FAIRNESS AND INFLATION PERSISTENCE

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Abstract
We argue that peoples' concern for fairness may explain an unsolved puzzle in macroeconomics: the persistence of inflation. We extend a 1990 wage-contracting model of Bhaskar in which workers' disutility from being paid less than other workers exceeds their utility from being paid more. This model generates a continuum of equilibria over a range of wages and unemployment rates. If workers' expectations are based on the past behavior of wage growth, these beliefs will be self-fulfilling, generating inflation persistence within, but not outside of, this range. Based on quarterly U.S. data over the period 1955–2000, we find evidence that inflation is more persistent between unemployment rates of 4.7 and 6.5% than outside these bounds. (JEL: E31, E3, E5)

1. Introduction

In recent years a number of experimental studies have documented that peoples' concern for fairness affects their microeconomic behavior (see Fehr and Schmidt 2003 for an overview). Since other departures from standard assumptions about preferences have important aggregate implications (see Akerlof 2002 for a survey), it is worth asking whether that is also true of fairness.

In this paper we argue that concern for fairness may explain an unsolved puzzle in macroeconomics: the persistence of inflation. As first pointed out by Fuhrer and Moore (1995), the standard aggregate supply schedule based on the forward-looking, overlapping contracts models of Taylor (1980) and Calvo (1983)— often called the New Keynesian–Phillips curve—predicts stickiness in

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prices, but not in inflation, in contrast to much available evidence. Moreover, Ball (1994), Taylor (1999), and Mankiw (2001) have pointed out further empirical failings of this model.

The search for an alternative model that is both theoretically and empirically satisfying has led to a number of different approaches, including the assumption of near-rational expectations (Roberts 1998; Ball 2000), replacing the output gap with a proxy for marginal costs (Galí and Gertler 1999), slow diffusion of information (Mankiw and Reis 2002) or limitations to agents' ability to absorb information (Woodford 2003); yet it seems fair to say that the profession is still looking for a satisfying alternative.

Our approach starts from the assumption, following Bhaskar (1990), that workers are concerned about fair treatment, in the sense that they care disproportionately more about being paid less than other workers than they do about being paid more than other workers. When incorporated into a standard wage-bargaining model, the result is a continuum of rational expectations equilibria, in the form of a range of wage growth rates for which each wage setter will aim for the same wage growth as set by the others. This range in wage growth rates translates into a continuum of equilibria for output levels.

In this situation we argue that wage setters' past behavior may work as an equilibrium selection device: among all the actions consistent with a possible equilibrium, agents expect other agents to play as they have played in the past.[1] This focus on past actions can thus rationalize adaptive expectations, and therefore inertia in inflation, as a self-fulfilling prophecy. Outside this range of equilibria, the labor market is sufficiently tight or slack that it dominates workers' concern for fair treatment, and the model collapses to Taylor's (1980) canonical formulation.

Our paper is related to McDonald and Sibly (2001), who independently discuss the effects of monetary policy in a model with a range of equilibria based on customer markets and worker loss aversion relative to past real wages, and Lye, McDonald, and Sibly (2001), where Phillips-curve like equations are derived based on an assumption of worker loss aversion. However, neither of these papers focuses on inflation persistence.

We confront the model with U.S. quarterly data for unemployment and CPI inflation for the period 1955–2000. The results are generally favorable. Consistent with our theory and previous evidence, we find that inflation is highly persistent, and that the relationship between inflation and unemployment is much noisier than standard theory would suggest. More importantly, the results concerning the novel predictions are also promising: we find that inflation seems

1. Bhaskar (1990) also derives a range of output equilibria based on similar assumptions on preferences (but within a different wage setting framework). He mentions that the continuum of equilibria may induce inertia in nominal wage growth, but does not pursue this idea.

less persistent outside a set of "bounds" for the unemployment rate, though the effects are stronger for low levels of unemployment than for high levels.

The paper is organized as follows: Section 2 presents the model and describes the resulting dynamics of inflation; Section 3 presents the empirical results; and Section 4 concludes.

2. The Model[2]

We consider an economy consisting of K symmetric firms, each producing a different good. In each firm the workers bargain jointly with the firm over their wage. Then, each firm sets the price of its product. All agents are fully aware of how the economy works, so they can predict what other agents will do at the same and later stages of the model.

Each firm j has a constant returns to scale production function $Y_{jt} = N_{jt}$, where Y_{jt} is output, N_{jt} is employment, and the t subscript indicates the time period. Real profits of the firm are

$$\Pi_{jt} = (P_{jt}Y_{jt} - X_{jt}N_{jt})/P_t, \tag{1}$$

where P_{jt} is the price of output, X_{jt} is the nominal wage in firm j, and

$$P_t = \left(\frac{1}{K}\sum_j P_{jt}^{1-\eta}\right)^{1/1-\eta} \qquad \eta > 1, \tag{2}$$

is the aggregate price level. Each firm faces a Dixit-Stiglitz style, constant elasticity, demand function:

$$Y_{jt} = (P_{jt}/P_t)^{-\eta}Y_t/K, \tag{3}$$

where Y_t is aggregate output.

We now turn to the payoff function of the workers. Following Bhaskar (1990) we assume that workers are concerned with fair treatment. They resent being treated worse than identical workers elsewhere, in the sense that their dissatisfaction from being paid less than identical workers in other firms is greater than their benefit from being paid more. Formally, their utility functions are nondifferentiable at the wage level of other workers, so that the left-hand derivative is greater than the right-hand derivative.

There is considerable empirical support for an assumption of this kind. First, several experimental studies (including Austin, McGinn, and Susmilch 1980 and Ordonez, Connolly, and Coughlan 2000) report asymmetric effects of

2. The model is a shortened version of Driscoll and Holden (2003).

pay differences on levels of satisfaction. Second, several studies (Loewenstein, Thompson, and Bazerman 1989; Fehr and Schmidt 1999; Goeree and Holt 2000) report asymmetric aversion to inequity. Third, experiments on loss aversion, by Kahneman and Tversky (1979) and others, indicate that the value function appears to be steeper for losses than for gains.

The payoff function of a representative worker is

$$V_{jt} = V\left(\frac{X_{jt}}{P_t}, \frac{X_{jt}}{X_{Jt}}, \frac{X_{jt}}{X_{Gt}}\right) \equiv \frac{X_{jt}}{P_t}\left(\frac{X_{jt}}{X_{Jt}}\right)^{\alpha + D_{jt}\Phi}\left(\frac{X_{jt}}{X_{Gt}}\right)^{\lambda} \tag{4}$$

$$0 < \Phi,\ \lambda < 1,\ 0 < \alpha + \Phi < 1,$$

where X_{Jt} is the average wage of workers in the same group, X_{Gt} is the average wage of workers in the other groups, and D_{jt} is a dummy variable being one if $X_{jt} < X_{Jt}$ and zero otherwise. The payoff is continuous in real and relative wages, and strictly increasing in the real wage. The key assumption is that the payoff is assumed to be nondifferentiable at the point where wages are equal to the wages of other workers in the same group, $X_{jt} = X_{Jt}$, so that the loss in payoff of a reduction in the relative wage is strictly greater than the gain in payoff of an increase in the relative wage. The nondifferentiability only applies to workers in the same group, which could reflect that workers in different groups are different, so that the notion of equal wages for identical workers does not apply to workers in other groups. Note, however, that allowing the comparison to workers in other groups to be nondifferentiable as well would strengthen our results. With the exception of the nondifferentiability assumption, the results are robust to plausible variations in preferences, as well as to other assumptions about the wage setting.[3]

The first-order condition of the profit maximization problem implies $P_{jt} = \mu X_{jt}$, where $\mu = \eta/(\eta - 1) > 1$. The indirect payoff function of the firm, as a function of the real wage and aggregate output is thus

$$\Pi_{jt} = \Pi(X_{jt}/P_t, Y_t) = (\mu - 1)(X_{jt}/P_t)^{1-\eta}\mu^{-\eta}Y_t/K \tag{5}$$

2.1 Wage Setting

Wage setting takes place simultaneously in all firms. Each firm is small, so parties in a single firm are assumed to take the values of the aggregate variables X_{Jt}, X_t, P_t and Y_t as exogenous in the negotiations. However, the parties will take into consideration that employment is set to maximize profits, and thus depends on the wage level.

3. While uncertainty about others' wages will smooth out any nondifferentiability, if there is a minimum unit of account, or if wage settlements focus on round amounts, nondifferentiability will reemerge and our results still hold. For simplicity, we neglect these complexities.

We assume that the outcome of wage negotiations is given by the Nash bargaining solution $X_{jt} = \arg\max \Omega_{jt}$, where

$$\Omega_{jt} = \left[\Pi\left(\frac{X_{jt}}{P_t}, Y_t\right) - \Pi_0\right] \cdot \left[V\left(\frac{X_{jt}}{P_t}, \frac{X_{jt}}{X_{Jt}}, \frac{X_{jt}}{X_{Gt}}\right) - V_0\right] \tag{6}$$

subject to $\Pi \geq \Pi_0$ and $V \geq V_0$, and profit maximization as implied by (5). As argued by Binmore, Rubinstein, and Wolinsky (1986), the appropriate interpretation of the threat points of the parties depends on the force that ensures that the parties reach an agreement. We assume that if no agreement is reached (which will not happen in equilibrium), there is a risk that negotiations break down. Let $V_{0t} = V_0(Y_t)$ be the expected payoff of the workers in this event; higher aggregate output is associated with higher aggregate employment, and thus makes it easier for the workers to find a new job, increasing the expected payoff for job losers. The expected payoff of the firm in the case of a breakdown of the negotiation is for simplicity set to zero.

We base our explanation of the implications of the model on two diagrams. For comparison, first consider the model when fairness considerations are ignored (setting $\Phi = 0$ in (4)), see Figure 1. The model is then essentially that of Layard, Nickell, and Jackman (1991, p. 19), or Blanchard (2003, p. 132), although they use employment rather than output on the horizontal axis. The upward-sloping wage curve represents the outcome of the wage bargain; workers receive higher real wages when output is high, since they have a stronger

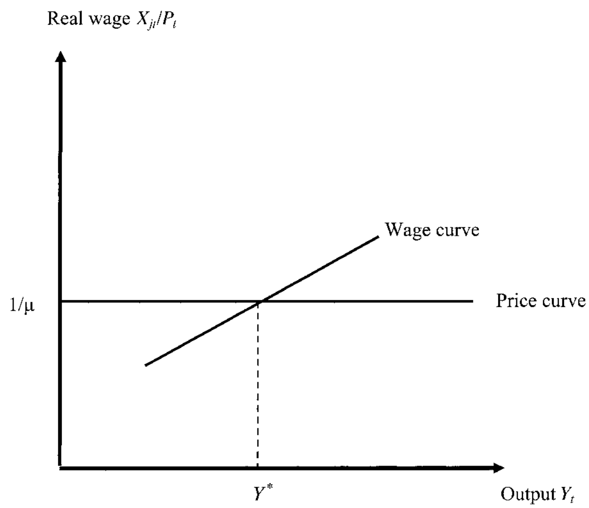

FIGURE 1. No fairness considerations. The unique equilibrium, Y^*, is given by the intersection of the wage and price curves.

bargaining position. The horizontal curve represents the outcome of price setting; as there is constant returns to scale and constant elasticity of demand, the real wage is uniquely determined. The overall equilibrium, determining output Y^*, is given by the intersection of the wage and price curves.

However, when workers care about fair treatment, there is a range of wage levels for which the wage setters will match the wage set by other wage setters. This range is indicated by the two wage curves in Figure 2. The upper wage curve represents the upper limit to the wage each wage setter is able to obtain, given the expectation that other wage setters set the same wage. The lower curve represents the corresponding lower limit to the wage each wage setter will set. Thus, for a given output, any wage between the two wage curves can be the outcome of wage setting in a symmetric equilibrium. Again, the overall equilibrium must be on the price curve; thus, the range between the two wage curves on the price curve (i.e., any output level in $[Y^L, Y^H]$) is consistent with equilibrium.

2.2 Overlapping Wage Contracts

Now consider an overlapping contracts version of the model: There are two groups, and each group set wages for two periods, one group in odd periods and the other in even periods, as in the standard Taylor model. Let x_t denote the log

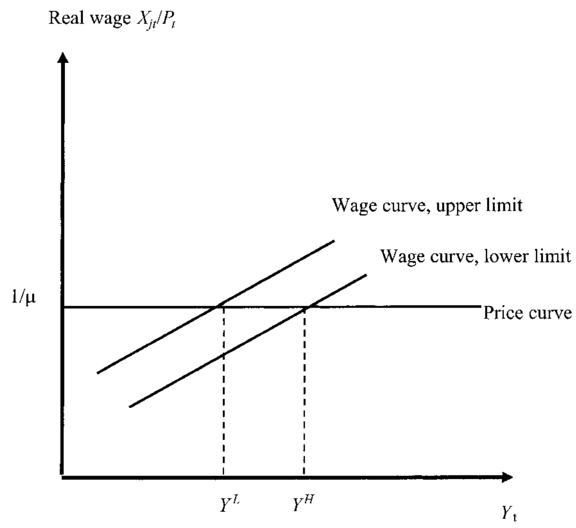

FIGURE 2. With fairness considerations. Any wage between the wage curves is consistent with a symmetric equilibrium in the wage setting. The overall equilibrium is on the price curve, in the range $[Y^L, Y^H]$.

wage set in period t, and $\Delta x_t = x_t - x_{t-1}$. As shown by Driscoll and Holden (2003), the constraints derived from wage setting, as illustrated by the two wage curves in Figure 2, can be rewritten as constraints on the nominal wage growth (y is log of output)

$$\Delta x_t \leq E_t \Delta x_{t+1} + \gamma_0 (y_t - y^L) \qquad \gamma_0 > 0 \tag{7}$$

$$\Delta x_t \geq E_t \Delta x_{t+1} + \gamma_0 (y_t - y^H) \qquad y^H > y^L > 0. \tag{8}$$

When there is a range of possible equilibria in wage setting, agents cannot deduce other agents' behavior logically from the assumption that they behave rationally. In this situation it seems reasonable to assume that agents base their beliefs regarding wage growth on the past behavior of wage growth. This basic premise is common to a variety of approaches to expectation formation. Evans and Honkapohja (2001) advocate adaptive learning as a selection mechanism in situations with multiple rational expectations equilibria. Experiments on games with a multiplicity of equilibria also show that agents learn from the past behavior of other agents (Ochs 1995).

Consider a stylized version of existing empirical wage equations

$$\Delta x_t = \beta \Delta x_{t-1} + (1 - \beta) \Delta x_{t-2} + \gamma_1 (y_{t-1} - y^*), \qquad \gamma_1 > 0. \tag{9}$$

Assuming that agents have observed wage inflation to adhere to (9) in the past, it seems reasonable that they would expect wage inflation to follow (9) in the future also, as long as this is consistent with the rational expectations equilibrium of the model, that is, it satisfies the constraints given by (7) and (8). In this case (9) would work as a focal point for wage-setting behavior.

Given (9), y^* is the unique long run equilibrium rate of output. Note however that y^* is inherently expectations-based, suggesting that the relationship between output (or employment or unemployment) and inflation will be unstable if expectations change. This is consistent with the considerable imprecision in the estimates of the natural rate of unemployment found by Staiger, Stock, and Watson (1997) on U.S. data.

In Driscoll and Holden (2003), we argue that as long as output and unemployment is within the bounds, wage growth and inflation is likely to be persistent as represented by (9). However, if the bounds bind, or are expected to bind in the future, inflation will not be determined by the persistent and adaptive behavior specified in equation (9), but will fluctuate with changes in expected future inflation, caused, for example, by expected changes in future monetary policy. Empirically, we would consequently expect inflation to be less persistent outside the bounds. Furthermore, we would expect output to have a larger impact on inflation if one of the bounds bind, as output will affect inflation both directly via the output term in the bound, and via the expected future inflation term in the bound.

3. Empirical Specification

To test the predictions, we adopt a levels version of Staiger, Stock, and Watson's (1997) specification:

$$\begin{aligned}\pi_t = {} & \alpha_0 + \alpha_1\pi_{t-1} + \alpha_2\pi_{t-2} + \alpha_3\pi_{t-3} + \beta_1 u_{t-1} + \beta_2 u_{t-2} + \gamma Z_t + \alpha_0^H I^H \\ & + \alpha_1^H I^H \pi_{t-1} + \alpha_2^H I^H \pi_{t-2} + \alpha_3^H I^H \pi_{t-3} + \beta_1^H I^H (u_{t-1} - u^H) \\ & + \beta_2^H I^H (u_{t-2} - u^H) + \gamma^H I^H Z_t + \alpha_0^L I^L + \alpha_1^L I^L \pi_{t-1} + \alpha_2^L I^L \pi_{t-2} \\ & + \alpha_3^L I^L \pi_{t-3} + \beta_1^L I^L (u_{t-1} - u^L) + \beta_2^L I^L (u_{t-2} - u^L) + \gamma^L I^L Z_t + \varepsilon_t,\end{aligned} \tag{10}$$

where $\pi_t \equiv p_t - p_{t-1}$, I^H is a dummy variable taking the value 1 when $u > u^H$, I^L is a dummy variable taking the value 1 when $u < u^L$, and Z represents a vector of proxies for aggregate supply shocks[4] (we invoke an Okun's Law relationship to replace output with unemployment). The interaction of the dummy variables with the inflation and unemployment terms above and below the bounds allows us to test the model's prediction that the short-run dynamics of inflation and unemployment differ for low and high levels of unemployment. The bounds are found using a structural break approach; we reestimate (10) for different values of the bounds and pick the specification yielding the highest value for the log-likelihood. Table 1 provides the main empirical results. The first column of Table 1 reports the results of estimating (10) without any bounds. The coefficients on unemployment alternate in sign but do sum to −0.213, so that the Phillips curve is downward sloping, as one would hope. Also as expected, the coefficients on lagged inflation are all positive and sum to 1.004, implying inflation is persistent.

The next three columns report the results of imposing the bounds, endogenously determined by the method described above. The first column reports the coefficients on output, inflation, and the supply shocks between the bounds; the next columns the additional effects below and above the bounds. We find the bounds to be at 4.7 and 6.5%, which correspond to (approximately) the 30th and 70th percentiles of observed unemployment.[5] Note that the more elaborate specification allowing all coefficients to take different values outside the bounds, as predicted by our model, is supported by the data, as the restrictions

4. We use the same measures employed in Ball and Mankiw (1995): measures of relative inflation rates for food and fuel, and a dummy variable for the Nixon price and wage controls.

5. Since our technique may also pick up any possible nonlinearity in the Phillips curve, we restrict the bounds to lie above and below the median value of unemployment observed. If we relax this restriction, the estimated bounds lie at 9.9 and 10.1%, the third-highest and second-highest unemployment rates observed.

TABLE 1. Phillips curve regressions, quarterly data, 1955:I–2000:IV

		Dependent variable: π_t					
		With bounds					
Without bounds		Between bounds		Below bound		Above bound	
Const.	1.268**	Const.	2.956	I_L^* Const.	0.646	I_H^* Const.	1.766**
	(0.428)		(1.827)		(0.627)		(0.585)
π_{t-1}	0.510**	π_{t-1}	0.438**	$I_L^*\pi_{t-1}$	−0.114	$I_H^*\pi_{t-1}$	−0.083
	(0.070)		(0.127)		(0.272)		(0.156)
π_{t-2}	0.111	π_{t-2}	0.348**	$I_L^*\pi_{t-2}$	−0.363	$I_H^*\pi_{t-2}$	−0.387*
	(0.079)		(0.123)		(0.275)		(0.163)
π_{t-3}	−0.384**	π_{t-3}	0.413**	$I_L^*\pi_{t-3}$	−0.297	$I_H^*\pi_{t-3}$	0.018
	(0.067)		(0.130)		(0.247)		(0.151)
u_{t-1}	−1.821**	u_{t-1}	−1.967**	$I_L^*(u_{t-1} - u_L)$	0.857	$I_H^*(u_{t-1} - u_H)$	0.363
	(0.314)		(0.532)		(1.46)		(0.689)
u_{t-2}	1.608**	u_{t-2}	1.358**	$I_L^*(u_{t-2} - u_L)$	−2.23	$\mathrm{I}_H^*(u_{t-2} - u_H)$	0.225
	(0.306)		(0.422)		(1.46)		(0.590)
Food	0.046**	Food	0.042*	I_L^*Food	0.030	I_H^*Food	0.000
	(0.015)		(0.020)		(0.043)		(0.033)
Fuel	0.011	Fuel	−0.005	I_L^*Fuel	0.015	I_H^*Fuel	0.032
	(0.009)		(0.013)		(0.021)		(0.020)
Nixon	1.807	Nixon	−0.498				
	(2.889)		(2.851)				
Sum on inflation	1.004**		1.198**		−0.775**		−0.453**
	(0.040)		(0.0526)		(0.227)		(0.083)
Sum on unempl.	−0.213**		−0.608		−1.378		0.587
	(0.073)		(0.332)		(0.907)		(0.374)
Bounds	N/A			u_L	4.7	u_H	6.5
Adjusted R^2	0.810			0.841			
LogL	−311.30			−286.19**			
# Obs.	184			184			

Note: Inflation is measured by the (annualized) quarterly percent change in the seasonally adjusted CPI for all urban consumers. The unemployment rate is that for all civilians over age 16. "Food" is the relative PPI inflation rate for processed foods and feeds, and "Fuel" is the relative inflation rate for energy, both lagged one period. "Nixon" is a dummy for wage and price controls. $I_H$and I_L are dummy variables for periods when lagged unemployment is outside the bounds $u_H$and $u_L$described in the text. Thus, the total effect of the RHS variables below (above) the bound, is given by the sum of the coefficient between bounds and the coefficient below (above) bounds.
* Denotes statistical significance at the 5% level.
** Denotes statistical significance at the 1% level.

that are involved by the regression without bounds (column 1) is rejected in a likelihood ratio test at the 1% level.

The third and fourth columns report the interaction terms describing how the coefficients change outside the bounds. First, note that the coefficients on the lagged inflation interaction terms are almost all negative—implying that inflation is less persistent both below and above the bounds, as predicted by our model. Below the bounds, the interaction terms sum to −0.775 and above to −0.453, which are large in magnitude and statistically significant.

Below the bounds, the interaction terms on unemployment sum to −1.378, implying that the Phillips curve is more steeply sloped, as predicted by our model. Above the bounds, however, the unemployment terms sum to 0.587, which is close in magnitude to the value of 0.608 estimated between the bounds, implying a nearly-flat Phillips curve above the bound (although highly imprecisely determined), in contrast to the predictions of our model.

4. Conclusion

The use of preferences taken from behavioral economics has become commonplace in explaining various empirical puzzles in consumption and asset pricing. In this paper, we take a step towards applying such preferences to explain the empirical puzzle in the Phillips curve literature of inflation persistence. Specifically, following Bhaskar (1990), we argue that workers, concerned with fairness, care disproportionately more about being paid less than other workers than they do about being paid more than other workers. This yields a range of equilibria for both wages and unemployment. As wage setters want to match the wage growth set by others, the behavior of wages in the recent past will be a natural starting point for expectations. Within the range, such beliefs will create a self-fulfilling prophecy; and thus be consistent with rational expectations. These beliefs combine the attractive features of both adaptive and rational expectations; they are consistent with key facts on inflation, but do not imply that agents make systematic errors.

We estimate the model, including the bounds, on quarterly data for the United States over the period 1955–2000. We find that the dynamics of the Phillips curve do change at unemployment rates below 4.7% and above 6.5%. As predicted by our model, inflation seems less persistent outside the bounds. The prediction that inflation is more sensitive to changes in unemployment outside the bounds receives mixed results: we find stronger effects for low unemployment, but not for high unemployment.

References

Akerlof, George (2002). "Behavioral Macroeconomics and Macroeconomic Behavior." *American Economic Review,* 92, 411–433.

Austin, William, Neil C. McGinn, and Charles Susmilch (1980). "Internal Standards Revisited: Effects of Social Comparisons and Expectancies on Judgments of Fairness and Satisfaction." *Journal of Experimental Social Psychology,* 16, 426–441.

Ball, Laurence S. (1994). "Credible Disinflation with Staggered Price Setting." *American Economic Review,* 84, 282–289.

Ball, Laurence S. (2000). "Near-Rationality and Inflation in Two Monetary Regimes." NBER Working Paper 7988.

Ball, Laurence S. and N. Gregory Mankiw (1995). "Relative-Price Changes as Aggregate Supply Shocks." *Quarterly Journal of Economics,* 105, 161–193.

Bhaskar, V. (1990). "Wage Relatives and the Natural Range of Unemployment." *Economic Journal,* 100, 60–66.

Binmore, Ken, Ariel Rubinstein, and Asher Wolinsky (1986). "The Nash Bargaining Solution in Economic Modelling." *RAND Journal of Economics,* 17, 176–188.

Blanchard, Olivier J. (2003). *Macroeconomics.* 3rd International Edition. Prentice Hall.

Calvo, Guillermo (1983). "Staggered Prices in a Utility-Maximizing Framework." *Journal of Monetary Economics,* 12, 983–998.

Driscoll, John C. and Steinar Holden (2003). "Coordination, Fair Treatment and Inflation Persistence." Working paper, Board of Governors of the Federal Reserve System.

Evans, George W. and Seppo Honkapohja (2001). *Learning and Expectations in Macroeconomics.* Princeton University Press.

Fehr, Ernst and Klaus M. Schmidt (1999). "A Theory of Fairness, Competition, and Cooperation." *Quarterly Journal of Economics,* 114, 769–816.

Fehr, Ernst and Klaus M. Schmidt (2003). "Theories of Fairness and Reciprocity-Evidence and Economic Applications." In *Advances in Economics and Econometrics—8th World Congress, Econometric Society Monographs,* edited by Mathias Dewatripont, L. Hansen, and S. Turnovsky. Cambridge University Press.

Fuhrer, Jeffrey and Gerald Moore (1995). "Inflation Persistence." *Quarterly Journal of Economics,* 110, 127–160.

Galí, Jordi and Mark Gertler (1999). "Inflation Dynamics: A Structural Econometric Analysis." *Journal of Monetary Economics,* 44, 195–222.

Goeree, Jacob K. and Charles A. Holt (2000). "Asymmetric Inequality Aversion and Noisy Behavior in Alternating-Offer Bargaining." *European Economic Review,* 44, 1079–1089.

Kahneman, Daniel and Amos Tversky (1979). "Prospect Theory: An Analysis of Decision under Risk." *Econometrica,* 47, 263–291.

Layard, Richard, Stephen Nickell, and Richard Jackman (1991). *Unemployment, Macroeconomic Performance and the Labour Market.* Oxford University Press.

Loewenstein, George F., Leigh Thompson, and Max H. Bazerman (1989). "Social Utility and Decision Making in Intermpersonal Contexts." *Journal of Personality and Social Psychology,* 62, 426–441.

Lye, Jenny, Ian. M. McDonald, and H. Sibly (2001). "An Estimate of the Range of Equilibrium Rates of Unemployment for Australia." *Economic Record,* 77, 35–50.

Mankiw, N. Gregory (2001). "The Inexorable and Mysterious Tradeoff Between Inflation and Unemployment." *Economic Journal,* 111, C45–C61.

Mankiw, N. Gregory and Ricardo Reis (2002). "Sticky Information versus Sticky Prices: A Proposal to Replace the New Keynesian Phillips Curve." *Quarterly Journal of Economics,* 117, 1295–1328.

McDonald, Ian M. and Hugh Sibly (2001). "Reference Pricing, Inflation Targeting and the Non-inflationary Expansion." Working paper, University of Melbourne.

Ochs, Jack (1995). "Coordination Problems." In *Handbook of Experimental Economics,* edited by John H. Kagen and Alvin Roth. Princeton University Press.

Ordonez, Lisa D., Terry Connolly, and Richard Coughlan (2000). "Multiple Reference Points in Satisfaction and Fairness Assessment." *Journal of Behavioral Decision Making,* 13, 329–244.

Roberts, John (1998). "Inflation Expectations and the Transmission of Monetary Policy." Working paper, Board of Governors of the Federal Reserve System.

Staiger, Douglas, James Stock, and Mark Watson (1997). "How Precise Are Estimates of the Natural Rate of Unemployment?" In *Reducing Inflation: Motivation and Strategy,* edited by Christina D. Romer and David H. Romer. University of Chicago Press.

Taylor, John (1980). "Aggregate Dynamics and Staggered Contracts." *Journal of Political Economy,* 88, 1–24.

Taylor, John (1999). "Staggered Wage and Price Setting in Macroeconomics." In *Handbook of Macroeconomics,* edited by John B. Taylor and Michael Woodford. North-Holland.

Woodford, Michael (2003). "Imperfect Common Knowledge and the Effects of Monetary Policy." In *Knowledge, Information, and Expectations in Modern Macroeconomics: In Honor of Edmund S Phelps,* edited by Philippe Aghion, Roman Frydman, Joe Stiglitz, and Michael Woodford. Princeton University Press.