Why Was the Plaza Accord Unique?

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The attention given to the 30th anniversary of the Plaza Accord—reached by the United States, Japan, Germany, France, and the United Kingdom on September 22, 1985—is testament to the fact that it was a watershed moment in exchange rate policy. It initiated a new paradigm of cooperation among the major economies outside of a currency crisis, leading to more ambitious, though arguably less successful, efforts like the Louvre Accord (Baker 2006, 431–32; Mulford 2014, 171). It appears to be the most effective example of coordinated exchange rate policy in the post–Bretton Woods period, with the dollar appreciating far more against the yen and mark than anticipated.[1]

What made the Plaza so unique, combining both strong cooperation among major countries and effectiveness at impacting exchange rates? The uniqueness of the Plaza relates at least partly to the rarity of simultaneous motivation by the major economies to engage in potentially costly intervention. Several explanations could play a role in dissuading countries from attempting intervention.

This chapter explores two potential explanations of why the Plaza has not been repeated. The first is that 1985 was an outlier in post–Bretton Woods experience in the degree of currency misalignment present. Using a measure of real overvaluation relative to real interest differentials, we show that in the

1. Agreement on the effectiveness of the Plaza is not universal. See Feldstein (1986) and Bordo, Humpage, and Schwartz (2010).

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first quarter of 1985 the US dollar was more overvalued against all other G-7 currencies except the Canadian dollar than at any other time. The potential disruption from such large overvaluation may have provided an overwhelming motivation for intervention.

The size of overvaluation may also have amplified the effectiveness of intervention via a "coordination channel." By pointing out that the market had deviated from fundamentals, sterilized intervention coordinates the beliefs of traders that the market needs to correct toward fundamentals-determined values.[2] After the Plaza intervention, when the market finally began to realign with fundamentals, it had a large correction to make. The size of the correction made the Plaza anomalously effective.

The second explanation we investigate is whether the intervention was consistent with the direction of monetary policy implied by domestic economic conditions for the three key countries (the United States, Germany, and Japan) in 1985. Since at least the 1983 Jurgensen Report, it has been recognized that sterilized exchange rate intervention is most likely to be effective when it is consistent with the direction of monetary policy (see, for instance, Jurgensen 1983, Sarno and Taylor 2001, and Menkhoff 2010).[3] The need for policy consistency relates to the need for credibility with markets for intervention to work through signaling or coordination channels. Signaling involves sterilized intervention indicating the direction of monetary policy to markets. For the coordination channel, the direction of monetary policy is one critical fundamental.

In 1985 inflation had stabilized in all three countries (at below 4 percent in the United States, at 2 percent in Japan and Germany). However, growth rates were moving in opposite directions. According to real-time data available to policymakers, in the first half of 1985 the United States was experiencing slower economic growth whereas growth was trending upward in Germany and Japan. The Plaza intervention may have been effective partly because it was consistent with looser monetary policy in the United States and tightening in Germany and Japan. If intervention credibly signaled future monetary policy consistent with the intervention, any coordination effect would have been amplified, because the fundamentals themselves would be moving in favor of a weaker dollar.

There are other explanations for the Plaza's uniqueness. For instance, the strong depreciation of the dollar may have been assisted by expectations of shifts in fiscal policy. The Gramm-Rudman-Hollings Balanced Budget Act passed the US House of Representatives on August 1, 1985, and the Senate on October 1, 1985, becoming law in December 1985.

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2. The "coordination channel" does not necessarily imply coordinated intervention by multiple monetary authorities. Coordination in this case involves coordinating the beliefs among traders about fundamentals-based exchange rate values. Researchers have provided evidence for the coordination channel operating in the dollar-mark (Reitz and Taylor 2008) and dollar-yen (Reitz and Taylor 2012) markets.

3. The intervention undertaken by these countries at the Plaza, in accord with essentially all intervention by major economies, was sterilized.

Contributing to the uniqueness of the Plaza is the fact that coordinated intervention in general has been rare; major shifts in exchange rate policy of the magnitude announced at the Plaza have been even rarer. Ideology contributes to this rarity, as key players in office at other times, such as Treasury secretaries Donald Regan and Robert Rubin, preferred to trust the market to determine the exchange rate rather than attempt to influence market outcomes.

Experience matters, as empirical evidence of the effectiveness of sterilized intervention is not strong. Whether measured using instrumental variables, event study methods, or high-frequency data, sterilized intervention by major economies has no impact on exchange rates beyond a period of a few weeks, according to more than 30 years of empirical work.[4] Monetary authorities may believe intervention is effective (Neely 2001, 2008), but they likely subscribe to Truman's (2003) view that short-term impacts are the best that can be achieved.

Economic theory may have discouraged efforts to coordinate intervention. New Keynesian open economy models typically suggest that optimal monetary policy can ignore the exchange rate and focus exclusively on domestic inflation, using a Taylor rule. Since the turn of this century, researchers have developed dynamic stochastic general equilibrium models that include nominal rigidities, monopolistic competition, and producer-currency pricing (Obstfeld and Rogoff 2002, Benigno and Benigno 2006, Clarida 2014). These models demonstrate that domestic inflation–targeting regimes constitute optimal monetary policy or come trivially close. In other words, the exchange rate need not enter the objective function of the central bank. Exchange rate intervention—or, equivalently, altering domestic interest rates to achieve an exchange rate target—is not necessary for optimal monetary policy. Allowing coordination of policies does not alter this theoretical result. A floating exchange rate with the central bank remaining focused on domestic targets remains optimal, so coordinated exchange rate intervention cannot improve welfare.[5]

In exploring our first potential explanation for the uniqueness of the Plaza accord, we define overvaluation as the residual between the actual and predicted real exchange rate from a simple short-term real interest rate differential model. We calculate dollar overvaluation against the mark, lira, franc, euro, yen, pound, and Canadian dollar for the entire post–Bretton Woods period. The period just before the Plaza demonstrates the greatest historical overvaluation of the dollar against every European currency. Against the yen,

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4. For surveys of the literature on intervention effectiveness at various points in time, see Jurgensen (1983), Edison (1993), Sarno and Taylor (2001), and Menkhoff (2010).

5. John Taylor discusses the policy implications of these results in chapter 12. A model developed by Engel (2011) suggests that monetary policy should target the real exchange rate. His model is similar to others reviewed by Clarida (2014), except that it makes the more realistic assumption of local-currency pricing. This assumption allows something akin to differential pricing, creating welfare losses that are better minimized by including a real exchange rate term in the Taylor rule. Although domestic interest rates provide sufficient tools to hit the target, his model opens the door to exchange rate intervention consistent with the optimal monetary policy target when large deviations of the real exchange rate occur.

the dollar overvaluation peaked in the third quarter of 1982, but it remained high and nearly matched the peak in the first quarter of 1985. The Canadian dollar, in contrast, was only mildly undervalued in 1985.

For examining the second potential explanation, we propose that the deviation of policy rates from the rate implied by the Taylor rule indicates policy space for credible, consistent, sterilized intervention. For instance, if the policy rate is above the Taylor rule–implied rate, markets would be likely to believe a central bank signal that it wants to loosen monetary policy. Intervention to depreciate the domestic currency would be consistent with movement toward the Taylor rule–implied rate and hence more likely to be credible.

Clarida, Gali, and Gertler (1998) indicate that Taylor rules do a reasonable job of describing monetary policy for most G-7 countries, at least since the 1980s. Studies like Orphanides (2003) establish the importance of using real-time data when evaluating historical policy scenarios. Survey data show that Taylor rules provide close approximations to professional forecasts of policy interest rates across the G-7 countries since at least the Greenspan era (Mitchell and Pearce 2010; Fendel, Frenkel, and Rülke 2011; Pierdzioch, Rülke, and Stadtmann 2012). Engel, Mark, and West (2008) and Molodtsova and Papell (2009) show that Taylor rule models provide more evidence of out-of-sample exchange rate predictability than monetary, interest rate, or purchasing power parity models. Consistent with the theory that foreign exchange market participants pay attention to Taylor rule deviations, Wilde (2012) finds that real exchange rates correlate with bilateral Taylor rule deviations (deviations of the interest differential from the Taylor rule–implied differential) in the expected direction in both the dollar-mark and dollar-yen markets. One interpretation of Wilde's evidence, however, is that markets respond to Taylor rule deviations regardless of whether intervention occurs. Ito and Mishkin (2006) caution against using Taylor rules for Japan because of the sensitivity of results to the estimation period and measure of the output gap.

There are many ways to specify policy rules. We focus on the original Taylor (1993) rule, where the federal fund rate equals 1.0 plus 1.5 times inflation plus 0.5 times the output gap, assuming that the target inflation rate and the equilibrium real interest rate both equal 2.0 percent. We use real-time data available to policymakers when interest rate decisions were made: real-time GDP (or GNP) and GDP (or GNP) deflator data. We compute Taylor rule deviations as the difference between the central bank's policy rate and the interest rate implied by the Taylor rule in the United States, Germany, and Japan.

By our metric, foreign exchange intervention to depreciate the dollar in the third quarter of 1985 was consistent with monetary policy for the United States. Intervention by Germany and Japan was not consistent. However, it was consistent with the Taylor rule–implied interest rate differentials between the United States and both Germany and Japan. We consider this evidence of weak consistency for Japan and Germany. The overall pattern of consistency suggests that, to the extent consistency with monetary policy mattered, the effectiveness of the Plaza derived from the fact that markets were focused on the United States.

The next section focuses on the real overvaluation explanation, laying out the empirical approach, describing the data, and presenting the results. The following section does the same for the monetary policy consistency explanation. The last section discusses the results in order to interpret the historical record and considers the current context.

Overvaluation of the Real Exchange Rate

Nominal exchange rates receive the bulk of attention from policymakers, primarily because of their high-frequency availability. They matter for inflation because of the impact on imported goods. These considerations should play into policymakers' inflation-targeting rules, according to most variations of the models mentioned above.

In practice the impact of nominal exchange rates on inflation rises to the fore. Truman (2014 and chapter 9 of this volume) documents that concern outside the United States about the impact of dollar appreciation on domestic inflation was one impetus for commissioning the Jurgensen Report on the effectiveness of foreign exchange intervention. Germany in particular was concerned about the inflationary impact of the depreciation of the mark against the dollar in the pre-Plaza period (Funabashi 1989). For these reasons most evaluations of exchange rate misalignment during the Plaza period have examined nominal values.[6]

Real exchange rates are the preferred unit of observation for understanding incentives to intervene. They matter for trade balances and hence for most of the political pressure related to exchange rates.

There are many metrics for measuring the overvaluation of real exchange rates, the development of which remains an active area of research. For instance, as part of its exchange rate surveillance, the International Monetary Fund uses the residual of a panel regression of real effective exchange rates on a substantial battery of explanatory variables, including real short-term interest rate differentials (Phillips et al. 2013).

Because it is concerned with monetary policy, this chapter uses a benchmark for overvaluation that relies exclusively on the short-term real interest rate differential. Central banks primarily target short-term nominal interest rates and inflation, which yield the real interest rate. Real interest parity theoretically indicates that real exchange rate movements can be explained entirely by the expected short-term real interest rate differential. Compared with uncovered interest parity in nominal terms, real interest parity has more—if not conclusive—evidence of validity (Edison and Melick 1999, MacDonald and Nagayasu 2000, Mark and Moh 2005, Hoffmann and MacDonald 2009, Byrne and Nagayasu 2010), although it is generally found to hold only at long-run (business cycle) frequencies.

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6. For instance, Feldstein (1994) informally assesses the dollar to be overvalued relative to interest rate differentials in nominal terms by the end of 1984.

From a theoretical perspective, real interest parity derives from combining the uncovered interest parity condition $E_t \Delta s_{t+1} = i_t - i_t^*$ with the Fisher equation $r_t = i_t - E_t \pi_{t+1}$ to get

$$E_t \Delta q_{t+1} = r_t - r_t^* \tag{8.1}$$

where s_t is the log of the nominal exchange rate at time t (foreign currency/US dollar), i_t is the nominal short-term interest rate, r_t is the real interest rate, $\pi_t \equiv p_t - p_{t-1}$ is the inflation rate, p_t is the log of the price level, and q_t is the log of the real exchange rate, defined as $q_t \equiv s_t + p_t - p_t^*$. The operator $E_t(\cdot_{t+j})$ indicates expectations at time t of the value of $(\cdot)$ for time $t + j$, Δ is the first-difference operator, and * indicates a foreign variable.

Equation 8.1 requires specification of the future value of the real exchange rate, so we make what Edison and Melick (1999) describe as the "standard" assumption that relative purchasing power parity (PPP) holds (that is, the expected real exchange rate is constant). Hence the relationship we estimate is

$$q_t = \alpha + \beta(r_t - r_t^*). \tag{8.2}$$

This specification, which we use to explain short-run movements of the real exchange rate, admittedly plays a little loose by using a long-run PPP relationship. For identifying overvaluation, however, this assumption is unlikely to materially change the results.[7] We assume, from Engel (2015), that the real exchange rate is stationary and therefore estimate the equations using ordinary least squares (OLS).

We examine the misalignment of the dollar against the mark, franc, lira, pound, yen, and Canadian dollar using quarterly data from the second quarter of 1973 through the second quarter of 2015.[8] The nominal exchange rates from the Pacific Exchange Rate Service are the average of the daily rates in the last month of the quarter.

Consumer price indexes and short-term interest rates come from the OECD database, using the last month of the quarter. Because of missing short-term interest rate data, for interest differentials in Japan and the United Kingdom (including the counterpart US rate) we use T-bill data from the International Financial Statistics database. The real interest rate is constructed as the nominal interest rate for the quarter minus the percentage change of the consumer price index on the same quarter one year earlier.[9]

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7. Many more sophisticated approaches to estimating this equation have been performed. See, for example, Campbell and Clarida (1987), Edison and Pauls (1993), Mark and Moh (2005), Hoffmann and MacDonald (2009), and Engel (2015).

8. The data for Italy begin only in the fourth quarter of 1978. Before adoption of the euro, these series are historical. Following the euro adoption, the mark, franc and lira are pseudo rates imputed by applying the euro locking rate to the current euro exchange rate.

9. Although π_t is not a sophisticated proxy for $E_t \pi_{t+1}$ it is not uncommon to use it as such (see, for instance, Edison and Pauls 1993 and Edison and Melick 1999).

Table 8.1 Regression results for real exchange rates and real interest differentials in the G-6 countries

Country	β	Standard error	t-statistic	P-value
Canada	0.005	0.002	2.206	0.028
France	0.007	0.002	3.445	0.000
Germany	0.014	0.002	6.428	0.000
Italy	0.009	0.002	4.711	0.000
Japan	0.012	0.002	5.633	0.000
United Kingdom	0.003	0.001	2.867	0.004

Note: The regression for each country reflects the equation $q_t = \alpha + \beta(r_t - r_t^*)$. Results are based on quarterly data for the period between 1973Q2 and 2015Q2. The data for Italy begin only in 1978Q4.

Source: Authors' calculations.

We begin with nominal exchange rates, because they frame the public perception of currency values. Panel a in figures 8.1 to 8.6 depicts the nominal exchange rate for the other G-6 currencies against the dollar. For all of the European currencies, March 1985 is a very clear peak of dollar strength, with no comparable episodes within 10 years before or after.[10] Of course, the franc, mark, and lira were joined in the exchange rate mechanism (ERM) at the time and so did not float independently. For Japan the dollar had been strong for some time, having reached comparable values in the late 1970s, 1980, and 1982; it never saw comparable strength against the yen after February 1985. Even Canada, which was not part of the Plaza narrative, faced a historically strong dollar that year, although the Canadian dollar would remain weak for another year, before declining in March 1986.

Adjusting for prices makes 1985 stand out more prominently. Panel b in figures 8.1 to 8.6 presents the log of the real exchange rates. For the European countries, even extending the euro countries forward in a composite series for France, Germany, and Italy, March 1985 is an absolute maximum in the post–Bretton Woods era. For Japan February 1985 becomes an absolute maximum, although the real yen had been weak since 1982. In real terms the second quarter of 1995 also stands out for an extremely strong yen, almost of the magnitude of 10 years earlier.

Panel b also includes the predicted exchange rates from the real interest differential models. The predicted values derive from the results of the regressions of equation 8.2, presented in table 8.1. The coefficients for the real interest differential have the proper sign at high levels of significance, indicating that higher relative interest rates strengthen a country's exchange rate. The coef-

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10. There may be some discrepancy between the peaks for monthly average and daily data. For instance, Germany's daily peak occurred on February 25.
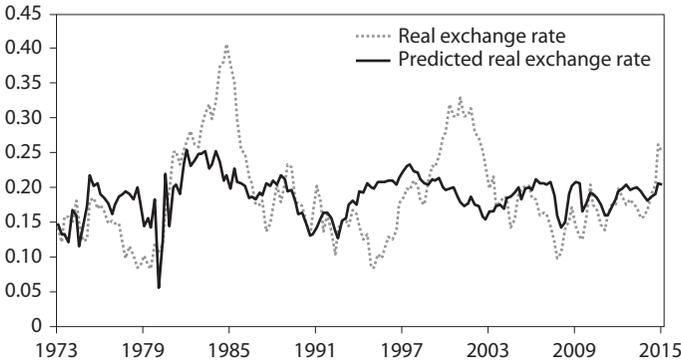
Figure 8.1   Nominal, actual real, and predicted real deutsche mark/US dollar exchange rates, 1973Q2–2015Q2

a. Nominal deutsche mark/US dollar exchange rate (log)
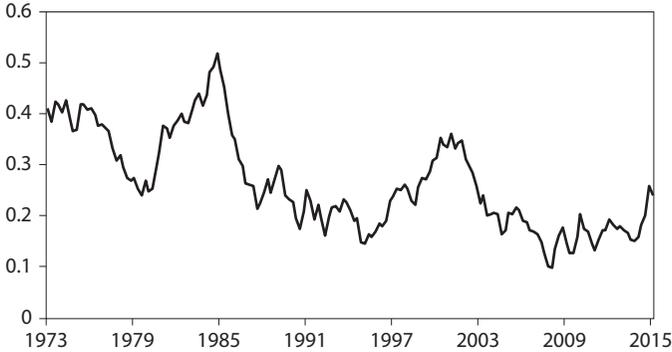
Source: Pacific Exchange Rate Service.

b. Actual and predicted real deutsche mark/US dollar exchange rate (log)
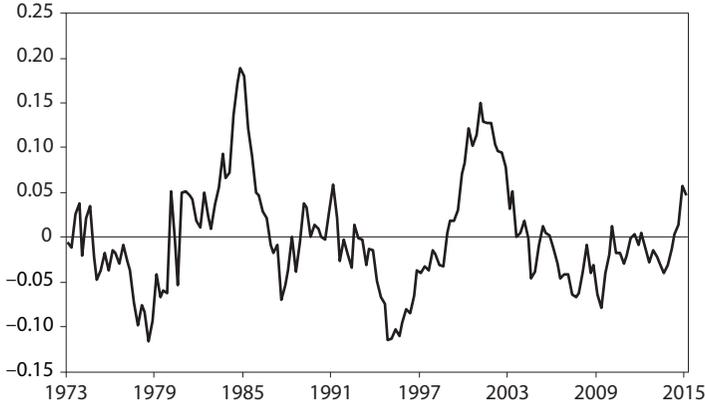

Source: Authors' calculations.

(figure continues)

ficients are consistent with the ones Engel (2015) finds using a vector error correction model and forecasted future inflation rates. The explanatory power of our model is low, however, with the possible exception of Germany. This is apparent in figures 8.1 to 8.6, as real exchange rates display much greater volatility than real interest differentials would predict.

The wide difference in volatility means that our key indicator, the regression residuals, or the deviation of the real exchange rate from the rate predicted by real interest differentials, broadly reflects the same pattern as the real interest rate. Panel c in figures 8.1 to 8.6 presents this measure. Once again March 1985 stands out as having the largest dollar overvaluation relative to the European countries in the post–Bretton Woods period. For Germany, France, and Italy,

c. Deviations of actual from predicted real deutsche mark/US dollar exchange rate (log)
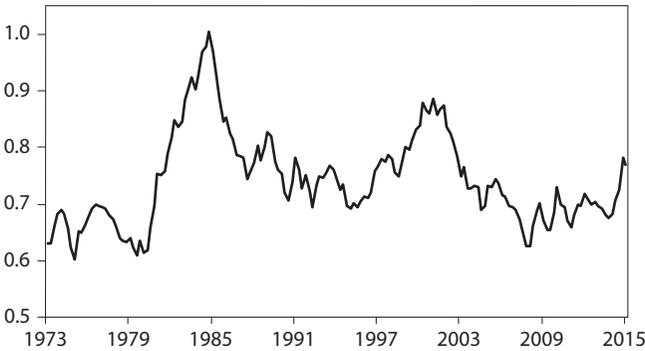

Source: Authors' calculations.

however, the euro weakness in 2000–2001 presents another period of similar dollar strength, with a peak in the second quarter of 2000 of comparable magnitude to that seen in the days before the Plaza. For the United Kingdom the 2000–2001 period of dollar strength is visible but not especially pronounced.

Outside Europe the deviations continue to show that 1985 was an outlier, though perhaps not as unique as for the Europeans. The dollar had experienced episodes of strength against the yen for a decade, with February 1985 representing only a local maximum within an episode that had begun in 1982. The dollar weakness 10 years later, in the second quarter of 1995, emerges as the largest single episode of dollar-yen misalignment. In Canada the deviations draw out the strength of the dollar in the pre-Plaza period, with a local maximum in the first quarter of 1985 and a decline beginning in the fourth quarter of 1985. Although the maximum is not an all-time high for the US dollar against the Canadian dollar—and Canada is not conventionally part of the Plaza-Louvre narrative—at the time it was the highest point in the post–Bretton Woods period.

Unmentioned thus far is the obvious fact that the Plaza meeting took place six to seven months after the peak of dollar overvaluation. The beginning of the decline coincided with Secretary Baker taking office at the Treasury in early February; Frankel (1994) dates the policy switch to that time. Nevertheless, it seems unlikely that markets would have anticipated the Plaza. Surprise was central to the planning of the Plaza (see chapter 3). It remains an open question whether the entire post-Plaza decline of the dollar resulted from the Plaza, whether the Plaza only accelerated the decline for a brief period, or something in between.
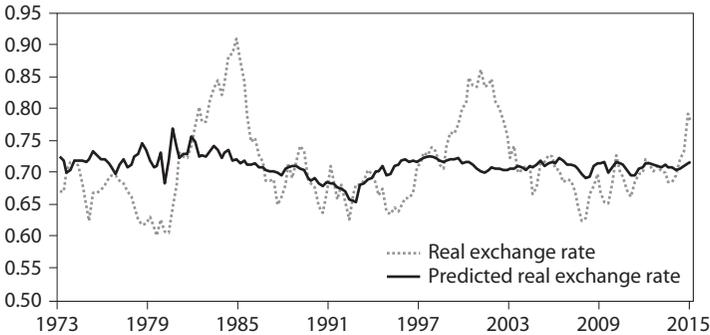
**Figure 8.2 Nominal, actual real, and predicted real franc/
US dollar exchange rate, 1973Q2–2015Q2**

a. Nominal franc/US dollar exchange rate (log)

b. Actual and predicted real franc/US dollar exchange rate (log)

(figure continues)

Consistency of Intervention with Monetary Policy

We now turn from the question of why the G-5 intervened in 1985 to the question of why that intervention appeared effective. For this exercise we narrow our focus to the G-3 (the United States, Germany, and Japan), in whose currencies the Plaza intervention was planned. The intention is to identify the signaling or coordination channel content of intervention, as perceived in real time by the monetary authorities, central bankers, and market participants. We focus on the question of whether intervention was consistent with the intentions of the central bank, a factor critical for the effectiveness of sterilized intervention.[11]

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11. There is a difference between sterilized intervention consistent with monetary policy and unsterilized intervention. In practice nearly all intervention by major economies is immediately

**Figure 8.2 Nominal, actual real, and predicted real franc/
US dollar exchange rate, 1973Q2–2015Q2**
(continued)

c. Deviations of actual from predicted real franc/US dollar exchange rate (log)
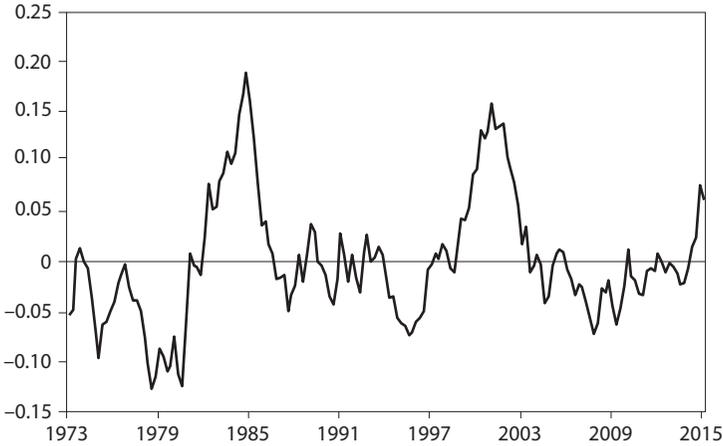
Source: Authors' calculations.

The need for policy consistency relates to the need for credibility of sterilization, pointed out in King's (2003) survey of intervention effectiveness. For intervention to work through signaling or coordination channels, the message about future monetary policy or a broader set of fundamentals that influence exchange rate values must be credible. Consistency of intervention with monetary policy provides credibility.

Furthermore, although they have done so, central banks do not like intervening when doing so is inconsistent with their monetary policy objectives. Truman (2003) calls the risk that inconsistent intervention will damage central bank credibility on the inflation front "signal risk." He and Bordo, Humpage, and Schwartz (2010) document how this concern led the Federal Reserve in 1990 to unilaterally stop the practice of joining the US Treasury Department in US intervention. The desire to avoid signal risk is another reason why monetary policy consistency provides a useful indicator of policy space for intervention.

For this purpose we need a measure of consistency with monetary policy available in real time with at least quarterly frequency. A target policy rate predicted by a Taylor rule using real-time data meets this requirement. Although the Taylor rule does not perfectly predict policy rates—many more subtle factors influence central banks' decisions than the arguments of the Taylor rule—

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sterilized, leaving open the question at the time of intervention of whether monetary policy will move consistently with the intervention. In contrast, unsterilized intervention is a form of monetary policy that should be immediately recognizable by the lack of central bank action to sterilize.
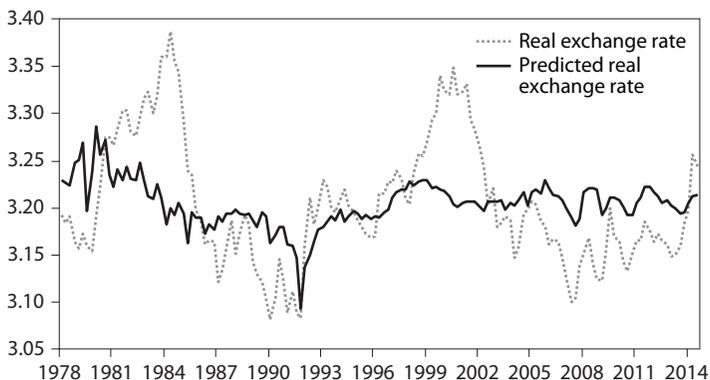
Figure 8.3 Nominal, actual real, and predicted real lira/US dollar exchange rate, 1978Q4–2015Q2

a. Nominal lira/US dollar exchange rate (log)
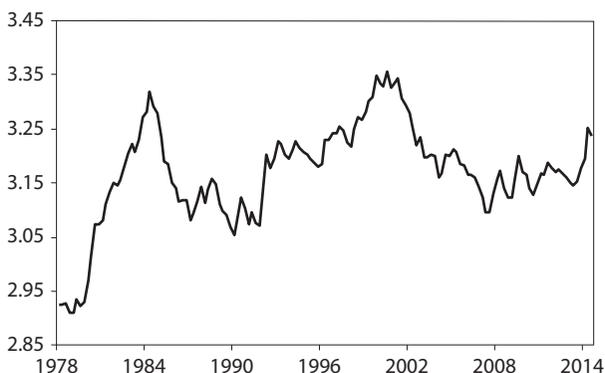
Source: Pacific Exchange Rate Service.

b. Actual and predicted real lira/US dollar exchange rate (log)

Source: Authors' calculations.

(figure continues)

the rule's broad success at predicting policy rates makes it a reasonable proxy. In this section we shift the analysis back to nominal measures, as is standard for Taylor rule analysis.

Taylor (1993) originally proposed the following monetary policy rule:

$$i_t^* = \pi_t + \delta(\pi_t - \pi_t^*) + \gamma y_t + r^* \tag{8.3}$$

where i_t^* is the central bank's target level of the short-term nominal interest rate, π_t is the inflation rate, π_t^* is the central bank's target level of inflation, y_t is the output gap (the percent deviation of actual real GDP from an estimate of

**Figure 8.3   Nominal, actual real, and predicted real lira/
US dollar exchange rate, 1978Q4–2015Q2**
(continued)

c. Deviations of actual from predicted real lira/US dollar exchange rate (log)
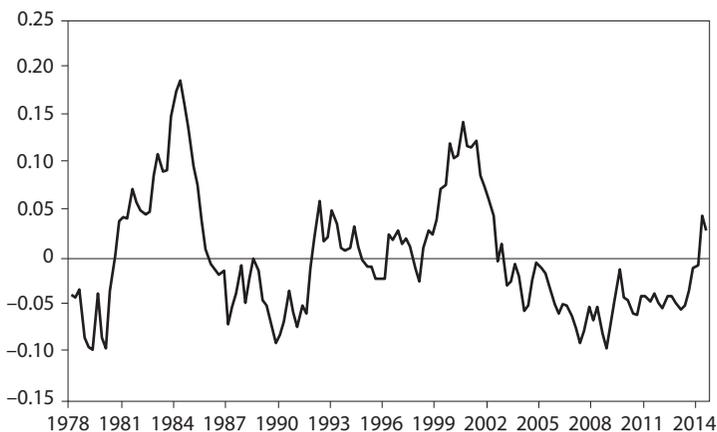
Source: Authors' calculations.

its potential level), and r^* is the equilibrium level of the real interest rate. Taylor postulated that the output and inflation gaps enter the central bank's reaction function with equal weights of 0.5 ($\delta = \gamma = 0.5$) and that the equilibrium level of the real interest rate and the inflation target were both equal to 2 percent, producing the following equation:

$$i_t^* = 1.0 + 1.5\pi_t + 0.5y_t. \tag{8.4}$$

We define deviations as the difference between the actual federal funds rate and the interest target implied by the Taylor rule with the above coefficients. A positive deviation of the observed federal funds rate from the Taylor rule rate can be interpreted as providing the central bank with policy space to raise the interest rate if it wanted to appreciate its currency. In this case sterilized intervention to appreciate the currency (sales of foreign exchange reserves in exchange for domestic currency, combined with using the domestic currency for offsetting open market purchases of domestic assets) would be viewed as consistent with domestic monetary policy objectives.

We apply this specification of the Taylor rule to the G-3 economies (figures 8.7–8.9). Taylor originally proposed the parameters with the Federal Reserve in mind. Gerberding, Seitz, and Worms (2005) and Clausen and Meier (2005) use real-time data to establish the rule's suitability for Germany as well. For Japan Bernanke and Gertler (1999) and Ito and Mishkin (2006) support an inflation target of 2 percent. Kamada (2005) prefers a Taylor rule with an inflation target of zero, which effectively shifts the implied interest rate up by
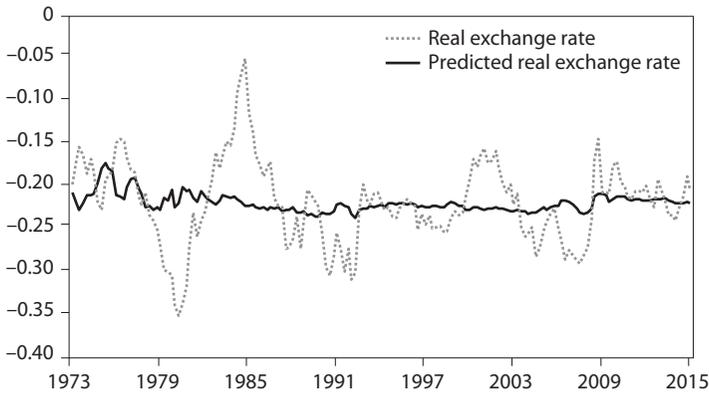
Figure 8.4 Nominal, actual real, and predicted real pound/ US dollar exchange rate, 1973Q2–2015Q2

a. Nominal pound/US dollar exchange rate (log)
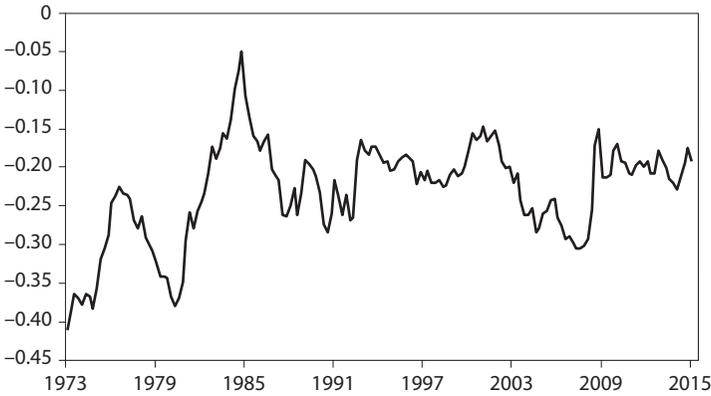
Source: Pacific Exchange Rate Service.

b. Actual and predicted real pound/US dollar exchange rate (log)
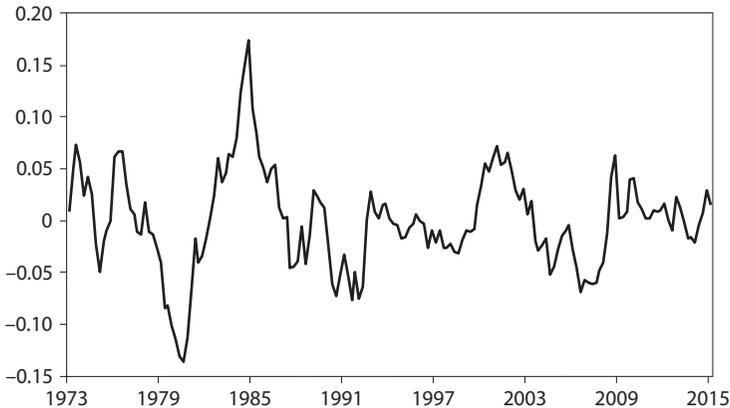

Source: Authors' calculations.

(figure continues)

1 percentage point relative to the standard parameterization. For the purposes of analyzing the Plaza period, the choice of inflation target makes no difference, as we show that the deviation exceeds 1 percentage point in 1985.[12]

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12. In their benchmark work using revised data, Clarida, Gali, and Gertler (1998) find a significant coefficient for the real exchange rate in the German and Japanese Taylor rules, potentially complicating the relationship between misalignment and monetary policy–consistent intervention. However, the coefficient is small. Adding a comparable term to our Taylor rule does not affect the implied interest rates.

**Figure 8.4   Nominal, actual real, and predicted real pound/
US dollar exchange rate, 1973Q2–2015Q2**
(continued)

c. Deviations of actual from predicted real pound/US dollar exchange rate (log)

Source: Authors' calculations.

The implied Taylor rule interest rate is calculated from data on inflation and the output gap. We limit our analysis to data from the first quarter of 1980 to the fourth quarter of 1989, the period surrounding the time of the Plaza-Louvre Accords. For the United States, we use the Real-Time Data Set for Macroeconomists, originated by Croushore and Stark (2001) and maintained by the Philadelphia Fed. It contains vintages of nominal and real GDP (GNP before December 1991) from the fourth quarter of 1965, with the data in each vintage extending back to the first quarter of 1947. For Japan we use the international real-time dataset compiled by Fernandez, Koenig, and Nikolsko-Rzhevskyy (2011), which contains vintages of nominal and real GNP with the data in each vintage extending back to the first quarter of 1968.[13] For Germany we use the real-time dataset compiled by Gerberding, Seitz, and Worms (2005), which includes real and nominal output, the Bundesbank's own estimates of potential output, and the GDP deflator.[14]

To construct the output gap (the percentage deviation of real GDP from potential GDP) for the United States and Japan, we must detrend the real GDP data. We use real-time detrending, where the trend is calculated from the first quarter of 1947 through the vintage date for the United States and from the first quarter of 1968 for Japan. The three leading methods of detrending are linear, quadratic, and Hodrick-Prescott (HP). For the United States, Nikolsko-

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13. Their dataset was assembled from the original OECD Main Economic Indicators, available for 1962–98, which was merged with the current OECD real-time dataset, which starts in 1999.

14. For details about this dataset, see Molodtsova, Nikolsko-Rzhevskyy, and Papell (2008).
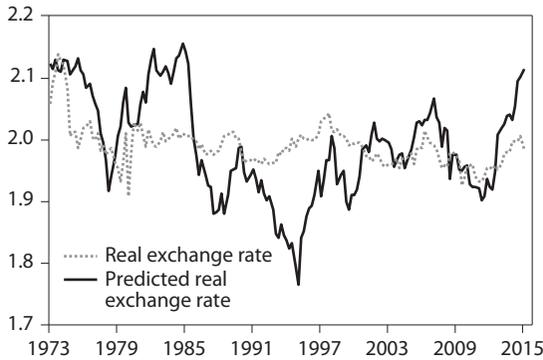
Figure 8.5   Nominal, actual real, and predicted real yen/US dollar exchange rate, 1973Q2–2015Q2

a. Nominal yen/US dollar exchange rate (log)

Source: Pacific Exchange Rate Service.

b. Actual and predicted real yen/US dollar exchange rate (log)

.... Real exchange rate
———— Predicted real exchange rate
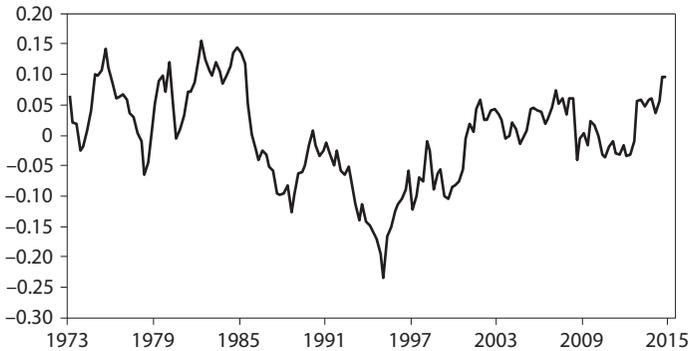
Source: Authors' calculations.

(figure continues)

Rzhevskyy, Papell, and Prodan (2014) find that quadratic detrended output gaps provide a closer approximation to benchmark real-time output gaps calculated using Okun's Law and a better representation of the recovery from the Great Recession than the alternatives. On this basis they suggest that quadratic detrending is the preferred method.

For Japan we also compute the quadratic detrended output gaps from the fourth quarter of 1980 through the fourth quarter of 1989. During this period the measure corresponds with all three of Japan's official business cycle turning points, as determined by the Cabinet Office. Most important for this chapter, it corresponds well with the peak of the Japanese business cycle in the second quarter of 1985, when we find a real-time output gap of 3.3 percent. Previous

**Figure 8.5   Nominal, actual real, and predicted real
yen/US dollar exchange rate,
1973Q2–2015Q2** *(continued)*

c. Deviations of actual from predicted real yen/US dollar exchange rate (log)

Source: Authors' calculations.

studies, using real-time and revised data and an HP filter, find an output gap
that falls between 0 and 1 for the same period.[15] Such low output gap values
at the peak of the cycle suggest that the quadratic detrending method is more
accurate than the HP detrending method for Japan. For Germany the output
gap is simply the difference between real and potential GDP, so no detrending
is necessary. For all countries we construct inflation rates as the year-on-year
change in the GDP deflator, the ratio of nominal to real GDP.

Figure 8.7 displays the actual federal funds rate and the original Taylor
rule–implied interest rates for the United States, as well as the deviations from
the original Taylor rule, for 1980–89. It shows that Taylor rule deviations were
positive throughout the Plaza-Louvre period. Positive deviations at that time
are consistent with other Taylor rule findings using revised (Clarida, Gali,
and Gertler 1998) or real-time (Orphanides 2003) data. The positive devia-
tions during the Volcker disinflation period preceding the Plaza Accord were
atypical of the US historical experience of negative deviations during most of
the 1970s and 2000s and small deviations during the Great Moderation of
the late 1980s and 1990s, as Nikolsko-Rzhevskyy, Papell, and Prodan (2015)
show.

We can also look in detail at what happened with rates around the Plaza
Accord. The Federal Reserve had been easing interest rates back into the single
digits since 1984, but it stopped easing in mid-1985. The target rate edged up

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15. Kamada (2005), using an HP filter, finds a real-time output gap of 1 percent. Using an HP
filter with revised data, Haltmaier (2001), Hirose and Kamada (2003), Kamada (2005), Urasawa
and Seitani (2008), Hirose and Naganuma (2010), and Yamada and Jin (2012) find values for the
output gap that fall between 0 and 1 percent. The only exception to this pattern is the *World
Economic Outlook* estimate of –0.5 percent (IMF 2015).
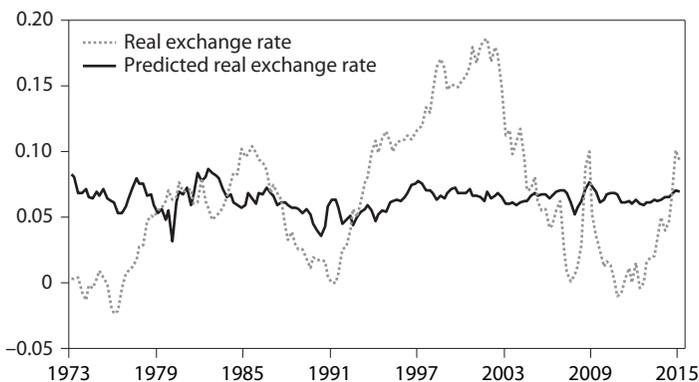
**Figure 8.6   Nominal, actual real, and predicted real
                Canadian dollar/US dollar exchange rate,
                1973Q2–2015Q2**

a. Nominal Canadian dollar/US dollar exchange rate (log)
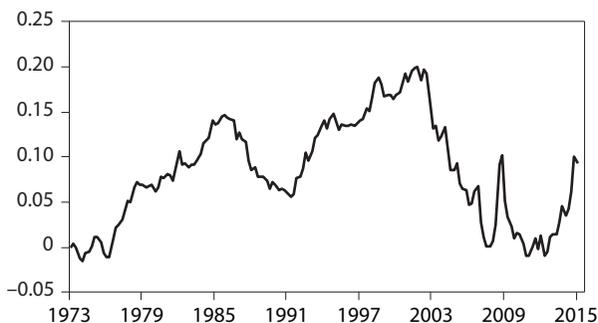
Source: Pacific Exchange Rate Service.

b. Actual and predicted real Canadian dollar/US dollar exchange rate (log)

Source: Authors' calculations.

(figure continues)

slightly from 7.75 percent on May 20, 1985, to 8.0 on September 6, and the
effective federal funds rate rose from 7.5 to 7.9 percent.[16] The Taylor rule sug-
gests loosening rates by 0.4 percent over this period because of a drop in the
output gap and a minor decline in inflation.

By December the effective federal funds rate had tightened to 8.3 percent,
despite the fact that the federal funds target had edged back to 7.75 percent

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16. At this time the Federal Open Market Committee established 4–percentage point bands for
the federal funds rate, so the target rate comes from the Federal Reserve Bank of New York that
administered the band (see www.newyorkfed.org/markets/statistics/dlyrates/fedrate.html).

Figure 8.6   Nominal, actual real, and predicted real Canadian dollar/US dollar exchange rate, 1973Q2–2015Q2 *(continued)*

c. Deviations of actual from predicted real Canadian dollar/US dollar exchange rate (log)
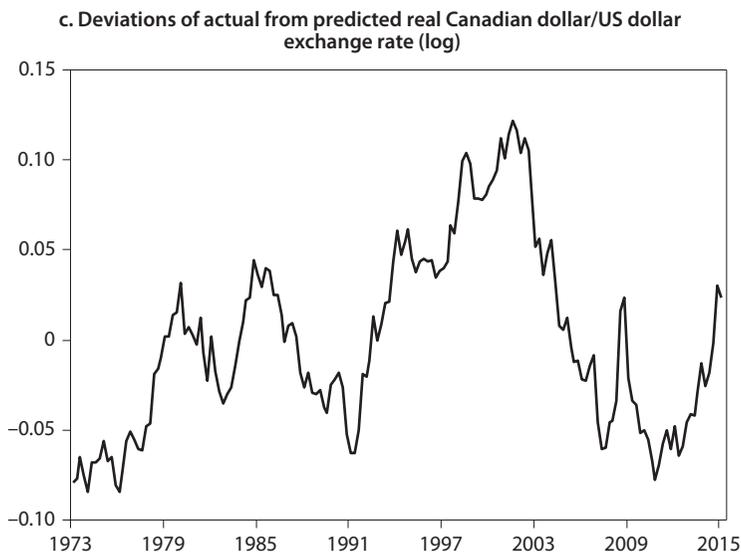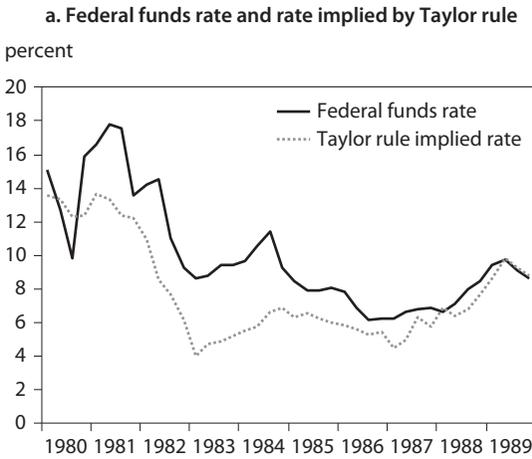

Source: Authors' calculations.

on December 18. The decline in the policy rate matches the suggestion of the Taylor rule to reduce rates by 0.2 percent. Indeed, the Fed went on to continuously lower target rates until the rate reached 5.875 percent at the end of 1986. So while the Taylor rule was suggesting interest rates 1.5–2.0 percentage points below the effective rate in 1985, US intervention during the fourth quarter of 1985 forecast a resumption of monetary policy loosening as it moved closer to the rate implied by the Taylor rule.

The results for Germany do not comport as nicely with the hypothesis. The Taylor rule–implied rate and the money market rate track fairly closely, but they reveal large, sustained positive deviations in the early 1980s, similar to the United States (figure 8.8). Where the rate does deviate, such as in the early 1980s, it roughly matches previous results using revised (Clarida, Gali, and Gertler 1998) or real-time (Gerberding, Seitz, and Worms 2005) data.

Most important for this study, the Taylor rule lies below the money market rate, which we interpret to mean that the Bundesbank did not have policy space for intervention to weaken the dollar. Indeed, the Lombard rate was cut by half a percentage point in August 1985 and not moved until the start of 1987. However, the Bundesbank reduced the deviations between the key money market interest rates and the Taylor rule–implied rate to zero between the fourth quarter of 1984 and the second quarter of 1986, with money market rates falling until the first quarter of 1988. Rates moved consistently with the

Figure 8.7 Deviations from the Taylor rule in the United States, 1980–89

a. Federal funds rate and rate implied by Taylor rule

percent

Legend:
— Federal funds rate
⋯⋯ Taylor rule implied rate

Source: Federal Reserve Economic Data (FRED) at the Federal Reserve Bank of St. Louis.

b. Deviation of actual rate from rate implied by Taylor rule

percent
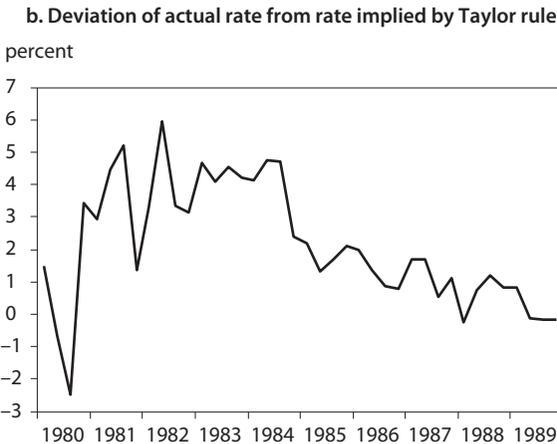
Source: Authors' calculations.

Taylor rule, helping validate its use as an indicator of the direction of monetary policy at this time.

The interest rate differential is an important factor determining the exchange rate, as discussed in the previous section. If the foreign Taylor rule suggests that foreign rates would fall more slowly than US rates, foreign monetary policy could still be interpreted as consistent with dollar weakening. In 1985 overnight money market rates in Germany were below the federal funds rate, with the differential growing steadily over the year, from 2.75 to 3.5 percentage points. Because of lower inflation and a much more negative output

Figure 8.8 Deviations from the Taylor rule in Germany, 1980–89

a. Money market rate and rate implied by Taylor rule
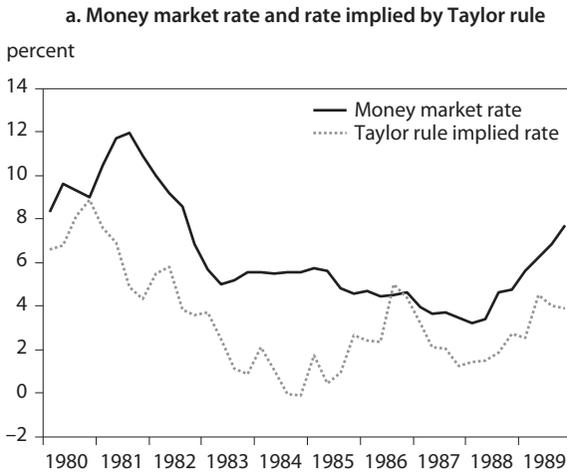
percent

Source: IMF, *International Financial Statistics* database (line 60B).

b. Deviation of actual rate from rate implied by Taylor rule
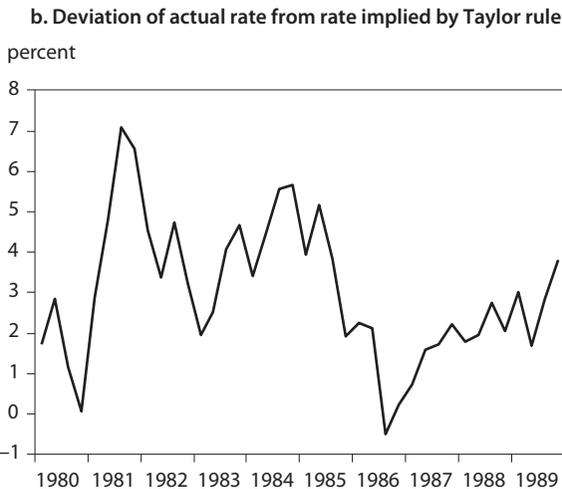
percent

Source: Authors' calculations.

gap in Germany, the differential in the Taylor rule–implied rates was much larger than the observed differential, hitting 6.1 percentage points in the second quarter of 1985.

In the third quarter of 1985, however, output improved in Germany and softened in the United States, shrinking the Taylor rule–implied differential. In the next four quarters, the Taylor rule–implied differential continued to fall on the back of strengthening German growth and inflation and persistent

softening of US inflation. The change was not a mere blip; the actual nominal interest rate differential fell as well throughout 1986.

For Japan the Taylor rule–implied rate presents a fairly tight fit after 1980 to the overnight call rate targeted by the Bank of Japan, though it too exhibits a large, sustained positive deviation in the early 1980s (figure 8.9). The Taylor rule rates correspond with previous results using real-time data (Kamada 2005).[17] For our period of interest, the deviation of the call rate and the Taylor rule rates declines from the first quarter of 1984 through the second quarter of 1985, suggesting that the Taylor rule provides some guidance for the direction of monetary policy during the Plaza.

As with the United States and Germany, Japanese interest rates were well above the Taylor rule–implied rates throughout 1985. Positive deviations suggest that Japanese participation in the Plaza intervention was not consistent with the presence of policy space for monetary policy. The Bank of Japan did not heed the Taylor rule, however, allowing the call rate to rise through the second half of 1985, perhaps in support of the intervention. Real-time data showed inflation falling in the final quarter, however, so the Taylor rule–implied interest rate dropped, causing the deviation to grow in the fourth quarter of 1985. The next move of the official discount rate did not come until January 1986, when it was lowered by half a percentage point. Inflation picked up in Japan that year, but the Bank of Japan continued to ease rates. As a result, for 1986 and most of 1987 the call rate converged to the Taylor rule.

In the third quarter of 1985, as the G-5 began intervening, rates in Japan were lower than in the United States. As Japanese call rates rose that quarter, the nominal rate differential moved to support the direction of intervention. Inflation ticked up in Japan that quarter while US output softened, so the Taylor rule–implied interest rate differential moved in the same direction as the nominal differential. However, as intervention continued into the fourth quarter, the two differentials diverged. The nominal differential supported the intervention, but the Taylor rule–implied differential moved in favor of dollar strengthening. For the next five quarters, the Taylor rule–implied differential suggests growing policy space in support of a weakening dollar, but with the Bank of Japan cutting rates the observed nominal differential did not favor a weakening dollar.

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17. As Ito and Mishkin (2006) point out, there is disturbingly little consistency in the Taylor rule–implied interest rates estimated for Japan in the mid-1980s. Findings vary significantly, depending on the estimation period, the measure of output gap, and the estimation method (Kamada 2005 and Miyazawa 2011 illustrate the variety of results). Looking only at 1985, Clarida, Gali, and Gertler (1998) find no significant gap. Several studies that attempt to follow the Clarida, Gali, and Gertler methodology find positive gaps in 1985 (Bernanke and Gertler 1999, Okina and Shiratsuka 2002, Miyazawa 2011, Wilde 2012).

Figure 8.9   Deviations from the Taylor rule in Japan, 1980–89

a. Money market rate and rate implied by Taylor rule

percent
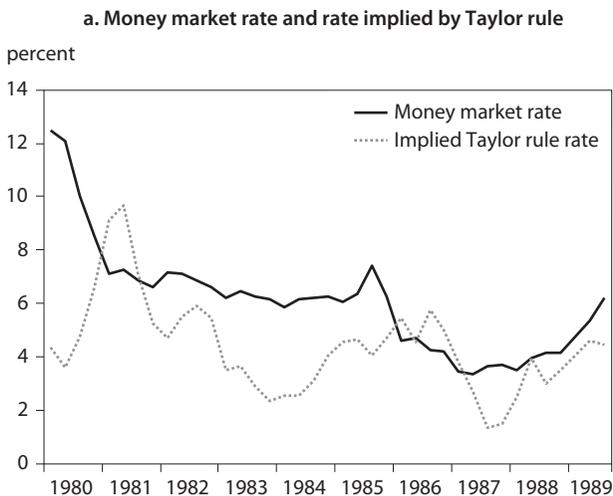
Source: Data from the Organization for Economic Cooperation and Development.

b. Deviation of actual rate from rate implied by Taylor rule

percent
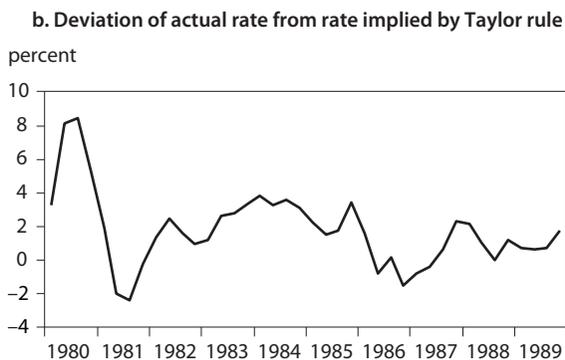
Source: Authors' calculations.

Discussion

It is uncontroversial to observe that the overvaluation of the dollar at its peak in the first quarter of 1985 was unprecedented in the post–Bretton Woods era. We document the overvaluation by examining the real exchange rate relative to a rate implied by the real interest rate differential. Other chapters in this volume provide more detail on the general point we aim to make: that such a large overvaluation provides the necessary motivation for policymakers to attempt a difficult act like coordinated exchange rate intervention. Fortunately, such large misalignments of the dollar against other major currencies are rare. Against the European currencies examined here, 1985 was the largest single

episode of real misalignment seen under floating exchange rates, with or without adjusting for interest rate differentials. The degree of misalignment helps explain the uniqueness of the Plaza Accord.

Of course, the dollar turned around in the first quarter of 1985; the US real exchange rate adjusted for interest rate differentials had depreciated by almost 20 percent in September relative to its peak. Why was the urgency not gone by then? As noted by others in this volume, the US Congress was actively considering protectionist trade measures. While the depreciation would certainly have helped their constituents, the *J*-curve effect imposes a long lag between movements in the real exchange rate and the political pressure to help producers of tradable goods. Not until a year after the Plaza did US industry begin to feel the impact of the dramatic reversal in the exchange rate (Feldstein 1994); not until the time of the Louvre Accord would it have started to make a difference. Funabashi (1989) documents that political pressure from Congress supported US Treasury negotiations on exchange rate policy throughout this period.[18]

Examination of Taylor rule–implied interest rates reveals one potential source of impact. The chapters in this volume by David Mulford (chapter 3), Jeffrey Frankel (chapter 6), Joseph Gagnon (chapter 11), and Fred Bergsten (chapter 14) note that the major policy change that affected the foreign exchange market came from the United States. In chapter 7 Takatoshi Ito cites findings from his research (Ito 1987) that most of the exchange rate movement in the first month after the Plaza Accord occurred in New York, which he interprets as evidence that markets were responding primarily to the US policy change. Our evidence is consistent with this interpretation. The United States was the only G-3 country with policy space to intervene consistently with monetary policy, as measured by the deviation of target short-term rates from the Taylor rule–implied interest rate, as both Germany and Japan shared the large, sustained positive Taylor rule deviation with the United States throughout most of the early 1980s.

It can be argued, however, that the Taylor rule–implied interest differential was consistent with the Plaza intervention for both currency pairs. Both declined going into the third quarter of 1985, suggesting greater policy space for the Bundesbank and the Bank of Japan to cut rates more slowly than the Fed. This type of policy space is a weaker standard for monetary policy consistency, as it does not resolve the purely domestic policy inconsistency. (Unsterilized sales of dollars by foreign central banks would move foreign interest rates upward, while the Taylor rule indicates policy space for cutting rates.) In fact, the Bundesbank did subsequently reduce rates slowly enough to close the interest differential, though the Bank of Japan did not.

To the extent that there was a signaling or coordination channel propelling the dollar downward after the Plaza, it was primarily a US story. The coor-

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18. In nominal terms the dollar fell until the end of 1988, depreciating another 37 percent against the mark and 48 percent against the yen beyond the decline it experienced before the Plaza.

dinated nature of the Plaza helped amplify the signal from the United States, making it appear more credible and durable. In addition, the US Treasury wanted to leverage its policy change to extract concessions from Japan and Germany (Funabashi 1989). The combination of fiscal stimulus in Germany and Japan and discipline in the United States noted in the Plaza communiqué were also consistent with a weaker dollar. One can speculate about whether the impact would have been similar if the United States had made a Plaza-type announcement unilaterally.

The synchrony of large positive deviations from the Taylor rule in all three countries in this period may be no coincidence. Presumably, the large US deviation at this time reflected Paul Volcker's effort to rebuild the Federal Reserve's inflation-fighting credibility. Rates in the other two economies may have been pulled above Taylor rule–implied rates in order to resist the pace of dollar appreciation. Hutchison (1988) and Glick and Hutchison (1994) show empirically that attempts to stabilize the exchange rate against the dollar influenced Bank of Japan monetary policy from 1975 until the Plaza. Clarida, Gali, and Gertler (1998) and Molodtsova, Nikolsko-Rzhevskyy, and Papell (2008) find the same result for the Bundesbank starting in 1979; Bundesbank data show consistent intervention to weaken the dollar from the first quarter of 1981 until the first quarter of 1985.

After the Plaza Accord provided assurance of the direction of the dollar, both the Bundesbank and the Bank of Japan appeared to take advantage of their policy space to lower rates, despite the fact that doing so worked against continued dollar weakness. The Taylor rule deviation closed for both economies by the middle of 1986.

As the Taylor rule deviations for all three countries moved closer to zero in 1986 and 1987, the language of various communiqués shifted emphasis toward currency stability. The Louvre Accord of February 1987 exemplifies this shift most effectively. The negotiating tactic of the US Treasury was to elicit more economic stimulus from Germany and Japan in exchange for US support for putting a floor beneath the falling dollar. In terms of policy consistency, however, the United States' push for economic stimulus sent mixed messages about how exchange rates should move.

The US Treasury wanted lower rates in all three countries. To the extent that all three lowered equally, differentials would not change, so monetary policy would not be inconsistent with (but also not supportive of) stopping the dollar's fall. The central banks paid significant attention to moving rates in step together, though synchrony did not always happen (Funabashi 1989, Volcker and Gyohten 1992).

In contrast, fiscal policy goals were explicitly inconsistent with exchange rate objectives. They had remained unchanged from the Plaza Accord: fiscal stimulus in Germany and Japan and greater discipline in the United States. Textbook macroeconomic models indicate that this pattern of fiscal policy change should cause the dollar to fall further. Had the G-3 countries been more successful at implementing their fiscal commitments, fiscal policy might

have been a reasonable explanation for why the Louvre Accord was not more effective at halting the decline of the dollar. Funabashi's (1989) interpretation of contemporary market reports indicates the opposite. The lack of progress on the fiscal agenda helped cause the dollar to fall during this period.

The dollar is, of course, strong again. Our measure of overvaluation indicates that it rose about 10 percent in real terms against the euro and Canadian dollar and 15 percent against the yen through the second quarter of 2015. Against the euro, the pace of real appreciation implies that the dollar will hit the 1985 peak within 2.5 years. The level of dollar overvaluation against the yen is already approaching the peaks witnessed in 1985. The pace of nominal yen appreciation slowed in the second half of 2015, but the previous pace of appreciation was rapid.

A strong dollar at the 30th anniversary of the Plaza naturally raises questions about the desirability of a similar agreement today. All three G-3 central banks (with the European Central Bank [ECB] now replacing the Bundesbank) have hit the zero lower bound for short-term interest rates. In order to be consistent with monetary policy, a coordinated intervention to weaken the dollar would require the ECB and Bank of Japan to raise interest rates; it is inconceivable that either institution would agree to higher interest rates in order to strengthen their currencies. By the end of 2015, monetary policy in the United States was moving, albeit slowly, toward tightening; intervention to take the steam out of the dollar would not be consistent with monetary policy. Furthermore, the prospects for enacting fiscal policy changes consistent with a weakening dollar appear similar to what they were 30 years ago, with a lack of fiscal space in Japan, gridlock in the United States, and conservative fiscal preferences in Germany. For the moment, at least, we should not expect another Plaza Accord.

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