Distribution of the Disinflation of Prices in 1990-91 Compared with Previous Business Cycles

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The disinflation of 1990-91 is compared with previous cycles using distributions of changes in the same group of producer prices, which reveals patterns not disclosed in aggregate indexes. The pattern in 1990-91 was quite similar in the aggregate to the earlier cycles of 1960-61 and 1969-70, but the impact of disinflationary pressures on particular commodities differed appreciably between 1990-91 and 1969-70. In addition, 1990-91 had somewhat more prices disinflating overall, but only in the first year after the business trough, reflecting a milder recovery in activity.

I. Introduction

After the post-World War II price decline in 1946, all substantial disinflations are associated with business contractions. The recent recession of July 1990 to March 1991 fits the usual pattern, except that its disinflation *during* the business contraction was on the low side, despite a fairly strong decline in economic activity. This exception appeared to depart from the historical Phllips Curve, and led initially to consternation over the seeming failure of monetary restraint to combat inflation. In fact, however, most of the disinflation came *after* the business contraction. Overall the fraction of prices disinflating exceeded the fraction in every cyclical episode since 1960 except for the severe 1981-82 cycle.

To compare price behavior among cyclical episodes we may assemble frequency distributions for the same group of producer prices. Aggregate price indexes comprise a changing coverage of prices over time, and being weighted do not capture the distribution of inflationary pressures throughout the economy. The BLS (Bureau of Labor Statistics) compilation of producer prices allows us to select individual prices at the most basic level that cover a period long enough to compare 1990-91 with previous cycles. Of course, the BLS sometimes extends a particular item by substituting a different price for the original one that for any reason becomes unavailable, but such extensions occur only if the new and original price are considerred virtually identical. Otherwise the price coverage of the good in question is discontinued.

*Professor of Economics, Columbia University. Xingli Zhu expertly handled the computations.

II. The Data

On the BLS tape of all producer prices, the same 633 series cover the cycles from 1969-70 through 1990-91, and the same 472 series cover the longer period from 1960-61 through 1990-91. Gaps (absence of data) occur in the coverage of many series. To use as many series as possible, the gaps were filled with interpolations from surrounding values if the gap did not seriously interfere with the calculation of the inflation rate for the periods covered.

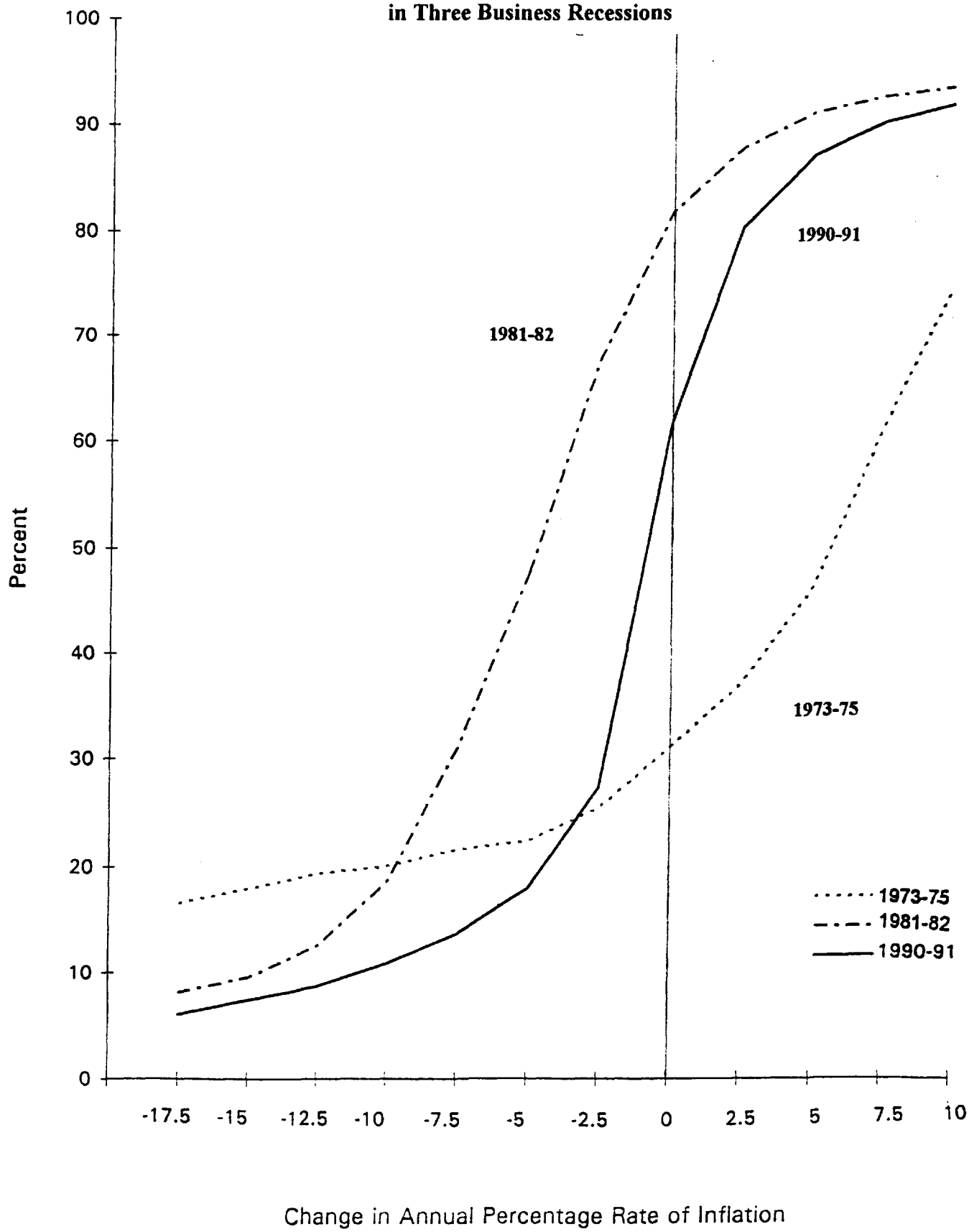
Each of two measures of disinflation here cover the change in rate of inflation from the expansion period to the contraction or later period of the cycle. The annual average rate of price change in the year up to the business cycle peak month is subtracted, in the first measure, from the annualized average rate of inflation from the peak to the business trough month, and in the second measure from the average rate from the peak to one year after the business trough (to catch delayed effects). To avoid exceptional jumps in the series, the measures use three--month centered averages of the beginning and end of the periods.[1]

III. The Distribution of Price Changes

Figures I and II present cumulative frequency distributions of the inflation changes comparing 1990-91 with two groups of previous cycles. These use the second measure covering the peak to one year after the business trough minus the year up to the business peak. The figures collect the frequency changes in rate of inflation into ten cells, differing by 2½ percentage points, beginning with a change of less than minus 17½ annual percentage points and ending with a change of up to less than plus 10 annual percentage points. The zero line indicates the fraction of series in which the rate of inflation declined.

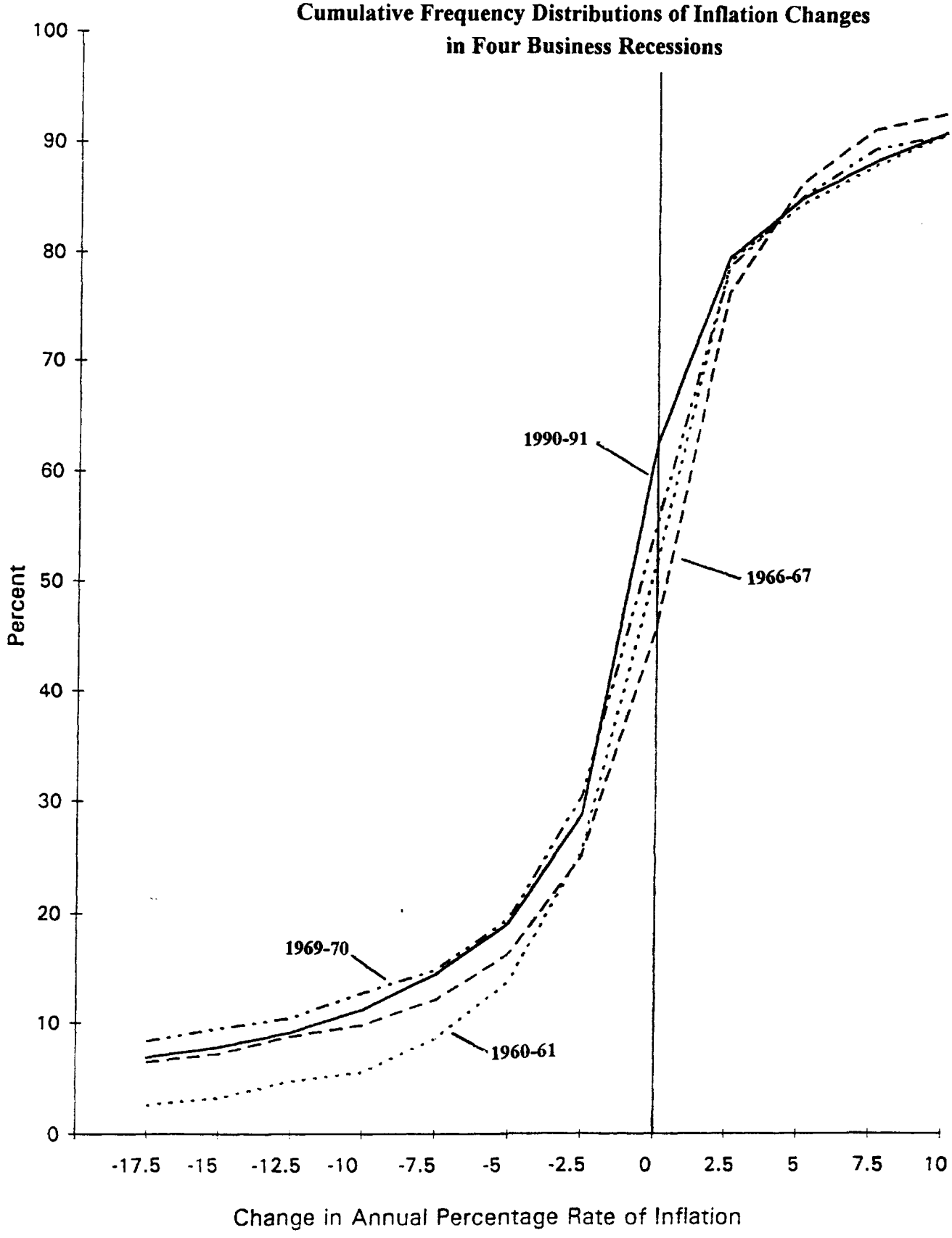
Figure I of 633 series compares 1990-91 with two previous cycles in which price behavior differed radically: 1972-75 following the world-wide explosion of prices, marked by the OPEC increase in oil prices, and 1981-82 covering the Federal Reserve's severe monetary restraint to bring down the runaway inflation of the 1970s. The short recession of 1980-81 is not covered because it was so short and also overlaps with 1981-82.

Figure I
Cumulative Frequency Distributions of Inflation Changes in Three Business Recessions



Note: From business cycle peak to 1 year after business trough, the same 633 series.
Source: Appendix Table.

Figure II
Cumulative Frequency Distributions of Inflation Changes in Four Business Recessions



Note: From business cycle peak to 1 year after business trough, the same 472 series.
Source: Appendix Table.

Table I

Real GDP during Business Recessions and First year of Recoveries

Date of Peak in Real GDP	*Peak Quarter*	*Peak Quarter Plus:* 1Q	2Q	3Q	4Q	5Q	6Q	7Q	8Q	9Q
1960Q1	100.0	99.7	99.8	99.2	100.0	101.5	102.9	105.0	106.4	
1966Q4	100.0	100.6	101.1	102.2	102.8	104.2	105.9			
1969Q3	100.0	99.7	99.4	99.1	100.4	99.6	101.9	102.1	102.7	103.2
1973Q4	100.0	99.1	99.3	98.5	98.1	95.9	97.0	98.8	100.1	102.1
1981Q3	100.0	98.4	97.2	97.6	97.2	97.3	97.9	100.6	102.1	103.8
1990Q2	100.0	99.6	98.6	97.8	98.3	98.6	98.7	99.4		

Notes: Based on *Survey of Current Business* for July 1992 and 1993 and National Bureau of Economic Research cycle dates. Peak in GDP to 1 year after NBER trough. Peak in real GDP occurs one quarter before NBER designated cycle peak in 1960, 1969, and 1990. In 1966 no cyclical peak in real GDP occurred. Selection of the mini-cycle peak in 1966Q4 is based on other variables.

The three distributions of Figure I have little in common. Compared with 1990-91, 1973-75 displays little disinflationary pressures while 1981-82 exhibits widespread and sharp disinflation.

Figure II of 472 series (fewer owing to the longer coverage) compares 1990-91 with three quite similar patterns: the mild recessions of 1969-70 and 1960-61, and the minirecession of 1966-67 (not cited by the National Bureau of Economic Research as a full-fledged recession).[2] Here we can see that 1990-91 displays a more widespread disinflation (higher values in the middle sections of the figure) than these earlier cycles do. This agrees with its much weaker recovery in real GDP, as shown in Table I.

What is not revealed by Figure II is that nearly all the disinflation in 1990-91 (and also 1969-70) comes after the business trough. Table II presents some pertinent statistics of the distributions. The spread (absolute deviation) and symmetry (skewness) of the 1990-91 distribution is similar to the previous mild cycles. Its percent declining in the top group of series is appreciably higher, exceeded only by the severe disinflation of 1981-82. But in the bottom group, measuring the peak to trough period only, the percent declining in 1990-91 is virtually the same as in the previous cycles, excepting 1966-67. (The latter disinflation was atypically rapid and short.) In the other mild cycles the fraction declining does not exceed one-half during the business downturn, and only goes above

Table II

Characteristics of Distributions of Changes in Rates of Change of Producer Prices Associated with Business Recessions

Peak-Trough of Recession	*Percent Declining*	*Absolute Deviation*	*Skewness*
		Change in Annual Percentage Rates	
	Peak to 1 year after Trough minus Year up to Peak		
N=3214			
Jul 90-Mar 91	59.0	3.9	0.7
N=472			
Apr 60-Feb 61	51.5	4.5	0.6
Nov 66-May 67	45.6	5.1	0.8
Dec 69-Nov 70	55.1	5.7	0.8
Nov 73-Mar 75	33.3	9.3	0.6
Jul 81-Nov 82	81.1	6.5	1.0
Jul 90-Mar 91	62.3	5.2	0.8
	Peak to Trough minus Year up to Peak		
Apr 60-Feb 61	50.6	5.2	0.7
Nov 66-May 67	56.6	6.4	0.8
Dec 69-Nov 70	50.4	6.1	0.7
Jul 90-Mar 91	49.8	6.1	0.8

Notes: Based on 13 cell frequencies of the cumulative distributions shown in Figures I and II and Appendix Table.
Series in each cell are assumed to be at the midpoint of the cell,and the open-ended cells are assumed to be 5 percentage points in width.
Formula for absolute deviation is $\Sigma|x-\bar{x}|/N$ and skewness $\Sigma(x-\bar{x})^3/N \div 2\{\Sigma(x-\bar{x})^2/N\}^{3/2}$.

one-half in the subsequent year of recovery.

Table II and the Appendix Table also show how the preceding distributions fare under different coverage. For all 3214 series covering the 1990-91 episode, the distribution has relatively fewer extreme values (smaller absolute deviation), but the middle point (percent declining) differs only by 3 percent of the total number of series. In the Appendix Table the exclusion of basic agricultural series removes some of the extreme values, but except for

1973-75 does not change the number declining appreciably.

III. Disinflation, Real GDP, and Monetary Policy

The stronger post-recession disinflation in 1990-91 can be attributed to the mild business recovery. Although the contraction was not much deeper, GDP did not exceed its peak level during the full year after the trough, unlike the strong recoveries of all these other cycles. Table I shows that real GDP was flat in the mild contractions (except 1966-67) and then rose sharply in the first year of recovery, excepting 1990-91 in which it continued flat.[3] The broader disinflation of prices combined with slow growth of output in the recovery from 1990-91 meant that aggregate demand remained subdued.

Table III

Indicators of Monetary Policy during Four Mild Recessions and Recoveries

Date of	*Peak*	*Peak Quarter Plus:*							
Cycle Peak	*Quarter*	*1Q*	*2Q*	*3Q*	*4Q*	*5Q*	*6Q*	*7Q*	*8Q*
				Monetary Base					
1960Q2	100.0	100.6	101.5	101.7	101.8	102.6	104.0	104.6	
1966Q4	100.0	102.8	104.5	106.5	108.0	109.5			
1969Q4	100.0	102.5	104.4	106.3	108.6	110.7	112.9	114.4	
1990Q3	100.0	106.0	107.1	108.9	111.1	113.7			
				M1					
1960Q2	100.0	100.9	100.9	101.4	102.2	102.8	103.7	104.4	
1966Q4	100.0	101.0	102.4	104.7	106.4	107.8	109.6		
1969Q4	100.0	101.1	101.8	103.2	105.0	106.8	109.0	110.9	112.0
1990Q3	100.0	100.9	102.3	104.2	106.2	109.1	113.6		
				M2					
1960Q2	100.0	101.8	103.3	105.1	107.0	108.8	110.7	113.0	
1966Q4	100.0	101.6	104.0	106.9	109.1	111.0	112.8		
1969Q4	100.0	100.5	101.2	103.3	106.1	109.5	113.9	117.2	120.4
1990Q3	100.0	100.5	101.4	102.5	102.7	103.3	104.4		
				Commercial Paper Rate					
				(Percentage Points)					
1960Q2	0.00	-0.70	-0.80	-1.06	-1.21	-1.18	-1.02	-0.83	
1966Q4	0.00	-0.55	-1.28	-1.03	-0.70	-0.42	+0.08		
1969Q4	0.00	-0.07	-0.45	-0.78	-2.33	-4.03	-3.58	-2.88	-3.55
1990Q3	0.00	-0.15	-1.24	-1.78	-2.00	-2.92	-3.64		

Notes: Peak to 1 year after NBER trough. 1966 based on minirecession from 1966Q4 to 1967Q2. Data are ratios of indicated quarter to peak value except for 6-month commercial paper rates which are differences. Monthly data were averaged to quarters. Monetary base is the St.Louis version.

Can this subdued recovery be attributed to monetary policy? Table III records the role of monetary policy in the four mild cycles. In 1990-91 the monetary base and M1 rose rapidly and short-term interest rates fell sharply. The only indication here of monetary restraint in this cycle was the slow growth of M2, which reflected the disruption and retrenchment of savings and commercial banks. An unprecedented shift in demand occurred away from time and savings deposits in these institutions. Monetary policy responded with the strong expansion of the base and M1. All that can be concluded from these data is that monetary policy offset but did not counteract the financial and other developments at large restraining the growth in aggregate demand. If sustained disinflation was the objective of policy, somehow it succeeded.

IV. Behavior of Individual Prices among Cycles

The preceding distributions do not show how the same commodity prices behaved in the different cycles. Are some particular commodities leaders and others laggards in similar disinflationary episodes? We can answer this question by regressing price behavior of each commodity in one cycle on its behavior in another cycle. A slope coefficient of unity would indicate that changes in inflation rates for individual commodities typically differed from the mean change by the same amount in both cycles. A slope of zero would indicate no similarity in behavior between the two cycles.

A comparison of 1990-91 with the similar earlier disinflation of 1969-70 is presented in Table IV. To allow for different mean changes among industries, dummy variables for all but one industry have been included. The slope coefficients are virtually zero and with extreme values excluded statistically insignificant. They indicate a very small positive correspondence, except for the anomalous negative (but quite small) coefficient for all series including agriculture. Therefore, virtually no relation exists between the relative disinflation of a commodity in the 1990-91 cycle and its disinflation in the 1969-70 cycle.

Similar results (not shown) apply to the other mild cycles. We may conclude that, while economic contractions produce disinflationary pressures in the aggregate, the *distribution* of these pressures across the economy do *not* conform to any systematic pattern.

Table IV
Regression of Individual Price Behavior, 1990-91 on 1969-70

Number of Prices	*Slope Coefficient*	*t Statistic*	*Industry Dummies Included?*	$\bar{R}^2$
All series 625	-.14	-3.1	yes	.01
Excl. extreme values				
>|7.5| 419	+.08	1.7	no	.005
Excl. agriculture 558	+.07	2.1	yes	.05

Note: Agriculture comprises unprocessed farm products (BLS code 01).

V. Conclusions

Slow recoveries from mild recessions, partly reflecting monetary policy and no doubt fortuitous other influences, are fundamental for a sustainable reduction of inflation. The 1990-91, 1969-70, and 1960-61 cycles illustrate this proposition. A crucial part of these disinflations come after the business trough. The main points of impact of the disinflation cannot be predicted, however. Despite the aggregate effect of the disinflation process, the distribution across the economy differs appreciably among cycles.

An important characteristic of the 1990-91 cycle was the increase in percent of declining inflation rates compared with earlier mild cycles. An earlier study of mine (Cagan 1972) reported a reduction in the percent declining in successive mild recessions through 1969-70, presumably reflecting spreading and increasing expectations of inflation in that period. As the back-to-back recessions of 1957-58 and 1960-61 broke the momentum of the creeping inflation of the 1950s, so 1981-82 and 1990-91 reversed the runaway inflation and heightened expectations of the 1970s.

Appendix Table
Cumulative Frequency Distributions
(in percent)

Cycle	*Change in Annual Percentage Rates of Inflation*											
	<-17½	<-15	<-12½	<-10	<-7½	<-5	<-2½	<0	<2½	<5	<7½	<10
	Peak to 1 Year after Trough minus Year up to Peak											
3214 Series												
1990-91	3	4	5	7	9	14	25	59	82	90	94	96
633 Series												
1969-70	7	8	9	11	13	18	31	56	79	87	91	92
1973-75	17	18	19	20	22	23	25	31	37	46	61	75
1981-82	8	10	13	19	31	48	68	82	88	91	93	94
1990-91	6	7	9	11	14	18	27	62	80	87	90	92
487 Series (excluding agriculture BLS code 01)												
1969-70	4	5	5	6	8	13	26	57	80	89	93	95
1973-75	6	7	7	8	9	10	12	19	25	36	54	70
1981-82	5	6	9	14	28	47	69	85	91	95	96	97
1990-91	1	3	3	5	8	12	22	64	86	92	95	97
472 Series												
1960-61	3	3	5	6	9	14	26	52	79	84	88	91
1966-67	6	7	9	10	12	16	25	46	76	86	91	92
1969-70	8	10	10	13	15	20	31	55	79	85	89	91
1973-75	17	19	21	22	24	25	27	33	40	48	64	77
1981-82	9	10	13	20	31	48	69	81	88	91	92	93
1990-91	7	8	9	11	14	19	29	62	80	85	88	91
	Peak to Trough minus Year up to Peak											
633 Series												
1969-70	8	10	11	13	16	19	28	50	74	84	89	92
1973-75	17	18	18	19	21	21	22	24	29	35	42	50
1981-82	10	13	17	23	34	49	69	83	91	93	95	95
1990-91	8	9	10	11	15	18	27	50	74	84	87	90
472 Series												
1960-61	5	6	7	10	13	17	28	51	75	84	88	89
1966-67	10	12	14	16	18	23	33	57	81	88	91	92
1969-70	9	11	12	14	17	20	29	50	74	83	88	90
1973-75	18	19	20	21	22	23	24	26	31	36	43	51
1981-82	12	14	19	24	35	50	69	82	90	93	94	94
1990-91	9	10	11	12	16	19	28	50	73	81	86	89
	Year after Trough minus Year up to Peak											
633 Series												
1969-70	7	8	10	12	14	20	36	60	77	85	88	90
1973-75	17	20	23	26	30	35	44	55	70	84	92	96
1981-82	7	9	12	20	34	51	64	75	80	84	86	88
1990-91	6	7	8	10	13	20	32	66	82	87	90	92

Source: BLS monthly producer prices. Number of series varies because only those that cover all designated periods are included.

Notes: Periods are NBER business cycles, with addition of 1966-67 minirecession. For monthly dates of business peaks and troughs see Table II.

For each price series, the average rate of change from 1 year before the peak to the peak is subtracted from the change from peak to 1 year after trough or from peak to trough or for 1 year after the trough (based on 3-month centered averages of monthly levels at each beginning and end of period), expressed as an annual percentage rate. For formula see footnote 1.

Footnotes

[1]The formula in percentage points is

$\{\log_e(X_{E-1} + X_E + X_{E+1}) - \log_e(X_{P-1} + X_P + X_{P+1})\}1200/N$ minus

$\{\log_e(X_{P-1} + X_P + X_{P+1}) - \log_e(X_{B-1} + X_B + X_{B+1})\}100$

where E is the month at the end of the period covered, P the month of the business peak, and N the number of months from P to E, and B one year before the peak.

[2]On the dating of the 1966-67 minirecession see Cagan 1979, p. 138.

[3]For further discussion see Brauer 1993 and Judd and Beebe 1993.

References

Brauer, David. "A Historical Perspective on the 1989-92 Slow Growth Period." Federal Reserve Bank of New York *Quarterly Review,* summer 1993, 1-14.

Cagan, Phillip. *Persistent Inflation Historical and Policy Essays.* New York: Columbia University Press, 1979.

_____. "Changes in the Recession Behavior of Wholesale Prices in the 1920's and Post-World War II." *Explorations in Economic Research,* winter 1975, 54-104.

Judd, John P., and Jack H. Beebe. "The Output-Inflation Trade-off in the United States: Has It Changed Since the Late 1970s?" Federal Reserve Bank of San Francisco *Economic Review,* 1993 no. 3, 25-34.

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