TARGETING NOMINAL INCOME: A CLOSER LOOK

Evan F. Koenig

November 1995

RESEARCH DEPARTMENT

WORKING PAPER

95-18

Federal Reserve Bank of Dallas

Key Words: nominal income target
monetary policy

JEL Codes: E52
E61

TARGETING NOMINAL INCOME: A CLOSER LOOK

by

Evan F. Koenig*

Research Officer
Federal Reserve Bank of Dallas
2200 N. Pearl Street
Dallas TX 75201
Tel.(214)922-5156
Fax (214)922-5194

September 1995

Abstract:

I derive conditions under which the monetary authority should target nominal spending. The relevant spending target is a weighted average of income and consumption. Despite "sticky" nominal wages, under optimal policy the economy behaves as if all markets clear.

* Finn Kydland and Mark Wynne offered helpful comments on an earlier version of this paper. Neither they, the Federal Reserve Bank of Dallas, nor the Federal Reserve System necessarily share the views expressed here.

There is little agreement on how the Federal Reserve ought to allow prices to respond to near-term changes in real economic activity. Some analysts would have the Federal Reserve maintain a constant price level (Barro 1986). Other analysts have advocated policy rules that mandate short-run departures from zero inflation in response to unusually slow or unusually rapid output growth, or in response to deviations of output away from trend (Hall 1984, McCallum 1984 and 1988, Taylor 1985).

Bean (1983) addresses the short-run stabilization issue in the context of an economy with a predetermined nominal wage. He demonstrates that output is too sensitive to aggregate productivity shocks in such an economy unless the monetary authority allows the price level to vary inversely with output. In the special case where the supply of labor is perfectly inelastic with respect to the real wage, the monetary authority can optimally stabilize output by targeting nominal income.

A key simplifying assumption in Bean's analysis is that the supply of labor is independent of household wealth. I show that relaxing this assumption has two important policy implications. First, a nominal spending target is no longer optimal when the supply of labor is perfectly inelastic. Instead, a nominal spending target is optimal in the much more realistic case in which the wealth and substitution effects of an aggregate productivity shock offset one another. Second, the monetary authority should target not nominal income but, rather, a geometric average of nominal income and nominal consumption.

Insofar as the monetary authority successfully implements the optimal rule, the economy will behave exactly as predicted by a standard real business cycle model. An implication is that the fraction of output variation that can be explained by aggregate productivity shocks may say less about the importance or effectiveness of monetary policy than it does about how well the Federal Reserve has been doing its job.

Aggregate Supply in a Market-Clearing Economy

The representative competitive firm will equate labor's marginal product

to the real wage. If output is produced according to

$$Y = \theta N^{1-\beta}/(1 - \beta), \tag{1}$$

where Y is real output, N is hours of work, $0 < \beta < 1$ is a fixed parameter, and θ is a random productivity shock, it follows that

$$\theta - \beta n = w - p, \tag{2}$$

where lower-case letters denote the logs of their upper-case counterparts.

Under perfect competition, the representative household will equate minus the marginal rate of substitution between labor and consumption to the real wage. If the representative household's utility function takes the form

$$U(C,N) = (C^{1-\alpha} - 1)/(1 - \alpha) - N^{1+\lambda}/(1 + \lambda),$$

where C is real consumption and $\alpha > 0$ and $\lambda > 0$ are fixed parameters, then

$$\lambda n + \alpha c = w - p. \tag{3}$$

The supply of labor is positively related to the real wage and inversely related to consumption.

Finally, take the logarithm of equation 1:

$$y = (1 - \beta)n + \theta - \ln(1 - \beta), \tag{1'}$$

and let

$$g \equiv y - c \tag{4}$$

denote the fraction of output that is unavailable to households. For now, the

reader may wish to think of g as measuring the fraction of output consumed by the fiscal authority. In general, g will have a random component. Moreover, this component may be correlated with θ.

The market-clearing values of output, consumption, the real wage, and labor are obtained by simultaneously solving equations 1', 2, 3, and 4:

$$y^* = \left[\frac{1}{\alpha + \beta(1-\alpha) + \lambda}\right]\left[(1+\lambda)\theta + \alpha(1-\beta)g - (\beta+\lambda)\ln(1-\beta)\right] \quad (5)$$

$$c^* = \left[\frac{1}{\alpha + \beta(1-\alpha) + \lambda}\right]\left[(1+\lambda)\theta - (\beta+\lambda)g - (\beta+\lambda)\ln(1-\beta)\right] \quad (6)$$

$$(w-p)^* = \left[\frac{1}{\alpha + \beta(1-\alpha) + \lambda}\right]\left[(\alpha+\lambda)\theta - \alpha\beta g - \alpha\beta\ln(1-\beta)\right] \quad (7)$$

$$n^* = \left[\frac{1}{\alpha + \beta(1-\alpha) + \lambda}\right]\left[(1-\alpha)\theta + \alpha g + \alpha\ln(1-\beta)\right]. \quad (8)$$

A positive productivity shock will raise equilibrium output, equilibrium consumption, and the equilibrium real wage for any given value of g. The impact on equilibrium hours is ambiguous, due to opposing wealth and substitution effects. When $\alpha = 1$, equilibrium hours of work are independent of θ.

If the fraction, g, of output that is denied to consumers rises, the representative household, feeling worse off, will cut back on both consumption and leisure. Households' increased willingness to work is reflected in a lower equilibrium real wage and increased equilibrium output.

Aggregate Supply with a Pre-Determined Money Wage

If relocation costs are negligible when workers switch jobs one period in advance and prohibitive otherwise, then the labor market will be competitive *ex ante* and monopsonistic *ex post*. Workers will insist that some of the terms of their employment be spelled out in advance. In practice, it is often the money wage that is predetermined. Flexibility is preserved by giving firms control of hours. For supporting empirical evidence, see Card

(1990), Cho and Cooley (1992), Cho (1993), and McLaughlin (1994).

Assume that the money wage is specified one period in advance. Moreover, consistent with the existing literature, assume the wage is fixed at its expected market-clearing level. Equations 1', 2, and 4 then imply

$$y - y^* = [\frac{1-\beta}{\beta}](p - p^e) + [\frac{1-\beta}{\alpha+\beta(1-\alpha)+\lambda}][(\frac{\alpha+\lambda}{\beta})(\theta - \theta^e) - \alpha(g - g^e)], \quad (9)$$

where an "e" superscript indicates an expected value conditional upon information available in the immediately preceding period. Intuitively, firms respond to unanticipated shocks as if the labor supply schedule is horizontal at the predetermined wage. As a result, employment and output respond too strongly to unanticipated shifts in labor demand (due to unanticipated changes in p or θ), and do not respond strongly enough to unanticipated shifts in labor supply (due to unanticipated changes in g).

Optimal Policy

Since competitive equilibria are efficient, the monetary authority should seek a policy that achieves a competitive allocation. I claim that the sticky-wage economy will achieve exactly the same allocation as the market-clearing economy provided that the monetary authority implements a policy rule of the form $p_t + Ac_t + By_t = T_t$, where T_t is an arbitrary pre-announced target and A and B are fixed parameters.[1] If $\alpha = 1$, then A + B = 1 and the policy rule can be rewritten as $A(p + c)_t + (1 - A)(p + y)_t = T_t$. That is, if $\alpha = 1$ the monetary authority should target a geometric weighted average of nominal consumption and nominal income.

To see that the proposed rule is optimal, begin by noting that the rule implies that $p_t - Ag_t + (A + B)y_t = T_t$. Since the target, T_t, is announced at least one period in advance, it follows that $(p - p^e)_t = A(g - g^e)_t - (A + B)(y - y^e)_t$ or, equivalently, that $(p - p^e)_t = A(g - g^e)_t - (A + B)[(y - y^*)_t + (y^* - y^e)_t]$. Using the latter expression to eliminate $(p - p^e)_t$ from equation 9:

$$y - y^* = \left[\frac{1-\beta}{\beta+(A+B)(1-\beta)}\right]\left[\frac{1}{\alpha+\beta(1-\alpha)+\lambda}\right]\left[\left[(\alpha+\lambda) - (1+\lambda)(A+B)\right](\theta - \theta^e)\right.$$

$$\left. + \left[A(\alpha+\beta(1-\alpha)+\lambda) - \alpha\beta - (A+B)(1-\beta)\alpha\right](g - g^e)\right]. \qquad (10)$$

To ensure that $y - y^* = 0$ for arbitrary values of $g - g^e$ and $\theta - \theta^e$, it is necessary and sufficient that $A = \alpha/(1 + \lambda)$ and $B = \lambda/(1 + \lambda)$. Note that $A + B = 1$ when $\alpha = 1$ --i.e., when the wealth and substitution effects of a productivity shock have exactly offsetting effects on the supply of labor.

Concluding Remarks

In an economy with capital investment, movements in θ will reflect changes in the capital stock as well as changes in total factor productivity. Similarly, movements in g will reflect changes in investment as well as changes in government purchases. Consequently, the current value of θ will depend upon past realizations of g. Also, the current value of g will depend upon today's expectation of future levels of total factor productivity, future real output, and future real factor prices. Since the policy derived above yields the same time paths of output and real factor prices as a market-clearing economy for any given time path of g, the policy remains optimal even in an economy with investment. In such an economy, however, it is essential that agents be confident that the policy will not be abandoned in the future.

Results derived above extend easily to an economy with multi-period, overlapping contracts--*provided that each contract sets the money wage equal to its expected market-clearing level, period by period, over the contract's life*. In this case, any change in the monetary authority's target must be announced far enough in advance that all existing contracts will have expired before the change takes effect. If, as in Taylor (1980), multi-period contracts specify a fixed wage *level* (rather than a wage *path*), or if prices as well as wages are "sticky," then the analysis presented above breaks down. More generally, results presented by West (1986) suggest that conclusions reached here are likely sensitive to alternative specifications of the aggre-

gate supply equation, expectations formation, and policymakers' objectives.

Note, finally, that labor contracts would probably move away from the simple form assumed here if the monetary authority insisted upon pursuing a rule not fully efficient given those contracts (Fischer 1974, p. 204).

NOTES

1. Note that the optimal policy rule does not require that the monetary authority observe the realized values of productivity disturbances.

References

Barro, Robert J. "Recent Developments in the Theory of Rules versus Discretion," *Economic Journal* (Supplement 1986) 23-37.

Bean, Charles R. "Targeting Nominal Income: An Appraisal," *Economic Journal* 93 (December 1983) 806-19.

Card, David "Unexpected Inflation, Real Wages, and Employment Determination in Union Contracts," *American Economic Review* 80 (September 1990) 669-88.

Cho, Jang-Ok "Money and the Business Cycle With One-Period Nominal Contracts," *Canadian Journal of Economics* 26 (August 1993) 638-59.

Cho, Jang-Ok and Thomas F. Cooley "The Business Cycle With Nominal Contracts," unpublished manuscript, Queen's University (December 1992).

Fischer, Stanley "Long-Term Contracts, Rational Expectations, and the Optimal Money Supply Rule," *Journal of Political Economy* 85 (February 1977) 191-205.

Hall, Robert E. "Monetary Strategy With an Elastic Price Standard," in *Price Stability and Public Policy*, Federal Reserve Bank of Kansas City (1984).

McCallum, Bennett T. "Monetarist Rules in the Light of Recent Experience," *American Economic Review* 74 (May 1984) 388-91.

McCallum, Bennett T. "Robustness Properties of a Rule for Monetary Policy," *Carnegie-Rochester Conference Series on Public Policy* 29 (Autumn 1988) 173-203.

McLaughlin, Kenneth J. "Rigid Wages?" *Journal of Monetary Economics* 34 (December 1994) 383-414.

Taylor, John B. "Aggregate Dynamics and Staggered Contracts," *Journal of Political Economy* 88 (February 1980) 1-23.

Taylor, John B. "What Would Nominal GDP Targeting Do To The Business Cycle," *Carnegie-Rochester Conference Series on Public Policy* 22 (Spring 1985) 61-84.

West, Kenneth D. "Targeting Nominal Income: A Note," *Economic Journal* 96 (December 1986) 1077-83.

RESEARCH PAPERS OF THE RESEARCH DEPARTMENT
FEDERAL RESERVE BANK OF DALLAS

Available, at no charge, from the Research Department
Federal Reserve Bank of Dallas, P. O. Box 655906
Dallas, Texas 75265-5906

Please check the titles of the Research Papers you would like to receive:

___ 9201 Are Deep Recessions Followed by Strong Recoveries? (Mark A. Wynne and Nathan S. Balke)
___ 9202 The Case of the "Missing M2" (John V. Duca)
___ 9203 Immigrant Links to the Home Country: Implications for Trade, Welfare and Factor Rewards (David M. Gould)
___ 9204 Does Aggregate Output Have a Unit Root? (Mark A. Wynne)
___ 9205 Inflation and Its Variability: A Note (Kenneth M. Emery)
___ 9206 Budget Constrained Frontier Measures of Fiscal Equality and Efficiency in Schooling (Shawna Grosskopf, Kathy Hayes, Lori L. Taylor, William Weber)
___ 9207 The Effects of Credit Availability, Nonbank Competition, and Tax Reform on Bank Consumer Lending (John V. Duca and Bonnie Garrett)
___ 9208 On the Future Erosion of the North American Free Trade Agreement (William C. Gruben)
___ 9209 Threshold Cointegration (Nathan S. Balke and Thomas B. Fomby)
___ 9210 Cointegration and Tests of a Classical Model of Inflation in Argentina, Bolivia, Brazil, Mexico, and Peru (Raul Anibal Feliz and John H. Welch)
___ 9211 Nominal Feedback Rules for Monetary Policy: Some Comments (Evan F. Koenig)
___ 9212 The Analysis of Fiscal Policy in Neoclassical Models[1] (Mark Wynne)
___ 9213 Measuring the Value of School Quality (Lori Taylor)
___ 9214 Forecasting Turning Points: Is a Two-State Characterization of the Business Cycle Appropriate? (Kenneth M. Emery & Evan F. Koenig)
___ 9215 Energy Security: A Comparison of Protectionist Policies (Mine K. Yücel and Carol Dahl)
___ 9216 An Analysis of the Impact of Two Fiscal Policies on the Behavior of a Dynamic Asset Market (Gregory W. Huffman)
___ 9301 Human Capital Externalities, Trade, and Economic Growth (David Gould and Roy J. Ruffin)
___ 9302 The New Face of Latin America: Financial Flows, Markets, and Institutions in the 1990s (John Welch)
___ 9303 A General Two Sector Model of Endogenous Growth with Human and Physical Capital (Eric Bond, Ping Wang, and Chong K. Yip)
___ 9304 The Political Economy of School Reform (S. Grosskopf, K. Hayes, L. Taylor, and W. Weber)
___ 9305 Money, Output, and Income Velocity (Theodore Palivos and Ping Wang)
___ 9306 Constructing an Alternative Measure of Changes in Reserve Requirement Ratios (Joseph H. Haslag and Scott E. Hein)
___ 9307 Money Demand and Relative Prices During Episodes of Hyperinflation (Ellis W. Tallman and Ping Wang)
___ 9308 On Quantity Theory Restrictions and the Signalling Value of the Money Multiplier (Joseph Haslag)
___ 9309 The Algebra of Price Stability (Nathan S. Balke and Kenneth M. Emery)
___ 9310 Does It Matter How Monetary Policy is Implemented? (Joseph H. Haslag and Scott Hein)
___ 9311 Real Effects of Money and Welfare Costs of Inflation in an Endogenously Growing Economy with Transactions Costs (Ping Wang and Chong K. Yip)
___ 9312 Borrowing Constraints, Household Debt, and Racial Discrimination in Loan Markets (John V. Duca and Stuart Rosenthal)
___ 9313 Default Risk, Dollarization, and Currency Substitution in Mexico (William Gruben and John Welch)
___ 9314 Technological Unemployment (W. Michael Cox)
___ 9315 Output, Inflation, and Stabilization in a Small Open Economy: Evidence from Mexico (John H. Rogers and Ping Wang)
___ 9316 Price Stabilization, Output Stabilization and Coordinated Monetary Policy Actions (Joseph H. Haslag)
___ 9317 An Alternative Neo-Classical Growth Model with Closed-Form Decision Rules (Gregory W. Huffman)
___ 9318 Why the Composite Index of Leading Indicators Doesn't Lead (Evan F. Koenig and Kenneth M. Emery)

___ 9319 Allocative Inefficiency and Local Government: Evidence Rejecting the Tiebout Hypothesis (Lori L. Taylor)
___ 9320 The Output Effects of Government Consumption: A Note (Mark A. Wynne)
___ 9321 Should Bond Funds be Included in M2? (John V. Duca)
___ 9322 Recessions and Recoveries in Real Business Cycle Models: Do Real Business Cycle Models Generate Cyclical Behavior? (Mark A. Wynne)
___ 9323* Retaliation, Liberalization, and Trade Wars: The Political Economy of Nonstrategic Trade Policy (David M. Gould and Graeme L. Woodbridge)
___ 9324 A General Two-Sector Model of Endogenous Growth with Human and Physical Capital: Balanced Growth and Transitional Dynamics (Eric W. Bond, Ping Wang,and Chong K. Yip)
___ 9325 Growth and Equity with Endogenous Human Capital: Taiwan's Economic Miracle Revisited (Maw-Lin Lee, Ben-Chieh Liu, and Ping Wang)
___ 9326 Clearinghouse Banks and Banknote Over-issue (Scott Freeman)
___ 9327 Coal, Natural Gas and Oil Markets after World War II: What's Old, What's New? (Mine K. Yücel and Shengyi Guo)
___ 9328 On the Optimality of Interest-Bearing Reserves in Economies of Overlapping Generations (Scott Freeman and Joseph Haslag)
___ 9329* Retaliation, Liberalization, and Trade Wars: The Political Economy of Nonstrategic Trade Policy (David M. Gould and Graeme L. Woodbridge) (Reprint of 9323 in error)
___ 9330 On the Existence of Nonoptimal Equilibria in Dynamic Stochastic Economies (Jeremy Greenwood and Gregory W. Huffman)
___ 9331 The Credibility and Performance of Unilateral Target Zones: A Comparison of the Mexican and Chilean Cases (Raul A. Feliz and John H. Welch)
___ 9332 Endogenous Growth and International Trade (Roy J. Ruffin)
___ 9333 Wealth Effects, Heterogeneity and Dynamic Fiscal Policy (Zsolt Becsi)
___ 9334 The Inefficiency of Seigniorage from Required Reserves (Scott Freeman)
___ 9335 Problems of Testing Fiscal Solvency in High Inflation Economies: Evidence from Argentina, Brazil, and Mexico (John H. Welch)
___ 9336 Income Taxes as Reciprocal Tariffs (W. Michael Cox, David M. Gould, and Roy J. Ruffin)
___ 9337 Assessing the Economic Cost of Unilateral Oil Conservation (Stephen P.A. Brown and Hillard G. Huntington)
___ 9338 Exchange Rate Uncertainty and Economic Growth in Latin America (Darryl McLeod and John H. Welch)
___ 9339 Searching for a Stable M2-Demand Equation (Evan F. Koenig)
___ 9340 A Survey of Measurement Biases in Price Indexes (Mark A. Wynne and Fiona Sigalla)
___ 9341 Are Net Discount Rates Stationary?: Some Further Evidence (Joseph H. Haslag, Michael Nieswiadomy, and D. J. Slottje)
___ 9342 On the Fluctuations Induced by Majority Voting (Gregory W. Huffman)
___ 9401 Adding Bond Funds to M2 in the P-Star Model of Inflation (Zsolt Becsi and John Duca)
___ 9402 Capacity Utilization and the Evolution of Manufacturing Output: A Closer Look at the "Bounce-Back Effect" (Evan F. Koenig)
___ 9403 The Disappearing January Blip and Other State Employment Mysteries (Frank Berger and Keith R. Phillips)
___ 9404 Energy Policy: Does it Achieve its Intended Goals? (Mine Yücel and Shengyi Guo)
___ 9405 Protecting Social Interest in Free Invention (Stephen P.A. Brown and William C. Gruben)
___ 9406 The Dynamics of Recoveries (Nathan S. Balke and Mark A. Wynne)
___ 9407 Fiscal Policy in More General Equilibriium (Jim Dolman and Mark Wynne)
___ 9408 On the Political Economy of School Deregulation (Shawna Grosskopf, Kathy Hayes, Lori Taylor, and William Weber)
___ 9409 The Role of Intellectual Property Rights in Economic Growth (David M. Gould and William C. Gruben)
___ 9410 U.S. Banks, Competition, and the Mexican Banking System: How Much Will NAFTA Matter? (William C. Gruben, John H. Welch and Jeffery W. Gunther)
___ 9411 Monetary Base Rules: The Currency Caveat (R. W. Hafer, Joseph H. Haslag, andScott E. Hein)
___ 9412 The Information Content of the Paper-Bill Spread (Kenneth M. Emery)
___ 9413 The Role of Tax Policy in the Boom/Bust Cycle of the Texas Construction Sector (D'Ann Petersen, Keith Phillips and Mine Yücel)
___ 9414 The P* Model of Inflation, Revisited (Evan F. Koenig)
___ 9415 The Effects of Monetary Policy in a Model with Reserve Requirements (Joseph H. Haslag)

___ 9501 An Equilibrium Analysis of Central Bank Independence and Inflation (Gregory W. Huffman)
___ 9502 Inflation and Intermediation in a Model with Endogenous Growth (Joseph H. Haslag)
___ 9503 Country-Bashing Tariffs: Do Bilateral Trade Deficits Matter? (W. Michael Cox and Roy J. Ruffin)
___ 9504 Building a Regional Forecasting Model Utilizing Long-Term Relationships and Short-Term Indicators (Keith R. Phillips and Chih-Ping Chang)
___ 9505 Building Trade Barriers and Knocking Them Down: The Political Economy of Unilateral Trade Liberalizations (David M. Gould and Graeme L. Woodbridge)
___ 9506 On Competition and School Efficiency (Shawna Grosskopf, Kathy Hayes, Lori L. Taylor and William L. Weber)
___ 9507 Alternative Methods of Corporate Control in Commercial Banks (Stephen Prowse)
___ 9508 The Role of Intratemporal Adjustment Costs in a Multi-Sector Economy (Gregory W. Huffman and Mark A. Wynne)
___ 9509 Are Deep Recessions Followed By Strong Recoveries? Results for the G-7 Countries (Nathan S. Balke and Mark A. Wynne)
___ 9510 Oil Prices and Inflation (Stephen P.A. Brown, David B. Oppedahl and Mine K. Yücel)
___ 9511 A Comparison of Alternative Monetary Environments (Joseph H. Haslag))
___ 9512 Regulatory Changes and Housing Coefficients (John V. Duca)
___ 9513 The Interest Sensitivity of GDP and Accurate Reg Q Measures (John V. Duca)
___ 9514 Credit Availability, Bank Consumer Lending, and Consumer Durables (John V. Duca and Bonnie Garrett)
___ 9515 Monetary Policy, Banking, and Growth (Joseph H. Haslag)
___ 9516 The Stock Market and Monetary Policy: The Role of Macroeconomic States (Chih-Ping Chang and Huan Zhang)
___ 9517 Hyperinflations and Moral Hazard in the Appropriation of Seigniorage: An Empirical Implementation With A Calibration Approach (Carlos E. Zarazaga)
___ 9518 Targeting Nominal Income: A Closer Look (Evan F. Koenig)

Name:	**Organization:**
Address:	**City, State and Zip Code:**
Please add me to your mailing list to receive future Research Papers: ____ **Yes** ____ **No**	

Research Papers Presented at the
1994 Texas Conference on Monetary Economics
April 23-24, 1994
held at the Federal Reserve Bank of Dallas, Dallas, Texas

Available, at no charge, from the Research Department
Federal Reserve Bank of Dallas, P. O. Box 655906
Dallas, Texas 75265-5906

Please check the titles of the Research Papers you would like to receive:

____ 1 A Sticky-Price Manifesto (Laurence Ball and N. Gregory Mankiw)

____ 2 Sequential Markets and the Suboptimality of the Friedman Rule (Stephen D. Williamson)

____ 3 Sources of Real Exchange Rate Fluctuations: How Important Are Nominal Shocks? (Richard Clarida and Jordi Gali)

____ 4 On Leading Indicators: Getting It Straight (Mark A. Thoma and Jo Anna Gray)

____ 5 The Effects of Monetary Policy Shocks: Evidence From the Flow of Funds (Lawrence J. Christiano, Martin Eichenbaum and Charles Evans)

Name:	Organization:
Address:	City, State and Zip Code:
Please add me to your mailing list to receive future Research Papers:	_____ Yes _____ No