The Reaction of Interest Rates to the Employment Report: The Role of Policy Anticipations

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Participants in the financial markets have been intensely interested in the monthly employment report in recent years. Interest rates have frequently changed sharply following the report, and the report appears to have strongly influenced market expectations of Federal Reserve policy actions. The employment report for November 1988, for example, indicated that nonfarm payroll employment had risen by 463,000, which was well above the increase expected by market participants of about 255,000. The *Wall Street Journal*'s financial market story the following day reported that "the Federal Reserve is likely, in light of November's strong employment figures, to decide to raise short-term interest rates at its policy meeting December 14." Treasury bill rates rose about 25 basis points the day of the employment report, and the *Journal* subsequently reported that the Fed raised its target for the federal funds rate on December 15.

As this example suggests, many market participants believe that Federal Reserve policy actions in recent years have been more closely linked to the employment report than in previous years and that the reaction of rates to the report at least partly reflects this link. According to this view, after the Fed deemphasized the monetary aggregates in the early 1980s, it began to place relatively greater emphasis on current economic conditions. The monthly employment report provides an early, comprehensive reading on the economic conditions of the previous month.

The idea that market participants' reaction to economic news is influenced by their expectations of the Federal Reserve's response to the news has been called the "policy anticipations hypothesis."[1] According to this view, the Federal Reserve makes periodic changes in its target for the federal funds rate in response to new information, and these changes are highly persistent and seldom quickly reversed. Treasury bill rates, like other longer-term rates, are linked to current and expected levels of the federal funds rate in accordance with the expectations theory of interest rates. Consequently, the reaction of bill rates to economic news depends on how market participants expect the Fed to move its target for the funds rate in reaction to this news. This view implies that as the economic and monetary variables influencing the Fed's policy decisions change, so should the market reaction to the announcement of new information on these variables.[2]

In this paper we examine the reaction of interest rates to the employment report since the mid-1980s and find that it has been significant. We then look at the reaction of interest rates to the employment report over a longer period of 20 years and find that, consistent with the policy anticipations hypothesis, the reaction in recent years has been considerably stronger than it used to be. In the final part of the paper we illustrate in more detail how the employment report has influenced market expectations of Fed policy actions.

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[1] This term comes from the money announcement literature, which documented the reaction of interest rates to money announcements in the late 1970s and early 1980s and proposed a number of explanations for this reaction. The most widely accepted explanation is that the reaction reflected the effect of money announcements on market participants' anticipations regarding subsequent Federal Reserve policy actions. See Dwyer and Hafer (1989) and Santomero (1991).

[2] Poole (1988) and Santomero (1991), among others, emphasize this point.

I. THE REACTION OF INTEREST RATES TO THE EMPLOYMENT REPORT SINCE 1985

The employment report for a given month is generally released on the first Friday of the following month. The most widely publicized and anticipated data in the report is the change in nonfarm payroll employment. Two other elements of the report are the unemployment rate and the revision in the previous month's employment, which can be substantial.[3] To examine the reaction of interest rates to the employment report, we collected monthly data for nonfarm payroll employment and the unemployment rate as they were *initially* reported by the Bureau of Labor Statistics in its monthly publication, *Employment and Earnings*.

We would expect interest rates to react only to the *unexpected* part of the announced changes in employment, the unemployment rate and the revision.[4] As a proxy for the market's expectations of the change in nonfarm payroll employment, we use survey data from MMS International, which are available starting in January 1985. The expectations series is the median forecast of a large group of market specialists surveyed by MMS International. The unexpected component of the employment announcement is the difference between the actual change in employment and the survey expectation. The unexpected component of the change in the unemployment rate is calculated in a similar way using survey expectations for the unemployment rate, which MMS International has collected since 1980. Survey data on expectations of the revision in employment are not available, so in the empirical work below we are unable to separate the expected and unexpected components of the revision.

In addition to general economic conditions, two factors affecting the monthly changes in nonfarm payroll employment numbers over the 1985-91 period were the number of workers on strike each month and the number of government workers collecting data for the 1990 census. The survey data on expectations are not adjusted for strikers and census workers so, in effect, the survey participants have to incorporate their knowledge about strikers and census workers into their forecasts. The employment report comes out *after* the end of the month, however, and it is probably reasonable to assume that survey participants had a good idea of the number of strikers and census workers in the month when making their forecasts. In any case, neither the actual employment numbers nor the survey expectations are adjusted for strikers or census workers, so this feature of the data presents no problem in this section of the paper.

To measure the change in interest rates following the employment report, we use the change in the three-month, six-month, and twelve-month Treasury bill rates from the afternoon prior to the report to the afternoon following the report, as provided in the Federal Reserve Board's H.15 release.[5] We examine the response of interest rates to the employment report by estimating the coefficients of the equation:

$$\begin{aligned}\Delta Rn_t = a &+ b1\Delta\text{Expected Emp}_t \\ &+ b2\Delta\text{Unexpected Emp}_t \\ &+ b3\Delta\text{Expected UR}_t \\ &+ b4\Delta\text{Unexpected UR}_t \\ &+ b5\text{Rev}_t + e_t \qquad (1)\end{aligned}$$

where ΔRn is the one-day change in the n-month Treasury bill rate surrounding the employment report, Emp is employment as initially reported, UR is the unemployment rate as initially reported, Rev is the revision in the previously reported monthly employment figure,[6] and e is an error term. The coefficients are estimated over the period from February 1985 through April 1991. The starting point for the regressions is dictated by the availability of the MMS International survey data, but as noted above it also corresponds roughly with the growing interest in the employment report among market participants as indicated by the financial press.

On three occasions in the 1985-91 period the Federal Reserve changed the discount rate on the

[3] The employment report also includes data on hourly wages and the workweek. We do not include these because we do not have expectations data for them and because they receive relatively little emphasis in accounts of the market's reaction to the employment report. See Webb (1989) for a description of the data in the employment report.

[4] The reason is that if interest rates (and, hence, security prices) reacted to the expected component of these announcements, that would imply that market participants were ignoring an easy way to make large profits.

[5] All yields are converted to a simple interest basis.

[6] We calculated the revision in employment as the difference between the initial report of the monthly level of employment and the next report of that level. This computation includes revisions in the changes in employment for all previous months. We also calculated the revision as the revised change in employment over the two most recent months. The regression results were generally similar, although the revision calculated in the latter way added less to their explanatory power.

same day as the employment report. (On March 7, 1986, the Fed lowered the discount rate by one-half percentage point; on September 4, 1987, it raised the discount rate by one-half percentage point; and on February 1, 1991, it lowered the discount rate by one-half percentage point.) Discount rate changes have well-documented effects on market interest rates. To control for these effects, we added to the regressions a variable set equal to the change in the discount rate.

The estimates of equation (1) are reported in Table 1. The estimates of the coefficients of the expected components of the changes in employment and the unemployment rate are not significantly different from zero in any of the regressions. The coefficients of the unexpected change in employment are positive and significantly different from zero at the 1 percent level in all three regressions. The coefficients indicate that over this period an unexpected increase of 100,000 in nonfarm payroll employment on average caused about a 5 to 8 basis point increase in Treasury bill rates on the day of the announcement.

The coefficients of the unexpected component of the change in the unemployment rate and the revision are significant at the 5 percent level in all the regressions, and these variables account for about one-fourth of the explanatory power of the regressions.[7] These results suggest that while market participants put greatest weight on the payroll employment figure, they also consider other aspects of the employment report in evaluating its likely effects on interest rates and monetary policy.

The coefficient of the revision in employment is about one-third of the coefficient of the unexpected component of employment in the most recent month. The coefficient on the revision is smaller for two reasons. First, market participants probably place less weight on more lagged data in evaluating the current state of the economy and the Federal Reserve's likely response to it. Second, some of the revision may be anticipated.[8]

II. The Reaction of Interest Rates to the Employment Report Prior to the Mid-1980s

While the regression results for the 1985-91 period are consistent with the policy anticipations hypothesis, they are also consistent with an alternative hypothesis called the "real activity hypothesis."[9] According to the latter hypothesis, a stronger-than-expected employment report may be signaling only that the economy is stronger than previously thought, thereby leading market participants to raise their

[7] This statement is made on the basis of a comparison of the R^2 of the regressions in Table 1 with the R^2 of unreported regressions that include as independent variables only employment or only the unemployment rate and the revision. These regression results and others mentioned but not reported in the paper are available from the authors, as are the data from *Employment and Earnings* used in the regressions.

[8] Neumark and Wascher (1991, p. 198) provide evidence that some of the revision can be forecast. They find that "incorporating other labor-market information available at the time of the release of the preliminary estimate [of nonfarm payroll employment] into a forecast equation for the first revision leads to a reduction of about 10 percent in the unanticipated component of the revision."

[9] This term also arose in the early literature on money announcements, when this hypothesis was proposed as an explanation for the reaction of interest rates to money announcements. See Cornell (1983, pp. 647-48).

Table 1

The Reaction of Interest Rates to Employment Announcements, 1985–1991

	Constant	ΔExpected Emp	ΔUnexpected Emp	ΔExpected UR	ΔUnexpected UR	Revision	Discount Rate	R^2	DW
ΔR3	0.61	−0.26	5.31	8.18	−12.83	1.71	0.20	.59	2.14
	(0.29)	(0.24)	(7.29)**	(0.68)	(2.08)*	(2.74)**	(2.15)*		
ΔR6	2.56	−1.49	6.40	1.17	−20.00	2.37	0.25	.58	2.18
	(0.95)	(1.10)	(6.87)**	(0.08)	(2.54)*	(2.96)**	(2.14)*		
ΔR12	2.57	−1.81	7.41	5.82	−20.56	2.01	0.15	.50	2.24
	(0.78)	(1.09)	(6.49)**	(0.31)	(2.13)*	(2.04)*	(1.07)		

Note: Treasury bill yields and the discount rate are in basis points, employment is in hundreds of thousands, and the unemployment rate is in percentage points. Estimation period is February 1985 through April 1991. t-statistics are in parentheses. DW is the Durbin-Watson statistic.

* denotes significant at 5 percent level and ** denotes significant at 1 percent level.

expectations of the real interest rate. Thus, a stronger-than-expected report will be associated with an increase in Treasury bill rates. Under this hypothesis, any change in the Fed's funds rate target following the report is interpreted simply as a contemporaneous reaction to the same underlying "real" shock. Hence, monetary policy anticipations cannot be said to have contributed to the rise in bill rates following the report.

The obvious way to provide evidence on which of the two hypotheses is right would be to reestimate equation (1) for the period prior to 1985. Under the policy anticipations hypothesis we would expect the reaction of interest rates to the unanticipated information in the employment report to be greater in a period when the Fed was putting greater emphasis on the report. Hence, if the coefficient of the unexpected component of the employment report were significantly greater in the period after the mid-1980s than earlier, that would be evidence that policy anticipations were affecting the market's reaction to the report. Unfortunately, we cannot conduct this exercise because MMS International did not begin to collect expectations data for nonfarm payroll employment until the beginning of 1985. But this fact in itself suggests that market participants became more interested in the employment report in the mid-1980s because they perceived it was becoming more important in the Fed's policy decisions.

Although expectations data on nonfarm payroll employment are not available before 1985, such data on a wide variety of other macroeconomic variables were collected prior to that time. Specifically, MMS International collected survey data as far back as the beginning of 1980 for industrial production, the unemployment rate, the trade balance, the producer price index, and the consumer price index. Dwyer and Hafer (1989) estimate regressions from 1980 through 1987 of changes in the 3-month Treasury bill rate and the 30-year Treasury bond rate on the unexpected component of these government statistics. They find very little evidence of an interest rate response.[10,11] In light of their finding, it seems unlikely that the strong reaction of interest rates to the unexpected component of nonfarm payroll employment since the mid-1980s results solely from the impact of this news on the market's perception of the economy.

In the absence of survey expectations for nonfarm payroll employment prior to 1985, we estimated an autoregressive time series model and used it to generate a series of proxy expectations. The steps of our procedure were as follows. (1) We used final data (i.e., the latest revised historical series) on nonfarm payroll employment to estimate an autoregressive time series model from 1955 through 1970. In this model, the logarithm of employment is first-differenced and then regressed on two lags of itself.[12] (2) We generated a forecast of the change in employment for each month (month t) from January 1971 through March 1991 using the coefficients of the time series model and the employment figures available in the previous month (month t-1) as *initially* reported in *Employment and Earnings*. (3) Prior to making these forecasts, we adjusted the initial employment data for strikers and 1990 census workers by adding the former and subtracting the latter. After making the forecasts, we subtracted strikers and added census workers to get a prediction of the actual employment numbers. In effect, we assumed that market participants knew the number of strikers and census workers prior to any month's employment announcement.[13]

As before, we subtracted forecasted from actual employment to generate a series for the unexpected component of the employment announcement. Then we estimated the regression:

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[10] Dwyer and Hafer's finding that the unexpected component of the unemployment rate did not affect interest rates in the period from 1985 through 1987 at first appears inconsistent with the regression results reported in Table 1. When we estimated the regressions from 1985 through 1987, however, the coefficient of the unexpected component of the unemployment rate was not significant.

[11] Hardouvelis (1988) examines the response of interest rates and exchange rates to 15 macroeconomic series from October 1979 to August 1984. He finds that markets respond primarily to monetary news, although he also finds some evidence that markets respond to variables that reflect the state of the economy.

[12] The estimated coefficients of this model are (t-statistics in parentheses):

$$\Delta E_t = \underset{(3.06)}{.00078} + \underset{(2.99)}{.2026}\Delta E_{t-1} + \underset{(5.59)}{.3793}\Delta E_{t-2} \qquad R^2 = .24$$

[13] The series for 1990 census workers is from the December 1990 issue of *Employment and Earnings*. The series for strikers is from the Board of Governors. The strikers series does not begin until 1968, so we were unable to use it to estimate the autoregressive model. We did, however, reestimate the model after making adjustments for the steel strikes of 1956 and 1959, which were the two major strikes of the 1955-70 period. We used the "Highlights" section of the *Employment and Earnings* reports to estimate the effects of these strikes on the monthly employment numbers and then used these estimates to reestimate the autoregressive model and generate employment forecasts. The resulting forecasts were very similar to those made without these adjustments.

$$\Delta Rn_t = a + b1\Delta\text{Expected Emp}_t + b2\Delta\text{Unexpected Emp}_t + e_t, \quad (2)$$

where expected employment is the forecast of the change in employment and unexpected employment is the difference between announced employment and this forecast.

Table 2 shows the estimates of equation (2) for seven subperiods from the beginning of 1971 through early 1991. The coefficient of the expected component of the change in employment is not significantly different from zero in any of the regressions. (Nor was the constant statistically significant in any regressions, and it is not reported in the table to conserve space.) The coefficient of the unexpected component of the change in employment is not significantly different from zero in any of the three subperiods in the 1970s. The coefficient then jumps sharply in the period from 1980 through 1982 and is highly significant. It then falls substantially in the 1983-84 period, rises again in the 1985-87 period and stays high in the 1988-91 period.[14] In the latter two periods the coefficient is significant at the 1 percent level and is only a little lower than the coefficient in comparable regressions using the survey expectations data, shown at the bottom of Table 2. These results suggest that the autoregressive time series procedure is doing a reasonably good job of mimicking market expectations.[15]

[14] We also estimated equation (2) over one-year periods, and the results were very similar to those reported in Table 2. The coefficient of the unexpected component of the employment announcement was statistically significant at the 10 percent level in only one year (1980) prior to 1984, but was significant at the 10 percent level in each of the years from 1984 through 1990. The coefficient was also significant at the 5 percent level in four of the latter years and in 1980.

[15] We did three additional exercises to check the robustness of the results reported in Table 2. First, rather than estimating the autoregressive model only once over a fixed period ending in 1970, we extended the estimation period to month t-1 prior to forecasting employment in month t. Second, we forecast employment without making the adjustments for strikers and census workers described in the text. Third, we added another lagged term to the autoregressive model. In each case the interest rate regression results were not substantially different from those reported in Table 2.

Table 2

The Reaction of Interest Rates to Nonfarm Payroll Employment Announcements, 1971–1991

	ΔR3			ΔR6			ΔR12		
	Expected	Unexpected	R^2/DW	Expected	Unexpected	R^2/DW	Expected	Unexpected	R^2/DW
1971-73	−1.61	−1.04	.04	−1.09	−1.69	.06	0.64	−0.97	.02
	(0.71)	(0.92)	2.07	(0.43)	(1.33)	2.31	(0.26)	(0.79)	2.47
1974-76	−2.71	1.04	.09	−2.43	0.61	.08	−2.23	0.10	.05
	(1.62)	(0.86)	1.86	(1.63)	(0.56)	1.93	(1.34)	(0.09)	1.82
1977-79	−0.55	−0.29	.00	−0.35	0.29	.00	−0.71	0.57	.02
	(0.30)	(0.28)	1.74	(0.21)	(0.29)	1.61	(0.42)	(0.58)	1.92
1980-82	4.13	9.14	.27	1.49	9.47	.32	−0.98	10.88	.39
	(1.07)	(3.38)**	1.85	(0.44)	(3.97)**	1.69	(0.29)	(4.56)**	1.49
1983-84	0.57	1.78	.09	0.67	2.84	.19	0.74	3.14	.16
	(0.64)	(1.40)	1.69	(0.74)	(2.20)*	2.31	(0.66)	(1.95)	2.47
1985-87	1.57	5.11	.32	1.76	5.98	.29	1.93	6.74	.33
	(0.53)	(3.86)**	2.20	(0.49)	(3.65)**	2.38	(0.51)	(3.98)**	2.53
1988-April 1991	1.09	4.70	.38	0.46	6.32	.37	−0.49	7.05	.33
	(0.83)	(4.38)**	2.06	(0.27)	(4.49)**	2.21	(0.23)	(4.18)**	2.13
Estimated with Survey Data									
1985-87	−2.38	5.72	.40	−2.87	6.74	.38	−3.48	7.49	.40
	(0.66)	(4.59)**	1.84	(0.65)	(4.43)**	2.13	(0.74)	(4.61)**	2.22
1988-April 1991	0.18	6.36	0.50	−0.35	8.30	.49	−1.18	9.25	.44
	(0.17)	(5.87)**	2.11	(0.25)	(5.82)**	2.15	(0.70)	(5.33)**	2.22

Note: Treasury bill yields are in basis points and employment is in hundreds of thousands. t-statistics are in parentheses. DW is the Durbin-Watson statistic.

* denotes significant at 5 percent level and ** denotes significant at 1 percent level.

On balance, the regression results are consistent with the policy expectations hypothesis. The coefficients of the unexpected component of the change in employment in the 1985-91 period are highly significant and much greater than those in the 1970s, which are essentially zero. The reason for the strong reaction of interest rates to the employment announcement in the period from 1980 through 1982 is not clear.[16] These years correspond roughly to the period from October 6, 1979, through October 9, 1982, when the Federal Reserve went on a "nonborrowed reserves" operating procedure intended to improve its control of the money supply. Movements in the funds rate were unusually large in this period, and they were largely determined on a judgmental basis by the Federal Reserve, as they had been before.[17] One interpretation of the sensitivity of interest rates to the employment announcement in this period is that it reflected the view of market participants that the Fed was reacting more aggressively to all information—money growth and economic conditions—affecting its policy decisions. Hetzel's (1986) description of the Fed's behavior in this period is consistent with this view.

III. The Employment Announcement and Market Forecasts of the Federal Funds Rate

As a final exercise, we use the financial market stories of the *Wall Street Journal* to illustrate the link in recent years between the employment report and market expectations of Federal Reserve behavior. Beginning in late 1988 the *Journal* stories immediately following the employment report regularly included what can be interpreted as a consensus market forecast of near-term Fed policy actions conditional on the report. These forecasts are summarized in Table 3. The table also shows (1) the market's expectation of the change in nonfarm payroll employment as reported by the *Journal*, (2) the unexpected component of the employment announcement, and (3) the *Journal*'s reports of changes in the Fed's target for the federal funds rate, if any, over the period until the following employment report. (The *Journal*'s reports of funds rate target changes shown in Table 3 are based on the perceptions of participants in the financial markets. They have not been confirmed by the Federal Reserve and may not correspond precisely with the timing of actual Fed policy changes.)

Table 3 confirms that in the late 1980s and early 1990s market participants believed there was a close link between the employment report and Fed policy actions and that market participants' forecasts of Fed behavior were strongly influenced by the report. Late in the period shown in Table 3, Fed policy actions appeared to be especially closely linked to the employment report. In December 1990, February 1991, and March 1991 the *Journal* reported that the Fed changed its target for the funds rate later on the same day as the employment report. And in January 1991 the *Journal* reported that the Fed changed its funds rate target on the market day following the employment announcement.

The near-term policy forecasts recorded in Table 3 were accurate three-fourths of the time.[18] The major forecasting error followed the weak employment reports of August and September 1990, which led market participants to anticipate that the Fed would lower its funds rate target. Following the September employment report the *Journal* reported that "[i]n a rare show of unanimity, many economists, bond strategists and big investors are predicting that the Federal Reserve will reduce short-term interest rates within four weeks." Yet the Fed did not reduce the funds rate target, and the *Journal*'s story following the employment report in October found the reason in the Fed's probable decision to link further decline in the funds rate to a federal deficit reduction package. After agreement on such a package was reached on Thursday, October 25, the *Journal* reported that the Fed lowered its target for the funds rate the following Monday.

VII. Conclusion

This article has provided evidence that market interest rates responded more strongly to the unexpected component of the employment report in the

[16] We reviewed the financial market stories in the *Wall Street Journal* to investigate the possibility that this coefficient was picking up the effect of monetary policy events. The *Journal* reported six policy events that were contemporaneous with employment announcements. These included two discount rate changes, one change in the funds rate, a speech by Chairman Volcker, the phase-out of credit controls, and a large unexpected money announcement. We reestimated the regressions for the 1980-82 period without these six observations. The coefficients of the unexpected component of the employment announcement were smaller in each of the regressions, but they were still significant at the 5 percent level.

[17] For detailed evidence on this point, see Cook (1989).

[18] The policy forecasts were accurate 18 times and wrong 6 times (in November 1989, March 1990, June 1990, July 1990, August 1990 and September 1990). In seven instances the forecast cannot be evaluated because the *Journal* did not provide a consensus forecast or because the Fed reportedly changed the target on the same day as the report.

latter half of the 1980s and the early 1990s than they generally did in earlier years. We have also documented the perception of market participants that the Fed's month-to-month policy decisions over this period were heavily influenced by the report. A reasonable conclusion is that the strong reaction of interest rates to the employment report in this period largely reflects the greater impact of this report on expectations of Fed policy. This conclusion reinforces the finding of the money announcement literature that monetary policy anticipations can strongly influence the way market interest rates react to economic news. A corollary, emphasized by Goodfriend (1991) and Poole (1988), is that movements in market interest rates cannot be used to extract information about the economy without an understanding of how monetary policy influences interest rate expectations.

Table 3

Employment Reports, Policy Forecasts, and *Journal* Reports of Funds Rate Target Changes

Announcement Date	Employment (thousands) Expected	Actual	Unexpected	Change in Six-Month Rate (Basis Points)	Policy Forecast in *Journal* Financial Market Story	*Journal* Report of Subsequent Change in Funds Rate Target
Oct-7-88	283	255	−28	−11	Friday's rally...came after government figures indicated the economy isn't expanding as rapidly as many people had thought. Money managers quickly concluded that removed any pressure on the Fed to tighten credit, at least until after Election Day.	No change in target
Nov-4-88	239	323	84	+16	Hopes for a credit-easing move by the Federal Reserve have vanished. Some analysts even predict tighter credit after the elections, especially if the dollar drops in the foreign-exchange markets.	Target raised late November
Dec-2-88	255	463	208	+28	The Federal Reserve is likely, in light of November's strong employment figures, to decide to raise short-term interest rates at its policy meeting December 14.	Target raised December 15
Jan-6-89	273	279	6	+1	[not available]	No target change
Feb-3-89	292	408	116	+12	Speculation that the Fed will tighten credit soon grew Friday after the government released its January employment report showing a robust increase of 408,000 in payrolls.	Target raised February 13 Target raised February 23-24
Mar-10-89	258	289	31	+17	The Federal Reserve probably will leave its credit grip unchanged for the next few weeks. But many economists think the central bank will raise short-term rates again next month to combat inflation.	No target change
Apr-7-89	215	180	−35	+3	Many analysts expect the Federal Reserve Board to sit tight and leave interest rates where they are in the wake of the report.	No target change

Announcement Date	Employment (thousands) Expected	Actual	Unexpected	Change in Six-Month Rate (Basis Points)	Policy Forecast in *Journal* Financial Market Story	*Journal* Report of Subsequent Change in Funds Rate Target
May-5-89	223	117	−106	−14	April's employment report makes it highly unlikely that the Federal Reserve Board will decide to push up interest rates when its policy-making committee meets here next week.	No target change
Jun-2-89	204	101	−103	−26	The meek growth in new jobs last month confirmed to many economists that the U.S. economy is on a slower track and could lead the Federal Reserve to ease its grip on credit this week.	Target lowered June 6 Target lowered July 6
Jul-7-89	214	180	−34	−5	Many economists expect the closely watched federal funds rate, which fell to 9¼% Thursday, to decline ¼ percentage point sometime soon.	Target lowered July 26
Aug-4-89	158	169	11	+30	It now appears that investors should expect the federal funds rate to remain at about 9%, according to many economists and analysts.... Before Friday, many investors were betting that the Fed would allow the rate to fall an additional quarter of a point.	No target change
Sep-1-89	70	110	40	−1	[not available]	No target change
Oct-6-89	279	209	−70	−24	Speculation that the Fed will ease credit grew Friday after a government report painted a darker picture of the economy than analysts had expected. The report indicated severe weakening in the manufacturing sector.	Target lowered October 16
Nov-3-89	152	233	81	+18	The jobs data dashed hopes for an immediate easing of interest rates by the Federal Reserve, and caused bond prices to tumble.	Target lowered November 7
Dec-8-89	155	210	55	−8	Many economists say the latest employment numbers—the government's first economic report for November—suggest the economy has weakened to the point the Fed may decide to cut interest rates further. But they expect the central bank to wait at least until its policy-making committee meets next Monday [December 18] before taking any action.	Target lowered December 20
Jan-5-90	208	142	−66	−4	[not available]	No target change
Feb-2-90	181	275	94	+4	The catalyst for Friday's retreat was a mixed bag of employment data, which economists said provided little reason for the Federal Reserve to alter its credit policy. That policy appears to be holding for now.	No target change

Announcement Date	Employment (thousands) Expected	Actual	Unexpected	Change in Six-Month Rate (Basis Points)	Policy Forecast in *Journal* Financial Market Story	*Journal* Report of Subsequent Change in Funds Rate Target
Mar-9-90	268	372	104	+9	Just a few weeks ago, many Wall Street economists were holding on to hopes that interest rates would soon resume their downward drift and that the Federal Reserve would cut short-term rates once again. Now they believe the Fed will push rates higher sometime this spring.	No target change
Apr-6-90	178	26	−152	−1	Interest rates are likely to remain relatively stable in the weeks ahead while the Federal Reserve keeps credit policy on hold, many economists believe.	No target change
May-4-90	384	64	−320	−20	But the weakness in the report led many analysts to predict that the Federal Reserve will refrain from pushing up interest rates for now.	No target change
Jun-1-90	253	164	−89	−11	Speculation that the Fed may choose to push rates lower began on Friday, after the Department of Labor released the May employment report.	No target change
Jul-6-90	100	40	−60	+11	Friday's employment report, coming on top of stronger than expected auto sales data on Thursday, has convinced investors that interest rates won't fall significantly and that the Federal Reserve will probably keep credit policy on hold.	Target lowered July 13
Aug-3-90	5	−219	−224	−12	Speculation that the Fed will soon ease interest rates has been swirling for weeks, but the prospects that such an easing will occur sooner, rather than later, were heightened on Friday when the government released a bombshell July employment report.	No target change
Sep-7-90	−29	−75	−46	+3	In a rare show of unanimity, many economists, bond strategists and big investors are predicting that the Federal Reserve will reduce short-term interest rates within four weeks.	No target change
Oct-5-90	−5	−101	−96	−7	Although Friday's employment report should have provided the Fed with an additional reason to lower rates, many economists believe that by linking lower interest rates to the deficit-reduction package, the Fed is now paralyzed. [Deficit reduction agreement approved on Thursday, October 25.]	Target lowered October 29
Nov-2-90	−43	−68	−25	+2	Then last week's batch of economic reports pointed straight toward recession...and the Federal Reserve is expected to ease interest rates further before year end.	Target lowered November 16

Announcement Date	Employment (thousands) Expected	Actual	Unexpected	Change in Six-Month Rate (Basis Points)	Policy Forecast in *Journal* Financial Market Story	*Journal* Report of Subsequent Change in Funds Rate Target
Dec-7-90	−78	−267	−189	−14	Treasury bond prices soared and short-term interest rates fell sharply after the government reported unexpectedly grim economic news.... The Fed reacted to the economic news by moving to nudge a key short-term rate slightly lower.	Target lowered same day Target lowered December 19
Jan-4-91	−149	−76	73	+12	[not available]	Target lowered January 8
Feb-1-91	−15	−232	−217	−25	Prices of U.S. government bonds soared in response to a surprisingly weak employment report and a slashing of the discount rate by the Federal Reserve.	Target lowered same day
Mar-8-91	−126	−184	−58	−11	The Federal Reserve eased credit another notch Friday....The move... came shortly after the [employment report].	Target lowered same day
Apr-5-91	−167	−206	−39	−2	Although the Fed left interest rate policy unchanged on Friday, many analysts expect the central bank to reduce the federal funds rate another notch sometime soon.	Target lowered April 30

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Monetary Policy and Operating Procedures in New Zealand

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I. INTRODUCTION

The current structure of financial intermediation and monetary policy in New Zealand provides an interesting environment for examining some recent work by Fama (1980, 1983) concerning unregulated financial systems and price level determinacy. In New Zealand, banks are not subject to interest rate regulations or reserve requirements. Currency is also supplied elastically, and yet monetary policy has been able to exert control over prices and to reduce inflation substantially. These attributes of New Zealand's financial system seemingly are at odds with Fama's analysis since in the absence of currency control he emphasizes the use of noninterest-bearing required reserves as a means of establishing a well-defined real value of a medium of exchange.

A closer look at the operations of the Reserve Bank of New Zealand, however, reveals an important legal restriction governing the settlement of accounts between a bank and the Reserve Bank. This restriction, together with the operating procedures used by the Reserve Bank, creates a well-defined demand for an asset whose nominal supply is under the direct control of the central bank. This asset, called exchange settlement funds or cash, pays a below-market rate of interest. Thus the general thrust of Fama's work on price level determinacy holds.

It is also interesting to study the procedures of the Reserve Bank of New Zealand from a monetarist perspective. The Reserve Bank of New Zealand currently uses a quantity-based procedure rather than an interest rate instrument in conducting monetary policy. Like most central banks, however, the Reserve Bank is averse to directly controlling the stock of currency. Given the absence of reserve requirements the only other remaining quantity to target is excess reserves. The level of this target is extremely low compared to the size of the banking system and implies that monetary policy is implemented through its influence on a very small percentage of the monetary base. Also, as mentioned these excess reserves or settlement funds pay interest. Thus the operating procedures of the Reserve Bank of New Zealand impose a very small cost on the banking system compared to the costs imposed by most other institutional frameworks for monetary policy. New Zealand's arrangements, therefore, appear to be a relatively efficient means of anchoring the monetary system.

This paper outlines the major aspects of monetary procedures in New Zealand and examines how these procedures affect the price level. Section II briefly examines the setting for Reserve Bank operating procedures. Although New Zealand does not conform to any of the specific examples stressed by Fama that allow for price level determinacy, the monetary system does meet his general requirements. Section III presents a model of bank behavior based on a precautionary demand for exchange settlement or excess reserves. The model draws on past work on the precautionary demand for money, most notably Poole (1968). In Section IV the model's equilibrium and the determination of prices are discussed, while in Section V some extensions are examined. Section VI concludes the paper.

II. PRICE LEVEL DETERMINACY AND MONETARY POLICY IN NEW ZEALAND

Issues Concerning Price Level Determinacy

In some influential work Fama (1980, 1983) examines the behavior of economies with unregulated financial intermediation and analyzes the conditions under which a purely nominal commodity serves as a numeraire. Banks in his world provide two related services. They provide an accounting system of exchange that keeps track of exchanges of wealth

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between transactors. They also manage portfolios transforming one form of wealth (a particular portfolio) into another. This activity is related to banks' role in the exchange process because the recipient of a wealth transfer may wish to hold his wealth in a form that differs from that transferred by the initial holder. Since deposits are heterogeneous (every deposit may represent a claim to a different set of underlying assets), there is no sense in which a generic deposit can serve as a numeraire. Indeed, this unregulated world is not a monetary economy and has no object that resembles what is currently referred to as money.

To introduce a nominal commodity that serves as a medium of exchange into this abstract environment, Fama analyzes a number of monetary arrangements. The first relies on the introduction of a noninterest-bearing currency, which enjoys a relative advantage in certain types of transactions. The government monopolizes the printing of currency and sells a given quantity to banks for assets. Banks hold the currency for customers who may wish to exchange assets for currency. To get a well-defined price level, or real value for currency, there must be a well-defined demand and supply of currency, and currency must earn a below-market rate of return (see Patinkin). Because currency is valued for its transaction services there is a real demand for it, and the government is able to fix its nominal supply. As Wallace (1983) stresses, the government must prohibit privately issued competing transactions instruments (e.g., small denomination interest-bearing securities) for government currency to have value.[1]

Alternatively, the government could define a nominal unit of account through reserve requirements on bank deposits. Requiring banks to hold some fraction of deposits as noninterest-bearing reserves creates a well-defined real demand for reserves. The government can control the nominal supply of reserves and, as in the case of currency, produce a well-defined unit of account. Under this system nominal reserves are controlled and currency could be issued passively (i.e., on demand).

Fama also indicates that a hybrid policy of controlling the sum of reserves and currency, but not caring about their mix, is sufficient for defining a price level. In New Zealand, none of the above policies are followed. There are no reserve requirements and currency is issued passively. What the Reserve Bank of New Zealand does is control the quantity of the transactions medium used to settle interbank balances between banks in the New Zealand Bankers Association and between these banks and the Reserve Bank. These settlement balances, referred to as cash, earn 65 percent of the seven-day Reserve Bank bill yield.[2]

The institutional structure of the interbank market and the rules for settlement set by the Reserve Bank generate a well-defined demand for cash. The Reserve Bank controls the nominal quantity of cash implying that the monetary system in New Zealand obeys Fama's necessary conditions for a determinate price level. In the United States an analogous policy would be controlling the supply of excess reserves.

The Operation of New Zealand's Monetary Policy

At the beginning of each new banking day the net position of each bank from business conducted on the previous day is calculated. Banks must then settle among themselves and with the Reserve Bank. There is a net flow of funds between the banking system and the Reserve Bank because the Reserve Bank serves as the government's banker. Also, the Reserve Bank does not permit overdrafts on settlement accounts. Any bank that has a net debit position must either borrow settlement cash from another bank or rediscount Reserve Bank bills of less than 28 days to maturity. These bills are issued with a maturity of 91 days and are the only instrument rediscounted by the Reserve Bank at a penalty of 150 percent above the market rate on seven-day certificates of deposit. The discount rate penalty, therefore, depends on the term to maturity of the bill. To avoid these penalties, banks hold an inventory of cash as well as an inventory of Reserve Bank bills. The rediscount feature of these bills implies that their supply affects the liquidity of the banking system and that their quantity, along with the quantity of exchange settlement, directly influences the price level.

A crucial feature of the New Zealand system is the uncertainty involving movements in the government's accounts. These movements must occasionally cause the banking system as a whole to have a net debit position with respect to the Reserve Bank. Banks can borrow and lend cash to satisfy net interbank

[1] Wallace's legal restrictions argument is somewhat severe. Privately issued bearer notes would be consistent with price level determinacy if the government auctioned off rights to print a fixed value of notes and required a below-market yield on these notes.

[2] The policy of paying interest on cash would be analogous to a policy of paying interest on excess reserves in the United States.

positions, implying that in the absence of stochastic cash flows with the government, the banking system as a whole need not hold cash. All settlement could be done through credit arrangements. Negative cash flows with the government require payment with exchange settlement or the rediscounting of Reserve Bank bills. Since rediscounting involves a penalty the optimal response by the banking system is to hold an inventory of cash for clearing purposes.

The primary instruments of monetary policy are, therefore, the supply of cash and the supply of Reserve Bank bills. The supply of cash is largely controlled through open market operations which are conducted in an attempt to hit a specific cash target, currently 30 million $NZ. Whether the end-of-day cash balance equals the target will depend on how well the Reserve Bank forecasts the net flow of government transactions. The Reserve Bank cannot afford to forecast or offset government flows too exactly or there will never be a need for rediscounting by the banking system as a whole. Without periodic rediscounting there would be no demand for cash, since an inventory of cash is only held to avoid rediscounting.

The Reserve Bank can also affect the demand for cash through its second instrument, namely the supply of Reserve Bank bills. These bills affect the liquidity of the banking system. A decrease in their supply would imply a greater likelihood that any individual bank would not have a sufficient amount of bills for rediscounting and would have to incur the additional transactions costs of obtaining such bills if the need should arise. Also, with a smaller supply of bills, a bank caught short of cash would have to rediscount bills of a greater average maturity, incurring a larger rediscount penalty. To avoid these added penalties, banks increase their demand for cash. By influencing the demand for cash the supply of Reserve Bank bills affects the price level and serves as an additional instrument of monetary policy.

III. A Model

The following model attempts to capture the major aspects of monetary operations in New Zealand and examines how these operations affect the price level. The most important aspect is the precautionary nature of the banking system's demand for cash and the role that unanticipated flows in the Crown's accounts have in generating that demand. Throughout it is assumed that there exists a perfectly competitive interbank market. In this respect the model is similar to that of Poole (1968) and also is related to much of the literature on the precautionary demand for money.

The major characteristic of the model is the simple and direct way it relates nominal magnitudes to Reserve Bank policy. The cost of doing this requires the assumption that the real and monetary sectors of the economy are exogenous. But this assumption is to some extent justified by treating New Zealand as a small open economy with perfectly flexible prices and a flexible exchange rate. Under such treatment, the real rate of interest and the real exchange rate are taken parametrically and are unaffected by domestic monetary policy. Also, for simplicity, currency, being elastically supplied and so having no essential effects on any other variables, is omitted from the model. Adding a currency demand function would only serve to determine the nominal supply of currency without affecting the main channels through which monetary policy affects nominal magnitudes.

The Real Economy

The real rate of interest, ρ_t, and the real exchange rate, ϵ_t (expressed as the number of world goods per New Zealand good), are taken as given. Thus,

$$(1) \quad i_t = (1+\pi_t^e)(1+\rho_t)$$

and

$$(2) \quad e_t = \frac{P_t^*}{P_t}\,\epsilon_t$$

where i_t is the nominal rate of interest, π_t^e is expected inflation, e_t is the nominal exchange rate (the number of New Zealand dollars per unit of world currency), P_t^* is the rest of the world's price level, and P_t is the price level in New Zealand.

Banks

The banking system is assumed to be competitive and provides transactions accounts called demand deposits to individuals. Funds flow between banks for two reasons. One is that individuals transact among themselves creating interbank flows. The net of these flows for the banking system as a whole is zero, and it is assumed that an interbank credit market exists to handle short-term imbalances. Individuals also transact with the government, creating a net flow of funds between the banking system and the Reserve Bank of New Zealand. The Reserve Bank does not permit overdrafts requiring

banks to maintain a nonnegative balance of settlement funds at the end of the day. A bank that has a net negative position with the Reserve Bank is required to pay a penalty by rediscounting Reserve Bank bills at a penalty rate, r^P. These bills are auctioned regularly by the Reserve Bank and constitute the only rediscountable security it accepts. The absence of overdraft privileges, plus the penalty on rediscounting, creates a precautionary motive for holding a settlement account at the Reserve Bank and a corresponding motive for holding Reserve Bank bills. In the presence of an interbank market it is the net expenditure flows with the government, as well as the rediscounting policy of the Reserve Bank, that creates a well-defined precautionary demand for exchange settlement funds or cash.

A simplified representation of a bank's balance sheet is depicted in Figure 1.

Figure 1

Assets	Liabilities
C	D
RB	
L	

A representative bank supplies demand deposits D at a constant marginal cost α and pays a nominal interest rate of r^D on the account. Banks hold at the Reserve Bank cash or clearing balances C which yield a below-market rate of r^C. They also purchase Reserve Bank bills, RB, that yield a rate r and make loans, L, that earn a risk-adjusted nominal interest rate of i. A further assumption is that if a bank does not have the necessary amount of Reserve Bank bills for rediscounting, it must buy some in the market and incur a proportional transactions cost of ϕ. Further, since rediscounting is at a penalty rate, it is easiest to think of each dollar of Reserve Bank bills rediscounted as incurring a net proportional cost of δ. Because Reserve Bank bills have the added feature of being rediscountable they will never trade at a rate greater than i in equilibrium.

Before describing the simple model that depicts the major features of a bank's decision in this environment, it may be useful to highlight some of the operating characteristics of the interbank model. In doing so I focus on movements in the overnight interbank interest rate that occur under various realizations of stochastic cash flows between the banking system and the government. First, when cash is plentiful and all banks' exchange settlement accounts have a positive balance at the end of the day, the interbank rate should equal the rate paid on cash. If the interbank rate fell below the rate paid on cash, a bank would find it profitable to borrow cash and deposit it at the Reserve Bank. Also, from the standpoint of the lending bank it would be better to deposit the money at the Reserve Bank than lend the cash at a lower rate. If the banking system on the whole is short of cash, then the interbank rate should rise to the level of the penalty rate on the shortest available maturing Reserve Bank bill.[3] If the rate were to exceed the penalty rate, banks could earn profits by rediscounting a bill and lending the cash. The interbank rate will, therefore, be bounded by the rate paid on cash and the penalty rate for rediscounting.

Given the Reserve Bank's operating procedures, banks will decide on an optimal level of both C and RB. These levels will be based on the penalties associated with rediscounting, the opportunity cost of holding cash and Reserve Bank bills, transaction costs, and the stochastic processes governing flows between each bank and the government. I will discuss in detail the simplest case in which there are no interbank flows and where each bank realizes the same stochastic cash flow with the government. In this case a representative bank can serve as a stand-in for the banking system as a whole. I make this simplifying assumption to concentrate on aggregate disturbances to the cash position of the banking system as a whole. It is these disturbances and the resulting precautionary demand for cash that are crucial for understanding nominal determinacy in New Zealand. In particular, let deposits held at a bank be $\hat{D} = D + pg$, where D is expected deposits, p is the price level, and g is a mean zero random variable with a density function f(g) that takes on positive values over the interval $[-\bar{g}, \bar{g}]$. Deposits are decomposed into these two components because banks in this model are only able to choose an ex ante expected level of deposits. Actual deposits will equal expected deposits plus any stochastic deposit flows. A representative bank maximizes its expected profits, Q, subject to the balance sheet constraint $C + RB + L = D$. Formally, a bank solves the optimization problem seen in the accompanying box.

[3] Note the yield on Reserve Bank bills should not change significantly for temporary cash shortages since their yield is governed by intertemporal considerations. That is, their demand is a function of expected future cash shortages as well.

$$(3)\quad \max_{C,RB,D,L} Q = (i+\delta+\phi)\int_{-\bar{g}}^{\frac{-(C+RB)}{P}} (C+RB+pg)f(g)dg - \delta\int_{-\bar{g}}^{\frac{-(C+RB)}{P}} RBf(g)dg$$

$$+ \delta\int_{\frac{-(C+RB)}{P}}^{\frac{-C}{P}} (C+pg)f(g)dg + r\int_{\frac{-(C+RP)}{P}}^{\frac{-C}{P}} (RB+C+pg)f(g)dg$$

$$+ r^C\int_{\frac{-C}{P}}^{\bar{g}} (C+pg)f(g)dg + r\int_{\frac{-C}{P}}^{\bar{g}} RBf(g)dg$$

$$+ iL - (r^D+\alpha)\int_{-\bar{g}}^{\bar{g}} (D+pg)f(g)dg$$

subject to $C+RB+L = D$.

The first two terms in (3) represent the case where *there is a large transfer of funds to the government.* For such a large negative value of g the bank is short of Reserve Bank bills. It must borrow and pay a brokerage fee to obtain the bills and then rediscount them at a proportional loss of δ.[4] The expression inside the first integral is, therefore, negative and represents a cost. Furthermore, in this case the bank must rediscount its entire stock of bills and this cost is given by the second integral. When g is not so negative as to force all of the bank's bills to be rediscounted, the bank rediscounts a portion at a cost δ (the third term) and earns r on the rest (the fourth term). When the outflow of funds to the government is not less than the bank's inventory of cash (i.e., $g > -C/P$), the bank earns r^C on its cash balances and r on all its bills. This realization is given by the fifth and sixth terms in (3). Finally, banks earn i on loans and incur a cost of $r^D+\alpha$ on each dollar deposited.

The first-order conditions for the bank's profit maximization are:

$$(4a)\quad \phi F\left(\frac{-C-RB}{P}\right) + r\left[1-F\left(\frac{-C-RB}{P}\right)\right] = i\left[1-F\left(\frac{-C-RB}{P}\right)\right]$$

$$(4b)\quad (\phi-r)F\left(\frac{-C-RB}{P}\right) + (r+\delta-r^C)F\left(\frac{-C}{P}\right) + r^C = i\left[1-F\left(\frac{-C-RB}{P}\right)\right]$$

$$(4c)\quad r^D+\alpha = i$$

Since banks produce deposits at a constant marginal cost the equilibrium value of deposits will be demand determined. The bank's balance sheet constraint can be used to calculate L once p, i, r^D, C, and RB are determined. Given i, r^D is obtained from (4c). Using (1), (4a), (4b), and the equilibrium conditions

$$(5a)\quad C = C^S,$$

$$(5b)\quad RB = RB^S,$$

where C^S and RB^S are cash and Reserve Bank bills supplied, one can calculate i, p, C, RB, and r.

IV. EQUILIBRIUM

The simple model of Section III is now used to analyze the equilibrium determination of prices and interest rates. One case involves the situation where the supply of Reserve Bank bills is such that, in equilibrium, $(C+RB)/p \geq \bar{g}$. In this case equation (4a) implies that $r=i$ and (4b) implies

[4] It is easiest to think of rediscounting as a collateralized loan at the rate r^P. In the area of the distribution where $g < (-C-RB)/P$, the bank essentially must swap a loan or Treasury bill for a Reserve Bank bill at a cost of ϕ per dollar of transaction and then take out the equivalent of a penalty loan from the Reserve Bank. The bank must also use its stock of Reserve Bank bills to secure a penalty loan at a net cost of r^P-r. Alternatively one could look upon rediscounting as involving a proportional loss of δ per dollar of bills rediscounted (i.e., $\delta = r^P-r$). In the case where a bank is out of cash and must borrow Reserve Bank bills, the bank must first borrow the money (sell off a loan at rate i) to get a Reserve Bank bill that earns r, pay a proportional transactions cost ϕ', and rediscount at r^P earning a proportional loss of δ. Thus $\delta+i+\phi' = r^P+\phi$ in the paper.

that $(\delta + r - r^C)F(\frac{-C}{P}) = i - r_C$. Here the supply of Reserve Bank bills is so abundant that the marginal bill supplies no liquidity services and hence the yield on bills is driven to i. When that happens the price level is directly proportional to C because a proportional change in cash and the price level still solves equation (4b). Also if $\phi = 0$ then (4a) once again implies $r = i$, and (4b) yields a solution in which prices are proportional to cash. With no transaction costs in acquiring Reserve Bank bills, Reserve Bank bills and loans become perfect substitutes from an individual bank's standpoint and hence bills provide no added liquidity benefits. In these cases, marginal changes in Reserve Bank bills have no effect on the real demand for settlement cash. Hence the price level is proportional to the supply of cash.

Since Reserve Bank bills typically yield less than other financial instruments (i.e., $r < i$), one must conclude that $(C + RB)/p < \bar{g}$. For the simple model with independently distributed flows among banks this implies that at times banks may not have enough Reserve Bank bills for rediscounting. The transaction cost ϕ could then be interpreted as an additional penalty imposed by the Reserve Bank. In these circumstances the price level would no longer be directly proportional to cash since equations (4a) and (4b) would no longer be satisfied if cash and the price level were changed proportionately from their equilibrium values. These equations would still be satisfied, however, if cash, Reserve Bank bills, and prices changed proportionately. Hence the price level is sensitive to the supply of Reserve Bank bills even though these bills pay a competitive rate of interest. The sensitivity of the price level to a financial instrument paying a competitive rate occurs because in this case the supply of Reserve Bank bills influences the real demand for settlement cash. With the possibility that a bank may incur an additional cost of ϕ, the real demand for cash decreases as the supply of Reserve Bank bills is increased.

In reality, each bank does not hold enough cash and Reserve Bank bills to cover all stochastic realizations of flows with the government. Yet the banking system as a whole does. This happens because the flow of funds between banks and the government is not independent across banks. Although removing the assumption of independence and analyzing idiosyncratic as well as aggregate movements in cash greatly complicates the analytics of the model, it should not change the basic result that the price level is a function of both the supply of cash and Reserve Bank bills. Neglecting independence, one could think of each bank receiving a stochastic cash flow composed of a common term g and an idiosyncratic term u, where the sum of the idiosyncratic terms across banks is zero and these terms take on values over the interval $[-\bar{u}, \bar{u}]$. Hence, any one bank could be in the position of $\bar{g} < (C + RB)/p < \bar{g} + \bar{u}$, in which case the banking system as a whole would have enough Reserve Bank bills but the individual bank experiencing the large cash drain would have to purchase bills and incur the transaction cost ϕ. If the penalty for being unable to cover stochastic outflows through rediscounting were severe enough (say closing the bank), then the first-order conditions would guarantee that each bank would hold enough liquid assets $(C + RB)$ so that in equilibrium the banking system would not be short of Reserve Bank bills.

For example, with a banking system composed of two identical banks A and B, bank A would invoke the penalty of being closed down if

$$(C_A + RB_A)/p < 2\bar{g} - \frac{C_B + RB_B}{P}.$$

If the penalty of being closed is sufficiently negative, then the first-order conditions for bank A would not be met unless the preceding inequality were reversed. Since each bank is identical, the system as a whole could meet its liquidity needs. However, a solution with $(C_A + RB_A)/p < \bar{g} + \bar{u}$ is entirely possible and r would be less than i as long as there is a transaction cost for purchasing additional Reserve Bank bills. Also, the price level would be sensitive to the supply of bills.

One should also note that the first-order conditions (4a) and (4b) depend on the form of the distribution function F. The distribution of net cash flows between the Reserve Bank and the banking system is also under the control of the Reserve Bank. Specifically, the Reserve Bank can to some extent control the variability of these flows and thus influence the demand for cash. Hence different choices of F can lead to different equilibrium outcomes. The Reserve Bank can also choose r^C and δ, and can achieve the same equilibrium for a variety of choices regarding F, r^C, and δ. Different combinations of these instruments will generally alter the overall tax on the banking system associated with the Reserve Bank's monetary policy. For example, making cash flows less variable would require costly additional monitoring of government transactions. There are, therefore, tradeoffs between costs to the banking system and costs to the Reserve Bank in obtaining

any equilibrium price level (or price level path). A quantitative assessment of these costs would be interesting.

V. Extensions

While extending the model to incorporate some stochastic dependence among banks may not qualitatively affect price level determination, it would provide a framework for examining fluctuations in the interbank interest rate. Interbank lending is an ex post decision with respect to cash flows and this rate would be a function of given realizations of g. In a setting where profits from cash management do not affect economic activity, and where the price level and other market rates are not influenced by these unexpected flows, the interbank rate will vary with realizations of g. When all banks are flush with cash, the interbank rate, under a quantity target, should fall to the rate paid on cash. When, on the other hand, banks are rediscounting, the interbank rate should rise to the rediscount rate. One could then investigate how various institutional changes (e.g., with respect to rediscounting) would affect the volatility of the interbank interest rate.

One could also extend the analysis to consider a banking system under imperfect competition. Comparing operating procedures that use an interest rate instrument as opposed to a quantity target would have different implications for bank behavior.

VI. Summary

This article provides an analytical framework for investigating the nominal implications of targeting interbank balances in New Zealand. The institutional structure of the interbank market is such that banks demand clearing balances for precautionary reasons. The Reserve Bank through its supply of cash and Reserve Bank bills is able to affect the price level and nominal interest rates. Of particular interest is the result that the supply of Reserve Bank bills influences the price level even though these bills pay a competitive rate of interest. These bills do so because they provide an additional form of liquidity and, therefore, affect the demand for exchange settlement funds.

Further, one observes that the Reserve Bank of New Zealand conducts monetary policy through a reserve instrument, namely exchange settlement funds. Except in the case of an optimal deflation, the operation of any monetary system that produces nominal determinacy must do so through some sort of efficiency loss. One part of the efficiency loss arises because the monetary instrument must by necessity earn less than the market determined nominal rate. Holding this instrument, therefore, incurs an opportunity cost [for a more detailed discussion of efficiency losses see Wallace (1983)]. While all central banks prohibit interest on currency, New Zealand's system seems to impose a smaller tax on its banking system than most other monetary systems. There are no reserve requirements. Moreover, excess reserves, which constitute a small fraction of bank assets, do earn some interest. The full cost borne by New Zealand banks also involves any interest differential between Treasury bills and Reserve Bank bills as well as any costs incurred through rediscounting. These costs still appear relatively small so it may well be that New Zealand's monetary policy will be a precursor for other central banks.

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International Trade and Payments Data: An Introduction

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This article is part of a series published by this Bank in the second edition of Macroeconomic Data: A User's Guide. *The book, scheduled for publication in the first quarter of 1992, contains introductions to important series of macroeconomic data, including prices, employment, production, and money. The articles in the book are designed to help the reader accurately interpret economic data and thereby allow the numbers to be useful analytical tools.*

International trade and payments statistics are constantly discussed by journalists, businessmen, unions, politicians, and academicians. Nationalism has often made these data a source of emotion and politics. A primary goal of Adam Smith and other founders of modern economics, for example, was to subdue the ancient belief that a nation's economic strength could be measured solely by its volume of gold imports.

Terms like trade deficit, protection, quotas, and tariffs can raise red flags. The severity of the Great Depression has been blamed on the Smoot-Hawley tariff and retaliatory measures which greatly reduced world trade.[1] Some historians view tariffs passed by Northern states as a proximate cause of the American Civil War. In our own time, concerns about trade with Japan, Mexico, Europe, and other countries rank high on the U.S. political agenda. At the center of each controversy is the interpretation or misinterpretation of a set of trade data.

It is important to know that, by themselves, trade data have no meaning—they cannot speak for themselves. Depending on what question is being asked, the same trade deficit, for example, can be viewed correctly by different observers as good, bad, neutral, understated, overstated, or illusory. Imports are frequently a source of policy concern. Sometimes these concerns are well reasoned: one can rightfully be concerned about luxury good imports—financed by debt to foreigners—which arise because of tax distortions. Sometimes these concerns are less well-reasoned, as in the case where debt-financed imports do not indicate economic weakness, but rather indicate investment in a growing economy.

International transactions are controversial, and they are crucial to the world economy. It is impossible to understand an economy without understanding its relationship with the world around it, and it is impossible to understand that relationship without a knowledge of international financial data. This article lists many weaknesses in international data and offers many reasons to be skeptical of analyses using them. These weaknesses are not presented to warn the user away from international data, but rather to suggest that the data be used with eyes open to their frailties. A simple reading of numbers often results in simplistic conclusions. Used with care and understanding, international financial data are indispensable. The purpose of this article is to give the reader a modicum of that understanding and to suggest further areas of exploration.

The article is organized as follows:

[1] Barry Eichengreen [*The Political Economy of the Smoot-Hawley Tariff*, NBER Working Paper Series #2001 (1986)] examines the literature on Smoot-Hawley and argues against the view that the tariff was central to the depth of the Depression.

I. BASIC DEFINITIONS

Components of the Balance of Payments

The balance of payments accounts—of which trade accounts are a part—are a compilation of international transactions. Included in a country's balance of payments are, in principle, all movement of resources across borders. Balance of payments accounts are related to the National Income and Product Accounts (NIPA),[2] the system by which we calculate Gross National Product (GNP) and other measures of national productivity. Net exports, plus domestically earned income, yield GNP, for example.

The types of transactions that appear in the NIPA do differ from the types that appear in the balance of payments accounts. Notably, trade in second-hand goods is excluded from the NIPA but not from the balance of payments. A used car sold by a Virginian to a North Carolinian does not appear in the NIPA (though the commission on the sale would be included). The NIPA measure economic transactions resulting in the addition of new final products to the economy. Domestic transactions in the NIPA are those which *create* things of economic value; the value of a car is added to the accounts at the time it is first sold. At the time of subsequent resale, the only addition of value to the economy (new final product) is the service provided by the car dealer and represented by his commission. Balance of payments accounts, in contrast, measure the *movement* of value across borders rather than the *creation* of value. Thus, if an American sells a used car to a Canadian, that sale will appear in the balance of payments.

Merchandise trade, goods and services trade, the current account, and the overall balance[3] are all aggregate measures of trade in resources, but their definitions and interpretations are very different. Table 1 shows some of the major accounts that comprise the balance of payments and shows how they are aggregated into the current account and the capital accounts which finance the current account.

[2] For an introduction to these accounts, see Roy H. Webb, "The National Income and Product Accounts" in Roy H. Webb, ed., *Macroeconomic Data: A User's Guide*, Richmond: Federal Reserve Bank of Richmond, 1990. This article also appeared in the Richmond Fed's *Economic Review* (May/June 1986).

[3] For some purposes, the International Monetary Fund separates international monetary flows from other capital flows. These monetary flows are defined to consist mainly of movements of central bank reserves and related liabilities. The overall balance is the sum of the current and capital accounts minus these monetary flows.

There are other ways to divide up the balance of payments accounts. Sometimes the capital account is divided into short- and long-term capital. Sometimes the monetary portion of the capital account is itself divided into flows of gold, central bank reserves, Special Drawing Rights (SDRs), and other accounts. In general, the United States maintains its balance of payments accounts in accord with the International Monetary Fund's procedures.

Trade: Bilateral vs. Total and Gross vs. Net

In discussing international trade and payments, failure to distinguish among different definitions can cause confusion and misunderstanding. Particularly troublesome can be the distinctions between (1) bilateral vs. total accounts and (2) gross vs. net accounts. In most data sources, merchandise, service, and income trade accounts are compiled on both gross and net bases. In some data sources, unrequited transfers and capital accounts are available only on a net basis. While the discussion here uses the word "trade," the concepts are equally applicable to other payments accounts.

Bilateral trade refers to trade between two regions (a region can be an individual country or a group of countries). Total trade refers to a country's trade with the rest of the world combined. Gross exports or imports constitute the quantity of resources flowing *in one direction* between two regions, while net exports equal gross exports minus gross imports.

Gross Bilateral Exports and Imports: Table 2 shows the gross bilateral trade between three regions—the United States, Japan, and Other Countries (all countries except the U.S. and Japan).

In Table 2, rows 1, 2, and 3 give each country's gross imports, and columns a, b, and c give gross exports. For instance, the U.S. exported $45 billion worth of goods to Japan while importing $97 billion in goods from Japan.

Gross Total Exports and Imports: In Table 2, adding columns a, b, and c gives each region's total imports (column d), while adding rows 1, 2, and 3 gives each region's total exports (row 4). If there are no data or measurement errors, total world exports will always equal total world imports, since any goods leaving one country will enter some other country. As later sections will indicate, though, there are always measurement problems.

Total Net Exports: Total net exports are defined as the total gross exports minus total gross

Table 1

Balance of Payments Components
United States, 1989
(billions of dollars)

−114.87	a	**Merchandise (goods):** manufactures, commodities, etc.
11.75	b	**Services:** insurance, shipping, tourism, education, etc.
7.84	c	**Income:** interest, profits, dividends
−95.28	d=a+b+c	**Goods, Services & Income**
−1.33	e	**Private Transfers:** private unrequited gifts, wage remittances, etc.
−13.43	f	**Official Transfers:** unrequited government transfers (foreign aid payments to international organizations, etc.)
−14.76	g=e+f	**Unrequited Transfers**
−110.04	h=d+g	**Current Account Balance**
40.52	i	**Direct Investment:** asset (e.g., factory, firm) where purchaser gains substantial managerial control
44.79	j	**Portfolio Investment:** asset purchase where little managerial control is gained (e.g., bonds)
18.96	k	**Other Capital:** investments not classified as direct or portfolio
22.56	l	**Errors & Omissions:** balancing item to reconcile the overall balance and the sum of current and capital accounts
−16.79	m	**Reserve and Other Monetary Flows***
110.04	n=i+j+k+l+m	**Capital Account Balance**

* Reserve and other monetary flows appear in IMF statistics as the Overall Balance. In published statistics, the sign is reversed—in this case, the Overall Balance would appear as +16.79 instead of −16.79. An explanation is that the sign here indicates an "import" of money; 16.79 in net monetary reserves are flowing into the United States. We do not normally think, however, of importing or exporting money. We think of importing and exporting current items and capital, using money as the payment medium. Thus, by convention, the Overall Balance is listed as +16.79 to indicate that the U.S. was a net *exporter* of total current items and capital.

Source: *International Financial Statistics*, July 1991. This table is described in the adjacent text. Note that the figure for net exports (−114.87) appears inconsistent with the net exports in Table 2 (−130). The principal reason for this discrepancy is that *Directions of Trade Statistics* values imports on a c.i.f. basis, while *International Financial Statistics* values imports on an f.o.b. basis. (See discussion of f.o.b. and c.i.f. below.)

imports. Table 2, row 6 shows total net exports for each region. If a country's net exports are positive, then that country is exporting more than it is importing. Negative net exports means that the country is importing more than it is exporting. Assuming no measurement errors, the sum of all regions' net exports will equal zero.

Bilateral Net Exports: Finally, bilateral net exports can be calculated from the data in Table 2. For example, Japan's net exports to the United States would equal $52 billion ($97 billion − $45 billion), and U.S. net exports to Japan would equal −$52 billion.

II. Defining and Measuring International Transactions

Table 1 defines a number of international accounts which together comprise the balance of payments. At first glance, the divisions between different classes of cross-border transactions seem self-evident. Exporting a piece of fruit is merchandise trade. Buying legal advice from an overseas firm is a service import. Investing in foreign bonds is portfolio investment. The lines, though, are not as clear as these examples would suggest.

We can define two broad classes of problems in compiling statistics. First, even with complete information on each and every transaction, simply defining the lines between different aggregates would be a chore. Second, complete information on every transaction does not exist, so there are errors, sometimes large, in measurement. In the text that follows, a set of hypothetical transactions are aggregated into balance of payments statistics, as shown in Table 3.

For example, in the first row of the top portion of Table 3, an exporter in the U.S. sends wheat to a purchaser in some other country and, in exchange,

Table 2

Gross Bilateral & Total Trade Accounts

(billions of U.S. dollars)

	Importer	Exporter US a	JA b	OC c	Gross Total Imports d
1	United States	—	97	397	494
2	Japan	45	—	165	210
3	Other Countries	319	178	—	497
4	Gross Total Exports	364	275	562	1,201
5	Gross Total Imports	494	210	497	1,201
6	Gross Net Total Exports	−130	65	65	0

Mathematical Relationships

column d = column a + column b + column c

row 4 = row 1 + row 2 + row 3

row 5 = column d

row 6 = row 4 − row 5

Note: 1989 data adapted from the IMF's *Directions of Trade Statistics Yearbook*. This table is described in the adjacent text and is used to illuminate the mathematical relationships between the gross accounts. In order to make exports equal imports (for illustrative purposes), the numbers here ignore measurement errors present in the actual data.

the importer issues to the exporter a liability whose value is equal to that of the wheat. Importantly, the rows represent transactions between disparate individuals, firms, and governments, with the paper trails (if any) widely dispersed. In the bottom portion of Table 3, the sale of wheat shows up in U.S. merchandise exports and the corresponding trade credit shows up in other capital.

It is expensive to collect and sort data, so resources should be spent on the most useful information. Collecting enough information to sort merchandise trade by color, for instance, would cost a great deal and would not seem a sensible use of resources—it is difficult to think of anyone who would find this information useful. Thus this information is not collected. There are potentially useful distinctions which are not collected, though, because the usefulness is still not viewed as worth the costs. In deciding what data will be collected, it must also be remembered that the mere act of collecting and classifying data implies that the classification is economically meaningful. It is easy, for instance, to take for granted that the distinction between current and capital transactions is clear and economically significant; for some purposes, that is an overstatement.

Table 3

Aggregating Balance of Payments Transactions

(see adjacent text)

Resources Transmitted From U.S. to Rest of World	Rest of the World to U.S.
[a] wheat	[b] trade credit
[c] tourist's hotel room	[d] cash
[e] wages remitted	[f] private transfer
[g] bank deposits	[h] bonds issued by factory
[i] automobiles	[j] tin
[k] stock issued by factory	[l] gold ingots
[m] cash	[n] property rental
[o] steel ingots	[p] automobiles
[q] illegal drugs	[r] cash

U.S. Balance of Payments Accounts

derived from transactions [a] through [r] above

Merchandise (goods)	a + i + o + q − j − p
Services	c
Income	−n
Private Transfers	−f
Direct Investment	k
Portfolio Investment	−h
Other Capital	−b
Reserve Flows	(e + g + m) − (d + l + r)
Goods and Services	**(a + i + o + q − j − p) + c**
Goods, Services & Income	**(a + i + o + q − j − p) + c − n**
Current Account Balance	**(a + i + o + q − j − p) + c − n − f**
Capital Account Balance	**k − b − h + (e + g + m) − (d + l + r)**
Overall Balance	**(d + l + r) − (e + g + m) =**
	(a + i + o + q − j − p) + c − n − f + (k − b − h)

The top portion of this table lists hypothetical individual transactions, each consisting of two movements of resources of equal value. The bottom portion shows the resulting balance of payments accounts. In the adjacent text, this table is used to illustrate measurement and classification problems. As explained in Table 1, the sign is reversed for the Overall Balance.

A current account deficit is viewed by some as collective profligacy,[4] while a current account surplus is taken to mean saving for a rainy day (Section III explains why this view may be erroneous). On the basis of such views, governments sometimes enact policies, such as trade or capital controls, to influence

[4] For an article taking this view, see Benjamin M. Friedman, "Implications of the U.S. Net Capital Inflow," in R.W. Hafer, ed., *How Open Is the U.S. Economy?*, Lexington, Massachusetts: Lexington Books, 1986.

the current and capital accounts. A current account deficit, though, may be illusory—resulting less from economic realities than from the means of defining and measuring current and capital transactions.

Problems in Defining Aggregates

This section gives some conceptual problems encountered in classifying international transactions. In the paragraphs below, the transactions found in the top portion of Table 3 are aggregated into the balance of payments accounts in the lower portion of the table.

Consumption vs. Investment: Distinguishing between consumption and investment purchases is difficult in international trade, as it is in all national income accounting. Consider automobiles and tin in [i] and [j]. Both are treated here as merchandise trade (current account transactions), thus implying that they are consumption goods. Autos, however, are *consumer or producer durables*, meaning they are part capital good, yielding services over time. A company which imports an automobile for business use over the next five years is investing as surely as is the purchaser of the factory stock in [k]. Similarly, tin is a storable commodity and can be purchased either to use next week (consumption) or to store for the next ten years (investment). Classifying durable goods as current account items can thus imply a lower rate of investment than is true in an economically meaningful sense, since the capital portion of the good never shows up in the capital account.

Merchandise vs. Money—Gold and Silver: The gold ingots sold to the U.S. in Table 3 [l] appear in the capital accounts as reserve flows, implying that gold is money. Gold, though, can also be a form of nonmonetary capital or a merchandise good (say, for a jeweler). The United Nations classification system distinguishes between monetary and nonmonetary gold. It assumes that gold received by a central bank is money, and gold received by anyone else—even commercial banks—is not money. While this is an imperfect way to divide the data, the U.N. system views this as closer to the truth than classifying all gold as money or all as merchandise. This convention also implies that a more accurate classification system is viewed as not worth the expense.

In Table 3, the fact that gold appears as a monetary flow indicates that it was received by the central bank of the U.S.—the Federal Reserve. Had the gold been received by a commercial bank, the U.S. accounts would have shown higher merchandise imports and lower monetary receipts, even if everyone involved had considered the gold to be money. (It should be noted that since 1973, gold has for the most part ceased being a means of international settlement.)

Defining Countries: International data are critically dependent on where national boundaries are drawn. Changes in the amount of trade over time will be affected by changes in boundaries. For instance, the trade statistics for the Federal Republic of Germany might be expected to drop because of that country's recent reunification. The reason is that transactions between West Germany and East Germany used to count as international trade, but are now counted as domestic transactions. Similarly, the independence of the Baltic States should increase measured international trade; transactions between the Baltics and other Soviet republics were previously considered domestic transactions, but now enter world trade statistics. The changes, though, do not necessarily represent any changes in any individual's economic activity or well-being.

Customs unions can cause world trade to be understated. These organizations are collections of countries which have eliminated or limited their trade barriers with each other—the European Community is an example. Sometimes, customs unions will cease collecting statistics on trade between member countries and only report trade between the union and countries outside the union. When this happens, measured international trade drops because the customs union hides the intra-union trade. Note that Table 1 understates the amount of world trade by hiding all trade between "Other Countries."

Goods Destined for Embassies or Military Bases: The wheat shipped in transaction [a] is a merchandise export because the shipment of grain reduces the material resources found in the U.S. If, however, the grain were sent to a U.S. embassy abroad, then this line would not appear in the trade statistics. Thus, a shipment to an American in a hotel in Paris would appear as an export, while a shipment to an American at the U.S. embassy down the street is treated as a domestic sale. In principle, shipments of military resources across borders should be included in balance of payments statistics, but they are sometimes omitted for security reasons.

Ships and Aircraft: In transaction [j], tin, a material resource, is transported to the United States in the hold of a ship, which is also a material resource. The movement of the ship itself is not counted as

an export to the U.S. because the ship will only reside temporarily in the U.S., and we do not wish temporary resource movements to be counted as trade. Ships and airplanes move frequently between countries in this manner, but sometimes they do move permanently from one country to another, or they change their national ownership or flag of registration. By convention, the sale of a new ship or airplane across national boundaries is counted as merchandise trade. The sale of old vessels is omitted from some trade data (e.g., United Nations data), even though such a sale might constitute a real (and enormous) movement of resources. This is because the ownership of ships and airplanes is highly complex, and it is difficult to define and measure international trade of such vessels. IMF statistics include such sales, though there are serious measurement problems involved.

Pass-Through Trade: Suppose that in transaction [p], a U.S. importer buys cars from Germany and then plans to sell them next week to a buyer in Mexico. Then, [p] would generally not be considered an import, but rather would be counted as a temporary import destined for re-export and dropped from U.S. trade figures. If this were not so, then the automobile transaction would be counted twice, thus overstating the volume of world trade. Some de facto temporary imports are counted as if they were permanent due to the form of their legal documentation.

Tourist Effects: Suppose the tourist in transaction [c] takes his car on his trip. If he goes for a week and then brings the car back, then the car will not appear in the trade statistics because this relocation is, again, regarded as temporary. If the car were to remain abroad for ten years, that would constitute a merchandise export, offset by a private transfer. A line between permanent and temporary must be drawn, usually at one year, but that line is arbitrary.

Ownership vs. Location: In general, concerns about imports revolve around the question "Are we buying too much from foreigners?" The way international trade is measured makes it difficult to even know how much a country buys from foreigners. Until recent decades, capital mobility was quite limited by today's standards. By and large, factories in Germany were owned by Germans, firms in the U.S. were owned by Americans, and so forth. Today, capital is highly fluid, but our trade statistics can obscure that fact. Suppose Acme-USA buys equipment from American-owned Apex-Germany or from Acme's wholly-owned subsidiary Acme-Germany. The trade accounts treat these transactions as imports, even though no foreigners are involved. Similarly, if Acme-Germany sells widgets to a German distributor, this is treated (in the merchandise trade accounts) as a wholly German transaction, despite the fact that Germans are buying goods from Americans.

It should be noted that this last transaction would not be a problem in the current account, as opposed to the merchandise trade account. Acme-Germany's profit on the sale to a German distributor would either be paid to the American parent company as a dividend or would be kept on Acme-Germany's books as retained earnings. Either way, the income would show up as a credit item in the income account of America's balance of payments.

Our accounting conventions record trade on the basis of place of origin, rather than nationality of ownership. In the past, the two were usually the same, so the distinction made little difference. Nowadays, the country of production is a poor guide to nationality of ownership. An alternative accounting system would define trade by *ownership* rather than by *location*. Under such a system, a shipment to an American factory overseas would be treated as a domestic transaction, just as shipments to embassies are already treated. According to *The Economist* ("Tricks of the trade," 3/31/91, p. 61), this change in accounting procedures would change America's 1986 merchandise trade balance from a $144 billion deficit into a $57 billion surplus. If the question being asked is how much American firms are selling to foreigners, then trade ought to be defined by ownership. If, alternatively, the question is where jobs will be found, then perhaps trade ought to be defined by location, since Acme-Germany is likely to be staffed by German workers instead of American workers.

Measurement Problems

Even if all conceptual problems in defining trade data could be resolved, measuring the data would still be difficult. Unlike the hypothetical example in Table 3, there is in actuality no complete record of individual transactions. Much information is confidential or simply not recorded, so aggregate estimates must be made; there are statistical sampling problems; some data are intentionally distorted by those involved; price, quantity, and exchange rate data often come from different sources, and reconciling them is a challenge. In other words, trade data are developed by splicing together bits and pieces of inaccurate, incomplete, inconsistent information. Any

such aggregation requires judgment and any such judgment will, at times, cause problems. Again using Table 3, some problems can be illustrated.

Timing of Prices, Exchange Rates, and Quantities: A major problem in measuring the value of trade is that our information on quantities and prices often comes from separate sources. In blending these different data sources, timing is often critically important. Suppose we are estimating the dollar value of tin purchases represented in Table 3, transaction [j]. Estimating this figure may require that the numbers and calculations in Table 4 be used. Here, a foreign exporter sells tin to the U.S. for a foreign currency (here called francs), and we wish to know the dollar value of those sales.

Exchange rate data are readily available on a daily or even more frequent basis, and the same is true for prices of many goods—especially commodities. Information on physical quantities of goods sold, though, is often reported only for longer periods of time. In Table 4, it is assumed that quantity information is available on a quarterly basis, while price and exchange rate information are available on a monthly basis. As is explained in the table, the result is that the hypothetical country's export earnings are greatly overestimated.

This sort of indexation problem is less severe for merchandise trade in a country like the U.S., where statistical collection procedures have been developed and refined over time. Trade data are mostly gathered from customs forms which list both quantity and price information. Such indexation problems, though, become much more severe in services and capital accounts, where data collection relies on surveys and, to a large extent, voluntary compliance. The sort of problem shown in Table 4 is also more common in poorer countries, where data collection is less complete, where the collection process is poorly financed, and where documentation is less reliable.

Other Timing Differences: In Table 3, item [o] is the sale of steel ingots. This sale, though, could show up in a number of different time periods, depending on the methods of accounting and data collection. The movement of ingots could end up being counted when the sale was made, when the steel was loaded onto a ship in the U.S., when the steel was unloaded overseas, when the steel reached the buyer, when the customs documents reached the data collection agency, when the data collection agency sifted through its in-box, and so forth. A change in procedures, for example, could result in items [o] and [p]—which are the two sides of the same transaction—showing up in different years, thus distorting the merchandise trade balance and capital account. Timing problems may wash out in the long run, but for some purposes, the data may remain permanently distorted.

Index Number Problems: Aggregating data lets us make more important observations. Trade data begins as millions of individual bits of data on narrow ranges of transactions, and the usefulness of

Table 4

Estimating Quarterly Tin Exports

	Jan	Feb	Mar	3 Months	Estimates
Tin Price (in francs)	10	10	4	8 (average)	
Quantities	0	0	10	10 (total)	
Value (in francs)	0	0	40=4x10	40 (total)	80=8x10
Exchange Rate (francs/$)	1	1	4	2 (average)	
Value (in dollars)	0	0	10=40/4	10 (total)	40=8x10/2

In this table, a hypothetical country exports tin, priced in francs, and paid for in dollars. Price information is available on a monthly basis, but quantity information is only available on a quarterly basis. In this three-month period, total trade is actually 40 francs, or 10 dollars. However, the data only say that 10 units of the tin were sold, and it is not specified whether the tin was sold in January, February, or March. In this situation, total value of sales could be estimated by multiplying the average quarterly price (8 francs) by the total units sold (10 units). Using this method, total sales appear to be 80 francs—twice the actual amount.

When the world moved to floating exchange rates in the early 1970s, a further complication was added. Here, the exchange rate moved from 1 franc per dollar to 4 francs per dollar. To estimate the dollar value of tin sold, divide the estimated total franc value (80 francs) by the period average exchange rate (2 dollars per franc), yielding estimated total dollars sales of 40 dollars—four times the actual amount.

these individual data is limited. Data on aggregate merchandise trade is more important than data on trade in swiss cheese or vacation packages (unless you deal in swiss cheese or vacation packages). Aggregating data, though, introduces judgment and ambiguity into measurement.

In the case of a single good—say, a standard gold coin—one can unambiguously separate changes in price from changes in quantity. Suppose in one year, 10 coins are sold at $100 apiece ($1,000 in total), and in the second year, 15 are sold at $80 apiece ($1,200 in total). Several unambiguous observations can be made: The trade value went up by $200; the trade volume went up by 5 coins; and the trade price went down by $20.

Suppose, though, that data on two goods—say, melons and grapes—are being aggregated, with the intention of calculating the change in trade volume and trade price. First of all, measuring change in aggregate volume requires that statistical weights be applied to the separate volumes of melons and grapes. Individual fruits could serve as the unit; then, a decrease of one melon and an increase of two grapes would be considered an increase in fruit trade. For most purposes, this choice of weights seems unsatisfactory. Statistical weights could be based on physical weight or on physical volume so that the one-melon decrease would outweigh the two-grape increase; these weights might also yield unsatisfactory results, though.

Usually statistical weights are based on the *values* of the goods in some base year; to measure changes in aggregate trade volume, ask how the aggregate value of goods would change if the prices of all goods remained the same but quantities changed. Similarly, changes in price per unit of aggregate trade is measured by asking how much aggregate value would change if quantities purchased of each good remained the same but prices changed. The problem is that by choosing different base years, the same data can indicate falling or rising volumes and prices—there is no means of aggregating dissimilar data that precisely answers every possible question.[5]

Accounting Methods and Valuation: The value of cross-border flows is generally assumed to be the price paid when the title to the resource changes. Some items, though, have no readily verifiable market price—services and capital are especially vulnerable to these problems. In highly developed market economies, merchandise trade data are of good quality, and price and quantity data come from the same source. In other countries, though, records may be less complete or consistent. Some data will report the value of an item—say, stock in a factory—according to its historical price—the price originally paid for it. Another method would value the factory according to its current replacement cost. Often, these valuation methods will differ greatly from the market value—the price that would actually be paid in a current transaction for that item. Such valuation problems become especially acute in the case of barter (counter-trade), such as in Table 3, items [o] and [p], where no monetary price is expressed on either side of the transaction.

Trade barriers (e.g., quotas and tariffs) can make the value of trade ambiguous. Suppose an importer pays $1,000 for an item, but the exporter only receives $500, with the rest going to tariffs. The value of merchandise trade might appear in one account at one price and in another account at the other price. This is because the inclusion or exclusion of taxes from the recorded price is in some cases a matter of discretion. In principle, the accounting treatment of taxes should be consistent in all countries. In practice, however, different countries apply different rules so that equivalent transactions will appear differently in the statistics.

Lightly Monitored Borders: Cross-border trade is not uniformly monitored. Some countries have free-trade zones whose attraction to business is that international trade through the zone is monitored lightly or not at all. Some countries are lax in monitoring cross-border trade in certain geographic areas or in specific industries. For example, customs officials may choose not to monitor livestock movements across inland borders, either because monitoring would be too expensive or because de facto immunity from customs laws may be a political favor to those involved in the trade.

Services: Sale of services across borders is particularly difficult to estimate, since there are no customs agents monitoring them. Tracking, say, banking and legal services between countries demands cooperation by those involved. Much information is derived from surveys, which are subject to a variety of statistical problems such as sampling error.

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[5] See Roy H. Webb, *Macroeconomic Data: A User's Guide*, Federal Reserve Bank of Richmond, 1990, p. 5 (Introduction) for a discussion of indexing problems. Fuller explanations of indexation problems can be found in any elementary textbook under Laspeyres Index or Paasche Index or a variety of other indexes.

False Invoicing in Response to Taxes: Taxes and customs on international transactions provide an incentive to overstate or understate various transactions. Referring again to Table 3, suppose that the United States were to place a high tax on the purchase of foreign bonds [h] while not taxing the rental of foreign property [n]. In response, a U.S. entity might purchase bonds and rent property from the same overseas entity, and then understate the sale price of the bonds and overstate the cost of the property rental. The effect would be to overstate the current account and understate the capital account.

Illegal Trade: Individuals do not routinely report illegal activities to their governments, so the sale of illegal drugs [q] will not likely show up as a merchandise import or as part of current account debit items. The likely result is that the illegal drugs will be mistakenly included in "Other Capital" or in "Errors and Omissions," the balancing item used to reconcile discrepancies between the accounts.[6]

Foreign Exchange Black Market: In Table 4, the dollar value of purchases was miscalculated because the quarterly average exchange rate was not equal to the actual exchange rate used in the transaction. Similarly, the dollar value of a transaction can be misjudged when foreign currency is purchased not at the official (or legal) exchange rate, but rather at an illegal black market rate.

Inconsistent and Inadequate Accounting: In Table 1, U.S. exports to Japan were said to total around $45 billion, based on U.S. estimates. In the same data source, Japan reported importing over $48 billion from the U.S. in 1989. Such discrepancies in reporting are the norm. Sometimes the discrepancies can be huge relative to total trade. When such conflicts arise, the user of data is forced to rely on judgment in deciding which numbers to use. Finally, measurement of trade between countries can be difficult because different countries use different accounting systems. Some are lax in accounting. Some lack the resources to measure trade adequately. Some, for political or other reasons, do not wish to measure trade accurately.

[6] A great deal of unrecorded transactions can be explained not by smuggling of goods, but rather by illegal or unseen capital flows. According to the *Wall Street Journal* ("U.S. Statistics on '90 Capital Inflow Are Off to the Tune of $73 Billion," 5/24/91, p. A2), unrecorded capital inflows into the U.S. appear to be the largest factor in the statistical discrepancies in the balance of payments accounts.

Other Definitional Ambiguities

Below are some additional ambiguities found in trade definitions. Comparisons can be severely distorted if inconsistently formulated data are used together.

F.O.B. vs. C.I.F.: Merchandise imports and exports are defined either f.o.b. (free on board) or c.i.f. (cost, insurance, and freight) terms. Trade on f.o.b. basis equals the value of the goods only. Trade on c.i.f. basis includes the value of the goods plus the cost of transporting the goods from the country of export to the country of import. Exports are almost always measured f.o.b. Imports are usually measured c.i.f., but some countries measure them f.o.b. In the latter case, the shipping costs appear as service trade instead of goods trade.

Services vs. Services & Income: Some data sources group services and income together as services or "invisibles" (merchandise goods being "visibles"). The International Monetary Fund and the U.S. Department of Commerce have recently adopted the convention of separating services and income.

Current Account and Official Transfers: Some sources consider official transfers to be part of the capital account rather than part of the current account.

Terms of Trade: A country's terms of trade is the ratio of a price index of the country's exports to a price index of its imports. The measured terms of trade, though, can differ greatly, depending on which goods are included in the measure, on the means of aggregating the prices of those goods, and on the base year chosen. (See the discussion above of index number problems.)

III. Interpreting Trade Data

The above sections have suggested that an observer must use great care in interpreting trade data, which are highly susceptible to problems of definition, measurement, and aggregation. They do not give us a perfect picture of resource movements, and the economic significance of resource movements themselves can be highly subjective. Following are a few examples of how data are frequently interpreted and problems with those interpretations.

Total Merchandise Trade: Properly measured, a U.S. merchandise trade deficit means that

in terms of value, more goods are leaving the U.S. than are arriving. For a shipping company planning its routing, that may be a meaningful piece of information. For public policymakers, however, a deficit may be less significant than is often assumed. Deficits on merchandise trade are often presented as boding ill for a national economy.[7] To be sure, a trade deficit might well be a sign of faltering commodity or manufactured goods sector. Alternatively, the deficit may just as easily indicate that a large share of the country's individuals have found it more advantageous to produce services than goods. The mercantilist idea that a merchandise trade deficit is bad per se is akin to the argument that it is inherently better for an individual to work in farming or manufacturing than in banking, sales, or engineering.

Bilateral Merchandise Trade: The same arguments described above for total merchandise trade hold here, but with an added caveat. Even if one has reason to believe that a total trade deficit is bad, there is no reason to believe that bilateral trade accounts should be balanced. It is possible for Country A to run a $100 million deficit with Country B, Country B to run a $100 million deficit with Country C, and Country C to run a $100 million deficit with Country A. All three countries have balanced total trade, despite their bilateral deficits and surpluses.

For a better understanding of the patterns of world trade, the reader can look in any macroeconomics or international trade textbook for explanations of the economic principles of comparative advantage and gains from specialization. These principles are generally thought to explain much of the flow of goods.

Current Account: A current account deficit equals the domestic investment minus domestic savings. This allows a country to spend more today than it is earning today by borrowing from abroad. For this reason, overseas borrowing is often taken to mean "living beyond one's means." There are many reasons, though, that a country might reasonably run a current account deficit. A current account deficit may mean that, collectively, the country is borrowing abroad to finance productive investment, with presumed gains for the country and its trading partners in the end. This is analogous to starting a business with borrowed capital, and paying back the loan in later years to the advantage of both the businessman and the bank. It often makes sense for a developing country to borrow in this way, though the borrowing must finance productive investments and not, say, luxury consumption goods. Some would argue that the U.S. was justified in running large current account deficits during the 1980s; the *Economic Report of the President* (1989, p. 106) said the following:

> Trade and current account deficits represent important channels through which an economy can acquire the resources needed to take advantage of profitable investment opportunities. They can also represent consumption out of previous saving. Trade deficits can arise when an economy's households and firms react to distorted incentives to consume today by borrowing from abroad at the expense of future generations. Whether the trade deficits of the 1980s signal promise or trouble for the current and future well-being of the United States is an important and difficult question.

Valuation of Overseas Investments: Thus far, this article has discussed *flows* of resources between countries—the balance of payments. In all of the above examples, some good or service or claim on future income has been shifted from an entity in one country to an entity in another. This section introduces *stock* adjustments—changes in one country's claims (net overseas investment position) on another that arise not because any resource or claim has moved across borders, but rather because the *price* of some cross-border obligation has changed.

Purchase of overseas assets by domestic residents (a capital account debit item) minus the purchase of domestic assets by foreign residents (a capital account credit item) is often assumed to be a measure of changes in a country's overseas investments. This, however, is a poor measure of a country's overseas wealth. Looking only at transactions ignores the

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[7] Benjamin Friedman, op. cit., for instance, describes growing U.S. merchandise trade and current account deficits as "deterioration" (p. 138) and describes the international imbalance as "the outstanding failing of U.S. macroeconomic performance in the 1980s" (p. 137).

In contrast, *The Economist* ("For whom the gloom tolls," 8/31/91, p. 16) warns that

> commentators should . . . mind their tongues when it comes to trade. America's trade balance is said to "improve" as its deficit shrinks, Germany's to "deteriorate" as its surplus disappears. Yet a trade surplus is a misleading measure of a country's economic strength, or a deficit of its weakness. Barring further information, it is neutral . . . . The idea that surpluses are good and deficits bad comes from the nasty mercantilist view that exports are good and imports are bad: yet the only reason to export is to enable your consumers to buy luvverly imports.

changes in values of investments. An individual would not properly evaluate his personal wealth by adding together what he has paid over the years for stocks and bonds. Rather, he ought to sum up the current market value of those investments. Ideally, a country ought to value its overseas investment position according to the current market values of those investments. Practically, though, such valuation is often difficult.

If the value of an American-owned company in Spain doubles, the American owner's claim on Spanish resources doubles, though no change of title has occurred. An American who owns bonds of a failed Australian company has lost his future claims on Australian resources, even though the American still holds a piece of paper promising future payment. In other words, the balance of payments is like a corporate income statement, while the net investment position is like a corporate balance sheet.

Treatment of capital gains in the balance of payments and net investment accounts deserves mention. First is the treatment of unrealized gains resulting from exchange rate changes. For example, suppose an American buys a German bond worth 1,000 marks, and the mark then strengthens against the dollar (so a mark buys more dollars than before). Now, the American has a paper gain, since the 1,000-mark bond is worth more in dollars, but until the bond is sold, it is only a paper (or unrealized) gain—the German bond issuer has not *paid* anything to the American bondholder. Previously, such unrealized gains were counted in the balance of payments as income. Now, however, unrealized gains are excluded from the balance of payments and only appear as valuation changes in the investment accounts.

On the other hand, the treatment is different for retained earnings of foreign subsidiaries. If a French subsidiary earns a profit and pays its American parent a dividend, that clearly appears as an income credit item in the balance of payments. If the subsidiary earns the profits and then retains those earnings (i.e., pays no dividend to the parent), convention still treats that as an income credit.

The statement that the United States has become the "world's largest debtor" has gained frequency.[8] This assertion may, in fact, be attributable to a systematic undervaluation of U.S. assets abroad and overvaluation (or smaller undervaluation) of foreign assets in the U.S., particularly with regards to direct investment. An account of the U.S. Commerce Department's attempt to remedy these valuation problems can be found in *Survey of Current Business* (May 1991, p. 40). Another piece of evidence indicates that the value of U.S. investment abroad continues to exceed the value of foreign investment in the U.S.: according to *International Financial Statistics* (August 1991, p. 554), U.S. income on foreign assets has exceeded foreign income on U.S. assets in every year over the period 1984-90 (all the years covered in that issue).

[8] Benjamin Friedman, op. cit. argues this case.

IV. Sources of Data and Other Information

Numerous organizations provide data on international transactions. Below are some of the major providers of data and analytical publications on international trade and finance. Included are the names of some specific publications, with subject matter in parentheses. Many of these agencies also sell data in electronic form.

International Monetary Fund: Publications include *International Financial Statistics* (all aspects of international and domestic finance) plus yearbooks and topical supplements, *Balance of Payments Statistics, Direction of Trade Statistics* (distribution by partner countries and by areas of countries' exports and imports). The *Balance of Payments Manual* explains in great detail the methodologies for measuring and interpreting international transactions. In addition, the IMF publishes numerous studies and documents on special topics. Articles in *Finance and Development* include information on developing country data.

World Bank (International Bank for Reconstruction and Development): The World Bank publishes *World Debt Tables* (external debt of developing countries, aggregate net resource flows and net transfers) and many topical reports.

Organization for Economic Cooperation and Development: OECD provides numerous printed, microfiche, and electronic data publications. Among these are *Monthly Statistics of Foreign Trade, Foreign Trade by Commodities, Financial Market Trends, OECD Financial Statistics, Main Science and Technology Indicators* (trade in technology), and *Quarterly Oil Statistics and Energy Balances.*

United Nations: U.N. publications include the *International Trade Statistics Yearbook, Statistical Yearbook for Asia and the Pacific, Statistical Yearbook for Latin America and the Caribbean, Agriculture, External Trade and International Cooperation, Foreign Trade Statistics of Asia and the Pacific, Handbook of International Trade and Development Statistics,* and the *UNCTAD Commodity Yearbook.*

Central Banks: For the United States, the *Federal Reserve Bulletin* includes data on U.S. international transactions, U.S. foreign trade, and assets and liabilities of Americans to foreigners and foreigners to Americans. Central bank publications in other countries provide similar data.

National Fiscal Agencies: The U.S. *Treasury Bulletin* includes data on international financial holdings, capital movements, and foreign currency. Other countries' treasuries or finance ministries release similar data.

National Economic and Foreign Trade Agencies: The U.S. Department of Commerce monitors U.S. foreign trade. The Department's Bureau of Economic Analysis publishes the *Survey of Current Business,* which includes data on U.S. international trade and finance. Other countries' foreign trade ministries publish similar documents. The Bureau has recently published a book—*The Balance of Payments of the United States: Concepts, Data Sources, and Estimating Procedures*—detailing the Bureau's methodology.

Textbooks: For a better understanding of international trade data, textbooks can be indispensable. One such book is Leland B. Yeager's *International Monetary Relations: Theory, History, and Policy* (Harper & Row).