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BOARD OF GOVERNORS
OF THE
FEDERAL RESERVE SYSTEM

Office Correspondence

Date January 29, 1982

To Federal Open Market Committee

From James L. Kichline

Subject: Ranges of Uncertainty for 1982-83 Staff Forecasts

Attached are staff estimates of ranges of uncertainty for the staff forecast and for forecasts associated with alternative monetary policy assumptions.

Attachment

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Date January 29, 1982

To Mr. James L. Kichline

Subject: Ranges of Uncertainty for Staff Forecasts of 1982-83

From Staff*/

In assessing the desirability of alternative monetary policies, it may be useful to examine not only the modal prospect of each policy considered but also the likely dispersion of consequences that may be associated with alternative policies.

This memorandum provides estimates of:

- Ranges of uncertainty surrounding the staff forecast that are conditioned on the staff's monetary policy assumption.
- Forecasts and associated ranges of uncertainty for alternative monetary policy assumptions.

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*/ P. Tinsley, J. Enzler, G. Fries, B. Garrett, W. Ramm, and C. Wilson with assistance from F. Brayton, M. Blackburn, and P. von zur Muehlen.

I. Introduction

Estimates of uncertainty presented in this memorandum are based on a set of average-history stochastic simulations of the staff quarterly econometric model. The staff forecast of economic activity in 1982-83 is reproduced by the model under the assumption that all forecast errors are zero. Alternative simulated outcomes are provided by introducing simulated forecast errors that are similar in size and pattern to the historical forecast errors of the quarterly econometric model.1/ Three hundred average-history replications of 1982-83 are generated for each monetary policy assumption.

The 70% confidence interval for a particular variable, such as the unemployment rate, is obtained by dropping the high 15% and low 15% of the three hundred simulated unemployment outcomes in a given quarter. The remaining outcomes define a range within which it is expected the actual unemployment rate will fall with 70% probability.2/

1/ The cross-correlations of simulated forecast errors reproduce both correlations over time and correlations across equations of the historical forecast errors of the model. Based on analysis of the increased uncertainty of the money demand function since the mid-1970's, the average size of forecast errors of the money demand function was increased by about 25%.

The stochastic simulation methodology also uses staff estimates of the probabilities of occurence for various patterns of tax cuts and expenditure reductions by the Administration.

2/ Due to the nonlinearity of selected equations in the model, such as the logarithmic formulation of money demand, the staff forecast (where all forecast errors are zero) of a given variable may not be positioned along the midline of the 70 percent confidence interval. That is, the nonlinear model structure may transform the impacts of random disturbances so that deviations from the central forecast may be asymmetric.

Alternative monetary policies considered are:

Q4/Q4 Percentage Growth Rates of M1

Policy	1982	1983
A	5-1/2	5
B	4	3-1/2
C	2-1/2	2-1/2

The M1 path of policy B is the same as that assumed in the staff forecast. The M1 growth rates of policy A are higher than those of policy B by 1-1/2 percentage points in both years. The M1 growth rates of the more restrictive policy C are lower than those of policy B by 1-1/2 percentage points in 1982 and by 1 percentage point in 1983.3/

II. Estimates of Dispersion about the Forecasts

Measures of the estimated dispersion of outcomes about the staff forecast are presented in figures (and tables) 1-B through 4-B. Table 2-B, for example, indicates that the staff forecast (based on monetary policy B) for the civilian unemployment rate in 1982Q4 is 9.3 percent, and there is a 70 percent probability that the unemployment rate may fall between 8.8 and 9.9 percent. The other tables show the range of probable outcomes for the four-quarter growth rates of nominal and real GNP and the implicit price deflator for GNP. The confidence ranges tend to widen noticeably as the forecast horizon increases.

3/ The intra-year pattern of M1 growth in 1982 for policies A and C is similar to the approximately V-shaped pattern assumed for the growth of M1 in 1982 under policy B.

Tables 1-A through 4-A show similar measures of dispersion for forecasts based on a more rapid growth of M1 under policy A. Alternatively, tables 1-C through 4-C provide the dispersion of outcomes associated with forecasts conditioned on a more restrictive M1 growth under policy C.

Figures 5 and 6 tabulate the same uncertainty information in a different fashion. Figure 5 indicates the probability that the unemployment and inflation rates may jointly fall within a given region. The middle region of figure 5, for example, shows the probability that both the unemployment and inflation rates will fall within a 100 basis point region centered on the staff forecast of 9.3 percent for the unemployment rate and 6.4 percent for the four-quarter inflation rate in 1982Q4. Under monetary policy B, there is a 35 percent chance that both variables may fall within this region. Under the alternative policies A and C, the probabilities of falling in this central region fall to 27 and 32 percent, respectively. As would be expected, the chance of observing an unemployment rate below the center region and an inflation rate above the region (within the top left region) increases with the more rapid monetary growth of policy A. The chance of observing an unemployment rate above and an inflation rate below the center region (within the bottom right region) increases with the slower money stock growth of policy C.

The row sums shown at the right of figure 5 show the probabilities of observing inflation rates above, within, and below the center region regardless of the unemployment rate. The probability of observing higher inflation rates rises with the rate of money growth.

The column sums near the bottom of figure 5 denote probabilities of the unemployment rate falling below, within, or above the center region regardless of the outcome for the inflation rate. The probability of obtaining lower unemployment rates increases with faster money growth.

Finally, the probabilities of joint outcomes for inflation and unemployment rates at the end of the second year of the forecast horizon, 1983Q4, are displayed in figure 6 for the three alternative monetary policy assumptions. The probabilities of attaining the center region are markedly lower than those for the center region of figure 5 indicating a smaller likelihood of remaining within a 100 basis point neighborhood of the staff forecast in the second year. This is due, in part, to the cumulative effects of alternative policies (as in the cases of the divergent policies A and C) and, in part, to the widening dispersion of outcomes that is a consequence of the increased uncertainty of longer-term projections (as in the case of outcomes distributed about the staff forecast, policy B).

Policy Assumption B

Q4/Q4 M1 growth = 4% ('82) and 3-1/2% ('83)

Figure 1-B

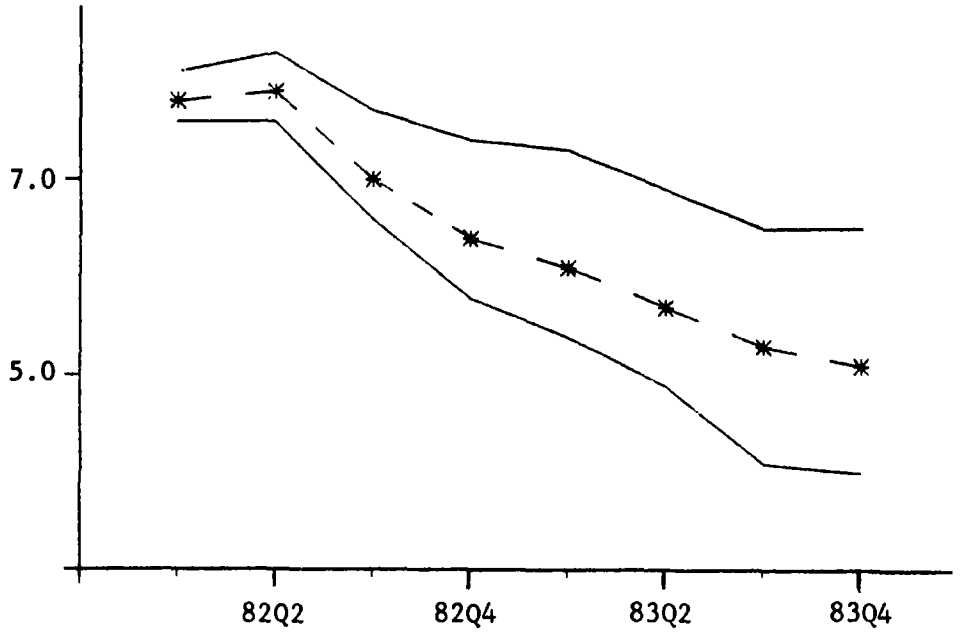


Table 1-B

4-QTR PERCENT GROWTH: GNP DEFLATOR

Date	Low	Predict	High	Range
82Q1	7.6	7.8	8.1	0.5
82Q2	7.6	7.9	8.3	0.7
82Q3	6.6	7.0	7.7	1.1
82Q4	5.8	6.4	7.4	1.6
83Q1	5.4	6.1	7.3	1.9
83Q2	4.9	5.7	6.9	2.0
83Q3	4.1	5.3	6.5	2.4
83Q4	4.0	5.1	6.5	2.5

Figure 2-B

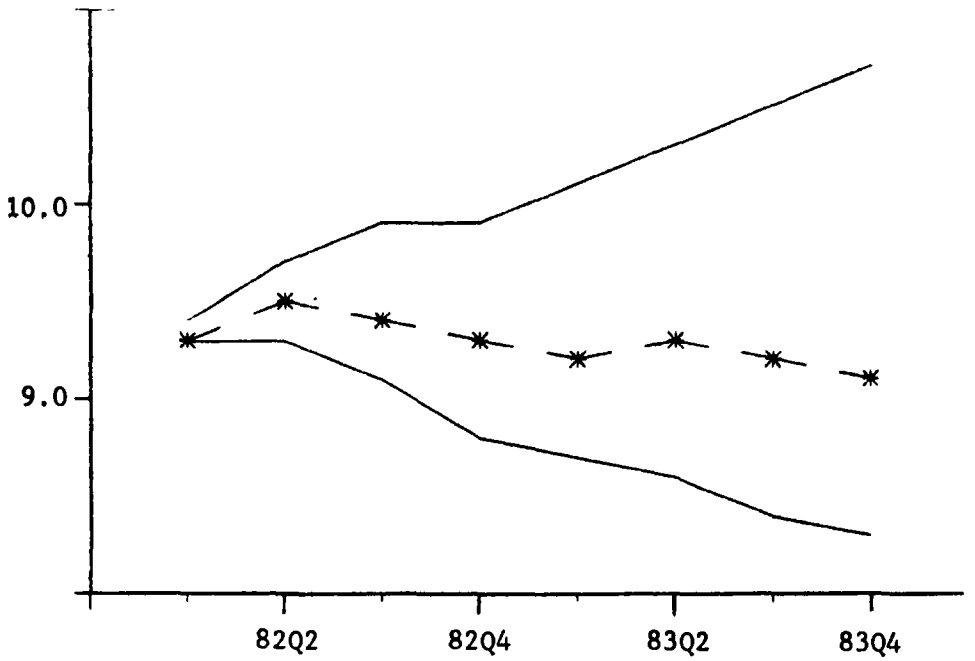


Table 2-B

CIVILIAN UNEMPLOYMENT RATE

Date	Low	Predict	High	Range
82Q1	9.3	9.3	9.4	0.1
82Q2	9.3	9.5	9.7	0.4
82Q3	9.1	9.4	9.9	0.8
82Q4	8.8	9.3	9.9	1.1
83Q1	8.7	9.2	10.1	1.4
83Q2	8.6	9.3	10.3	1.7
83Q3	8.4	9.2	10.5	2.1
83Q4	8.3	9.1	10.7	2.4

Policy Assumption B

Q4/Q4 M1 growth = 4% ('82) and 3-1/2% ('83)

Figure 3-B

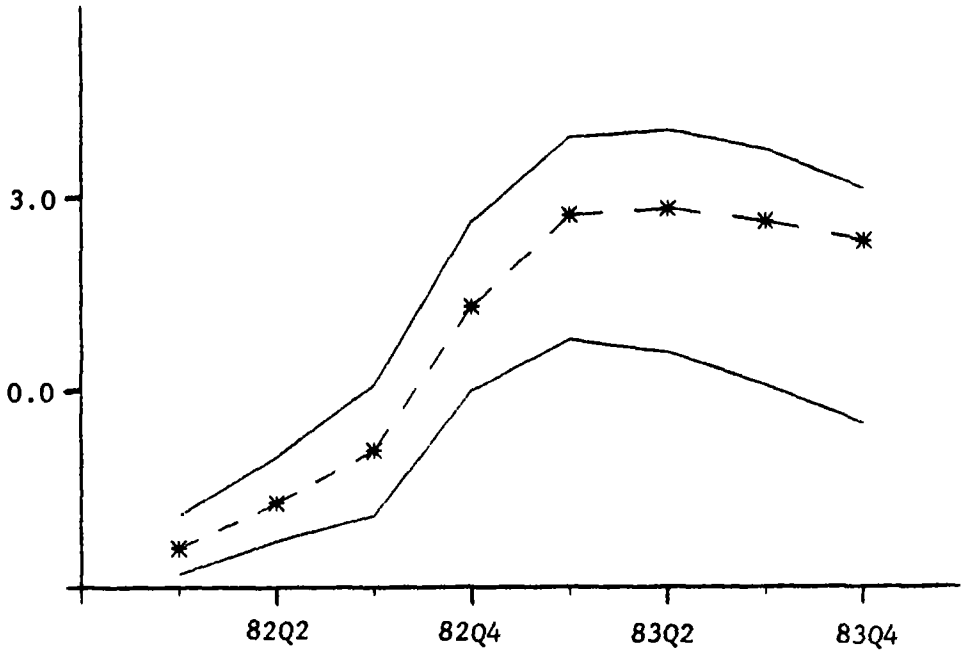


Table 3-B

4-QTR PERCENT GROWTH: REAL GNP

Date	Low	Predict	High	Range
82Q1	-2.8	-2.4	-1.9	0.9
82Q2	-2.3	-1.7	-1.0	1.3
82Q3	-1.9	-0.9	0.1	2.0
82Q4	0.0	1.3	2.6	2.6
83Q1	0.8	2.7	3.9	3.1
83Q2	0.6	2.8	4.0	3.4
83Q3	0.1	2.6	3.7	3.6
83Q4	-0.5	2.3	3.1	3.6

Figure 4-B

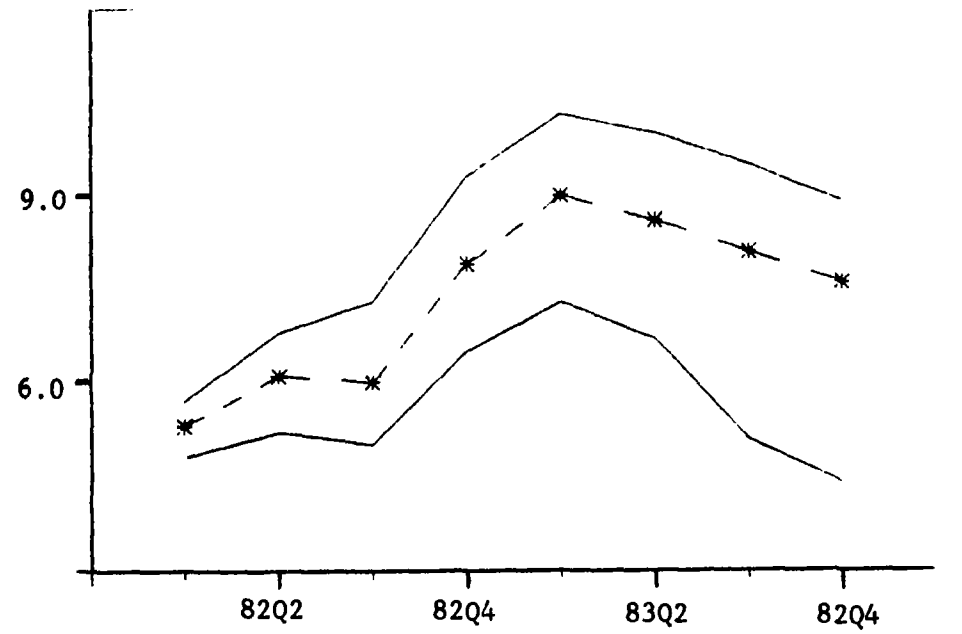


Table 4-B

4-QTR PERCENT GROWTH: NOMINAL GNP

Date	Low	Predict	High	Range
82Q1	4.8	5.3	5.7	0.9
82Q2	5.2	6.1	6.8	1.6
82Q3	5.0	6.0	7.3	2.3
82Q4	6.5	7.9	9.3	2.8
83Q1	7.3	9.0	10.3	3.0
83Q2	6.7	8.6	10.0	3.3
83Q3	5.1	8.1	9.5	4.4
83Q4	4.4	7.6	8.9	4.5

Policy Assumption A

Q4/Q4 M1 growth = 5-1/2% ('82) and 5% ('83)

Table 1-A

4-QTR PERCENT GROWTH: GNP DEFLATOR

Date	Low	Predict	High	Range
82Q1	7.6	7.8	8.1	0.5
82Q2	7.7	8.0	8.4	0.7
82Q3	6.6	7.0	7.9	1.3
82Q4	5.8	6.5	7.6	1.8
83Q1	5.5	6.2	7.6	2.1
83Q2	4.9	5.8	7.3	2.4
83Q3	4.1	5.5	6.9	2.8
83Q4	4.2	5.4	7.0	2.8

Table 2-A

UNEMPLOYMENT RATE

Date	Low	Predict	High	Range
82Q1	9.2	9.3	9.4	0.2
82Q2	9.2	9.4	9.7	0.5
82Q3	8.8	9.2	9.7	0.9
82Q4	8.5	9.0	9.6	1.1
83Q1	8.2	8.9	9.6	1.4
83Q2	8.0	8.8	9.8	1.8
83Q3	7.6	8.5	9.7	2.1
83Q4	7.3	8.2	9.7	2.4

Table 3-A

4-QTR PERCENT GROWTH: REAL GNP

Date	Low	Predict	High	Range
82Q1	-2.7	-2.2	-1.9	0.8
82Q2	-2.0	-1.4	-0.7	1.3
82Q3	-1.6	-0.4	0.4	2.0
82Q4	0.4	2.0	3.0	2.6
83Q1	1.6	3.5	4.6	3.0
83Q2	1.5	3.7	4.9	3.4
83Q3	1.3	3.7	5.1	3.8
83Q4	0.8	3.6	4.6	3.8

Table 4-A

4-QTR PERCENT GROWTH: NOMINAL GNP

Date	Low	Predict	High	Range
82Q1	5.0	5.4	5.8	0.8
82Q2	5.6	6.5	7.2	1.6
82Q3	5.6	6.6	8.0	2.4
82Q4	7.2	8.7	10.1	2.9
83Q1	8.3	10.0	11.7	3.4
83Q2	7.8	9.7	11.3	3.5
83Q3	6.6	9.4	10.9	4.3
83Q4	6.2	9.2	10.6	4.4

Policy Assumption C

Q4/Q4 M1 growth = 2-1/2% ('82) and 2-1/2% ('83)

Table 1-C

4-QTR PERCENT GROWTH: GNP DEFLATOR

Date	Low	Predict	High	Range
82Q1	7.6	7.8	8.0	0.4
82Q2	7.6	7.9	8.3	0.7
82Q3	6.5	7.0	7.6	1.1
82Q4	5.7	6.4	7.2	1.5
83Q1	5.1	6.0	6.9	1.8
83Q2	4.6	5.5	6.5	1.9
83Q3	4.1	5.1	6.3	2.2
83Q4	3.9	4.9	6.2	2.3

Table 2-C

UNEMPLOYMENT RATE

Date	Low	Predict	High	Range
82Q1	9.3	9.4	9.5	0.2
82Q2	9.4	9.6	9.9	0.5
82Q3	9.2	9.6	10.0	0.8
82Q4	9.1	9.6	10.2	1.1
83Q1	9.1	9.7	10.4	1.3
83Q2	9.2	10.0	10.9	1.7
83Q3	9.3	10.0	11.2	1.9
83Q4	9.3	10.1	11.7	2.4

Table 3-C

4-QTR PERCENT GROWTH: REAL GNP

Date	Low	Predict	High	Range
82Q1	-3.0	-2.5	-2.0	1.0
82Q2	-2.6	-2.0	-1.4	1.2
82Q3	-2.5	-1.5	-0.5	2.0
82Q4	-0.7	0.5	1.8	2.5
83Q1	0.0	1.7	3.1	3.1
83Q2	-0.5	1.6	3.0	3.5
83Q3	-1.3	1.2	2.7	4.0
83Q4	-2.2	1.1	2.0	4.2

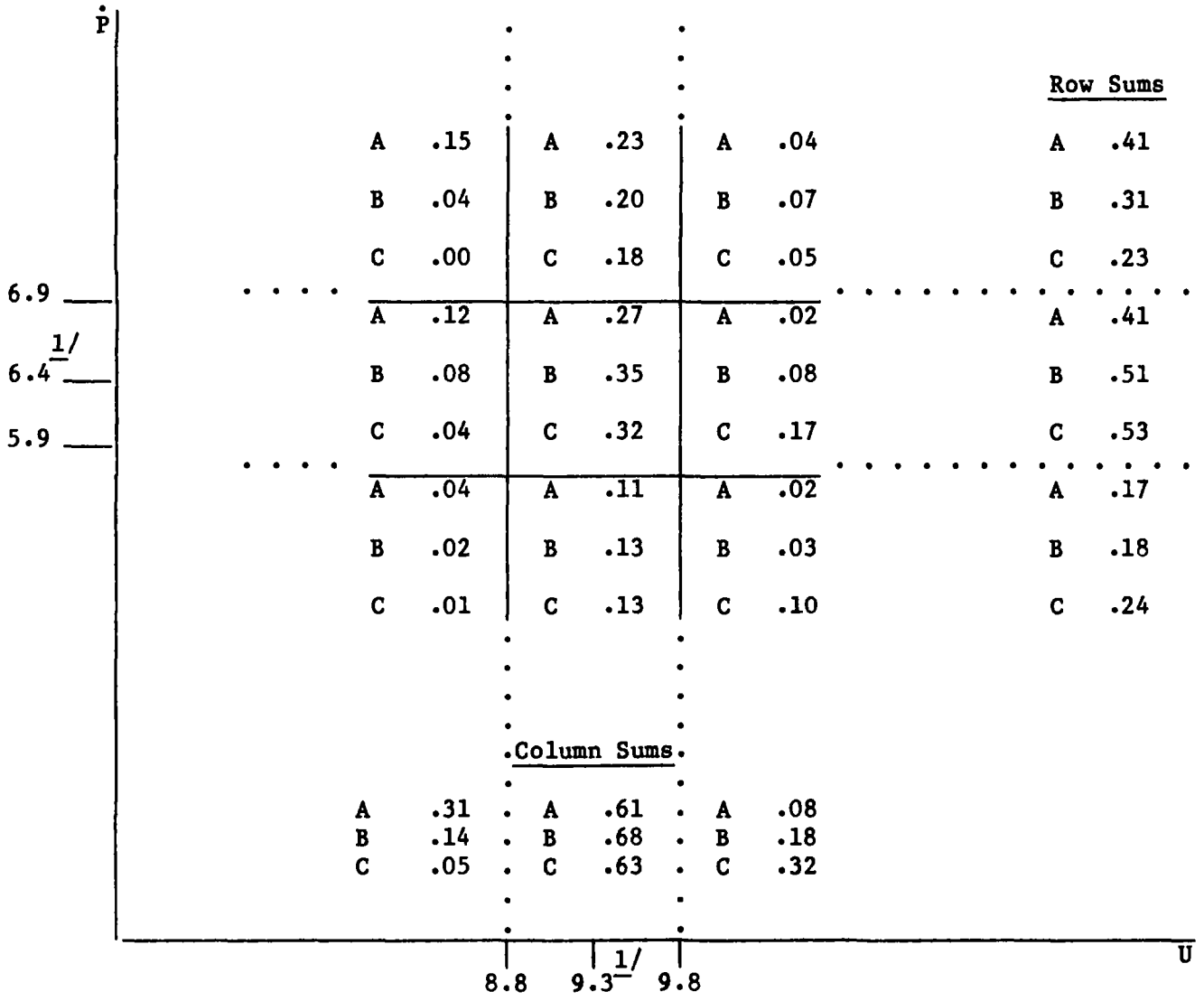
Table 4-C

4-QTR PERCENT GROWTH: NOMINAL GNP

Date	Low	Predict	High	Range
82Q1	4.7	5.1	5.6	0.9
82Q2	4.9	5.8	6.4	1.5
82Q3	4.3	5.4	6.5	2.2
82Q4	5.6	6.9	8.2	2.6
83Q1	6.2	7.8	9.3	3.1
83Q2	5.3	7.2	8.8	3.5
83Q3	3.8	6.4	7.9	4.1
83Q4	2.6	6.0	7.0	4.4

Figure 5

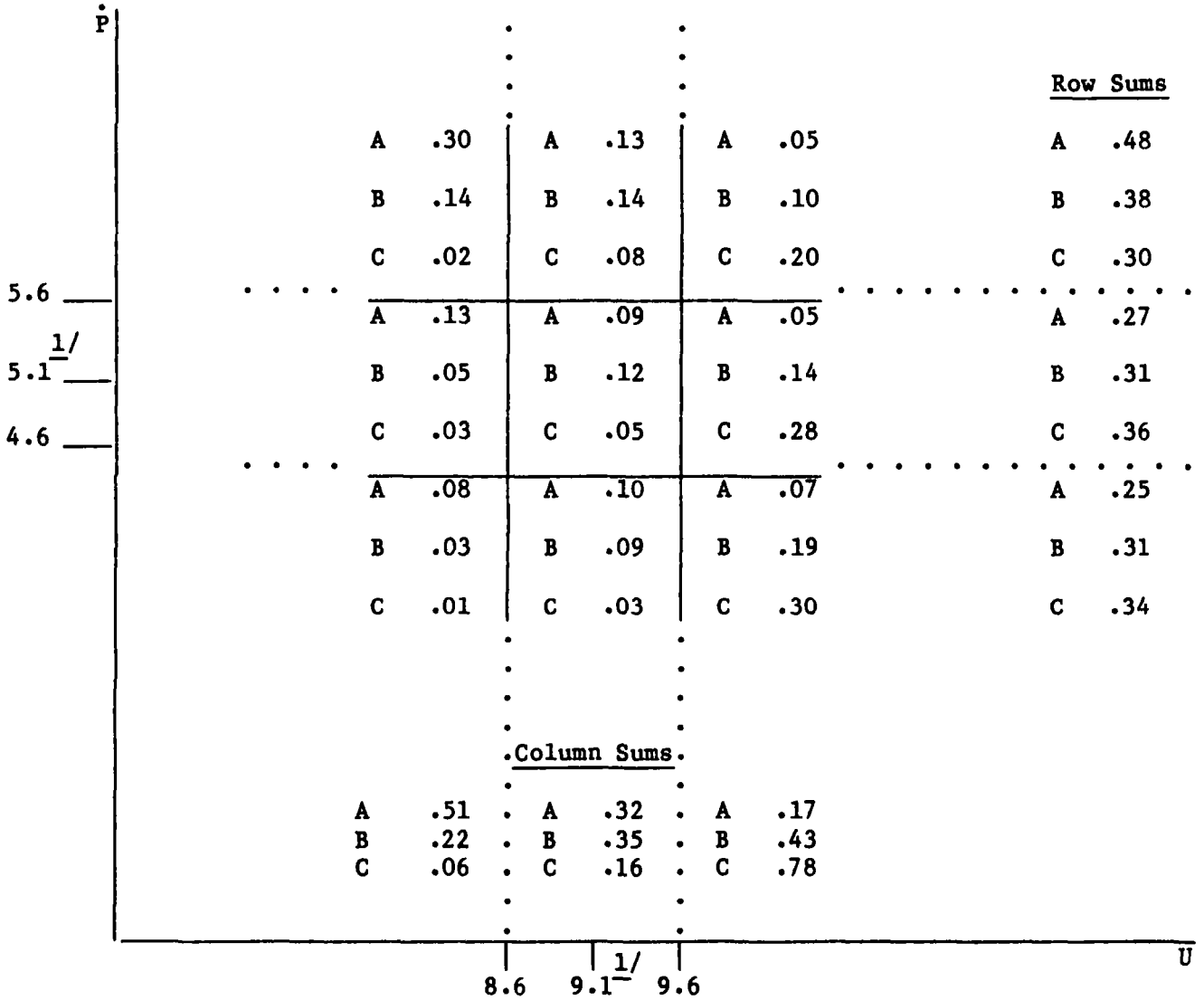
Joint Probabilities of Price Inflation, $\dot{P}$, and Unemployment, U, Rates under Alternative Monetary Policy Assumptions 1982Q4



1/ Staff forecasts of Q4/Q4 price inflation rate and civilian unemployment rate in 1982Q4.

Figure 6

Joint Probabilities of Price Inflation, $\dot{P}$, and Unemployment, U, Rates under Alternative Monetary Policy Assumptions
1983Q4



1/ Staff forecasts of Q4/Q4 price inflation rate and civilian unemployment rate in 1983Q4.

Appendix A: A Brief Review of 70% Confidence Intervals Projected in January 1981.

One purpose of estimating confidence intervals in the planning stage of policy formation is to establish a basis for screening the statistical significance of subsequent events that depart from the predicted consequences of planned policy. The choice of 70% confidence intervals implies that the odds be at least two to one that a subsequent event outside the boundaries of the projected confidence region represents a significant departure from the expected consequences of planned policy and is not the result of transitory disturbances or noise due to imperfect measurements. In the case of significant departures from expected consequences, alteration or continuation of planned policy may be desired, depending on the location and severity of the unexpected forecast errors.

The "Low" and "High" values in Table A.1 are boundaries of 70% confidence regions projected in late January, 1981 that were conditioned on the assumption that the annualized growth of shift-adjusted M1 would be 3.5% in each quarter of 1981.[1/] By midyear, the annualized growth of shift-adjusted M1 was 2.2%, somewhat lower than the conditioning assumption of the projected 70% boundaries of Table A.1. Nevertheless, the midyear records of the direct target indicators suggested that the economy was more resilient than expected.

Although the growth of the GNP deflator was more favorable than expected, the midyear outcomes of both the unemployment rate and the four-quarter growth rate of real GNP were outside the projected 70% regions in

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1/ The *ex ante* 70% confidence regions were reported in the January 30, 1981 memorandum, "The Ranges of Uncertainty in Staff Forecasts of 1981-2".

directions that indicated significant unexpected strength in real economic activity or, equivalently, unexpected increases in the velocity of shift-adjusted M1. Accompanied by a continuation in the second half of 1981 of the relatively tight annualized growth of shift-adjusted M1,2/ the unemployment rate returned to the interior of its projected confidence region and the growth of real GNP drew markedly closer to its upper boundary by the end of 1981. The terminal growth rate of the GNP deflator remained slightly below the lower boundary of the projected 70% confidence region. These direct target results lend some statistical support to the maintenance of a relatively restrictive growth of shift-adjusted M1 throughout 1981.

2/ The annualized cumulative growth rates of shift-adjusted M1 in the four quarters of 1981 were: -0.8, 2.2, 1.3, and 2.1.

Table A.1: Projected 70% Confidence Intervals and Historical Outcomes in 1981.[1/]

	4-QTR PERCENT GROWTH: GNP DEFLATOR			CIVILIAN UNEMPLOYMENT RATE		
Date	Low	Actual	High	Low	Actual	High
81Q1	10.2	9.9*	10.7	7.4	7.4	7.8
81Q2	9.8	9.0*	10.6	7.7	7.4*	8.5
81Q3	9.6	9.2*	10.6	8.0	7.2*	9.0
81Q4	9.0	8.6*	10.2	8.2	8.4	9.7

	4-QTR PERCENT GROWTH: NOMINAL GNP			4-QTR PERCENT GROWTH: REAL GNP		
Date	Low	Actual	High	Low	Actual	High
81Q1	9.1	10.9*	10.6	-1.2	1.0*	0.1
81Q2	10.4	12.5	12.6	0.3	3.2*	2.2
81Q3	9.3	12.4*	11.8	-0.8	3.0*	1.6
81Q4	6.6	9.3	10.2	-2.6	0.7*	0.4

1/ "Low" and "High" are boundaries of 70% confidence intervals projected in late January, 1981 (based on an assumed Q4/Q4 growth rate of 3.5% for shift-adjusted M1).

"Actual" denotes historical values (associated with a Q4/Q4 growth rate of 2.1% for shift-adjusted M1).

*/ Indicates historical value fell outside the projected 70% confidence interval.