Inflation and Unemployment: The Evolution of the Phillips Curve Volume III

Edited by

Richard G. Lipsey

Emeritus Professor of Economics
Simon Fraser University, Canada

and

William Scarth

Professor of Economics
McMaster University, Canada

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Volume III

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Contents

Acknowledgements ix
An introduction to all three volumes by the editors appears in Volume I

PART I THE PHILLIPS CURVE AS AN ANSWER TO FRIEDMAN'S MISSING EQUATION IN A COMPLETE MACRO MODEL

1. A.W. Phillips (1954), 'Stabilisation Policy in a Closed Economy', *Economic Journal*, **64** (254), June, 290–323 3
2. Richard G. Lipsey (1978), 'The Place of the Phillips Curve in Macroeconomic Models', in A.R. Bergstrom, A.J.L. Catt, M.H. Peston and B.D.J. Silverston (eds), *Stability and Inflation: A Volume of Essays to Honour the Memory of A.W.H. Phillips*, Chapter 4, Chichester, UK and New York, NY: John Wiley and Sons, 49–75 37
3. Bennett T. McCallum (1987), 'The Development of Keynesian Macroeconomics', *American Economic Review,* **77** (2), May, 125–9 64
4. Alan S. Blinder (1987), 'Keynes, Lucas, and Scientific Progress', *American Economic Review,* **77** (2), May, 130–36 69
5. Richard G. Lipsey (2000), 'IS-LM, Keynesianism, and the New Classicism', in Roger E. Backhouse and Andrea Salanti (eds), *Macroeconomics and the Real World, Volume 2: Keynesian Economics, Unemployment, and Policy*, Chapter 4a, New York, NY: Oxford University Press, 57–82 76

PART II SOME STABILISATION POLICY IMPLICATIONS OF THE EXPECTATIONS-AUGMENTED PHILLIPS CURVE: MONETARY POLICY RELEVANCE, DYNAMIC CONSISTENCY AND THE VOLATILITY TRADE-OFF

6. Stanley Fischer (1977), 'Long-term Contracts, Rational Expectations, and the Optimal Money Supply Rule', *Journal of Political Economy*, **85** (1), February, 191–205 105
7. Edmund S. Phelps and John B. Taylor (1977), 'Stabilizing Powers of Monetary Policy under Rational Expectations', *Journal of Political Economy*, **85** (1), February, 163–90 120
8. Stephen J. Turnovsky (1984), 'Rational Expectations and the Theory of Macroeconomic Policy: An Exposition of Some of the Issues', *Journal of Economic Education*, **15** (1), Winter, 55–69 148
9. Alex Cukierman (1986), 'Central Bank Behavior and Credibility: Some Recent Theoretical Developments', *Federal Reserve Bank of St. Louis Review*, May, 5–17 163

10. John B. Taylor (1994), 'The Inflation/Output Variability Trade-off Revisited (including 'Discussion' by Lawrence M. Ball)', in Jeffrey C. Fuhrer (ed.), *Goals, Guidelines, and Constraints Facing Monetary Policymakers*, Boston, MA: Federal Reserve Bank of Boston, 21–42 176
11. Michael Parkin (2000), 'What Have We Learned About Price Stability?', Peter Howitt, 'Discussion', W. Craig Riddell, 'Discussion', and Kim McPhail, 'General Discussion', *Price Stability and the Long-run Target for Monetary Policy: Proceedings of a Seminar Held by the Bank of Canada*, 223–81 198
12. Marvin Goodfriend (2004), 'Monetary Policy in the New Neoclassical Synthesis: A Primer', *Federal Reserve Bank of Richmond Economic Quarterly*, **90** (3), Summer, 21–45 257
13. Jeffrey M. Lacker and John A. Weinberg (2007), 'Inflation and Unemployment: A Layperson's Guide to the Phillips Curve', *Federal Reserve Bank of Richmond Economic Quarterly*, **93** (3), Summer, 201–27 282

PART III THE NEW NEOCLASSICAL SYNTHESIS: MORE MICRO-FOUNDATIONS FOR THE PHILLIPS CURVE

14. Guillermo A. Calvo (1983), 'Staggered Prices in a Utility-maximizing Framework', *Journal of Monetary Economics*, **12** (3), September, 383–98 311
15. N. Gregory Mankiw (2001), 'The Inexorable and Mysterious Tradeoff Between Inflation and Unemployment', *Economic Journal*, **111** (471), May, C45–C61 327
16. Jordi Galí (2000), 'The Return of the Phillips Curve and Other Recent Developments in Business Cycle Theory', *Spanish Economic Review*, **2**, 1–10 344
17. Michael T. Kiley (2002), 'Partial Adjustment and Staggered Price Setting', *Journal of Money, Credit and Banking*, **34** (2), May, 283–98 354
18. N. Gregory Mankiw and Ricardo Reis (2003), 'Sticky Information: A Model of Monetary Nonneutrality and Structural Slumps', in Philippe Aghion, Roman Frydman, Joseph Stiglitz and Michael Woodford (eds), *Knowledge, Information, and Expectations in Modern Macroeconomics: In Honor of Edmund S. Phelps*, Chapter 3, Princeton, NJ and Oxford, UK: Princeton University Press, 64–86 370
19. Richard Dennis (2007), 'Fixing the New Keynesian Phillips Curve', *Federal Reserve Bank of San Francisco Economic Letter*, No. 2007-35, November, 1–3 393
20. Michael Woodford (2007), 'Interpreting Inflation Persistence: Comments on the Conference on "Quantitative Evidence on Price Determination"', *Journal of Money, Credit and Banking*, **39** (1), February (Supplement), 203–10 396

21. Mark Gertler and John Leahy (2008), 'A Phillips Curve with an Ss Foundation', *Journal of Political Economy*, **116** (3), 533–72 404

PART IV THE NEW NEOCLASSICAL SYNTHESIS: THE ONGOING EMPIRICAL TESTING OF THE PHILLIPS CURVE

22. John M. Roberts (1995), 'New Keynesian Economics and the Phillips Curve', *Journal of Money, Credit and Banking*, **27** (4, part 1), November, 975–84 447
23. Jeff Fuhrer and George Moore (1995), 'Inflation Persistence', *Quarterly Journal of Economics*, **110** (1), February, 127–59 457
24. Jeremy Rudd and Karl Whelan (2007), 'Modeling Inflation Dynamics: A Critical Review of Recent Research', *Journal of Money, Credit and Banking*, **39** (1), February (Supplement), 155–70 490
25. Luca Benati (2008), 'Investigating Inflation Persistence Across Monetary Regimes', *Quarterly Journal of Economics*, **123** (3), August, 1005–60 506
26. Jean-Marie Dufour, Lynda Khalaf and Maral Kichian (2006), 'Inflation Dynamics and the New Keynesian Phillips Curve: An Identification Robust Econometric Analysis', *Journal of Economic Dynamics and Control*, **30**, 1707–27 562
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Part I
The Phillips Curve as an Answer to Friedman's Missing Equation in a Complete Macro Model

[1]

STABILISATION POLICY IN A CLOSED ECONOMY [1]

RECOMMENDATIONS for stabilising aggregate production and employment have usually been derived from the analysis of multiplier models, using the method of comparative statics. This type of analysis does not provide a very firm basis for policy recommendations, for two reasons. First, the time path of income, production and employment during the process of adjustment is not revealed. It is quite possible that certain types of policy may give rise to undesired fluctuations, or even cause a previously stable system to become unstable, although the final equilibrium position as shown by a static analysis appears to be quite satisfactory. Second, the effects of variations in prices and interest rates cannot be dealt with adequately with the simple multiplier models which usually form the basis of the analysis.

In Section I of this article the usual assumption of constant prices and interest rates is retained, and a process analysis is used to illustrate some general principles of stabilisation policies. In Section II these principles are used in developing and analysing a more general model, in which prices and interest rates are flexible.

SECTION I

Some General Principles of Stabilisation

1. *The Model* [2]

The model consists of only two relationships. On the supply side, it is assumed that the rate of flow of current production, measured in real units per year and identical with the flow of real income, is adjusted, after a time lag, to the rate of flow of aggregate demand, also measured in real units per year. On the demand side, it is assumed that aggregate demand varies with real income or production, without significant time lag.[3] The proportion by which any change in aggregate demand induced by a change in real income falls short of that change in income will be called the marginal leakage from the system. In the simplest

[1] This article is based on part of the material of a thesis submitted to the University of London for the degree of Ph.D. I am indebted to Mr. A. C. L. Day, Mr. A. D. Knox, Professor J. E. Meade, Mr. W. T. Newlyn, Professor Lionel Robbins and Dr. W. J. L. Ryan for helpful comments on an earlier draft.

[2] A mathematical treatment of models used and of the stabilisation policies applied to them is given in the Mathematical Appendix.

[3] A demand lag could be introduced in addition to the production lag, but has been omitted to avoid complicating the mathematical treatment.

case of a closed economy with government ignored and with constant investment it is equal to the marginal propensity to save. In all the illustrations given below the marginal leakage is assumed to be 0·25.

The response of production to changes in demand is assumed to be gradual and continuous. For aggregative models this is more realistic than the usual assumption that production changes in sudden jumps. Even if each producer were to have a rigid production plan which he altered only at intervals of several months, the planning periods of the thousands of individual

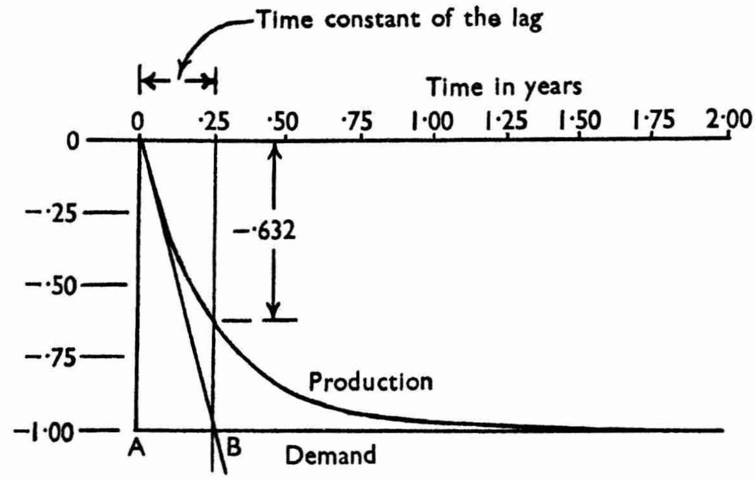

FIG. 1.—Single production lag.

producers would overlap, and the response of aggregate production to a sudden change in aggregate demand would consequently be more nearly approximated by a continuously changing variable than by one changing only at discrete intervals of time. To obtain a model in which this continuous change is represented, a distributed time lag is introduced by the hypothesis that whenever the production flow is different from the flow of demand, the production flow will be changing in a direction which tends to eliminate the difference and at a rate proportional to the difference.

The implications of this hypothesis are illustrated in Fig. 1, which shows the change that would occur in production if, from an initial equilibrium position, demand were to fall by one unit at time zero and to remain constant thereafter, on the assumption that the rate of change of production, measured in units per year per year, is four times the difference between demand and production, both measured in units per year. The factor of proportionality, 4 in this case, is a measure of the speed of response of production to changes in demand, and is indicated in Fig. 1 by the slope of the line *OB*, drawn tangential to the production-response curve at *O*. Its reciprocal is a measure of the slowness of response, or time taken to adjust production to changes in demand, and is called the time constant of the production lag. In this case it is equal to 3 months or 0·25 of a year, and is indicated in Fig. 1 by the length of the line *AB*. The time constant may also be defined as the time that would be taken, after a sudden change in demand, for production to change by an amount equal to 0·632 [1] of the full adjustment required for a new equilibrium, if demand were meanwhile to remain constant at its new value.

It is possible that a better representation of the real process of adjustment would be obtained by analysing the time lag into a number of separate components operating consecutively. For example, there may be a time lag in observing that an adjustment is necessary, another in making the decision to carry out the adjustment, and a third in actually making the adjustment. If two such lags are assumed, each with a time constant of $6\frac{1}{2}$ weeks so that the combined time constant is 3 months as in the previous example, the time path of the adjustment becomes that shown in Curve (*b*) of Fig. 2, while if three consecutive lags are assumed, each with a time constant of $4\frac{1}{3}$ weeks, the time path becomes that shown in Curve (*c*) of Fig. 2.[2] Although the slower adjustment obtained in the initial stages of the process with these multiple lags may be more realistic than that which results from the assumption of a single lag, the single lag is retained in the following analysis in order to simplify the mathematics.[3] In all the illustrations given below, the time constant of this single production lag is assumed to be 3 months.

In the complete model demand does not remain constant during the process of adjustment, but itself responds to changes in real income and production. It is therefore necessary to

[1] Or $1 - e^{-1}$, where e is the base of Napierian logarithms.

[2] If the number of consecutive lags is increased indefinitely, the time constants of the separate lags being simultaneously reduced so that the combined time constant remains fixed, the time path approaches the limit of a step function, jumping from 0 to -1 after a period of time equal to the combined time constant. I am indebted to Mr. J. Wise for providing me with a rigorous mathematical proof of this.

[3] Since aggregate production includes services, the provision of which responds instantaneously to changes in the demand for them, the more rapid initial response obtained by assuming a single lag may in fact represent quite a good approximation to the real process of adjustment.

distinguish between an initial or spontaneous change in demand, representing a disturbance or change in the relationships of the model, and the additional or induced changes in demand which result from the dependence of demand on production and in turn induce further changes in production by the familiar multiplier process. When these induced effects are taken into account the

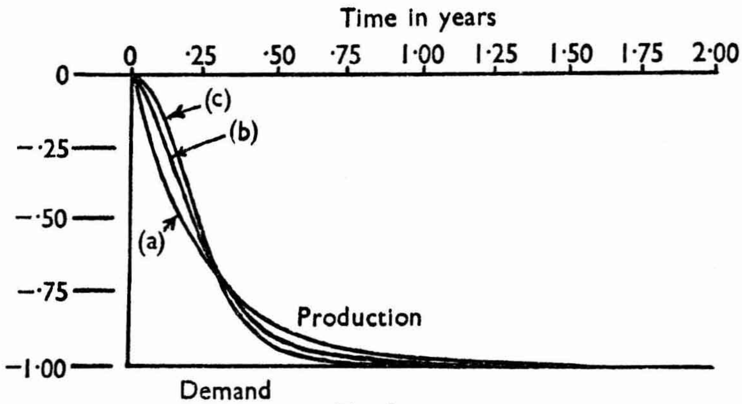

Fig. 2

Curve (*a*), single production lag.
Curve (*b*), double production lag.
Curve (*c*), triple production lag.

response of production, measured from an initial equilibrium value, to a spontaneous fall in demand of one unit, occurring at time zero and continuing thereafter, is shown by Curve (*a*) of Fig. 3. This is, of course, simply a continuous version of the ordinary multiplier process, the multiplier being the reciprocal of the marginal leakage, or 4.

2. *The Stabilisation Problem*

The adoption of a policy for stabilising production implies that there is some level of production which it is desired to maintain. The desired level may be that which, given the existing productive resources, would result in a certain level of employment, or it may be that which would result in a constant price index of consumers' goods, or the choice may be based on a number of other economic, political or social considerations. For the limited purpose of studying the principles of stabilisation in a closed economy the choice of desired production may be considered as given. The difference between the actual production and desired production at any time will be called the error in production.

Stabilisation policy consists in detecting any error and taking

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