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Olivier J. Blanchard

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ABSTRACT

This paper examines, in light of the Lucas Critique, the behavior of the Phillips curve and of the term structure of interest rates after October 1979.

It starts with an informal account of the policy change and then discusses how we might expect these two relations to shift after such a change.

It finds little evidence of a direct effect of the policy change on the Phillips curve, at least until 1982. It finds substantial evidence of a direct effect on term structure.

Olivier J. Blanchard
Department of Economics
M.I.T.
Cambridge, MA 02139
(617) 253-8891

The Lucas Critique and the Volcker Deflation

by Olivier J. Blanchard*

Robert Lucas warned us in 1976 [1976] that our econometric models were, by their very design, likely to perform poorly in the face of policy regime changes. The US economy has in the last four years experienced precisely such a change, namely a change in monetary policy. Now is therefore a good time to study how two of the central macroeconometric equations, the Phillips curve and the term structure of interest rates, have fared during that period.

The paper has four sections. The first is an informal account of the policy change and of its effects. The second discusses how we might expect the Phillips curve and the term structure equations to shift in the face of such a policy change. The third and fourth are empirical examinations of the behavior of pre-1979 Phillips curves and term structure equations in the last four years.

I. A brief description of events.

In October 1979, the Fed announced a change in monetary policy. Technically, the change was only in operating procedures, a shift from interest rate to money stock targeting; target growth ranges for the monetary aggregates were left unchanged.[1] This technical change was however intended to be both a

* Massachusetts Institute of Technology. I thank Stanley Fischer for discussions.

signal of the Fed's commitment and a prerequisite to lower money growth and lower inflation.

In retrospect, there is little doubt that this commitment was a serious one. Assessing the reality of the change was however much more difficult in the period following October 1979. Faced with what it perceived to be autonomous velocity shifts, the Fed chose partial accommodation, leading to large and erratic fluctuations in monetary aggregates.[2] As a result, the policy change was neither instantaneously perceived nor instantaneously believed. Direct evidence on the beliefs of financial markets suggests the following:[3] From October 1979 to December 1980, there was considerable doubt as to whether the Fed was committed to the reduction of inflation; in particular, doubts were fueled, in the spring and summer of 1980, by a decrease in short-term nominal rates in the face of the first recession. This decrease was interpreted by many as showing the unwillingness of the Fed to accept the recession. Doubts seem to have disappeared in the first half of 1981, due partly to the election of a new administration and partly to the Fed's policy of high interest rates. The increase in interest rates in June 1981, in the face of a second recession, seems to have been decisive in shifting financial markets' beliefs. Direct evidence on the beliefs of labor market participants is sparse; there is little to suggest that the change in policy was explicitly taken into account in labor contract negotiations, apart from its effects through unemployment.

This paper is not the place to give a thorough description of the effects of the policy change. We just note that, largely as a result of the change, inflation declined from 10% in 1979 to under 5% in 1982, most of the gains being achieved in 1982. At the same time unemployment rose from 5.8% in 1979 to just under 10% in 1982.

To summarize, although there was a definite policy change, it was not immediately believed by all agents. Direct, informal evidence suggests that it took more than a year to fully change the beliefs of financial markets, perhaps more than that to change those of labor markets. Thus, in the next section, we address the question of how the economic structure might evolve in response to such a policy change.

II. The effects of a policy change.

The monetary mechanism embodied in the econometric models is an intricate one, going from real money balances to short nominal rates, to long rates and asset prices, to the components of aggregate demand and finally to unemployment and price movements. I focus on two of the links for which expectations are usually believed to play an important role; the first is the relation between short and long nominal rates, or "term structure" relation, the second is the relation between inflation and unemployment, or "Phillips curve" relation.

Let's think of nominal money growth as following a stationary process around a positive mean and of the policy change as a decrease in this mean.[4] How will the two estimated equations perform after the change? More precisely, will the estimated Phillips curve, given unemployment, under- or overpredict inflation? Will the estimated term structure relation, given the short rate, under- or overpredict the long rate?[5]

Consider first the Phillips curve. Most recent macroeconomic models, whether of the imperfect information or contracting varieties, have the same qualitative implication: estimated Phillips curves, that is, estimated relations between inflation and unemployment, will overpredict the effects of a fully anticipated movement in money growth on unemployment. If, as in the original

model by Lucas, there are no predetermined elements affecting the behavior of prices and wages, and if the policy change is instantaneously believed, inflation will decrease with little movement in unemployment. The Phillips curve will therefore, given unemployment, consistently overpredict inflation. If however, prices and wages depend on past decisions or anticipations, the trade-off becomes more favorable as time passes and as decisions or anticipations formed before the policy change play less and less of a role. The quality of the Phillips curve forecasts may then deteriorate only slowly. The same is true if agents do not instantaneously believe the change in policy but slowly revise their beliefs as they observe lower average money growth. In the limiting case where agents do not believe the policy change at all, they do not change the way they form expectations and the quality of the Phillips curve forecasts may remain the same as before the change.

Turning to the term structure, what happens is more ambiguous. Assume that the movement of short and long rates is determined by the expectations hypothesis, so that the long rate is approximately a weighted average of current and expected future short rates. As in general, expected future rates move less than current rates, long rates move in the same direction as, but by less than short rates; this is what is captured by empirical term structure equations. Suppose now that there is little predetermination in prices and that the policy change is believed by both labor and financial markets; then although real money balances may be temporarily lower and the short-term nominal rate higher, anticipations are of lower inflation, of lower nominal rates in the future. The long-term nominal rate might well decline as the short rate increases; the estimated term structure will, given the short rate, overpredict the long rate. Suppose, on the other hand, that prices and wages are largely predetermined or

that labor markets are less convinced of the existence of a policy change than financial markets. Financial markets will anticipate inflation to decrease only slowly, real money balances to be lower for a sustained period of time. They will anticipate nominal rates to remain high for a long period of time: long rates may increase by nearly as much as short rates. The estimated term structure will, given the short rate, underpredict the long rate. To summarize, whether the term structure under- or overpredicts long rates depends on the speed at which financial markets expect inflation to decline after the policy change.

III. The Phillips curve during 1979-1983.

We choose to concentrate on the Phillips curve of the DRI model, as specified and estimated in 1978. It is representative of other wage-price Phillips curves. We have also examined the wage-wage Phillips curve specified by Gorge Perry [1978][6]; the results were similar and are not reported here.

The DRI Phillips curve is specified as:[7]

$$\dot{\omega} = \alpha_0 + \alpha_1 \dot{p}_{-1} + \alpha_2 \dot{p}^{e} + \alpha_3 \log u + \varepsilon$$

where $\dot{\omega}$ denotes wage inflation, with ω being the BLS earnings index: $\dot{p}_{-1}$ denotes lagged inflation, with p being the implicit price deflator; $\dot{p}_e$ denotes "expected inflation", expressed as a geometric distributed lag of past inflation, with decay coefficient .15; u is the unemployment rate for married males. The unit period is the quarter.

The upper half of Table 1 gives the results of estimation as years are added to the sample. There is extremely little change in the coefficients until 1982, thus no apparent direct - credibility - effects of the policy change. There is, from '82 on, some evidence of an increase of α_1 compared to α_2, that is a decrease in the mean lag effect of price inflation on wage inflation. There is also, in the last

Table 4. The Phillips curve.

Period of estimation	α_0	α_1	α_2	α_3	D.W.	s.e.r.	F*
64.2 to 79.3	5.2	.22	.42	-1.53	1.96	.99	
" 80.3	5.2	.22	.42	-1.54	1.98	.97	1.3
" 81.3	5.2	.25	.39	-1.48	2.04	1.00	1.9
" 82.3	5.4	.33	.26	-1.56	1.97	1.01	3.2*
" 83.2	5.5	.36	.29	-2.03	1.86	1.01	.5

F*: test statistic associated with hypothesis of no change in the last year of sample; distributed F(4,x) x = 56, 60, 64, 68 respectively. *: significant at 5%

Forecast errors. $(\dot{\omega} - \hat{\dot{\omega}})$

80 - 1	.36	81 - 1	.57	82 - 1	-1.65	83 - 1	-2.03
2	.38	2	-1.60	2	- .42	2	-2.19
3	-.89	3	.31	3	-1.35		
4	.70	4	-2.57	4	-1.18		

regression, some evidence of a larger effect of unemployment on wage inflation: this is more likely due to the very high unemployment rate in 1983 than to direct policy-change effects. The impression of stability is confirmed by the subsample stability tests reported in the last column.[8]

The lower half of Table 1 gives one period ahead forecast errors using actual values of the right hand side variables, and the equation estimated over 1964-2 to 1979-3. The errors are small until the end of 1981: there is again no noticeable effect of the policy change. The errors are however consistently negative from 1981-4 on: actual inflation is less than predicted; three of these forecast errors, including two in 1983, are more than twice the standard error of the regression (Forecast errors, using the Perry-type wage-wage equations, are also consistently negative from 1981-4 on.) This might indicate a potential, though belated effect of the policy change.

Overall, there is no evidence of a major shift in the Phillips curve. This in no way implies that the above relation is a correctly specified, structural relation, only that the movement of wage inflation, given unemployment, has not been strongly affected by the policy change. This may be due either to unchanged ways of forming expectations, or to expectations playing little role in the determination of wage inflation.

IV. The term structure during 1979-1983.

We concentrate on the quarterly term structure relation of the 1979 version of the MPS model, which was specified and estimated by Franco Modigliani and Robert Shiller [1973].[9] It is specified as follows:

$$R_L = \alpha_0 + \beta_0 R_s + \sum_{i=1}^{19} \beta_i R_s(-i) + \sum_{i=0}^{19} \gamma_i \Pi(-i) + \delta_0 V + \varepsilon \; ; \quad \varepsilon = \rho\varepsilon(-1) + u$$

Table 1. The Term Structure.

		α_0	β_0	$\sum_{i=1}^{19} \beta_i$	$\sum_{i=0}^{19} \gamma_i$	δ_0	ρ	s.e.r.	F*
Period of estimation:									
54-4 to	71-1	.96	.25	.66	.14	.15	.37	15.6	
"	79-2	1.16	.19	.61	.24	.02	.61	25.0	
"	80-2	.99	.19	.66	.19	.06	.66	29.7	3.7**
"	81-2	1.02	.19	.65	.20	.09	.57	27.8	8.3**
"	82-2	1.00	.18	.66	.22	.07	.49	28.5	10.9**
"	83-2	1.49	.19	.45	.32	.14	.67	45.6	11.1**

s.e.r. : standard error of the serially correlated residual ε, in basis points

F* : test statistic associated with hypothesis of no change in the last year of sample; distributed F(4,x), x = 90, 94, 93, 102 respectively.

Forecast errors $(R_L - \hat{R}_L)$ in basis points:

79-4:	-8	81-1:	4	82-2:	64
80-1:	42	2	102	3:	77
2:	38	3:	67	4:	-90
3:	37	4:	168	83-1:	-84
4:	66	82-1:	159	2:	-28

where the long-term rate R_L is the yield on AAA bonds; the short-term rate R_s is the three month rate on prime commercial paper, Π is the rate of CPI inflation and V is an index of variability of the short rate, measured as an 8-quarter moving variance of R_s. The distributed lag structures are third degree polynomials.

The upper half of Table 2 gives the results of estimation as years are added to the sample. (The first line gives the results of estimation over the original sample period.) There is, except in the last year, no clear change in the coefficients; there is however a rapid deterioration of fit. The standard error of the residual increases from 25 to 45 basis points. Subsample stability tests, reported in the last column, show each of the years to be significantly different from previous ones.

The lower half of Table 2 gives one period ahead forecast errors, using actual values of the right hand side variables and the equations estimated over 1954-4 to 1979-2. From 1980-1 to 1982-3, forecast errors are large and positive. Although forecast errors from 1982-1 on may be ascribed to unexpectedly large prospects of fiscal deficits, those from 1980-1 to 1981-4 are likely due to the change in monetary policy. Thus expectations appear to have changed and the term structure is very much subject to the Lucas critique. The fact that forecast errors are positive suggests that, although financial markets slowly believed the policy change, they did not expect inflation to slow down rapidly, did not expect labor markets to react to the policy change. This is consistent with the evidence on the Phillips curve presented above.

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Footnotes.

1. Target growth ranges chosen in July 1979 for 1978-4 to 1979-4 were of 1-1/2% to 4-1/2% for M1, 5 to 8% for M2, 6 to 9% for M3. They have remained approximately the same since.
2. In the period following October 1979, M1 consistently undershot its target range while M2 and M3 overshot theirs.
3. "Direct evidence" in the set of comments of market participants and analysts, in "Business Week", for the period October 1979 to June 1983.
4. This characterization ignores the second aspect of the policy change, that is the change in the feedback rule.
5. A formal model is developed in the working paper version of this article.
6. The estimated equation is a quarterly version of equation 5.7 in Perry's Table 5. The lagged wage terms are replaced by a geometric distributed lag of past wage inflation, with decay coefficient equal to .25.
7. See Otto Eckstein [1983], Table 13.2, p. 208 for a more precise description.
8. A more thorough analysis of the stability of the Phillips curve is performed by A. Steven Englander and Cornelis Los [1983]. They also find little evidence of subsample instability.
9. Robert Shiller, John Campbell and Kermit Schoenholtz [1983] have also reexamined recently the behavior of this term structure equation. Their results are very similar.