things enter into the policy rule in these countries. I guess the question is whether there's an overreaction relative to what you should expect based on the anticipated economic effects of the change in the US rate.

SEBASTIAN EDWARDS: Bill English raises the question of introducing forward-moving expectations and the global versus local economic effects. I do have in all of the estimates, as I said, the

breakeven between either the five-year or the ten-year note and the five- or ten-year corresponding TIPS. And that is the market expectations of US inflation, which for these countries is an important forward-looking measure of the global inflation. So that is already in the paper.

As to Harald's point about different lags: I have tried, of course, different lags. Reporting is a complication. Sometimes you report, sometimes you don't. I should, as Harald says, report results with additional lags.

EVAN KOENIG: I have a colleague—Scott Davis—at the Federal Reserve Bank of Dallas who's made the argument that in trying to understand which countries are going to follow the Fed's lead and which aren't, it's really important to allow for the amount of dollar-denominated debt the country has and also the size of their foreign exchange reserves. So the underlying concern is the real burden of their debt.

SEBASTIAN EDWARDS: Evan Koenig makes a good point. And in terms of the empirical strategy, we have to look at what happens to reserves in these countries, and we have to look at the degree of dollarization of their debt, and so the balance sheet effect and the fear to float. The dilemma or the tradeoff in this research is whether to bring in the cross-section variability and improve the data and have a panel or whether to accept them as the unhappy families in Tolstoy's *Anna Karenina* sense: each country is different, and you have to focus on each country separately. And there is very little variability during any period of time that is not long, long, long, long, long in terms of dollarization. So let's take into account, for example, Colombia. Liabilities of dollarization may have gone in this period from 0.239 to 0.235. So it's really very hard to do it. So that's a tradeoff. And I realize that that's an important question.