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The **TAYLOR RULE**

and the Transformation of Monetary Policy

Edited by

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PREFACE

Richard W. Fisher

Back in the late 1970s and early 1980s, John Taylor and a few others embraced the notion that households and firms are forward-looking in their decision-making and intelligent in forming their expectations, but rejected the view that wages and prices adjust instantaneously to their market-clearing levels. It is these nominal frictions that give policy short-run leverage to influence the real economy. This approach to macroeconomics has grown in popularity to the point that it has become dominant inside and outside the Federal Reserve System. It has also stimulated interest in the nuts and bolts of how labor and product markets work.

Combine rational expectations with forward-looking, maximizing households and firms, and suddenly the private sector's behavior depends on the entire expected future path of policy. Taylor was a pioneer in thinking about monetary policy in this new, rich, and complicated setting. This book will explore some of the literature that Taylor inspired and will help us understand how the new ways of thinking that he pioneered have influenced actual policy here and abroad.

* * *

Taylor has divided his career between academia and government service, and both spheres owe him a debt of gratitude for having done so. Fundamentally, Taylor has demonstrated that it is possible to do serious

Richard W. Fisher is president and CEO of the Federal Reserve Bank of Dallas. The views expressed in this preface are those of the author and should not be attributed to the Federal Reserve.

ONE

MONETARY POLICY RULES:
FROM ADAM SMITH
TO JOHN TAYLOR

Pier Francesco Asso and Robert Leeson

1. Introduction

At the November 1992 Carnegie-Rochester Conference on Public Policy in Pittsburgh, John Taylor (1993a) suggested that the federal funds rate (r) should normatively (with qualifications) and could positively (at least in the previous five years) be explained by a simple equation:

$$r = p + 0.5y + 0.5(p - 2) + 2,$$

where y is the percent deviation of real GDP from trend and p is the rate of inflation over the previous four quarters.

Within a few months of the publication of the Carnegie-Rochester volume, members of the Federal Open Market Committee (FOMC)

This paper is based on a paper prepared for presentation at the Federal Reserve Bank of Dallas' conference on "John Taylor's Contribution to Monetary Theory and Policy." It has benefited from comments from Ray Fair, John Taylor, participants at the Dallas Fed conference, and seminar participants at the Federal Reserve Board of Governors and at the Federal Reserve Banks of Boston and New York. Pier Francesco Asso is Professor of History of Economics at the University of Palermo, Italy. Robert Leeson is a Visiting Professor of Economics at Stanford University and a Visiting Fellow at the Hoover Institution.

were using the formula to inform their monetary policy deliberations. Governor Janet Yellen indicated that she used the Taylor rule to provide her "a rough sense of whether or not the funds rate is at a reasonable level" (FOMC minutes January 31–February 1, 1995). Taylor visited the Fed board staff in early 1995 and was then asked to discuss the rule with the chairman and other members of the Board of Governors (December 5, 1995).

Athanasios Orphanides (2003) used the Taylor rule to examine the post-World War II history of U.S. monetary policy decisions. The purpose of the current paper is different: it is to shed light on the intellectual history of monetary policy rules, with special emphasis on the Taylor rule. Section 2 introduces the fundamental debate of rules versus discretion and output stabilization versus inflation stabilization. Sections 3–5 examine the early history of policy rules: from Adam Smith to the Great War (section 3), from the Great War to the Great Crash (section 4), plus gold and commodity standard rules (section 5). Sections 6–7 examine three influential rules-based advocates: Henry C. Simons (section 6) plus A. W. H. Phillips and Milton Friedman (section 7). Sections 8–9 examine the evolution of Taylor's thinking between 1976 and 1991, during his two spells at the Council of Economic Advisers (section 8), and in the months immediately preceding the Carnegie-Rochester conference (section 9). Section 10 examines the influence of the Taylor rule on macroeconomic research. Concluding remarks are provided in section 11.

2. Cutting the Gordian Knot

Taylor chose his timing well. In 1946, the year in which he was born, the two competing intellectual leaders of the rules versus discretion debate died. They were Henry Simons (the leader of the Chicago "rules party," who advocated stabilizing " p " using a price level rule) and John Maynard Keynes (whose followers emphasized the importance of stabilizing " y "). The year 1946 was also important for two economists who were to exert seminal influences over Taylor's intellectual development: A. W. H. Phillips enrolled at the London School of Economics and Milton Friedman returned to Chicago, where shortly afterward he rediscovered the quantity theory as a tool for challenging his Keynesian opponents and developed the k -percent money growth rule as an alternative to Simons' price-level rule. The Taylor

rule (with r , not M , on the left-hand side) replaced the Friedman rule with a lag.

During the years between the Lucas critique and the Taylor rule (1976–1992), Taylor had a foot in academia and an almost equally sized foot in the policy apparatus (CEA 1976–77, Research Adviser at the Philadelphia Fed 1981–84, CEA 1989–91). By placing almost equal career coefficients on government service and academia, Taylor acquired an invaluable understanding of policy constraints and communication issues. The 1946 Employment Act created the CEA and initiated the *Economic Report of the President*. The act did not specify priorities about p and y ; this dual mandate sought to "promote maximum employment, production, and purchasing power." But by the 1960s many economists saw an irreconcilable conflict between promoting maximum employment and production, on the one hand, and promoting stable prices (maximum purchasing power). Keynesians tended to favor a Phillips curve discretionary trade-off as an expression of the emphasis attached to y .

The Taylor rule synthesized (and provided a compromise between) competing schools of thought in a language devoid of rhetorical passion. The Great Depression created a constituency which tended to emphasize the importance of minimizing y (and hence tended to increase the weight attached to y). Inflation was accommodated as a necessary cost of keeping debt servicing low (pre-1951), tolerated, or "controlled away" by wage and price controls. The Great Inflation (circa 1965–79) and the costs associated with the Great Disinflation (post-1979) created a constituency that sought to minimize p (and hence tended to increase the weight attached to p).

Keynes intentionally divided economists into (obsolete) "classics" and (modern) Keynesians; Friedman divided the profession into (destabilizing) fiscalists and (stabilizing) monetarists. Taylor (1989a) heretically suggested that different schools of thought should be open to alternative perspectives; his *Evaluating Policy Regimes* commentary suggested that "some of the differences among models do not represent strong ideological differences" (1993b, 428). The Taylor rule with its equal weights has the advantage of offering a compromise solution between y -hawks and p -hawks.

The rules-versus-discretion debate has often been broadcast at high decibels. Part of the Keynesian-Monetarist econometric debate was described as the battle of the radio stations: FM (Friedman and [David] Meiselman) versus AM ([Albert] Ando and [Franco] Modigliani).

Around the time of Taylor's first publication (1968), the macroeconomic conversation came to be dominated by what some regarded as the NPR "radio of the right" ("Natural" rate of unemployment, "Perfectly" flexible prices and wages or "Perfect" competition, and "Rational" expectations).

Robert Solow (1978, 203) detected in the rational expectations revolutionaries "a polemical vocabulary reminiscent of Spiro Agnew"; but the revolutionaries doubted that "softening our rhetoric will help matters" (Lucas and Sargent 1978, 82, 60). In a review of Tom Sargent's *Macroeconomic Theory*, Taylor (1981a) commented on Sargent's "frequently rousing style" of adversely contrasting new classical macro with the "Keynesian-activist" view. The Taylor rule embraced "R" (and, in the background though it is not required, "N"), replaced "P" with contracts, and provided a policy framework minus the inflammatory rhetoric.

When new rational expectations methods led to real business cycle models without a stabilization role for monetary policy, Taylor (2007c) recalled that it was a tough time: the dark ages for monetary policy rules research. Academic interests appeared to become decoupled from the needs of policymakers. A small group of monetary economists saw themselves as "toiling in the vineyards" (McCallum 1999).

A revival (at least in policy circles) began in the later 1980s. In 1985, the Brookings Institution and the Center for Economic Policy Research (later in association with the International Monetary Fund) launched a research project to investigate international macroeconomic interactions and policy. At the December 1988 Macroeconomic Policies in an Interdependent World conference, several papers investigated policy rules. At this conference, Taylor (1989b, 125, 138) had the short-run interest rate as the primary operating instrument of monetary policy: "placing some weight on real output in the interest rate reaction function is likely to be better than a pure price rule."

But the impressive body of rules-based academic literature appeared not to be leading to a consensus. In March 1990, Taylor (1993b, 426-9) noted that significant progress had been made, but "the results vary from model to model. No particular policy rule with particular parameters emerges as optimal for any single country, let alone all countries. Because of the differences among the models and the methodology, I would have been surprised if a clear winner had presented itself." However, policy rules which focused "on the sum of real output and inflation" outperform other types: "a consensus is emerging about a functional form." Yet there was no consensus about the size of coef-

ficients. Shortly afterward Taylor cut this Gordian knot with his simple but persuasive equation: a compromise between academic complexity and policy-influencing simplicity.¹

3. From 1776 to the Great War

The problem of designing rational rules to preserve monetary stability or to achieve other policy objectives has long occupied the minds of monetary authorities and thinkers. Some historians have traced the early seeds of the modern "rules versus discretion" dichotomy as far back as the Roman Empire or the Middle Ages (Volckart 2007). However, it was in the age of David Ricardo, Henry Thornton, Lord Overstone, and Walter Bagehot that, for the first time, the importance of monetary policy being rule-guided acquired a great practical and institutional importance.

Major historical events provided economists with the ideal environment for writing and conceiving new rules of conduct in monetary policy. In fact, it was in coincidence with the rise of nation-states and with the general introduction of paper money and its progressive dematerialization that the economic implications of alternative money rules produced some first results both analytically and for practical action. The recurring crises which affected the British economy after the Napoleonic Wars also provided new rationales for discussion of the objectives and instruments of monetary policy. Furthermore, it was in the aftermath of World War I that economists began to reconsider monetary stability and monetary management as a crucial factor for promoting economic stability and growth.

Most of the nineteenth-century controversies on the functioning of alternative monetary systems or on the nature and importance of money in generating cyclical fluctuation can be read through the lenses of the "rules versus discretion" dichotomy. After the financial chaos generated by the Napoleonic Wars, the importance of rules of conduct in monetary affairs began to attract the attention of bankers, professional associations, and political parties. As payments technologies evolved and became more complex, an explicit commitment to abide by rules of conduct was conceived as part of an enforcing mechanism

1. A notable precursor to the Taylor rule is the research reported in Bryant, Hooper, and Mann (1993), which sought to identify interest rate policy rules that delivered satisfactory macroeconomic performance across a range of models. See also Orphanides (2007).

to avoid abuses, maintain or restore confidence in the value of money and in the legitimacy of the new financial instruments, and establish on firmer grounds the relationships between banks of issue and commercial banks.

Some early perceptions of our story can be found in Adam Smith's *The Wealth of Nations*. Despite the many financial crashes which had accompanied the introduction of paper money, Smith did not assume a dogmatic approach on behalf of metal standards. On the contrary, he clearly anticipated the possibility that metal shortages would check the prospects of growth and that economic systems would inevitably move beyond the adoption of commodity moneys. At that time, "a well-regulated paper-money" will substitute for metals "not only without any inconvenience, but, in some cases, with some advantages" (Smith 1776, b. iv, c. i). Among the latter, Smith suggested a greater degree of flexibility but also a possible increase in the overall stock of capital.

However, it was the British suspension of the gold standard in 1797 and the publication of the Bullion Report in 1810 which originated a wave of new reflections and writings. Economists and pamphleteers opened a profound discussion on the nature of money, the causes of wartime inflation, and the role of the banking system which went on until the passage of the 1844 Peel Act. The field was split between the adherents of the Currency School—who explained inflation in terms of the monetary abuses primarily caused by excessive government expenditure—and the Banking School, which gave a more complex interpretation of the reasons for monetary instability and liquidity creation. It could be argued that both the Currency School and the Banking School provided cases for subjecting the Bank of England to some pre-conceived rules of conduct.

Inspired by the writings of Ricardo and of Robert Torrens, the Currency School firmly stood in favor of legislated rules to govern the money supply and set the guidelines for the country's monetary policy. Rules of conduct were also required to enforce the capacity of the Bank of England to protect confidence in new payments technologies and as a consequence of the spread of new financial instruments.

The Banking School proposed a "softer" rule which the national banks of issue ought to follow in governing their issuing operations. This rule, which went under the name of "the real bills doctrine," had also received intellectual recognition in several passages of Smith's *Wealth of Nations*. Under the real bills doctrine, new liquidity could be created only for those invoices whose object was to finance real goods in the course of production and distribution. Following Smith, Thomas

Tooke, James Fullarton, John Stuart Mill, and other Banking School economists suggested that banks of issue should not be constrained by a rigid, quantitative rule: in fact, the optimum quantity of money would be forthcoming automatically if the banks themselves regulated their notes and other liabilities by responding to "the needs of trade." It followed that, so long as outright convertibility in commodity moneys persisted, over-issue was a very unlikely event. However, as has been suggested by David Laidler (2002), it was the ultimate fallacy of the real bills doctrine as a guiding principle of monetary policy and as a sound explanation of general price alterations that may help to explain the search for more specific, quantitatively determined price rules.

Another rationale for money rules rose from the need to enhance the autonomy and the independence of the national banks of issue and rescue them from the greed of the political powers. Full monetary autonomy was an essential prerequisite for achieving different policy objectives: the absorption of external shocks; the protection of confidence in a paper-money system; the smooth transition toward the restoration of full and automatic convertibility; and the indispensable "gradualism" in the adjustment process of external disequilibria. Here, the leading authority was Henry Thornton who, in his 1802 essay, clearly established a set of rules which the banks of issue ought to follow for an optimal regulation of the money supply. In the final pages of his book, Thornton elaborated a series of "restrictive principles of a practical order." The most relevant were: 1. "in no case, however, materially to diminish the sum in circulation, but to let it vibrate only within certain limits"; 2. "to afford a slow and cautious extension of it, as the general trade of the Kingdom enlarges itself"; 3. "to allow of some special, though temporary, increase in the event of any extraordinary alarm or difficulty"; 4. "to lean to the side of diminution in the case of gold going abroad, and of the general exchanges continuing long unfavourable" (Thornton 1802, 295). According to Thornton, this was the "true policy" which the Bank of England ought to follow, without ever "suffering the solicitation of merchants, or the wishes of Government, to determine the measure of the bank issues."

The usefulness of money rules went beyond the necessity to halt inflation or avoid political abuses in the management of the money supply. In fact, as the market economy became more complex throughout the nineteenth century, economists began to realize the existence of dilemmas or conflicts among different policy objectives. This turned out to be a rather unpleasant discovery and it suggested that some external constraints should be placed upon the actions of policymakers.

In the age of Thornton and Ricardo, several economists noted that different varieties of economic and financial crisis tended to occur at the same time and seemed to require contrasting economic policy remedies. The most common experience took the shape of a sudden instability in the foreign exchange market which coincided with widespread episodes of depositors' runs. In these occurrences the dilemma took the shape of the alternative between financial stringency on one hand and the injection of more liquidity into the system on the other. Therefore, as Bagehot observed, sticking to a set of pre-announced or preconceived rules may become a good, second-best solution for these dilemmas. Also, the contrast between external and internal stability or the one between national autonomy and international coordination were often emphasized by political economists. Particularly after World War I, it was noted that money rules could become optimal instruments in this respect.

Moreover, as has often occurred in economic history, the growing complexity of the market economy did not correspond with a parallel evolution of norms and institutional settings which could help maintain confidence in the new payments technologies and protect purchasing power. Economists knew well that, in the past, many confidence crises had irredeemably swept away new financial innovations which—since the Middle Ages in both continental Europe and Asia—had been built around paper money and fiduciary credit instruments. This was just another reason why they believed that some prudential commitments on the part of banks of issue could become a helpful solution in times of institutional backwardness or fragilities in the management of monetary policy. In modern jargon, it could be said that rules could be conceived as a means to increase confidence under uncertainty and contractual incompleteness (Giannini 2004).

In the first half of the nineteenth century, another dilemma was often brought to the attention of policymakers. In fact many economists suggested the need for rules of conduct in the absence of central banks of issue, or for the reason that most central banks were private enterprises and often acted accordingly in the search for maximum profits on behalf of their shareholders. Many argued that the coexistence of two activities (issuing and banking) weakened the national banks' capacity to exert an effective control upon circulation. In fact the need for firmer rules stemmed from the often contradictory responsibilities which either the law or traditional working practices had attached to national banks of issue. The history of the Bank of England after the Napoleonic Wars well epitomizes these contradictions. Among its mani-

fold functions, the Bank of England was the issuer of notes; had formal responsibilities for managing the public debt; operated as a private banking company; was custodian of the country's official gold reserves; and was from time to time required to intervene as the "lender of last resort," which it often did with a high degree of discretion. These contradictions at a micro level were often reinforced by further dilemmas which originated at a macro level, among them the existence of external versus internal conflicts with interest-rate ceilings which the usury laws often imposed on monetary policy.² Samuel Jones Loyd (later Lord Overstone) was among the most active supporters of this quest for less ambiguity and clearer rules of action on the part of the national monetary authorities. As he put it while discussing the Bank of England's multiple functions, "we fall into . . . confusion of ideas, and of course are led to many practical errors, when, seeing that the Bank is at once Manager of the Currency and Head of the banking operations of the country, we confound these distinct characters . . ." (quoted by Eltis 2001, 6).

Finally, as the economy and the payments systems became more complex, rules began to be thought of as useful methods for defending the reputation and guaranteeing the stability of the banking system (Goodhart 1988). With the move away from commodity moneys to legal moneys, economists realized that the production of confidence had become a crucial activity. In this regard, one useful step was to limit freedom of action on the strongest contractual part by restricting opportunities for increasing the money supply. Money rules were conceived in order to ensure the anti-inflationary credibility of monetary policy (Giannini 2004).

4. From the Great War to the Great Crash

World War I was another external shock that exerted a major influence on this debate and, more generally, played an important role in reshaping monetary policy in accord with some legislated commitment. Money rules were given pride of place in many stabilization plans upon which economists elaborated in the immediate post-war years as part of their efforts to find a remedy for wartime inflation and mitigate the

2. Thornton, Bagehot, and many other nineteenth-century economists wrote against the usury laws which established an artificial interest-rate ceiling, thus preventing the monetary authorities from obtaining foreign credits in times of gold shortages.

sharp cyclical fluctuations which occurred in foreign trade and real output. As we shall see in the following sections, it was in the interwar years that one can trace some possible antecedents of Taylor's rule.

It must be noted that in the post-war environment the conditions for the practical introduction of money rules seemed to be particularly favorable. In fact, economists began to realize that in order to be reliable, rules needed a greater availability of data and a greater statistical accuracy. Policy rules could thus become credible tools only after systematic empirical research was undertaken and introduced in macroeconomic models. Index numbers, construction of national accounting systems, and basic accessibility to quarterly disaggregated data were instrumental steps for rules design and other related financial innovations. Beginning in the early 1920s, the statistical bureaus of central banks were significantly reinforced (see, among others, Meltzer 2003, chap. 4). Moreover, upon the ashes of military destruction and imperial segregation, a network of new central banks was founded; in some instances, their statutory charters began to indicate a priority list of monetary policy objectives. With the writings of Ralph Hawtrey, John Maynard Keynes, Gustav Cassel, and Irving Fisher, the controversy between a managed monetary policy and the adoption of legislative rules became an element of alternative explanations of the business cycle as well as of the international debate on the restoration of the gold standard.

In the 1920s, the growing professional reputation of economists gave them a more prominent role in designing new policy instruments. Money rules were thus the outcome of a new season of international economic advocacy which was inaugurated by the economists' professional successes in the management of wartime real and financial requirements (Bernstein 2001). During the war, most particularly in the United States, economists earned respect for their technical capacities to fix the economic machine and rationally steer it toward optimal goals.

In the first three decades of the twentieth century, the rules-versus-discretion debate was characterized by a pervasive Fisherian influence. Perhaps the leading monetary theorist at the turn of the century, Irving Fisher had made first-rate contributions to the revivification of the quantity theory of money and important suggestions for the improvement of the classical gold standard (Fisher 1911). He also devoted many intellectual and financial resources to support legislation on price stability (Fisher 1920). As the stability of the international monetary system seemed jeopardized by political tensions and the debt overhang, Fisher fought hard to convince economists and the financial community at large that price stability should be included among the

goals of the new Federal Reserve System. He also paid periodic visits to world political leaders urging them to sign a commitment on behalf of policy coordination and a new set of monetary rules (Asso 1994). Never before had one of the most promising young economic theorists virtually abandoned theoretical speculation to embrace a thirty-year crusade on behalf of "stable money," founding associations and pressure groups.

As we shall see below, Fisher himself was the father of many stabilization plans that entailed some form of money rule. It seems curious that Fisher's compensated dollar plan imposed a rather mechanical behavior on monetary authorities even though it completely disregarded the utility of the quantity theory of money he had helped to refine and reintroduce in economics with his 1911 treatise on the *Purchasing Power of Money* (Patinkin 1993). Until his very last days, Fisher tried to sell his plans to politicians, dictators, professional associations, and central bankers.

5. Golden Rules

The first golden rule in the history of economics is the "convertibility rule." According to this rule, the maintenance of convertibility of national moneys into gold at a fixed price is the dominant objective of monetary policy. Inspired by the influential Bullion Report, much of British monetary orthodoxy rested on the firm application of this rule. Through convertibility, it was believed that the domestic economy would be sheltered from external shocks, including governmental abuses in issuing paper money (Eltis 2001). Bullionists located the exclusive source of inflation in the central bank, which was also primarily responsible for the external drains of precious metals that led to the restriction of cash payments.

Thus, the "state of the exchanges" provided an automatic criterion with which to regulate the paper money supply. As Colonel Torrens put it, the one and only sound principle which should regulate the issue of banknotes was to let the money supply expand or contract according to the signs of the balance of payments. Issues could only be enlarged or contracted in response to gold inflows or outflows. Conversely, excessive issues not responding to this simple rule of conduct were the major cause of financial and banking crises.

In the age of the Bullion Report one can also find the first emergence of a concentrated and systematic application of the quantity theory as the standard conceptual framework for the analysis of monetary

problems and the formulation of practical policy recommendations. Opinions differed sharply on the definition of what "money" really was. However, the Bullionists were the first to develop the idea that the stock of money or at least its currency component could be effectively regulated via the control of a more narrowly defined monetary base. As one historian has put it, the Bullionist debate is at the origins of the quantitative view that the control of a narrowly defined base of high-powered money implies the virtual control of the money supply (Humphrey 1974).

Classical economists generally expressed a strong commitment on behalf of a legislated rule which aimed to render a paper money economy very much alike to a pure metal economy. The ultimate objective was to maintain stability and, in the meantime, increase economic efficiency due to the development of money and credit markets. Smith (1776, b. ii, c. ii) believed that through the "judicious operations of banking" some real resources could be liberated and invested in productive sectors; the use of paper money instead of gold provided "a sort of wagon-way through the air" enabling a country "to convert a great part of this dead stock into active and productive stock . . . and to convert a great part of its highways into good pastures and corn-fields." In his first published essay, Ricardo (1809, 505) wrote that stability of the standard was the one and only objective of monetary policy. Together with most classical economists he was quite optimistic that the imposition of the gold convertibility rule would render the monetary system less prone to financial instability (Laidler 2002). "Time" was also a crucial element in maintaining stability. In fact, the existence of a legal requirement on convertibility induced a prompt response on the part of monetary authorities which also implied that restrictive monetary policies would have a gradual and smooth nature. Risks of abuses, including abuses associated with imperfect information, could be avoided with the introduction of prudential rules. Ricardo and James Mill supported nationalization of the central bank to reduce margins of discretionality. In 1821 James Mill (1821, 113) wrote that the issue of notes was a business that governments must undertake, a business that could be reduced to a pure mechanism and to which a small number of clear and well-defined rules can be applied. For Thornton, practical rules were also a necessary means to assure a superintendence of general credit.

However, reality told a different story and the return to convertibility after the Napoleonic Wars was followed by a recurrent surge of economic and banking crises. Economists, bankers, and monetary writers

began to argue that—contrary to the precepts of their Bullionist fathers—gold convertibility as such was an insufficient rule for maintaining price stability and avoiding excessive issue of banknotes. As would occur more than a hundred years later, the Banking School doctrine based upon the "legitimate requirements of trade" was blamed for the 1825 banking crisis. As a consequence, a new rule-guided doctrine began to be discussed by economists and bankers. The first who gave it a full articulation was a prudent banker, John Horsley Palmer, governor of the Bank of England from 1830–32.

The "Palmer rule" appeared on the scene for the first time when the governor testified before the Parliamentary Committee on the Bank of England Charter. Should the new doctrine be embodied in the country's monetary constitution—Palmer concluded his testimony—the monetary base would be passively and exclusively regulated "by the actions of foreign exchanges."

Actually, the so-called "Palmer rule" consisted of a set of rules. First, it established that the Bank's rate of rediscount performed as an interest rate ceiling. This provided the money market with a clear indication that the national bank of issue was no longer willing to act in open competition with other institutions; from this rule it also ensued that, in abnormal times of crisis, market rates would soon become higher than the Bank rate so that the Bank could increase its rediscounting facilities and sustain confidence. Second, Palmer announced that, under ordinary conditions, the Bank of England maintained a rigid quantitative ratio between assets and liabilities. More specifically, the Bank would back one-third of its short-term liabilities of currency notes plus short-term deposits with gold and silver bullion, while the remaining two-thirds would be covered with bonds and other interest-yielding assets. Again, on several occasions, Palmer put the emphasis on the fact that abnormal conditions may require a temporary waiving of this prudential rule. Third, in order to gain an effective control of the money market, the Bank should be granted full monopolistic powers in the issuing of notes, at the expense of the private issuing banks operating in the peripheral regions of the country. In particular, this last rule of conduct indicated that the latter would no longer be put in a position to offset the restrictive monetary policy of the former.

Optimism in the soundness of the Palmer rules proved to be misplaced and, in the making of the Peel Act, the Currency School preached for the introduction of a more restrictive set of rules. In fact, some economists objected that the Bank of England did not rigidly link its currency issue to its gold reserve; as gold flowed out in 1825, 1837, and 1839, the

Bank merely sold investments to sustain the two-thirds ratio, thus contributing to an expansion of its note issue (Eltis 2001).

Thus, between the Bullion Report (1810) and the Peel Act (1844), many writers belonging to the Currency School suggested that monetary policy responses to gold outflows and exchange rate movements had been destabilizing, perverse, or simply ineffective. Time was also an important variable in determining whether, in the end, money was a neutral factor for the country's long-term growth prospects. This was the reason why the Bank's intervention risked accentuating, rather than alleviating, economic disturbances. Since the Bank of England's reactions often arrived too late, her interventions did not protect reserves and ultimately weakened public confidence. Thus, what was needed was convertibility plus some strict regulation of the volume of bank notes. In the writings of members of the Currency School can be found a first manifestation of the belief that the only efficient rule was an outright, quantitative limitation of the stock of money.

The writings, speeches, and letters of Lord Overstone (1857) are particularly illuminating in this respect. There, one can find a clear statement that preservation of the convertibility rule could only be secured through another rule which concerned the backing of national banknotes and coinage with earmarked gold reserves. Unlike Bullionists, members of the Currency School argued that convertibility as such was inadequate to check over-issue for a number of reasons, including an unfavorable balance of payments and a weak foreign exchange rate (Humphrey 1974).

In fact, to effectively maintain stability in a paper-money economy, the simple convertibility rule required the existence of a class of spirited public servants who acted as wisely as disinterested mandarins. A very platonic world indeed—so it was clearly perceived by Ricardo and his followers—which needed further rules to increase its degree of resemblance to a world where corruption, selfishness, and the search for private interest dominated the behavior of the markets as well as of the sovereigns. As Lord Overstone (1857, as quoted by Eltis 2001) observed, “. . . if the banker, in addition to what may be properly called his ordinary and legitimate resources, is also entrusted with the power of issuing paper money *ad libitum*; is it not inevitable that he should abuse this power? . . . Will he, under such temptations, in no respect compromise his respective duties as a banker of issue and a banker of deposit and discount?”

More specifically, Currency School advocates sought rigid adherence to the principle of making the existing mixed gold-paper currency

behave exactly as would a wholly metallic currency. As some historians have argued, under the decisive influence of Lord Overstone, the Issue Department of the Bank of England was transformed into a “quasi currency board” by requiring banknotes to expand and contract one-for-one with variations in gold reserves (Eltis 2001; Laidler 2002).

With the Peel Act, the Issue Department was completely separated from the Banking Department. In this manner, reinforcing the gold convertibility rule, the money supply came to be endogenously determined: the Act established that the Issue department would hold the bullion reserve and would be allowed to sustain a note circulation which exceeded this by £14 million. This figure itself indicated a very restrictive attitude since it was close to the lowest level to which the overall note issue had fallen between 1821 and 1844: “. . . hence Britain's monetary base of notes plus bullion would precisely track the Bank's gold and silver reserve upwards and downwards” (Eltis 2001). Thus, the fiduciary issue of £14 million could only be increased after a positive variation of gold reserve assets.

According to the Currency School, the expanded convertibility rule was meant to achieve three long-term policy objectives upon which the general doctrines of the classical school were built: external equilibrium, growth, and money neutrality. In fact, on the one hand, David Hume's argument on behalf of automatic adjustments of external disequilibria could be swiftly expanded to a paper-money economy. On the other, the money supply would become endogenously determined, growing in line with the “needs of trade” and setting the conditions for domestic price stability. Growth prospects ultimately depended on real factors.

In several passages of Overstone's (1857) writings we can find a detailed statement of this rule and of its stabilizing effects on market expectations: “. . . there can be no fixed and definite rule to determine the time and extent of the proper contraction of paper circulation, except correspondence with the bullion. Without such a rule, all must be left to the irregularity and uncertainty of individual discretion. The manager of the circulation must undertake to foresee and to anticipate events, instead of merely making his measures conform to a self-acting test. In the exercise of such a discretion, the manager of the circulation, be he whom he may, we may safely say will, in nine cases out of ten, fall into error; whilst the interests of the whole community, and the fate of all mercantile calculations, will be dependent upon the sound or unsound discretion of some individual or body; instead of depending upon their own prudence and judgement, exercised under

the operation of a fixed and invariable law, the nature and provisions of which are equally known to every body."

In terms of other complementary rules, Overstone suggested that great consideration should be given to the "rule of transparency" on the part of the banks of issue. Enhancing the public's knowledge was a good thing for creating positive market sentiments. An essential feature of the new Banking Act was the regular publication of the state of the country's reserves since, as Overstone (1857) put it, "the public are thus furnished with accurate information from week to week . . . the public attention is now fixed upon the banking reserve."

As is quite well known, the 1844 Act closely followed the instructions of Lord Overstone and his fellows. In modern terms the Act established a marginal gold reserve requirement of 100 percent behind note issues (Humphrey 1974). New notes could be thus emitted only if the Bank had received an equivalent amount of gold. The principle that discretion in the management of the money supply was to be strictly limited by Parliament was later introduced in France (1848), the United States (1865), Italy (1874), Germany (1875), and Sweden (1897).

In the second half of the nineteenth century, Walter Bagehot was perhaps the economist most successful at reviving discussion of monetary policy. Bagehot addressed the issue of what rules of conduct central banks of issue should follow in order to safeguard financial stability. In his view, particularly whenever the emergency took the form of a short-term liquidity crisis, banks of issue should be actively involved in guaranteeing the stability of the banking system. It followed that the nation's central bank was required to act as a lender of last resort, support depositors' confidence, and defend the stability of the banking system, even though these actions might conflict with the profit motive. According to Bagehot, particularly in times of an international gold drain, the central bank should freely lend to domestic banks at higher interest rates.

The Bagehot rule implied that—contrary to the gold standard's "rules of the game"—central banks' foreign and domestic assets usually moved in opposite directions. In response to a sharp gold drain, Bagehot suggested that central banks inject liquidity into the system, thus sterilizing the impact of the gold losses on the money supply.³ As Bagehot (1873, 27–8) put it: ". . . very large loans at very high interest rates are the best remedy for the worst malady of the money market

3. Sterilization policies were eased by central banks' cooperation and mutual lending policies. See the classic studies by Bloomfield (1959) and De Cecco (1984).

when a foreign drain is added to a domestic drain." The influential legacy of Bagehot's rule on the conduct of monetary policy up to 1914 was enduring and widespread; as Bloomfield's (1959, 48) seminal research has shown: "in the case of *every* central bank the year-to-year changes in international and domestic assets were more often in the opposite direction (60 percent of the time) than in the same direction (34 percent of the time)."

The intellectual commitment to the gold standard was weakened by World War I. Significant changes in the price level produced serious economic, political, and social repercussions. Economists were involved in studying how to restore "normalcy" and formulated a long series of stabilization plans which were discussed in academic journals but also at international conferences. Different plans had different attitudes toward the role of commodity moneys in the future monetary systems: some explicitly devised a dethronement of gold; others maintained some forms of anchorage to metals; others suggested that gold be merely relegated to finance international transactions and central banks' clearing operations.

However, common to most of these plans was the idea that domestic price stability was to be regarded as a more optimal preference when compared to foreign exchange stability.

While economists debated stabilization plans, in the post-war years national governments worked hard to reintroduce some commitment to the gold standard. In the first half of the 1920s, it could be argued that another sort of unwritten but rigorously applied rule dominated the scientific debate and, what was worse, the governments' agenda. This invisible rule took the name of the resumption rule and still paid tribute to the sacred and universal values represented by the classical gold standard.

Anyone who is familiar with the interwar debates on the reform of monetary policies and systems knows that the resumption rule introduced stringent commitments on general economic policies. The resumption rule indicated that if, after the occurrence of an exogenous shock (a war or a confidence crisis), gold convertibility was temporarily suspended, it had to be restored at traditional mint parity as soon as practicable—if necessary by deflating the domestic economy. Time of resumption was the only debatable option, but the possibility of "gradualism" did not have to weaken the long-run commitment to exchange stability and gold convertibility. The presumption that full gold convertibility would eventually be restored at the traditional pre-trouble parity was fiercely debated. Particularly in peripheral countries, economists

argued that "gradualism" and "realism" ought to become the guiding principles in establishing the new grid of exchange rate parities.

The resumption rule de facto prevented governments from exerting a long-term influence on the level of domestic prices and was advocated with great force in the early 1920s. The reasons for this support can be identified in the contemporary evils of hyperinflation; in the defence of the prestige of London financial supremacy, i.e., the "City factor"; in the limited diffusion of bank moneys; and in the limited electoral powers of those who were most severely hit by the deflationary bent underlying the resumption rule (McKinnon 1993).

Despite the force of the resumption rule, interwar economists continued to conceive monetary policy in terms of legislated rules which ought to be gradually introduced in national constitutions and coordinated internationally through the concerted action of leading central banks. Keynes, Fisher, Cassel, Hawtrey, R. A. Lehfeldt, and other monetary theorists elaborated plans for monetary reforms which placed domestic price stability on top of the priorities of monetary policy. These reform plans considered the gold anchor as a "barbarous relic" (Keynes) or more politely relegated its functions to a minor role (Fisher and the compensated dollar plan).

In the 1920s critical essays on the actual working of the gold standard began to address the crucial question of how well it functioned according to some pre-established rules of the game. Keynes was not alone in viewing the gold standard not as an effective monetary rule that could automatically govern the monetary system but as a political institution that was managed by the discretion of central banks. It was a widespread perception that gold no longer provided a natural anchor for a rule-based monetary system. Most economists agreed that, in order to increase their effectiveness, money rules needed greater sophistication in the available data and in indexation schemes. World War I was also a key event in the development of the idea of a general price index. Many usable versions of measuring the purchasing power of money were formulated, thus increasing the potential for money rules.

Fisher offered a clear rule for stabilizing the domestic price level (Laidler 2002; Patinkin 1993). In his emphatic prose, Fisher (1920) wrote that the progress of modern capitalism is rooted on price stability: "... what is needed is to stabilize, or standardize, the dollar just as we have already standardized the yardstick, the pound weight, the pint cup ... Once the yard was defined. . . as the girth of the chieftain of the tribe . . . could one imagine the modern American business man

tolerating a dollar defined as the girth of the President of the United States?"

Unlike Keynes, the Yale economist believed that countries needed to maintain some connections with a commodity standard since history proved that full fiduciary systems had almost inevitably been "a curse" for the countries that adopted them. Well before the outbreak of World War I, Fisher thought that stability could be achieved through indexation schemes which automatically offset price variations by varying the gold content of the dollar. Hence he proposed the creation of a compensated dollar.

The essential property of the compensated dollar was to maintain gold convertibility but at a price that would be regularly adjusted to offset past fluctuations in gold's relative price in terms of goods. Such variations were measured by a suitable index number which would be regularly updated and published. Thus, Fisher advocated a price-level stability rule as an anchor for the monetary system and tried to get the U.S. Congress (and also other countries) to implement that rule in legislation. Fisher (1920, 81ff.) explained that if an index of the price level should increase by 1 percent, then the purchasing power of a dollar gold certificate would be restored by increasing the gold content of a dollar by 1 percent; if during the following quarter that should not succeed in restoring the original price level, the gold content would be further increased: "Let us correct gold instability, so that one dollar . . . buy[s] approximately that same composite basketful of goods . . . But how can we rectify the gold standard? By varying suitably the weight of the gold dollar . . . by adding new grains of gold to the dollar just fast enough to compensate for a loss in the purchasing power of each grain . . . What criterion is to guide the Government in making these changes in the dollar weight? Am I proposing that some Government official should be authorized to mark the dollar up or down according to his own caprice? Most certainly not . . . for every one per cent of deviation of the index number above or below par at any adjustment date, we would increase or decrease the dollar's weight by one per cent. In other words, to keep the price level of other things from rising or falling we make the price of gold fall or rise."

Here then, as Patinkin (1993) has argued, there was a rule in the modern sense of the term. The plan worked as an automatic device which, by simply changing one price in the economy, achieved the stabilization of the price level in general: "My aim was to make the whole plan of stabilization—both gold control and credit control—as automatic that is as free from discretion as possible" (Fisher 1920).

The Stable Money Association—founded and headed by Fisher—tried hard but unsuccessfully to impose a legal obligation upon the Fed to pursue price stability. Following Fisher's campaigns, Congressmen James A. Strong (R-KS) and T. Alan Goldsborough (D-MD) presented bills of amendment of the Federal Reserve Act with the aim of introducing price stability among the central bank's priorities. However, as Patinkin (1993) put it, "Fisher's persistent advocacy of his plan played a major role in placing the problem of stabilizing the price level on the agenda of U.S. monetary policy in the interwar period." Curiously, Fisher did not assign a primary role to the quantity of money. Despite his theoretical efforts to restore it at the center of monetary thinking, Fisher seemed to believe that the United States lacked an institutional framework that enabled offsetting changes in the quantity of money.

In Fisher's plan, the mechanical nature of gold-price adjustments did not exempt monetary authorities from practicing the virtuous policies of gradualism and fine-tuning: "So it is just like steering a bicycle or an automobile. If it deviates a little you turn the wheel slightly and if that is not enough you turn it some more, or if you turn too much you turn it back and keep the automobile in pretty nearly a straight line. Nobody can steer a machine with absolute straightness; but it is amazing how straight you can steer it if you only touch the wheel a little here and there; and that is exactly what we mean by these two bureaus, by trial and error every two months" (Fisher's testimony as quoted by Lawrence 1928, 86).

Another important contribution can be found in Fisher's more theoretical works. In agreement with the new Cambridge version of the quantity theory of money, Fisher wrote that monetary control could be achieved in a fractional reserve banking system via control of an exogenously determined stock of high-powered money. Here again we find the idea that the total stock of money and bank deposits would be a constant multiple of the monetary base, since banks desired to hold a fixed proportion of their deposits as reserves and since the public desired to maintain a constant ratio of cash holdings to demand deposits.

Although there were some interwar economists, such as Carl Snyder (1924) and Lionel D. Edie (1931), who explicitly advocated a constant-money rule, some historians have argued that it was the Swedish economist Knut Wicksell who, by the turn of the century, had outlined an approach to monetary policy which has the most striking similarities to the modern approach. The basic features of Wicksell's model include: the overriding objective of price stability; an interest rate instrument controlled by the rates of discount on settlement balances at the central

bank; and a policy rule under which the instrument varies in response to deviations from the objective (Clinton 2006).

Unlike Fisher's rule, Wicksell's rule was divorced from any kind of commodity convertibility and was based on interest rate movements through bank discretion. As some have argued (Bermanke et al. 1999), it could be said that Wicksell's rule followed a constrained management principle based on the search for a neutral rate of interest, advocating a price stability norm rather than a price stability rule. In fact, as recent interpreters have argued (Clinton 2006), Wicksell's rule did not imply that central banks ought to be actively searching for a new "holy Grail," trying to ascertain what the natural rate actually was and how and why it was changing. More practically, central banks were required to analyze the current price level which provided a reliable test of the agreement or of the diversion between the two rates.

In fact, recent writers have argued that the Wicksell rule was designed to stabilize the inflation rate rather than the price level, being appropriate for inflation targeting but not with the objective of price stability. As Wicksell put it, ". . . we have acquired an objective basis for attempts to prevent such changes by rational methods . . . it is no easy task that lies before the combined forces of economic science and economic practice" (quoted by Clinton 2006, 20).

However, at least in the Anglo-Saxon world, in the interwar years the influence of Wicksell's early writings was virtually nonexistent and bound to remain so for a long time. When the Depression so severely hit the industrialized economies, the field of professional economists was sharply divided between those who favored full discretion and those who argued on behalf of a new, more rigid set of money rules.

Among the former, New Dealers such as Lauchlin Currie (1933, 356) wrote on behalf of discretion as a remedy against the structural weaknesses of the banking system. As he wrote in the midst of the Depression, in such a delicate and difficult task as the determination of proper central banking policy it would appear to be a safe generalization that automatic rules render more difficult the task of central bankers, while discretionary powers facilitate it.

6. Henry C. Simons

6.1. Rules versus discretion

In February 1936, Henry Simons ([1936] 1962) effectively created what Richard Selden (1962, 323) described as the Rules Party with his "Rules Versus Authorities in Monetary Policy." In the same month,

Keynes (1936, 164, 378, 220–1) explained that he had become “somewhat skeptical of the success of a merely monetary policy directed towards influencing the rate of interest. I expect to see the State, which is in a position to calculate the marginal efficiency of capital-goods on long views and on the basis of the general social advantage, taking an even greater responsibility for directly organizing investment . . . I conceive, therefore, that a somewhat comprehensive socialization of investment will prove the only means of securing an approximation to full employment.”

Alvin Hansen (the “American Keynes”) favored a “dynamic approach” which stood in contrast to the passive acceptance of “the play of ‘natural’ forces . . . many economists are coming to think that action along these traditional lines would by itself be wholly inadequate. It is increasingly understood that the essential foundation upon which the international security of the future must be built is an economic order so managed and controlled that it will be capable of sustaining full employment” (Hansen and Kindleberger 1942, 467).

In response, Simons (1939, 275) complained that Hansen’s proposals would generate “a continuing contest between the monetary authority seeking to raise employment and trade-unions seeking to raise wage rates.” Simons also bemoaned that “the gods are surely on his side. What he proposes is exactly what many of us, in our most realistic and despairing moods, foresee ahead as the outcome of recent trends.” If Hansen succeeded in establishing a monetary system “dictated by the *ad hoc* recommendations of economists like himself . . . the outlook is dark indeed.”

For Simons ([1944] 1948, 1,213; 1943, 443–4), tariffs were part of the government sponsored “racketeering” which his rules were designed to thwart. Simons sought to defend Traditional Liberal Principles; his faith and hope for the post-war world rested on the construction of a “free-trade front.” Simons (1936) believed that Keynes’ *General Theory* could easily become “the economic bible of a fascist movement.” Keynes had now embarked on a mission which Simons found repellent: an authentic genius “becoming the academic idol of our worst cranks and charlatans.” According to Simons ([1945] 1948, 308), the New Deal had delegated arbitrary power to a series of agencies. This “high-road to dictatorship” was terrifying for “an old-fashioned liberal.” Elevating the “government of men” over the “government of rules” was tantamount to “accepting or inviting fascism.”

At the Chicago Harris Foundation lectures and seminars on “Unemployment as a World Problem,” Keynes (1931, 94) advocated dis-

cretionary macroeconomic management to “keep the price index and the employment index steady.” Hansen (1931, 94) asked whether it was not the case that “in our present state of knowledge we have no guide at all dependable, and consequently the system you propose is a purely Utopia one?” Keynes (1931, 94) responded that “statistics are becoming more adequate . . . I think we economists have given the practical business men very little real help in the past. If they were aided by more complete statistical data, then I think we should find central banks doing their best duty.” When asked by Hansen (1931, 94) about the reliability of the judgment of the central bankers, Keynes (1931, 94) replied: “I think we already know enough to give them general suggestions . . . Painful experience works wonders. It is really the economists who are primarily at fault. We have never given any sort of scientific conclusions, such as you would expect. So long as the supposedly experts fail to agree among themselves, it seems to me reasonable for the practical business men to pay only moderate attention to them.”

According to his disciples, Keynes “trusted to human intelligence. He hated enslavement by rules. He wanted governments to have discretion and he wanted economists to come to their assistance in the exercise of that discretion” (Cairncross 1978, 47–8).

6.2. Simons and the sticky-price tradition

The label attached to the combination of rules plus rational expectations and (sticky price) contracts is “New Keynesian.” Yet rules, expectations, and sticky prices were also in the Simons tradition. Indeed, to counter one version of a money-demand Chicago oral tradition, Don Patinkin (1969) and his research assistant, Stanley Fischer, located a sticky-price Chicago oral tradition. Simons ([1944] 1948, 131–2) used sticky prices to build an expectations-augmented-insider-outsider model of the labor market. Where trade unions had power and labor turnover was costly to firms, insiders could “insulate themselves from the competition of new workers merely by making their costs excessive, that is, by establishing labor costs and *wage expectations* [emphasis added] which preclude expansion of production or employment in their field.” Thus outsiders (new and displaced workers) would not typically migrate to such firms because jobs cannot be had. The privately optimal strategy for trade unions was to exclude lower-wage competitors.

This sticky-price tradition can be found in Simons’ ([1934] 1948, 64–5) “Positive Proposal for Laissez Faire,” in which he explains that

it was important to consider "how different possible [monetary] policy rules would operate given the basic inflexibilities in the price structure . . . no monetary system, however perfectly conceived and administered, can make a free-enterprise system function effectively in the absence of reasonable flexibility in the price structure." It can also be found in Simons' (1933, 550-1) review of Charles Beard's *America Faces the Future*. It was, Simons stated, "perhaps an incontrovertible position that the excess of booms and depressions are attributable, on the one hand, to the system of commercial banking and, on the other, to an exceeding and increasing 'stickiness' in many parts of the price structure . . . many prices have become quite inflexible and especially resistant to downward pressure . . . Mr. Beard beseeches us to adopt measures which will make the 'sticky' prices as much stickier as possible. To adopt such measures, while neglecting the problem of money and credit, is to assure the next depression will make the present one seem altogether trivial."

7. Phillips and Friedman

Milton Friedman's k percent money growth rule (and its breakdown) exerted a profound influence on monetary economics; his various influences on Taylor (his Hoover colleague) are apparent. Less widely known, perhaps, is A. W. H. Phillips' influence on Taylor. Taylor's (1968) first publication ("Fiscal and Monetary Stabilization Policies in a Model of Endogenous Cyclical Growth") combined two strands of Phillips' (1954b, 134) theoretical evaluation of policy rules and models of cyclical growth (1961, 195). Taylor's (1968, 1) objective was to "describe the product and money markets as developed by Phillips, and derive the government policies which will regulate the model."

The money market had the interest rate as a function of the price level (P), actual income (Y_A) and the money supply (M):

$$r = f(P, Y_A, M).$$

The Phillips curve equation had the rate of inflation depending on the gap between actual and full capacity income and on capacity growth (a proxy for productivity):

$$p = b(x - 1) - Yg + d,$$

where p = inflation rate, x = ratio of actual output to full capacity output (Y_A/Y_F), Yg = the proportionate growth rate of full capacity output, and d = constant.

Taylor (1968, 5, n5) defined rules for both monetary and fiscal policy, noting that they were "modified versions of the types of fiscal policies first suggested by A. W. Phillips (1954)". In conducting monetary policy, the central bank would increase the money supply when actual output fell below full capacity output; that is, when x is less than one. "These [fiscal and monetary] policies are analogous to feedback methods of control which engineers have used in stabilizing electrical systems." It is not hard to imagine the clear similarities between these 1968 Taylor equations and the Taylor rule.

The Taylor rule can be seen as a method of compressing the swing of the business cycle—minimizing the deviations from the "optimal" spot on an inflation-anchored Phillips curve. The continuities between Taylor and Phillips and between Taylor in 1992 (age 45) and Taylor in 1968 (the 21-year-old undergraduate) will be outlined below.

Phillips made five distinct but inter-related contributions to the policy rules literature: the Phillips machine (Phillips 1950, 68); the adaptive inflationary expectations formula (1952, meeting with Milton Friedman); the theoretical Phillips curve, an apparatus that facilitated policy rule evaluation (Phillips 1954b, 134); empirical illustrations of the theoretical Phillips curve (Phillips 1958, 243; Phillips 1959, 269); and a Lucas-style critique (Phillips 1968, 468; Phillips 1972, 479). Given that the Taylor rule can be seen as operating on the low-inflation-expectations part of a Phillips curve, it is worth exploring the connections between Taylor and Phillips in this regard.

7.1. Phillips machine

As an undergraduate, Phillips constructed a large physical model with which to explore the macroeconomic policy options (one version is on permanent display at the Science Museum in South Kensington, London). Dennis Robertson "practically danced a jig" when he saw the Phillips Machine in operation. When the Chancellor of the Exchequer and the Governor of the Bank of England attended a dinner at the London School of Economics (LSE), they adjourned to the machine room where the chancellor was given control of the fiscal levers and the governor control of the monetary ones (Dorrance 2000). It continues to influence policy design (Leeson, forthcoming).

Phillips' (1950, 73, 76–7) exposition of the machine involved a brief discussion of the destabilizing influence of expectations about prices: "This simple model could be further developed, in particular by making a distinction between working and liquid stocks, introducing lags into the production and consumption functions, and linking the demand curve for liquid stocks to the rate of change of price through a co-efficient of expectations. Each of these developments would result in an oscillatory system. They will not be considered further here . . ." ⁴ The "simple model" assumed that prices were constant or that values were measured in "some kind of real units." Phillips demonstrated that it was possible to "introduce prices indirectly into the system," allowing real and nominal magnitudes to be considered (and graphed) separately. In the operational notes accompanying the machine, Phillips wrote, "With this number of relationships and assumptions concerning the effects of price changes there is not much chance of getting very precise numerical multiplier results on the machine. But since, under conditions of rising prices there is not much chance of getting them in reality either, this is not a very great disadvantage from the point of view of exposition either" (cited by Vines 2000, 62).

Phillips told his colleagues that the empirical curve was an extension of the unfinished research agenda of the machine (Yamey 2000). He (1954a, 187) criticized Michel Kalecki's *Theory of Economic Dynamics* (1954) for attaching "no causal significance . . . to price movements." The opening sentence of the theoretical Phillips curve (1954b, 134) stated that the method of "comparative statics . . . does not provide a very firm basis for policy recommendations [because] 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. Secondly, the effects

4. Phillips' (1950) source for this "co-efficient of expectation" is Lloyd Metzler's (1941) essay on "The Nature and Stability of Inventory Cycles." Metzler replaced the "artificial" assumption that business expectations about future sales depended solely on the past level of sales with the "natural" addition of the direction of change of such sales. Metzler's (1941, 119, 128–9) "co-efficient of expectation" was the ratio of the expected change of sales between periods t and $t-1$ and the observed change of sales between $t-1$ and $t-2$. Cyclical changes in the coefficient needed to be investigated, but its interaction with the accelerator inevitably generated instability. Indeed, the introduction of the coefficient "places very severe restrictions upon our stability conditions." It is possible to view Phillips' subsequent research as an attempt to address Metzler's imperative to investigate empirically and theoretically macroeconomic systems that included such features.

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." Thus Phillips' academic career was, from the start, associated with the attempt to explain the instabilities and discontinuities associated with rising prices. As David Vines (2000) put it in his discussion of the "Phillips tradition," there is "more in the Machine . . . than is allowed for in macroeconomic conventional wisdom."

Phillips' LSE colleagues turned to him for assistance with the analysis of inflationary expectations. Henry Phelps Brown, for example, acknowledged a specific debt to Phillips for "the form of the argument" about inflationary expectations and profit expectations—the situation where "the price level itself is taking the initiative, and moving under the influence of a preponderant expectation about the likelihood and feasibility of rises and falls in product prices, which has itself been built up by such factors as changes in . . . 'the market environment' . . . [which impart] a gentle but continuing motion to the price level" (Brown and Weber 1953, 279). In recognition of his contribution to macroeconomic analysis (including, presumably, the analysis of inflationary expectations), in 1955 Friedman wrote to offer Phillips a visiting position in Chicago.

7.2. Phillips' adaptive inflationary expectations formula

In formulating the k percent money growth rule, Friedman derived his missing equation from Phillips. In his famous methodological essay, Friedman concluded, "The weakest and least satisfactory part of current economic theory seems to me to be in the field of monetary dynamics, which is concerned with the process of adaptation of the economy as a whole to changes in conditions and so with short-period fluctuations in aggregate activity. In this field we do not even have a theory that can be appropriately called 'the' existing theory of monetary dynamics" (1953, 42; see also 1950, 467).

George Stigler (1941, 358–9) referred to expectations as "the promised land to some economists and a mirage to others. The reviewer must admit that he leans towards the latter view: much of the literature on expectations consists of obvious and uninformative generalizations of static analysis." With respect to "the revision of anticipations . . . progress depends much more on the accumulation of data (of a type almost impossible to collect!) than on an increase in the versatility of our technical apparatus." Friedman ([1946] 1953, 277–300) attacked Oskar Lange on similar grounds: "An example of a classification that

has no direct empirical counterpart is Lange's classification of monetary changes . . . An explicit monetary policy aimed at achieving a neutral (or positive or negative) monetary effect would be exceedingly complicated, would involve action especially adapted to the particular disequilibrium to be corrected, and would involve knowledge about price expectations, that even in principle, let alone in practice, would be utterly unattainable."

In May 1952, Friedman (correspondence to Leeson, August 25, 1993) visited the LSE where he raised with Phillips the question of "how to approximate expectations about future inflation." Phillips then wrote down the adaptive inflationary expectations equation, which would later transform macroeconomics. At the time, economists were in no doubt about Phillips' implicit assumption about inflation: "*Implicitly* [emphasis added], Phillips wrote his article for a world in which everyone anticipated that nominal prices would be stable" (Friedman 1968a, 8). Friedman (correspondence to Leeson, August 25, 1993) explained that "the 'implicitly' is really needed . . . Phillips himself understood that his analysis depended on a particular state of expectations about inflation . . . Phillips' *Economic Journal* article (1954b) made a very real impression on me. However, his discussion of inflationary expectations in that article is very succinct."

Friedman returned from the LSE to Chicago, where he provided Phillip Cagan with the adaptive inflationary expectations formula. Cagan (1956), Marc Nerlove (1958, 231),⁵ and Kenneth J. Arrow (1958, 299) used this formula to transform economic analysis. This formula is generally known as the Friedman-Phelps formula, but Cagan (2000) calls it Phillips' Adaptive Expectations Formula. It was this formula which Friedman (1956, 19–20) predicted would transform whole sections of economics: Cagan's "device for estimating expected rates of change of prices from actual rates of change, which works so well for his data, can be carried over to other variables as well and is likely to be important in fields other than money. I have already used it to estimate 'expected income' as a determinant of consumption (Friedman 1957) and Gary Becker has experimented with using this 'expected income' series in a demand function for money . . ."

Friedman (1958, 252) outlined the proposition that as inflationary expectations adjust to rising prices, the short-run advantages of inflation disappear: "If the advantages are to be obtained, the rate of price

5. "The history of the idea is unclear: A. W. Phillips may have suggested the idea to M. Friedman about 1950" (Nerlove et al. 1979, 296).

rise will have to be accelerated and there is no stopping place short of runaway inflation." In 1960, he outlined the natural rate model in full to Richard Lipsey during a visit to the LSE. Friedman (1962, 284) informed his Chicago students, "Considerations derived from price theory give no reason to expect any systematic long-term relation between the percentage of the labor force unemployed and the rate at which money wages rise."

Friedman (1966a) described the natural rate model during an exchange with Robert Solow at an April 1966 University of Chicago conference. In his *Newsweek* column (October 17, 1966b), Friedman made this prediction: "There will be an inflationary recession." In his address to the American Economic Association (AEA), Friedman (1968, 8, 4) added "one wrinkle" to the Phillips curve in the same way as Irving Fisher added "only one wrinkle to Wicksell." In so doing, Friedman predicted that the Phillips curve trade-off between inflation and unemployment existed temporarily, but not permanently. Friedman asserted that "Phillips' analysis . . . contains a basic defect—the failure to distinguish between *nominal* wages and *real* wages." In his Nobel Lecture, Friedman (1976, 217–9) asserted that "Phillips' analysis seems very persuasive and obvious. Yet it is utterly fallacious . . . It is fallacious because no economic theorist has ever asserted that the demand and supply of labor are functions of the *nominal* wage rate. Every economic theorist from Adam Smith to the present would have told you that the vertical axis should refer not to the *nominal* wage rate but to the *real* wage rate . . . His argument was a very simple analysis—I hesitate to say simple minded, but so it has proved—in terms of *static* supply and demand conditions." (Emphases in text.)

Keynesians initially were not inclined to embrace this expectational constraint on macroeconomic discretion. Alvin Hansen (1964, 342–3, 288) discussed and dismissed "misguided expectations," preferring instead the "objective causes of the cycle." In academic year 1964–65, Paul Samuelson pondered before a blackboard, and dismissed as doubtful an early version of the natural rate model (Akerlof 1982, 337). James Tobin (1968, 53) argued that the coefficient on inflationary expectations was less than one: the worst outcome was that when inflationary expectations caught up with actual experience, unemployment would rise to its natural level. Solow (1968, 3), Harry Johnson (1970, 110–12), and Albert Rees (1970, 237–8) all continued to express faith in a moderate inflation-unemployment trade-off.

Shortly afterwards, Tobin (1972, 9) felt obliged to question the validity of the original Phillips curve which came to be described as "an

empirical finding in search of a theory." Solow (1978, 205) concluded that in the 1960s and 1970s the profession experienced a "loss of virginity with respect to inflationary expectations."

7.3. Theoretical Phillips curve

In his PhD dissertation and a subsequent essay in the *Economic Journal*, Phillips (1954b) stated that flexible prices are integral-type forces; he demonstrated the alarming consequences of integral-type policies generating a "dynamically unstable [system] . . . In such a case the oscillations would increase in amplitude until limited by non-linearities in the system and would then persist within those limits so long as the policy was continued . . . There may, however, be a tendency for monetary authorities, when attempting to correct an 'error' in production, continuously to strengthen their correcting action the longer the error persists, in which case they would be applying an integral correction policy . . . It will be seen that even with a low value of the integral correction factor, cyclical fluctuations of considerable magnitude are caused by this type of policy, and also that the approach to the desired value of production is very slow. Moreover, any attempt to speed up the process by adopting a stronger policy is likely to do more harm than good by increasing the violence of the cyclical fluctuations . . ."

The final and most crucial sub-sections of Phillips' stabilization model (1954b, 153–7) were "Inherent Regulations of the System" and "Stabilization of the System," which began with: "Some examples will be given below to illustrate the stability of this system under different conditions of price flexibility and with different expectations concerning future price changes" (emphasis added). The theoretical Phillips curve was then tested against a variety of scenarios, inflationary expectations being a crucial factor in determining whether the system has satisfactory outcomes or not: "Demand is also likely to be influenced by the rate at which prices are changing, or have been changing in the recent past, as distinct from the amount by which they have changed, this influence on demand being greater, the greater the rate of change of prices . . . The direction of this change in demand will depend on expectations about future price changes. If changing prices induce expectations of further changes in the same direction, as will probably be the case after fairly rapid and prolonged movements, demand will change in the same direction as the changing prices . . . there will be a positive feedback tending to intensify the error, the response of demand to chang-

ing prices thus acting as a perverse or destabilizing mechanism of the proportional type."

Even if Phillips saw inflationary expectations as destabilizing aggregate demand alone, this by itself would destroy the possibility of a stable trade-off because the expectation of further inflation tends to introduce fluctuations: "The strength of the integral regulating mechanisms increases with the increasing degree of price flexibility, while the total strength of the proportional regulating mechanisms decreases as demand responds perversely to the more rapid rate of change of prices, and both these effects tend to introduce fluctuations when price flexibility is increased beyond a certain point. When price expectations operate in this way, therefore, the system . . . becomes unstable . . ." (1954b, 155).

Thereafter he worked on the "central theoretical problems" of the Ford Foundation-funded "Project on Dynamic Process Analysis" (May 1956–April 1963). The objective was to specify and estimate models for the control of economic systems. In this period, he presented some empirical illustrations of his stabilization proposals, while continuing to pursue the matter theoretically. The theoretical Phillips curve was published in June 1954; in the three years to June 1957, Phillips became familiar with the Nyquist stability criterion and experimented with electronic simulations of stabilization proposals using equipment at the National Physical Laboratory (NPL) and Short Brothers and Harland Ltd. From about 1952, Phillips interacted with Richard Tizard at the NPL; and, in 1956, Tizard resigned as head of the NPL Control Mechanisms and Electronics Division to take up a two-year fellowship at the LSE to work full-time with Phillips (Swade 2000). These collaborations led Phillips (1957, 169) to conclude that "the problem of stabilization is more complex than appeared to be the case." An empirical agenda was needed: ". . . improved methods should be developed for estimating quantitatively the magnitudes and time-forms of economic relationships in order that the range of permissible hypotheses may be restricted more closely than is at present possible." It seems likely that around June 1957 he began to work on the first empirical Phillips curve (1958).

7.4. Empirical Phillips curve

Having pioneered the destabilizing effects of inflationary expectations, Phillips provided very little discussion of this topic in his 1958 empirical

curve. His second explanatory variable (the rate of change of unemployment) in Phillips' (1958, 243) model influenced wage changes through the expectation that the business cycle will continue moving upward (or downward).⁶ Lipsey (1960, 20) labeled this "an expectation effect . . . the reaction of *expectations* [emphasis in text], and hence of competitive bidding, to changes in *u*." But there is no systematic analysis of inflationary expectations. It is possible that Phillips instructed Friedman, Phelps Brown, and others how to model adaptive inflationary expectations in their empirical work, but decided to ignore it in his own. An alternative explanation is that Phillips was primarily interested in the low inflation "compromise" zone where inflationary expectations are not a dominating force.

There is a distinct continuity between the 1954 theoretical Phillips curve; the 1958, 1959, and 1962, empirical Phillips curves; and his growth model. In "A Simple Model of Employment, Money and Prices in a Growing Economy," Phillips (1961, 201–2) described his inflation equation as being "in accordance with an obvious extension of the classical quantity theory of money, applied to the growth equilibrium path of a steadily expanding economy." His steady state rate of interest, r_s ("the real rate of interest in Fisher's sense, i.e., as the money rate of interest minus the expected rate of change of the price level"), was also "independent of the absolute quantity of money, again in accordance with classical theory." His interest rate function was "only suitable for a limited range of variation of Y_p/M ." With exchange rate fixity the domestic money supply (and hence the inflation rate) become endogenously determined; the trade-off operates only within a narrow, low inflation band.

This was exactly how Phillips (1961, 201) described the limits of his model: he was only interested in ranges of values in which actual output (Y) fluctuates around capacity output (Y_n) by a maximum of 5 percent: "In order to reduce the model with money, interest and prices to linear differential equations in $x [=Y/Y_n]$, y_n and p it is necessary to express $\log Y$. . . in terms of $\log Y_n$ and x . For this purpose we shall use the approximation:

$$\log Y \cong \log Y_n + (Y - Y_n) / Y_n = \log Y_n + x - 1.$$

6. Phillips (1958, 243) wrote: ". . . employers will be bidding more vigorously for the services of labor than they would be in a year during which the average percentage unemployment was the same but the demand for labor was not increasing." In Phillips' model, when this "expectation effect" is removed, and demand held constant in the compromise zone, the rightward displacement of Phillips curve observations ceases.

The approximation is very good over the range of values of $(Y - Y_n) / Y_n$, say from -0.05 to 0.05 , *in which we are interested* [emphasis added].⁷ Since Phillips (1961, 196) stated that these output fluctuations were "five times as large as the corresponding fluctuations in the proportion of the labor force employed," this clearly indicates that Phillips limited his analysis to outcomes in the compromise zone of plus or minus 1 percentage point deviations of unemployment from normal. Phillips was restating the conclusion of his empirical work; normal capacity output (and approximately zero inflation) was consistent with an unemployment rate "a little under 2½ percent" (1958, 259).

Although Phillips drew an average curve representing the trajectory of the British economy as it swung from bust to boom and back again, at no stage did he suggest that *high* inflation would reduce unemployment for anything other than a temporary period. Yet Phillips' historical investigations had produced an average curve that encompassed 32 percent wage inflation and 22 percent unemployment (1958, 253, figure 25.9). Wage inflation in excess of 27 percent occurred in 1918 and this observation falls on Phillips curve. But Phillips' empirical analysis also reveals that 1918 was followed by two decades of extraordinarily high unemployment—hardly an augury of a stable high inflation trade-off. Phillips did not state or imply that any point on his average curve could be targeted for stabilization purposes.

But underpinning the original Phillips Curve was this argument: "One of the important policy problems of our time is that of maintaining a high level of economic activity and employment *while avoiding a continual rise in prices*" [emphasis added]. Phillips explained that there was "fairly general agreement" that the prevailing rate of 3.7 percent inflation was undesirable: "It has undoubtedly been a major cause of the general weakness of the balance of payments and the foreign reserves, and if continued it would almost certainly make the present rate of exchange untenable." His objective was, if possible, "to prevent continually rising prices of consumer goods while maintaining high levels of economic activity . . . the problem therefore reduces to whether it is possible to prevent the price of labor services, that is average money earnings per man-hour, from rising at more than about 2 percent per year . . . one of the main purposes of this analysis is to consider what levels of demand for labor the monetary and fiscal authorities should seek to maintain in their attempt to reconcile the two main policy objectives of high levels of activity and stable prices. I would question whether it is really in the interests of workers that the average level of

hourly earnings should increase more rapidly than the average rate of productivity, say about 2 percent per year" (1959a, 261; 1959b, 269–80; 1962, 208; 1961, 201; 1962, 218; 1958, 259).

Like Phillips, Friedman (1968, 9–11) described the initial expansionary effects of a reduction in unemployment. But when inflation became high enough to influence expectational behavior, Friedman later argued that expansion "describes only the initial effects." Modern macroeconomics has several explanations for the existence of a temporary trade-off (involving monetary misperceptions and inter-temporal substitution). Friedman's version of the Phillips-Friedman-Phelps Critique suggested a temporary trade-off between unanticipated inflation and unemployment lasting two to five years, taking a couple of decades to return to the natural rate of unemployment. Friedman's mechanism involved real wage resistance in response to the initial "simultaneous fall *ex post* in real wages to employers and rise *ex ante* in real wages to employees." Thus real wage resistance plays an equilibrating role in Friedman's version.

Unlike Friedman, Phillips was highly skeptical about equilibrating forces. In a May 21, 1957, Robbins seminar paper on "Stability of 'Self-Correcting' Systems," Phillips examined a system in which the rate of change of prices was proportional to excess demand. Phillips concluded, "If the 'equilibrating forces' are too strong they will make the system unstable . . . The argument extends without difficulty to any system, in which there are 'equilibrating' or 'self-correcting' forces operating through time lags."⁷

Phillips' version of the Phillips-Friedman-Phelps Critique was a far more potent constraint on policymakers than Friedman's version: inflation had far more serious consequences for Phillips than for Friedman. For Friedman, the (purely internal) imbalance corrected itself through utility-maximizing labor supply adjustments, as inflation ceased to be incorrectly anticipated. Only a temporary boom would result, and it would soon be eroded by real wage resistance. But in Phillips' model, external imbalance (driven by only minor inflation differentials) could be addressed by exchange rate adjustment, leaving the internal imbalance in need of still greater attention. In addition, the role Friedman allocated to inflationary expectations was benign, whereas the role allocated to inflationary expectations by Phillips (1954) was far more destabilizing, denying the possibility of a stable target in the presence of such expectations.

7. Phillips papers, LSE.

Not only was there "fairly general agreement" (Phillips 1962, 207–8) that non-trivial (3.7 percent) inflation was intolerable, but the assumption of low (but unspecified) and stable inflation rates was commonly invoked by model builders in the pre-stagflation era. For example, the Robert Lucas and Leonard Rapping (1969, 748) model of "Real Wages, Employment and Inflation" was assumed to hold "only under reasonably stable rates of price increase. To define what is meant by reasonable stability, and to discover how expectations are revised when such stability ceases to obtain, seems to us to be a crucial, unresolved problem." Friedman (1968a, 6; 1968b, 21) also stated that the "price expectation effect is slow to develop and also slow to disappear. Fisher estimated that it took several decades for a full adjustment and recent work is consistent with his estimate." Friedman presented evidence about the time it took for "price anticipations" to influence behavior that was "wholly consistent with Fisher's." Phillips' opposition to inflation was axiomatic: an expression of one of the eternal truths that separate economists from monetary cranks. Nevertheless, he clearly stated the assumptions under which small amounts of inflation could be traded-off for small amounts of unemployment in the "compromise" zone. He did not suggest that a permanent trade-off existed outside the compromise zone.

Taylor's work was in this Phillips tradition: "Milton Friedman's (1968) AEA presidential address was given during the middle of my senior year. Since I had a Phillips curve in the model used in my thesis, I am sure I discussed the issue with my advisers. In the thesis I did not exploit the long-run trade-off implicit in the Phillips curve by increasing the money growth rate and the inflation rate permanently to get a permanently higher utilization rate. This could have reflected a judgment that one could not in practice exploit the curve this way, despite what the algebra said. More likely it was simply that I was interested in stabilization policy rules, and such rules, very sensibly, did not even consider such a possibility" (Taylor 2007a).

7.5. A Lucas-style critique

Robert Lucas' original handwritten "Econometric Policy Evaluation" paper was presented at least as early as April 1973 (Sargent 1996, 539, n3). Lucas (1976, 19, 22–3) used the Phillips curve to illustrate the proposition that one of the traditions in economics "is fundamentally in error." Lucas complained that econometricians were averse to inspecting data prior to 1947 and rarely used 1929–46 data as a check on

post-war fits. Lucas refers to the "widespread acceptance of a Phillips 'trade-off' in the absence of *any* [emphasis in text] aggregative theoretical model embodying such a relationship." The reason for the urgency behind Lucas' reformulation was to undermine the Phillips curve: "... the case for sustained inflation, based entirely on econometric simulations, is attended now with a seriousness it has not commanded for many decades."

The Old Keynesian high inflation Phillips curve supposedly misled the Western world into the inflationary maelstrom of the 1970s (Lucas and Sargent 1978). The 1970s was the decade of "The Death of Keynesian Economics"—and the collapse of the Phillips curve trade-off, its failure to recognize the subtleties of both inflationary expectations and the Lucas Critique playing a major role in this "death rattle" (Sargent 1996, 543). As Lucas (1980, 18; 1981, 560; 1984, 56) put it: "... one cannot find good, under-forty economists who identified themselves or their work as Keynesian . . . I, along with many others, was in on the kill in an intellectual sense." According to Lucas, the quarry subjected to this "kill" was the proposition that "permanent inflation will . . . induce a permanent economic high . . . [the] shift of the 'trade-off' relationship to center stage in policy discussions appears primarily due to Phillips (1958) and Samuelson and Solow (1960)" . . . "We got the high-inflation decade, and with it as clear-cut an experimental discrimination as macroeconomics is ever likely to see, and Friedman and Phelps were right. It really is as simple as that" . . . "They went way out on a limb in the late '60s, saying that high inflation wasn't going to give us anything by way of lower unemployment."

Robin Court (2000) and Peter Phillips (2000) have highlighted A. W. H. Phillips' analysis of the relationship between policy control and model identification and the similarity between the equations used by Phillips and Lucas (1976) to derive their conclusions about econometric policy evaluation. Peter Phillips argues that the Phillips Critique implies "that even deep structural parameters may be unrecoverable when the reduced form coefficients are themselves unidentified. One can further speculate on the potential effects of unidentifiable reduced forms on the validity of econometric tests of the Lucas critique . . . [this] may yet have an influence on subsequent research, irrespective of the historical issue of his work on this topic predating that of Lucas (1976)."

Two decades before Lucas, Phillips (1956, 371) stressed, "There are, therefore, two questions to be asked when judging how effective a certain policy would be in attaining any given equilibrium objec-

tives. First, what dynamic properties and cyclical tendencies will the system as a whole possess *when the policy relationships under consideration themselves form part of the system?* [Emphasis added.] Second, when the system has these dynamic properties, will the equilibrium objectives be attained, given the size of the probable disturbances and the permissible limits to movements in employment, foreign reserves, etc.? The answer to the first question is important, not only because the reduction of cyclical tendencies is itself a desirable objective, but also because the second question cannot be answered without knowing the answer to the first. And the first question cannot be answered without knowing the magnitudes and time-forms of the main relationships forming the system."

Phillips stressed the importance of dynamic analysis and taught a course at LSE called Dynamic Process Analysis.⁸ The Final Report of the Dynamic Process Analysis Project stated, "It can be fairly claimed that the results obtained from [Phillips'] investigations, taken together, constitute a theoretical solution of the central problem which formed the basis of the project. It is believed that they can be applied directly to control problems arising in fields where fairly long time series are available from systems with stationary stochastic disturbances, for example in chemical manufacturing processes. It has to be admitted that direct applicability to control of an economy is limited by shortness of economic time series and the lack of stationarity of the system. However, the results obtained should provide the basis for valid work in this area." Four years later, these 1963 "admitted" doubts matured into the next stage of Phillips' critique of econometric policy evaluation.

Five months before Friedman's famous AEA Presidential Address, a conference was held in London in July 1967 on Mathematical Model Building in Economics and Industry (shortly before Phillips emigrated to Canberra). Richard Stone (1968) also delivered a paper to the conference. James Meade (2000) recalled that within months of arriving in Australia, Phillips wrote to him "asking whether there would be any chance of getting a position in Cambridge to work with Dick Stone and myself on dynamic macroeconomics again. It all came to nothing

8. In the first lecture (October 7, 1960), Phillips stated that he was concerned with "the study of processes which are changing" and the "study of time paths." Stochastic models of the economy were preferable to deterministic models which were "... not very adequate [although] better than comparative statics . . . Great simplification necessary to get quantitative dynamic model . . . We have no satisfactory way of checking and testing our models. Magnitude and timing must be estimated and this involves problems in statistical decision theory which are still unsolved." Phillips papers, LSE.

because very soon after he had his stroke . . . Perhaps he had some very simple but immensely promising new thoughts on the subject. It is tragic that we will never know." It seems possible that Phillips had given some more thought to his policy evaluation critique, because the only paper that survives from this period (dated July 1972) is the handwritten paper that Court (2000) and Peter Phillips (2000) found to contain a contribution comparable to that later made by Lucas (1976).

Phillips (1968) concluded in his Model Building conference paper, "The possibility that operation of the control may prevent re-estimation of the system should lead us to ask whether the decision analysis we have been considering does not have some fundamental deficiency. And indeed it has. The basic defect is simply that in deriving the decision rules no account was taken of the fact that the parameters of the system are not known exactly, and no consideration was given to ways in which we can improve our knowledge of the system while we are controlling it. In my view it cannot be too strongly stated that in attempting to control economic fluctuations we do not have the two separate problems of estimating the system and of controlling it, we have a single problem of jointly controlling and learning about the system, that is, a problem of learning control or adaptive control."

Taylor (2007a) followed this "learning" path also: ". . . my PhD thesis was on policy rules. The problem was to find a good policy rule in a model where one does not know the parameters and therefore had to estimate them and control the dynamic system simultaneously. An unresolved issue was how much 'experimentation' should be built into the policy rule through which the instrument settings would move around in order to provide more information about the parameters, which would pay off in the future. I proved theorems and did simulations, which showed various convergence properties of the least squares or Bayesian learning rules. My main conclusion from that research, however, was that in many models simply following a rule without special experimentation features was a good approximation. That made future work much simpler of course because it eliminated a great deal of complexity."

8. Rational Expectations Plus Contracts: the "General Theory" of Policy Rules

From the Lucas critique to the Taylor rule (1976–1992), Taylor had a foot in academia and an almost equally sized foot in the policy apparatus (CEA 1976–77, research adviser at the Philadelphia Fed 1981–84,

CEA 1989–91). These policy experiences led Taylor (1998; 1989b) to propose (in his Harry Johnson lecture) a "translational" theory of policy regime change, in contrast to Johnson-style emphasis on revolution and counter-revolution (Johnson 1971).

Shortly after leaving the CEA, Taylor—with Phelps (Phelps and Taylor 1977) and Fischer (1977)⁹—published a seminal article which rescued from the clutches of the Sargent and Wallace (1975) Policy Ineffectiveness Proposition the "old doctrine" that "systematic monetary policy matters for fluctuation of output and employment." Phelps and Taylor bottled the old wine, so to speak, in a rational expectations model in order to build a better model with which to evaluate monetary policy rules.

Taylor (2007a) was also persuaded by his first CEA experience to revise the Taylor curve paper (Taylor 1979, first draft 1976) to make it "more practical and more useful in practice." That paper had the first empirically realistic monetary policy rule that was calculated with new rational expectations methods. During his first CEA experience, Taylor (2007a) saw the need to "do a better job at explaining the persistence of inflation with rational expectations. That is where the staggered contract model came from." After leaving the CEA, Taylor (1977) wrote about the "incentive structure under which policy decisions are made" and "the fairly vigorous competition for ideas" and began to think systematically about the administrative dynamics of policymaking.

Taylor (2007a) recalled that "The Taylor Curve paper (Taylor 1979) was reviewed favorably at the time by people on both sides of the spectrum (the favorable review from Lucas was certainly a big boost for me), and because it showed that this approach to monetary policy could work in practice, it was a very big development on the road to the Taylor rule. The monetary policy rule in that paper had exactly the same variables on the right-hand side as the eventual Taylor rule. The rule had the objective of minimizing the weighted sum of the variance of output and variance of inflation; it also presented and estimated the first variance trade-off (Taylor Curve) with inflation and output and contained a simple staggered price setting model (laid out in an appendix and covered in much more detail in my 1980 JPE paper). The big difference from the future, of course, was that the money supply was on the left-hand side. The transition from the money supply to the interest rate on the left-hand side of the rule occurred a few years later."

9. For a connection between Fischer, Simons, rules, and sticky prices, see section 6.2 above.

Taylor (1999) saw the r-based rule as “complement[ing] the framework provided by the quantity equation of money so usefully employed by Friedman and Schwartz (1963) . . . this actually goes back to the inverted money demand equation in my 1968 paper. Such an inverted equation can generate interest rate behavior with similar characteristics to interest rate rules. When GDP rises, the interest rate also rises, for example. But the coefficients are not usually the same as interest rate rules like the Taylor rule” (Taylor 2007a).

At the Philadelphia Fed, Taylor (1981b, 145) assessed monetarist rules and nominal GNP targeting, concluding that monetarist rules were inefficient relative to a monetarist (no accommodation of inflation)/Keynesian (countercyclical) compromise: “. . . a classic countercyclical monetary policy combined with no accommodation of inflation is efficient.” Taylor (2007) recalled: “This was a way for me to emphasize that monetary policy had to react more strongly to both real GDP and inflation. By providing no accommodation to inflation, by keeping money growth constant, in the face of inflation shocks, the central bank would create a larger increase in the interest rate. At the same time, they could also respond aggressively to reduction in real GDP.”

With respect to nominal GNP targeting as a “new rule for monetary policy,” Taylor (1985, 61, 81) detected merits (“. . . the virtue of simplicity. Explaining how it works to policymakers seems easy . . .”) and explanatory power (“. . . during much of the postwar period, the Fed can be interpreted as having used a type of nominal GNP rule . . .”) plus a fundamental flaw (“This rule, when combined with a simple price-adjustment equation, has contributed to the cycle by causing overshooting and ‘boom-bust’ behavior . . .”). As an alternative he proposed a “new policy rule . . . a modified nominal GNP rule that keeps constant the sum of the inflation rate and the proportional deviations of real output from trend . . . The rule can be generalized to permit less than, or more than, one-to-one reactions of real GNP to inflation, depending on the welfare significance of output fluctuations versus inflation fluctuations.”

During his second CEA experience (1989–1991) Taylor co-wrote the February 1990 *Economic Report of the President*. This report (1990, 65, 84, 86, 64, 65, 107) noted that the “simple” (Friedman-style) monetary growth rule had become “unworkable”; it was “inappropriate” to follow “rigid monetary targeting.” However, the Fed had “not regressed to an undisciplined, ad hoc approach to policy . . . a purely discretionary approach.” Rather, it had “attempted to develop a more systematic,

longer-run approach.” Policies should be designed to “work well with a minimum of discretion . . . the alternative to discretionary policies might be called systematic policies . . . Unpredictable changes in economic and financial relationships imply that appropriate policy rules in some circumstances are rather general.” The February 1990 *Economic Report of the President* was a “translational” play: an opportunity to move the ball toward the rules party goal line (Taylor 1998).

9. Immediate Prelude to the Taylor Rule

After leaving the CEA, Taylor (1993c, xv) returned to his almost-finished monograph on *Macroeconomic Policy in a World Economy: From Econometric Design to Practical Operation*, noting that “this book is considerably different from the book that would have been published three years ago.” The Taylor rule must have been reflection-induced as the book was completed (1992): an equation in “Looking for a better monetary policy rule” almost described the Taylor rule (Taylor 1993c, 251).

It is likely that Taylor was influenced in his thinking by a March 1990 Brookings conference on “Evaluating Monetary Policy Regimes: New Research in Empirical Economics.”¹⁰ For the conference, participants prepared papers that compared the performance of various policy rules across a variety of models of the world economy—one of which was the multi-country model developed by Taylor and his colleagues at Stanford. While money supply and exchange rate rules were the primary rules considered, Dale Henderson and Warwick McKibbin asked the dozen or so modelers represented at the conference to evaluate interest rate rules. Initially, the interest rate rules that were proposed ran into problems of indeterminacy. Either they violated what came to be known as the Taylor principle—the idea that interest rates should be adjusted more than one-for-one with an increase in inflation—or the algorithms employed at the time may simply not have been adequate to solve the models.

As researchers become more familiar with algorithms for model solution, they found the interest rate rules to perform surprisingly well in a wide variety of models for various countries or regions (Minford, 2008, 333). Dale Henderson and Warwick McKibbin (1993a) described the results in a paper published in a Brookings conference volume

10. This paragraph and the next one draw heavily on Minford (2008). See Patrick Minford for further details.

edited by Ralph Bryant, Peter Hooper, and Catherine Mann (1993). Later, they presented another version of the paper at the Carnegie-Rochester conference where Taylor introduced his rule (Henderson and McKibbin 1993b).¹¹

In the thirteen months prior to the Carnegie-Rochester conference, four other conferences also appeared to have influenced Taylor's progress toward the rule (the first two provocatively). At the October 25, 1991, Bank of Japan conference on "Price Stabilization in the 1990s," David Laidler (1993, 336, 353) argued that the apparent instability of money demand functions required discretionary offsetting shifts in money supply. Faith that a "legislated, quasi-constitutional" money growth rule would produce price stability now appeared "naïve . . . uncomfortably like those for perpetual motion or a squared circle." Laidler saw the optimal route to price stability through independent central banks: "We are left, then, with relying on discretionary power in order to maintain price stability." Taylor (1993a, 5) noted that "Michael Parkin's oral comments at the conference were consistent with that view, and I think that there was a considerable amount of general agreement at the conference."

In April 1992, Taylor commented on Ben Bernanke's and Frederic Mishkin's (1992) "Central Bank Behavior and the Strategy of Monetary Policy," taking particular exception to the proposition, "Monetary policy rules do not allow the monetary authorities to respond to unforeseen circumstances." Taylor (1992a, 235) argued that "if there is anything we have learned from modern macroeconomics it is that rules need not entail fixed settings as in constant money growth rules." Taylor appeared to be suggesting that Bernanke and Mishkin were leading monetary economics in the wrong direction: their paper "eschews models and technique, [and] endeavors to go directly to a policymaking perspective . . . My experience is that there are far too many policy papers in government that do not pay enough attention to economic models and theory."¹²

11. Earlier references in the literature to interest rate rules include Dewald and Johnson (1963), Christian (1968), Fair (1978), and McNees (1986, 1992). Koury (1990) provides a survey of these early rules from the post-war period. Thanks to Ray Fair for pointing out this earlier literature.

12. In September 1992 Ben Bernanke and Alan S. Blinder (1992, 910-912) published a paper with a section entitled "Federal Reserve's Reaction Function" in which they write, "If the Federal funds rate or some related variable is an indicator of the Federal Reserve's policy stance, and if the Fed is purposeful and reasonably consistent in its policymaking, then the funds rate should be systematically related to important macroeconomic target

At a meeting of the Federal Reserve System Committee on Financial Analysis at the St. Louis Fed in June 1992, Taylor (1992b) commented on an early draft of Jeffrey Fuhrer's and George Moore's (1995) "Inflation Persistence." (Fuhrer was senior economist at the Fed's Board of Governors, 1985-92.) Taylor noted that the authors had made "an important contribution to the methodology of monetary policy formulation . . . they look at the response of the economy to a policy rule which they write algebraically, arguing that the functional form comes close to what the Federal Reserve has been using in practice . . . Their results, taken literally, are quite striking. They find that a policy rule that is a fairly close representation of Fed policy for the last eight or ten years is nearly optimal. The rule entails changing the federal funds rate, according to whether the inflation rate is on a target and whether output is on a target. Their results are not very sensitive to the choice of a welfare function. Basically, as long as price stability and output stability are given some weight, movements too far away from this particular rule worsen performance. This is a remarkable result and deserves further research. What are the implications for policy? The literal implication is to keep following that rule . . . It is perhaps too abstract for policymakers to think in terms of a policy rule, but it seems to me that this is the only way to think of implementing or taking seriously the policy implications of the paper."

At the Reserve Bank of Australia conference on "Inflation, Disinflation and Monetary Policy" in July 1992, Taylor (1992c, 9, 13, 15, 26, 29) noted that the historical era of "great" inflation/disinflation was concluding. A repeat of this unfortunate history was unlikely, he said, adding that the intellectual justification for inflation (the Phillips curve trade-off) had been mistaken and based on faulty models. Taylor argued that "the most pressing task is to find good rules for monetary policy—probably with the interest rate as the instrument—that reflect such [short-term inflation-output] trade-offs . . . monetary policy should be designed in the future to keep price and output fluctuations low . . . the recent research on policy rules in this research is very

variables like unemployment and inflation." Bernanke and Blinder then present estimated policy reaction functions which "show this to be true . . . The results look like plausible reaction functions. Inflation shocks drive up the funds rate (or the funds rate spread), with the peak effect coming after 5-10 months and then decaying very slowly. Unemployment shocks push the funds rate in the opposite direction, but with somewhat longer lags and smaller magnitudes. To our surprise, these relationships did not break down in the post-1979 period. Reaction functions estimated in the same way for the 1979-1989 period looked qualitatively similar."

promising. There is a need to find ways to characterize good monetary policy as something besides pure discretion."

At the same conference, Charles Goodhart (1992, 326, 324) noted that "unspecified" 1946-era multiple goals had been replaced by a philosophy which was reflected in Article 2 of the Statute of the European System of Central Banks (1992): "The primary objective of the ESCB shall be to maintain price stability." Goodhart pondered about a "backbone brace" rule in which interest rates should rise by 1.5 percent for each 1 percent rise of inflation above zero with a requirement that any divergence from that rule should be formally accounted for by the monetary authorities. But this Goodhart rule was inflation-first-and-foremost-based and possibly "too mechanical."

10. Impact of the Taylor Rule: Macroeconomic Research

The Taylor rule had the side effect of fostering renewed interaction and communication between academic and central bank economists. In the late 1970s and early 1980s, the rational expectations/real business cycle revolution had led many academics to question the effectiveness of activist monetary policy. A communication gap emerged between academic economists studying the propagation of business cycles resulting from productivity shocks in flexible price models and economists at central banks who were still interested in designing stabilization policies in models where monetary policy had real effects.¹³

Two separate developments in economic thought helped close this gap in research agendas, and Taylor played an important role in both. First, models of sticky price and wage adjustment and, later, models of sticky information made activist feedback rules dominate rules without feedback. Taylor's work on long-term wage contracts was seminal in this area. Second, the Taylor rule expressed policy in terms of an interest rate instrument rather than a monetary growth rule. This simple idea helped translate monetary theory into more practical terms. Together, the two developments put academic and central bank economists back on the same research track. Today, economists and economic ideas move freely between academic and central bank research departments.

13. An exception to this communications gap was at the Minneapolis Fed, where research on rational expectations and real business cycles flourished during this period.

The literature on Taylor rules is vast and growing. Only a small part of it can be summarized here. The research has been both positive and normative, theoretical and empirical. A wide range of topics has been addressed, including the evaluation of historical monetary policy, the estimation of Taylor rule parameters, the development of more complex—and presumably better—versions of Taylor's rule, and the identification of "optimal" and robust specifications.

10.1. Historical analysis and uncertainty about the output gap

The simplicity of the Taylor rule was quick to be questioned. Bennett T. McCallum (1993) in his discussion of Taylor's 1993 paper pointed out that the rule was not strictly operational because the current quarter output gap could not be observed. Data on current quarter GDP are not released until well into the next quarter. Therefore, to implement the Taylor rule, a policymaker would need first to estimate current-quarter real GDP and the implicit price deflator. Ignoring the lag potentially leads to overstating the performance of a Taylor rule and can potentially generate instrument instability.

Researchers addressed this issue in one of two ways. First, lagged data on output and inflation were substituted for contemporaneous data. This had a limited effect on the fit of the Taylor rule because of the high degree of inertia in output and inflation. Second, researchers incorporated forecasts of output and inflation. This had the appeal of recognizing the forward-looking aspect of monetary policy (even though some have argued that the contemporaneous—or lagged—output gap term is a forward-looking indicator of inflation).

In addition to Taylor's use of his rule to describe monetary policy, a number of researchers have used the Taylor rule to understand monetary policy and macroeconomic performance before and after 1987. For example, John P. Judd and Glenn D. Rudebusch (1998) estimate a version of the Taylor rule over three periods delineated by the terms of three recent Fed chairmen. The authors estimate a version of the Taylor rule allowing for a gradual adjustment of the federal funds rate to their rule's policy prescription, including an additional lagged output gap term to test for possible speed effects and incorporating a structural estimate of potential GDP.

The authors found that movements in the funds rate during Fed Chairman Alan Greenspan's tenure were largely consistent with the

Taylor rule. However, the response of the funds rate to the output gap was more gradual than, but with roughly twice the response of, Taylor's 1993 specification. During the chairmanship of Paul Volcker at the Fed, the authors found their specification fit less precisely, but nevertheless affirmed a gradual movement of the funds rate to bring inflation down over time. In addition, they found policy responding more strongly to the growth rate of GDP as opposed to the level of the output gap. During the Arthur F. Burns chairmanship, the authors found a weak response to inflation. Instead, policy responded mainly to cyclical movements in output, perhaps due to an estimate of potential output that appeared too high.

Along the same lines, Richard Clarida, Jordi Galí, and Mark Gertler (2000) found that policy responded much more aggressively to inflation after the Volcker period than before. Their policy rule incorporated forecasts of output and inflation, a gradual adjustment of the funds rate to the funds rate target, and an estimate of the output gap from the Congressional Budget Office (CBO). They found that the funds rate responds less than one-for-one with expected inflation in the pre-Volcker period but far greater than one-for-one for the post-Volcker period. In addition, the funds rate was sensitive to the output gap in both periods but more so in the pre-Volcker period. The authors speculated that an overly optimistic estimate of potential output or a lack of understanding of inflation dynamics may have led policymakers to maintain the real funds rate at too low a level in the pre-Volcker period.¹⁴

Athanasios Orphanides (2001; 2003) examined the issue of real-time estimates of the output gap and found that, indeed, policymakers may have been misled by unreliable contemporaneous estimates of the output gap that were later revised. In addition, researchers using revised data for historical analysis may have mischaracterized the real-time policy actions of policymakers. For example, using real-time estimates of the output gap, Orphanides (2003, 984) found that the Taylor rule "serves as a particularly good description of policy . . . both when subsequent economic outcomes were exemplary as well as less than ideal."¹⁵

14. Taylor rules have also been used as the basis for historical monetary analysis in other countries. For example, Ed Nelson (2001) examines Taylor rules for different UK monetary policy regimes. Cecchetti, Hooper, Kasman, Schoenholtz, and Watson (2007) examine the historical fit of Taylor rules in Germany, the United Kingdom, Japan, and the United States.

15. Taylor (2000), in commenting on a paper by Orphanides at the American Economic Association meetings, questioned the view that policymakers based decisions on faulty offi-

The implication of Orphanides' research was that the Taylor rule was useful for historical analysis if the researcher was careful to use only information available at the time policy was made. Moreover, policymakers who followed the Taylor rule were not guaranteed good macroeconomic performance. Because of uncertainty about real-time estimates of the output gap, policymakers should down-weight the output gap as a factor in adjusting the funds rate or adopt a first-difference version of the Taylor rule. Assuming potential GDP grows at a fairly constant rate, first-differencing the Taylor rule would eliminate the need to estimate the output gap.¹⁶

Robert Hall (2005, 138) went even further. He rejected the idea that the business cycle could be separated from longer-run trend movements in the economy. "Only an elaborate, realistic version of the [real business cycle] model can deliver values of [potential output] and [the equilibrium real rate] that take proper account of the movements of productivity and exogenous spending. Even that model does not know how to deal with movements of unemployment." Thus, he suggested a first-difference policy rule in which policymakers would raise the nominal rate from its earlier value only when inflation threatened to exceed its target—without regard to the tenuous and difficult-to-estimate concepts of equilibrium real rates or output gaps.

10.2. "Optimal" policy rules

Taylor (1993a, 202) chose a specification for the Taylor rule that reflected "the general properties of the rules that have emerged from recent research," picking round numbers for the rule's coefficients that make for easy discussion. Other researchers have computed policy rules that are optimal with respect to a particular macroeconomic model and loss function. The loss function describes the objectives of the central

cial estimates of the output gap. Taylor argued that there was no record of a potential series produced at the Fed in the 1960s and 1970s, so it is not clear what measure of the output gap influenced Fed policymakers at the time. Moreover, "potential GDP and its growth rate became politicized as early as the late 1960s" and "serious economic analysts—like Burns and Greenspan—paid no attention to it." Economists at the time were skeptical about data series that indicated "a GDP gap of 15 percent in the mid-1970s—comparable to the Great Depression!" and knew that "the revision in 1977 was still too small." Finally, Taylor noted that the historical "concept of potential GDP was a max not a mean."

16. Taylor (2000) also cautioned against reacting to only real GDP growth and not its level. Focusing only on real GDP growth could lead to overshooting, where "policy is too easy when [the] economy is way above capacity and growing at [the] potential growth rate," or undershooting, where "policy is too tight when [the] economy is below capacity and growing at [the] potential growth rate."

bank, typically penalizing volatility in output, inflation, and sometimes the policy interest rate. Still other researchers have computed rules that maximize a representative agent's welfare in a typically small dynamic stochastic general equilibrium model.

The papers published in the 1999 conference volume edited by Taylor provide examples of both strategies for estimating optimal rules in the context of an economic model or models. As summarized by Christopher Sims (2001, 562), the papers reach the following general conclusions: Taylor rules that fit the post-1982 data perform well in most of the models. However, the variability of output and inflation can be reduced further by increasing the size of the coefficients on inflation and the output gap in the Taylor rule.¹⁷ An optimized policy rule with a delay of one quarter in the response of policy to inflation and the output gap is almost as good as a rule with no delay. Simple rules perform almost as well as more complicated rules. And rules in which the change in the interest rate—as opposed to its level—is related to inflation and the output gap perform better than the original Taylor specification. Sims criticizes the papers for their lack of attention to statistical fit, their unquestioned assumption that policy has improved over the postwar period, the reliance on sticky-price models derived from optimizing monopolistic competition to justify price equations, and the focus on policy “as a ‘rule’ analogous to the decision rules of dynamic optimization” (p. 563).

10.3. Robustness

Another important area of research in the Taylor rule literature is the search for policy rules that are robust across a variety of structural macroeconomic models. Given uncertainty about the true structure of the economy, a key test of a policy rule is that it delivers favorable macroeconomic outcomes in a wide variety of models. Again, the papers in the 1999 Taylor conference volume provide evidence on this issue. Five different interest rate rules were evaluated across nine different models drawn from the papers in the conference volume. The rules varied the weights placed on the response of the policy rate to inflation, the output gap, and the lagged policy rate.

17. An exception is the rule recommended in the paper by Rotemberg and Woodford. This rule, which maximizes the welfare of the representative agent, puts a small weight on output and a very high weight on the lagged interest rate.

The comparison of policy rules across models yielded several findings. First, the result that a higher weight on the output gap improved macroeconomic performance was not robust across all models. While a higher weight on output led to less output variance in all models, it was associated with greater inflation variance in six of the nine models and greater interest rate variability in seven of eight models that reported interest rate variances. Second, rules with lagged interest rates did not dominate rules without a lagged interest rate. And third, lagged interest rate rules worked best in models with forward-looking behavior and rational expectations. Rules with lagged interest rates sometimes exhibited instability or extraordinarily high variances of output and inflation in backward-looking models.

Another, more recent, study (Andrew Levin and John Williams, 2003) examined the robustness of policy rules across non-nested models with varying assumptions about expectations formation and differing degrees of persistence of aggregate spending and inflation. The authors find that robust rules obtain only when the objective function places substantial weight on both output and inflation stabilization. A robust rule does not exist if the policymaker places no weight on output stabilization.

10.4. Taylor rules in small open economies

While most research on the Taylor rule has focused on closed economies, some researchers have looked at its applicability to small open economies. For example, recognizing the exchange rate as both an instrument and a channel of monetary policy, Laurence Ball (1999) modified the Taylor rule in two ways. First, he defined the policy variable—a monetary conditions index (MCI)—as a linear combination of the exchange rate and interest rate. And second, his measure of inflation was modified to filter out the direct effects of exchange rate fluctuations. Ball found that the weight on the exchange rate in the MCI in his version of the Taylor rule should be equal to or slightly greater than the exchange rate's relative effect on spending.

In contrast, Douglas Laxton and Paolo Pesenti (2003), using the IMF's Global Economic Model, found that there is only a very small role—if any—for the exchange rate to play in open economies “even when there are significant adjustment costs to export prices and short-run pass-through is relatively low. It may even be counterproductive

for monetary policy to react strongly to movements in the exchange rate, the information content of which is already captured by either current or expected CPI inflation." Instead, policy should follow a simple rule that responds strongly to the forecast of inflation (pp. 1142–43).

10.5. Other issues

In the last five years, research on the Taylor rule has continued to flourish. A partial list of topics includes: conditions under which Taylor rules lead to a unique stable equilibrium, conditions under which it may be necessary or desirable to deviate from rule-like behavior, the use of forecast-based rules versus backward-looking rules, the generalization of Taylor rules to allow for regime switching or time variation in the rule's coefficients, the desirability of instrument rules versus target rules in central bank decision-making and communications, the variability of equilibrium real rates and their impact on the Taylor rule, and the role of asset prices in policy rules.

11. Concluding remarks

This paper has described an important component of the transformation that swept through the monetary policy landscape in a remarkably few years following the abandonment of monetary targeting. The Taylor rule became an operational framework for central banks just as time-consistency (credibility), transparency, and independence replaced a culture of discretion, "mystique," and "democracy" (i.e., politically driven or influenced monetary policy). The dynamics of macroeconomic policy formation are as important as conventional macroeconomic dynamics. This paper has attempted to illuminate aspects of that dynamic process.

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TWO

THE TAYLOR RULE
AND THE PRACTICE OF
CENTRAL BANKING

George A. Kahn

I. Introduction

The Taylor rule has revolutionized the way many policymakers at central banks think about monetary policy. It has framed the conduct of policy as a systematic response to incoming information about economic conditions, as opposed to a period-by-period optimization problem. It has emphasized the importance of adjusting policy rates more than one-for-one in response to an increase in inflation. And various versions of the Taylor rule have been incorporated into macroeconomic

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