Working Paper Series

Monetary Policy Frameworks and Indicators for the Federal Reserve in the 1920s

WP 00-07

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Monetary Policy Frameworks and Indicators for the Federal Reserve in the 1920s[*]

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Federal Reserve Bank of Richmond Working Paper No. 00-7

August 2000

JEL Nos. E5, B1

Keywords: quantity theory, real bills doctrine, scissors effect, policy indicators.

Abstract

The 1920s and 1930s saw the Fed reject a state-of-the-art empirical policy framework for a logically defective one. Consisting of a quantity theoretic analysis of the business cycle, the former framework featured the money stock, price level, and real interest rates as policy indicators. By contrast, the Fed's procyclical needs-of-trade, or real bills, framework stressed such policy guides as market nominal interest rates, volume of member bank borrowing, and type and amount of commercial paper eligible for rediscount at the central bank. The start of the Great Depression put these rival sets of indicators to the test. The quantity theoretic set correctly signaled that money and credit were on sharply contractionary paths that would worsen the slump. By contrast, the real bills indicators incorrectly signaled that money and credit conditions were sufficiently easy and needed no correction. This experience shows that policy measures and measurement, no matter how accurate and precise, can lead policymakers astray when embodied in a theoretically flawed framework.

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[*]This paper does not necessarily represent the views of the Federal Reserve System or the Federal Reserve Bank of Richmond. The author is indebted to William Gavin, Bob Hetzel, Judy Klein, Mary Morgan, and Anna Schwartz for helpful comments.

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1. INTRODUCTION

Anyone who studies the early history of the Federal Reserve is bound to notice a singular curiosity. In the 1920s and early 1930s when U.S. gold holdings were sufficiently large to relax the constraint of the international gold standard and permit domestic control of the money stock and price level, the Fed deliberately shunned the best empirical policy framework that mainstream monetary science had to offer.

Developed by Irving Fisher and other U.S. quantity theorists, this framework was the outcome of an evolution in numerical measurement that had been occurring in monetary economics since the early years of the 1900s. Although somewhat crude and unsophisticated by today's standards, the quantity theory framework had by the mid-1920s progressed to the point where, statistically and analytically, it was state of the art in policy analysis. Its constituent variables, all expressed in a form amenable to empirical measurement, had been fitted with relevant data series. It boasted the ability to establish empirical causality between certain variables at cyclical and secular frequencies. It had survived rigorous testing, by the standards of the time, for accuracy and usefulness. Most of all, it claimed to predict the effects of Fed monetary policy on output and prices in both the short run and the long. Here, ready-made, seemed to be the answer to a central banker's prayers. Here was the model the Fed could use to conduct policy and to stabilize the economy.

Yet the Fed refused to have anything to do with the framework and its components. Instead of concentrating on the money stock, the price level, and other indicators featured in the quantity theory, the Fed focused on such measures as the level

of market interest rates, the volume of member bank borrowing, and the type and amount of commercial paper eligible for rediscount at the central bank.

Why would the Fed, seemingly in need of reliable and accurate gauges of the quantity and value of money, eschew them and the framework featuring them? Why would it deny itself the opportunity to take advantage of the improved empirical knowledge -- and potential policy advances stemming therefrom -- embodied in the quantity theory?

The answer, of course, was that the theory was incompatible with the type of institution created by the Federal Reserve Act of 1913. Far from being the activist, ambitious, price-level stabilizing central bank envisioned in the quantity theory, the Fed was a passive, decentralized, noninterventionist system of regional reserve banks designed to accommodate automatically all productive (nonspeculative) business demands for credit and money over the cycle. The 1913 Act expressly stated as much. Reserve banks, it declared, exist for the purpose of "accommodating commerce and business," a purpose they fulfill by "furnishing an elastic currency" and "affording a means of rediscounting commercial paper." Accommodation was the watchword. The Act said nothing about stabilization as a policy goal.

Nevertheless, by the mid-1920s there were voices -- some within, but most without, the Federal Reserve System -- claiming that the Fed should have learned that stabilization rather than accommodation was its overriding task and that certain statistical measures and indicators were available to help it accomplish that task. Accordingly, these same voices advocated that the original Federal Reserve Act be amended to make price stability the chief responsibility of the central bank.

But the Fed rejected these suggestions and clung to the notion that accommodation was its duty and that the proffered quantity theoretic measures were irrelevant to the discharge of that duty. The result was that the Fed spurned the quantity theory or monetary-approach-to-the-business-cycle framework for an entirely different one instead. Composed of an operational version of the real bills doctrine (also known as the commercial loan theory of banking), that framework had nonmonetary forces driving the price level just as it had output and the needs of commerce determining the money stock.

Since the doctrine taught (1) that money created by loans to finance real production rather than speculation has no influence on prices, (2) that causality runs from prices and output to money rather than vice-versa as in the quantity theory, and (3) that reserve banks in no way possess control over money, there was no reason for the Fed to accept a theory asserting the opposite.[1] Indeed, as previously noted, throughout the 1920s officials and economists located at the Federal Reserve Board and certain regional Fed banks went out of their way to reject the quantity theory and its notions that the price level and real output could and should be stabilized through money stock control.

The initial phase of the Great Depression starkly revealed the consequences of the Fed's choice of policy frameworks. That episode put the rival frameworks, or theories, to the test. The quantity theory passed the test with flying colors. Its indicators -- money stock, price level, and real rates of interest -- correctly signaled that monetary policy was extraordinarily restrictive and likely to precipitate a contraction.

[1] Conversely, there was every reason for Fed officials to endorse a doctrine that implied that their policies, being passive and automatic, could never be the cause of inflation or deflation. Such a doctrine promised to exonerate the officials from blame for these phenomena and perhaps accounts for its appeal to them.

The real bills doctrine, on the other hand, failed the test. Its indicators -- member bank borrowing and nominal market rates of interest -- signaled, wrongly, that policy was remarkably easy such that the Fed had already done all it could do to stop the slump. Guided by these indicators, the Fed did nothing to arrest and reverse the monetary contraction that was pushing the economy into depression.

Indeed, far from being alarmed by the monetary contraction, the Fed saw it as precisely what the real bills doctrine prescribed in an environment of falling output and employment. For the slumping levels of those variables meant, according to the doctrine, that less money and credit were required to finance them. Likewise, the price deflation accompanying the slump was interpreted as indicating not that money and credit were tight, but rather that the speculative excesses of the stock market boom of 1928-29 were being purged from the economy.

In brief, real bills indicators were telling the Fed early in the depression that it was doing the right thing and that its policy was sound. In actuality, however, the opposite was true and the real bills indicators were leading the Fed astray. Those indicators, though accurate and precise, nevertheless wreaked havoc because they were embodied in a framework instructing the policymakers to let money and credit vary procyclically rather than countercyclically.

The story of the rival theories and their constituent policy indicators is instructive for at least four reasons. First, it illustrates how different statistical gauges can yield conflicting policy signals. Second, it indicates that theory necessarily precedes measurement in the sense that central bankers must have an analytical framework first before they can determine the relevant indicator variables to measure. Third, it also

reveals the corollary proposition that policymakers observe only what they are predisposed to see. That is, it shows that their chosen analytical framework dictates the very indicators to which they will respond.

Finally, it indicates that theories superficially similar in some respects can differ fundamentally in others. In the case of the quantity theory and the real bills doctrine, it shows that while both recognized that money stock growth in excess of output growth might be inflationary, they disagreed over the cause. The quantity theory attributed inflation to the resulting excess aggregate spending. But the real bills doctrine attributed it to the wrong kind of spending, namely spending for speculative, as opposed to productive, purposes.

Likewise, the two theories yielded opposite predictions regarding the optimal cyclical behavior of the money stock. The real bills doctrine, stressing as it did that output generates the very money necessary to purchase it off the market, held that money should vary procyclically, rising with production in booms and falling with it in slumps. By contrast, the quantity theory, holding as it did that output is independent of money in long-run equilibrium but influenced strongly by it at cyclical frequencies, implied that money should vary countercyclically in the interest of economic stabilization.

The following paragraphs discuss the development and application of the two theories and their associated policy indicators in the 1920s and early 1930s. Three themes emerge. First, quantity theory indicators, although implied or foreseen as early as 1911, had to evolve through several stages of statistical work before emerging as serious candidates in the mid-1920s. Second, much the same can be said for the real bills doctrine. It too had to undergo several modifications and applications in the period 1914-

1928 before it could feature member bank borrowing and market interest rates as key policy guides. That the Fed was willing to countenance these modifications rather than switching to the quantity theory testifies to its allegiance to the doctrine. Third, the doctrine's failure to signal the onset of the Great Depression indicates that the Fed had allied itself with the wrong theory, one inappropriate to the task of monetary stabilization.

2. QUANTITY THEORY MODEL

The distinguishing characteristic of the framework that vied unsuccessfully for the Fed's acceptance is easily described. It consisted of a causal chain running from Fed policy to bank reserves to the money stock and thence to general prices and output. It implied that the Fed could control the money stock and thereby stabilize prices and smooth the business cycle. By the mid-1920s a vigorous empirical tradition had developed around the model. Key names in this tradition included Simon Newcomb, John P. Norton, E.W. Kemmerer, Irving Fisher, Warren M. Persons, Carl Snyder, and Holbrook Working.

It was Newcomb, a renowned astronomer and part-time economist, who, in his 1885 *Principles of Political Economy,* suggested that David Ricardo's $P=MV/T$ equation of exchange might serve as an empirical framework to examine money's effects on the economy.[2] Newcomb also suggested an idea that Norton, in his *Statistical Studies in the New York Money Market* (1902, pp. 1-12), would later incorporate into the most comprehensive and disaggregated version of the equation ever published, namely the

[2] Ricardo (1810-11, p. 311) stated the $P=MV/T$ equation as follows: "Put the mass of commodities of all sorts [T] on one side of the line -- and the amount of money [M] multiplied by the rapidity of its circulation [V] on the other. Is not this in all cases the regulator of prices [P]?"

notion that the total stock of circulating media could, in principle, be divided into its separate components -- coin, paper currency, demand deposits -- each with its own velocity coefficient.[3] Inspired by Newcomb, Kemmerer, in his 1907 *Money and Credit Instruments in Their Relation to General Prices*, and Fisher, in his 1911 *The Purchasing Power of Money*, elaborated Newcomb's suggestions in at least five ways.

They incorporated variables representing checking deposits *M'* and their velocity *V'* into the equation to obtain $P=(MV+M'V')/T$. Then, constructing data series of index numbers for each of the equation's elements, they combined these individual series into a single series for the entire right-hand side of the equation. The resulting magnitude, $(MV+M'V')/T$, gave them an estimated or predicted value of the price level *P* which they then compared with an independent price index series representing the actual observed price level.[4]

Visually comparing graphed curves of the two price series over the period 1878-1901, Kemmerer concluded that the fit was close enough to verify the quantity theory. When Warren Persons (1908, p. 289) questioned this conclusion by calculating the correlation coefficient for Kemmerer's series and reporting it as a meager 0.23 with a probable error of 0.13, Fisher ([1911] 1913, p. 294), in response, demonstrated that the coefficient for the two series for the different period 1896-1909 was a whopping 0.97, indicating a very close fit.

[3] Besides containing terms for each type of coin and currency in circulation and their velocities, Norton's equation included notation for bank reserves, the deposit expansion multiplier, proportion of maximum allowable deposits banks actually create, velocity of deposits, and the discounted and full maturity values of bank loans -- all for the four different classes of banks existing in the United States in 1902.

[4] Fisher constructed his independent price index series as a weighted average of the wholesale prices of 258 commodities, hourly wage rates, and the prices of 40 stocks.

Further support for Fisher came when he ([1911] 1913, p. 295) and Persons (1911, pp. 827-8) applied link-relative and proportional-first-difference techniques of trend removal to Fisher's original series. Doing so, they found that the correlation remained fairly high even when the series were cleansed of serial correlation. Fisher argued that these correlations, together with his finding that discrepancies between the actual and hypothetical price series predicted the direction of movement of the former as it gravitated to the latter, verified the quantity theory.

Still, skeptics could maintain that Fisher's work, and Kemmerer's too, consisted of attempts to confirm the equation of exchange rather than the quantity theory. They could further maintain that, because the exchange equation is an accounting identity tautologically true by definition, accurate measurement of its constituent variables could result in no disparity between the predicted and actual price levels that constituted the opposite sides of the equation. If so, then high correlation between the two price series indicates merely the absence of measurement error rather than the validity of the quantity theory.

To forestall such criticism, Fisher ([1911] 1913, p. 157) argued that the identity, when combined with "supplementary knowledge" of the behavior of its constituent variables, allowed him to confirm statistically that the price level P was indeed determined by velocity-augmented money per unit of real output MV/T as the quantity theory held. That is, he held that with velocity defined independently of the other variables so that the equation becomes non-tautological, the price level adjusts to equate the real or price-deflated money stock M/P to the real demand for it, this real demand

being the fraction *1/V* of real transactions *T* the public wishes to hold in the form of real cash balances.

With the empirical quantity equation in place, Carl Snyder (1924, pp. 699, 710) and Holbrook Working (1923, 1926) equipped its variables with time series to establish the direction of causation between money and prices at secular and cyclical frequencies. Secularly, prices evolved at the trend rate of growth of money per unit of trade. Long-term price stability therefore required that money grow at the same trend rate as trade, estimated by Snyder to be 4 percent per annum.

Cyclically, however, trade seemed to have a negligible influence on prices whose variations appeared to stem from variations in money alone. Evidently, short-term oscillations of trade mattered little for the price level because they were absorbed by accommodating oscillations in velocity. To Snyder, this finding -- that velocity cyclically co-varied in unison with trade to neutralize the price-level influence of both -- meant but one thing. It meant that the ratio of velocity to trade could be replaced by a constant term *k* in the equation of exchange $P = kM$, implying that money contemporaneously determined prices at every point of the cycle.

For Working, however, things weren't quite that simple. His data series told him that while money did indeed determine prices over the cycle, it did so with a lag rather than contemporaneously. Evidently Snyder's *k* term, rather than being an absolutely fixed constant, exhibited transitory deviations from its trend equilibrium level. These deviations explained the lag. Monetary shocks initially disturbed the *k* variable, driving it from equilibrium. Corrective price-level changes then occurred to eliminate the deviation and restore *k* and its constituent velocity and trade variables to trend.

To estimate the lead-lag relationship between money and prices corresponding to this result, Working (1923, 1926) correlated lagged and contemporaneous measures of the price level with detrended money. He found that such correlations, though high for all lag lengths up to a year, were highest at six to eight months. This result was consistent with his other finding that money led prices by twelve months at the lower turning point of the cycle and by nine months at the upper turning point.

2.1. Fisher's Definitive Version of the Model

To Working's analysis of money's cyclical price-level effects, Fisher added his seminal and definitive account of the output and employment effects. In essence, he equipped the model with an output-inflation price-surprise equation to argue that unanticipated price changes caused by monetary shocks were responsible for fluctuations in real interest rates and therefore in output and employment too. Towering above the rest, his empirical contributions to the monetary theory of the cycle are to be found in his three remarkable journal articles of 1923, 1925, and 1926. But he had already sketched the underlying theory in his classic 1911 volume *The Purchasing Power of Money*.

There he argued that whereas money stock changes have no permanent, enduring effect on real output and employment, they do affect those variables temporarily over periods lasting perhaps as long as ten years. To account for these transitory real effects, Fisher appealed to the distinction between real and nominal interest rates that he had first enunciated in his 1896 monograph *Appreciation and Interest.* That distinction defines the real rate as the difference between the nominal observed rate and the expected rate of price inflation or deflation. According to Fisher, unexpected inflation and deflation move the realized real rate when bankers, either surprised by or slow to perceive the price-level

changes, fail to incorporate them into the inflation-premium component of the nominal rate they charge.

Fisher ([1911] 1913, pp. 55ff.) attributed business cycles to such real rate movements. An increase in the money stock sets prices rising. Because nominal interest rates adjust slowly to inflation, the realized real rate falls. (Similarly, real wages, rents, and raw material costs also fall as their nominal values fail to adjust for inflation.) Such falls raise business profits, actual and expected, and spur corresponding rises in investment, output, and employment. As the expansion proceeds, banks run up against their reserve constraints. Moreover, they even begin to lose reserves when depositors, who need additional coin and currency to mediate a rising volume of hand-to-hand payments, withdraw cash from their checking accounts. To protect their reserves from such cash drains, banks raise their nominal loan rate until it catches up with and then surpasses the rate of inflation. Real rates rise, thereby precipitating the downturn. Causation runs from money to prices to real rates to output and employment.

Having sketched his theory, Fisher then sought its empirical verification. Citing Working's 1923 estimate that money stock changes over the period 1890-1921 had temporally preceded price level changes by about eight months, he took this finding as constituting strong evidence of money-to-price causality (Fisher 1925, p.199). To establish corresponding price-to-output causality, he correlated distributed lags of rates of price-level change with an index of the physical volume of trade (Fisher 1925).[5]

[5] Fisher employed at least three weighting schemes to distribute the lag. The first used linearly-declining monthly weights for eight-month intervals. The second used a unimodal sequence of lag coefficients to weight the past rates of price change. The third and most ambitious scheme distributed the lag according to the density function of a lognormal distribution (see Chipman 1999, pp. 192-94). All schemes yielded high correlation coefficients.

Likewise, to establish price-to-employment causality, he correlated distributed lags of rates of price change and employment (Fisher 1926). Finding a high correlation of 0.941 for the first set of series and 0.90 for the second, he concluded that "the ups and downs of [output and] employment are the effects . . . of the rises and falls of prices, due in turn to the inflation and deflation of money and credit" (Fisher 1926, p. 792).

Here was his statistical confirmation of the trade cycle as a monetary phenomenon receptive to a monetary cure. Cycles, in other words, stem from price-level movements caused by misbehavior of the money stock. It follows that monetary policy, properly conducted, could stabilize the price level and, in so doing, eliminate the business cycle as well. Policymakers had but to observe and react to the price level. Its deviations from target would trigger corrective monetary responses that would restore it to target. The price level itself was the main gauge of monetary policy. If the policymakers desired supplementary indicators of monetary tightness or ease, they could observe the money stock and real interest rates -- the chief variables of Fisher's analysis.

3. THE FED'S FRAMEWORK

Fisher's cycle model spotlighted the money stock, price level, and real interest rate as indicators. It linked these indicators through a causal chain running from the Fed to real activity with the Fed actively initiating the causal sequence. The Fed determined the money stock. The money stock determined the price level. The price level, or rather its rate of change, temporarily moved the real rate of interest. Movements of the real rate influenced output and employment. The cycle admitted to both a monetary cause and a monetary cure. The Fed, by stabilizing the price level, could smooth the cycle too.

By contrast, economists at the Federal Reserve Board adhered to the real bills doctrine in which causation ran in the opposite direction from prices and real activity to money with the Fed occupying a passive, accommodative role (Laidler 1999, p. 18: Yohe 1990, p. 486). In the Fed's framework, seasonal and cyclical movements in real activity drive business demands for bank loans. Since banks supply loans in the form of check-deposit money subject to a fixed fractional reserve requirement, these same movements lead to corresponding changes in bank demands for reserves, reserves borrowed from the Fed. The Fed passively accommodates these demands by discounting bank paper. In so doing, it contributes seasonal and cyclical elasticity to the money stock.

The Fed's model did not come ready-made, however. Like the quantity theory whose elements, though assembled or foreseen as early as 1911, only became fully coordinated into an empirical framework with Fisher's output-inflation correlations of the mid-1920s, the real bills doctrine had to go through at least five steps before it emerged in the form which the Fed employed to conduct policy in the initial phase of the depression. First came the pure or pristine version of the doctrine itself which the Fed inherited from nineteenth century Banking School economists (Laidler 1999, p.18; Yohe 1990, p. 486). Missing from that inherited version were the notions of legal reserve requirements and of central banks as providers of reserves. Consequently, the second stage saw Fed economists correct those omissions by incorporating into the model a representation of the central bank's rediscount function. Third came the application of the model to derive real bills guides to policy and to reject quantity theory ones. Fourth came the attempt to reconcile the doctrine with the newly discovered technique of open market operations. Such operations, constituting as they did activist, discretionary policy

intervention, conflicted with the doctrine's notion of policy as a passively accommodating and automatically self-correcting affair. The resulting reconciliation saw member bank borrowing and market interest rates emerge, in the fifth and final step, as the doctrine's key policy indicators.

3.1. Original Doctrine

The first step of the developmental process saw the Fed inherit from its nineteenth century Banking School predecessors the prototypal version of the doctrine. That version consisted of a rule gearing money (and credit) to production via the short-term commercial bill of exchange, thereby ensuring that output generates its own means of purchase and that money adapts passively to the legitimate needs of trade (Mints 1945, pp. 206-07, 284). The rule implied that money could be neither excessive nor deficient when issued against short-term commercial paper arising from real transactions in goods and services. More precisely, the rule implied that as long as banks lend only against bona-fide commercial paper the money stock will be secured by, and will automatically vary equiproportionally with, real output such that the latter will be matched by just enough money to purchase it at existing prices.

Finally, the rule ensured that no monetary overhang would persist to spark inflation after the goods had been sold. Instead, producers use their resulting sales proceeds to pay off their loans and the money returns to the banks to be retired from circulation. Here is the concept of the self-liquidating loan that constitutes the bedrock principle of the doctrine. Only if loans were made for speculative purposes would monetary overhang persist. Such loans, being nonproductive, finance no output to generate the sales revenue leading to their retirement. Consequently, the loans and the

money issued by way of them remain outstanding. The limitation of loans to self-liquidating uses rules out this pathological case. In short, inflationary overissue is impossible provided money is issued on loans made to finance real, rather than speculative, transactions.

3.2. Reformulating the Doctrine

System founders and architects E. Carter Glass and H. Parker Willis, together with Board economists Walter W. Stewart, Adolph G. Miller, Emanuel A.Goldenweiser and others, sought to spell out the logic of the foregoing conclusions and give them an exact and systematic formulation (Laidler 1999, pp. 192-5; Yohe 1990, p. 486). They realized that doing so would remove ambiguities clouding earlier statements of the doctrine, statements that Lloyd Mints, the leading expert on the doctrine's history, described as "invariably brief, incomplete, and frequently not consistent" (1945, p. 206). Correcting those statements and getting the doctrine right became the first order of business. It was absolutely essential to articulate precisely the framework that the Federal Reserve Act had mandated as a policy guide and to spotlight its indicator variables in sharp relief. In their reformulation, Fed officials presented no formal equations, not even rudimentary ones. Nevertheless, their statements can be expressed symbolically and condensed into a simple algebraic model without doing violence to their intentions. For their words, as contained in their speeches, writings, and testimony before congressional committees, read like the following set of instructions for formalizing the doctrine: [6]

First, define the needs of trade N as the value of inventories of working capital, or goods-in-process G, the production of which is financed by bank loans. Symbolically,

[6] See, for example, Willis's statements quoted in Laidler 1999, p. 194; West 1977, pp. 146-7 and Miller's statements quoted in Barger 1964, pp. 79-80, 88, 93.

(1) $N = G$.

Second, assume that each dollar's worth of goods-in-process G generates an equivalent quantity of paper claims in the form of commercial bills B which business borrowers offer as collateral to back their loan demands L_d. That is, assume that

(2) $G = B$,

and that

(3) $B = L_d$.

Third, observe that these loan demands L_d pass the real bills test (that is, they are secured by claims to real goods) and therefore qualify for matching supplies of bank loans L_s as indicated by the expression

(4) $L_d = L_s$.

Fourth, note that since banks supply loans in the form of banknotes and checking deposits the sum of which comprises the stock of bank money, the supply of loans L_s must equal that money stock M,

(5) $L_s = M$.

Substituting equations (1) through (4) into (5) and solving for the money stock yields

(6) $M = N$,

which says that as long as banks lend only against short-term commercial bills arising out of transactions in real goods and services, the money stock M will conform to the needs of trade N. Since the needs of trade N and the value of goods-in-process G are identically equal one can also write

(7) M = G

which states that the supply of bank money is ultimately secured by goods-in-process such that when those goods reach the market they will be matched by just enough money to purchase them at existing prices. This result can be shown by defining the value of goods-in-process G as the multiplicative product of the price P and quantity Q of those goods when they emerge as final output, that is,

$$(8)\quad G = PQ.$$

Here one avoids a stock-flow dimensionality problem by treating the inventory of goods in-process (a stock) as turning over once per period in the production of output (a flow). In short, multiplying the G variable by its unit turnover coefficient converts it into a flow, thus rendering both sides of the equation dimensionally equivalent.

Substituting equations (8) and (5) into (7) yields

$$(9)\quad M = L_s = PQ,$$

which says that, taking prices P as given and determined by nonmonetary considerations, the money stock M and volume of bank credit L_s vary in step with real production Q.[7]

Here was the essence of the real bills doctrine. Its flaw, of course, lay in its treatment of prices and output as given exogenous variables when, as Fisher had shown, they move under the influence of changes in the money stock itself.

[7] Expression (9), of course, is simply the equation of exchange $MV=PQ$ with the velocity term V assigned a value of one, or unity. The unit velocity term corresponds to the notion of the self-liquidating loan according to which output induces, via collateralized loans, money sufficient to purchase it and to retire the loans. Consumers spend the money once and once only on the final product. Recipient producers then use the resulting sales receipts to pay off their loans and the money returns to the banks who retire it from circulation. Quantity theorists, however, questioned such reasoning. They argued that money, once created, might be spent several times before loans were repaid. And even when loans were repaid, bankers might relend the proceeds so that the new money would remain in circulation with a velocity greater than unity.

3.3 Augmenting the Doctrine

When the Federal Reserve Act authorized reserve banks to rediscount bank paper, it added a new element to the real bills version of the monetary transmission mechanism. Step two saw Board economists recognize this element by incorporating a representation of the rediscount function into their policy framework. The rediscount function, of course, was useful to banks who, facing a mandatory legal reserve ratio r, had to obtain the necessary reserves R to back the money and credit required by the needs of trade. The Fed enabled them to do so by rediscounting the commercial paper they had acquired from their customers. By limiting the type of paper eligible for rediscount, the Fed ensured that reserves were just sufficient to underwrite production without promoting speculation. Nonborrowed sources of reserves, including inflows of gold and currency, were dismissed as superfluous. In principle, the discount window could supply all the reserves necessary to meet the needs of trade.[8] And it could do so at a discount rate normally aligned with or below short-term market interest rates so as to pose no barrier to accommodation. In short, the commercial banking system faced a reserve constraint $R = rM$ which it satisfied by borrowing from the Fed. With nonborrowed reserves ignored, all reserves were borrowed reserves R_B such that $R = R_B$.

The significance of these amendments cannot be overestimated. Here was the view, dominant at the Board in the early 1920s, of the Fed as passive accommodator rather than active initiator of changes in economic activity. Here was the idea that causation runs from output and prices to loans to bank money with the Fed supplying the necessary reserves. Standing at the end of the causal queue, the Fed cannot force money

on the economy. It merely supplies reserves on demand. Of course, it may influence this demand through changes in its rediscount rate. Still, it must accept all real bills tendered it at the prevailing rate. The contrast with the quantity theory could hardly have been more pronounced.

3.4. Making the Model Operational

Step three saw Board economists give the doctrine operational content by defining its variables so that they could be measured and serve as policy guides. Output *Q* was defined as aggregate physical product as measured by the Board's own index of industrial production. Constructed principally by Board economists Walter Stewart and Woodlief Thomas, this index was given pride of place in the Board's collection of statistical measures for two reasons. It quantified the needs-of-business criterion of the Federal Reserve Act. It also represented the strategic variable that, according to the real bills doctrine, drove all other variables -- loans, bills, money stock -- in the credit mechanism.

Likewise, the Board defined productive loans *L* as bank credit advanced solely to finance the production and marketing of goods in the agricultural, industrial, and commercial sectors of the economy. Real bills *B* were defined as paper pledged as collateral for such loans and eligible for rediscount at the Fed. The exact counterpart of productive loans, such bills constituted evidence of their soundness. Here was the Board's belief that the type of paper banks acquire in making loans describes and governs the particular use of the borrowed funds. Here was its conviction that real bills signify and measure productive credit just as non-real bills denote speculative credit.

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[8] In Wheelock's words (1991, p.13), "The Real Bills Doctrine implied that rediscounts alone would provide sufficient liquidity to accommodate commerce and meet financial emergencies. No [other

This belief -- that the type of collateral corresponds to the use of borrowed funds -- was not shared by all. Benjamin Strong of the New York Fed opposed it on the grounds that the very fluidity of credit across uses and instruments renders the belief fallacious (Chandler 1958, pp. 197-8). With credit fungible, banks and their customers could borrow on real bills to finance speculation. Conversely, they could borrow on speculative paper --stocks, bonds, and mortgages -- to finance production. If so, then type of paper is independent of purpose of loan and there is no assurance that credit advanced on real bills will remain in productive channels. But many Fed officials disagreed with Strong and throughout the 1920s continued to argue that the form of collateral denotes the particular use of the borrowed funds.

Finally, the Board defined the price level *P* as measured by the wholesale price index. The Board attributed movements in this latter index either to the long-term operation of exogenous real forces, notably technological progress or resource scarcity, or to short-term speculation, that is, to nonproductive uses of money and credit. Accordingly, secular price changes were ascribed either to cost-reducing productivity growth or cost-enhancing capacity constraints. Likewise, short-term rises in the price level were seen as evidence of a speculative withholding of goods from the market in anticipation of the higher future prices they might bring. And short-term falls in the price level were seen as the inevitable consequence of the bursting of the speculative bubble as goods were dumped on the market at fire-sale prices. The Fed's inclination was to do little to interfere with these latter price falls. Instead, it regarded them as necessary to purge the economy of its preceding speculative excesses. The upshot was the Fed

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sources of reserves] were necessary."

watched the price index for evidence of speculation and its aftermath rather than for evidence that money was plentiful or tight.

3.5. Policy Guides in the Board's *Tenth Annual Report*

With these definitions and interpretations in hand, the Board, in its famous *Tenth Annual Report* (1923) specified two policy guides designed to ensure that the volume of money and credit was neither excessive nor deficient.[9] These were the celebrated quantitative and qualitative tests, respectively.[10]

The quantitative test focused on the ratio of credit (or money) to trade. The test consisted, in the words of Friedman and Schwartz, of a "marriage of the traditional real bills doctrine and an inventory theory of the business cycle" (1963, p. 253). The real bills component stated that money and credit are optimally supplied when variations in their quantity match corresponding variations in nominal product or income according to the equation $M = L_s = PQ$.[11] In other words, money and credit would exhibit desirable elasticity when they rose and fell in procyclical fashion with the dollar value of real output whose financing they supported.[12]

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[9] Here Board economists obviously departed from the extreme version of the doctrine. According to that version, money and credit require no quantitative control since their amounts will automatically adjust to the needs of trade with neither excess nor deficiency as long as banks, commercial and central, make short-term, self-liquidating loans to finance the production and marketing of real goods and services.

[10] For critical evaluation of these tests, see Friedman and Schwartz (1963, pp. 252-3); Mints (1945, pp. 265-8). For more sympathetic treatments, see Hardy (1932, pp. 74-80); Reed (1930, pp. 59-64); West (1977, pp. 195-8), and Wicker (1966).

[11] Hardy (1932, p. 77) and Reed (1930, p. 62) go out of their way to emphasize this point. They note that the quantitative test called for the money stock to vary automatically with corresponding variations both in prices and output.

[12] That money and credit must vary procyclically rather than countercyclically according to the quantitative test was well understood. Hardy (1932, pp. 78-9) described how credit must, under the provisions of the test, adapt passively to the cycle, falling when business declines and expanding when business expands. The test, Hardy insisted, was not designed to ensure that money varies countercyclically so as to stimulate activity in slumps and damp it in booms. Rather the test was designed to ensure that money and credit adapt themselves passively to prevailing cyclical conditions.

The inventory theory component added the proviso that money and credit should so behave only as long as they finance no speculative inventory accumulation.[13] Money and credit should not, that is, finance production destined for speculative stockpiling rather than for final sales. The danger is that such stocks of commodities eventually would be dumped on the market to depress prices and real activity. Evidently, the sharp boom-bust cycle of 1919-21 had taught the Fed that such an outcome could happen. It had revealed that even legitimate credit expansion could, by financing inventory overinvestment instead of production for final consumption, lead to an inflationary shortage of consumers' goods followed by deflation when the excess stocks of those goods finally flooded the market. But this inventory cycle proviso, with its implication that credit is put to speculative uses when it finances production for inventory rather than for consumption, is inconsistent with the real bills doctrine. The latter, of course, equates all production, regardless of its purpose, with the proper use of credit.

Finally, the qualitative test stated that money is optimally supplied when it passes the real bills test, that is, when it is extended on loan for productive purposes as evidenced by eligible paper in bank portfolios. Whereas the quantitative test, sheared of its inventory proviso, stated that money and credit cannot be overissued when they move one-for-one with the value of real output, the qualitative test assures that this outcome is automatically achieved when banks lend only on real bills. The implication is that quantitative control can be attained through qualitative means. The Fed took this latter

[13] Hardy's account (1932, pp. 77) of the inventory proviso is classic. The Fed's responsibility, he says, is "not to check price increases [associated with expanding production] but to supply a volume of credit appropriate to the higher prices, so long as the latter are not interpreted as the evidence of speculative accumulation of inventories."

implication seriously. It largely abandoned quantitative tests after 1924 (see Reed 1930, pp. 60, 63; Yohe 1990, p. 482).

3.6. Rejection of Quantity Theory Indicators

Having deployed their framework to champion real bills indicators, Fed economists next applied it to reject rival quantity theory ones, specifically the price level and the money supply. Their doctrine taught them that money was demand-determined, that real forces drive the price level, and that causation runs from prices (and real activity) to money rather than vice-versa as in the quantity theory. Accordingly, when Congress held hearings in 1926-27 and 1928 on Representative James G. Strong's proposed legislation to make price-level stability an explicit goal of monetary policy, Fed economists who testified at the hearings expressed their opposition in no uncertain terms.[14]

Regarding the price level, Stewart, Miller, and Goldenweiser denied its reliability or usefulness as a policy guide on several grounds. First, the Fed, they claimed, cannot control the price level. Nonmonetary forces outside the Fed's purview or sphere of influence determine that variable. New York Fed Governor Benjamin Strong, who adhered to some strands of the real bills doctrine while rejecting others, voiced a variant of this argument. Even if money can influence the price level, he declared, it is but one of many factors doing so. Others include a variety of real shocks plus the state of business confidence and the public's expectations of the future, none of which the Fed controls (Strong 1926, p. 482). Quantity theorists including John R. Commons readily agreed with

[14] On Fed testimony in the stabilization hearings see Hetzel (1985), Hardy (1930, pp. 207-18), and Meltzer (1997, pp. 66-79).

this point but still contended that monetary policy was powerful enough to offset these forces and stabilize the price level (Hardy 1930, p. 207).

But Fed economists countered that even if Commons were right and the Fed could indeed stabilize the price level, it nevertheless has no business doing so. The Fed has no right to interfere either with price falls caused by cost-reducing technological progress or with price rises caused by exhaustion of supplies of scarce natural resources. To this contention quantity theorists like Fisher replied that, in the absence of changes in the stock of money per unit of real output, costs of production, whether lowered by technical progress or raised by increased scarcity, influence only the relative prices of individual goods but not the absolute price level, or general average of all prices. For, with the money stock and so aggregate spending held constant, cost-induced rises in the prices of some goods requiring consumers to spend more on those items would leave them with less money to spend on other goods whose prices would accordingly fall. If so, then the rise in the first set of relative prices would be offset by compensating falls in the second set leaving general prices unchanged. Only if cost shocks had an impact on the total volume of output or trade could they alter the price level associated with a given money stock. Fed economists offered no rebuttal to this argument. Instead, they advanced another reason why the general price level is a poor policy guide, namely that the public would confuse it with the prices of specific goods and assume that a policy of price-level stabilization required stabilizing the prices of individual commodities (Hardy 1930, p. 207).

Finally, Fed economists condemned price-level indicators on technical grounds. Stewart (1926, pp. 741-47) dismissed aggregate indexes of the price level as meaningless

averages masking diverse movements of their individual components. And Adolph Miller (1926, pp. 837-38), citing long lags in price adjustment, argued that the price level registers inflationary pressures too late for policy to forestall them. Long-time Fed Board member Charles S. Hamlin (1928, p. 393) added that there are many different measures of the price level, including wholesale price, retail price, and cost-of-living indexes, as well as Snyder's comprehensive composite index. Each measure may behave differently and call for a different stabilization action. What should the Fed do when confronted with alternative index numbers that are simultaneously rising, falling, and remaining unchanged? Which index should it choose?

As for the money stock, Stewart, Miller and company likewise gave it short shrift as an indicator. It was, they claimed, useless as a policy guide because the Fed exercised no control over it. Instead, the public determined the money stock through its demand for bank loans. The money stock was likewise useless as an indicator of inflationary pressure because it did not determine the price level. Or at least it did not do so if created by way of loans made to finance nonspeculative activity. Miller (1928, p. 109) said it all when he insisted that neither of the assumptions of the quantity theory -- that Fed policy causes money stock changes and that the latter cause corresponding changes in the price level -- is true.

The upshot was that Fed officials contended that all the foregoing considerations rendered the quantity theory and its money stock and price-level indicators unfit for policy use. The Fed might collect data on those indicators and report them in its publications. It might even monitor them as background information from time to time. In no case, however, would it use them for stabilization purposes. To influentual

congressmen, economists, and bankers alike the Fed's arguments proved convincing. Quantity theorists were unsuccessful in getting their price stability target enacted into law.

3.7. Incorporation of Open Market Operations

Ironically, the main challenge to the real bills doctrine came not from the quantity theory but rather from the Fed's own discovery in 1922-23 of open market operations as a means of reserve control. In incorporating this new policy instrument into the real bills framework, Board economists evidently reconciled the irreconcilable. That is to say, they reconciled the instrument with a doctrine whose precepts it violated in at least three ways. First, open market operations, involving as they did purchases and sales of U.S. government securities, conflicted with the notion that the Fed should deal solely in short-term, self-liquidating commercial paper. Government securities, according to the pristine version of the doctrine, represented speculative rather than productive use of credit. Second, when the Fed conducted open market operations, it did so at its own initiative. Such active intervention clashed with the principle of passive accommodation according to which the initiative for reserve provision should come not from the Fed but rather from member banks and their customers responding to the needs of trade. Finally, open market operations contradicted the idea that additional means of reserve provision were superfluous since banks could always obtain sufficient reserves at the discount window. How could use of such an instrument be squared with the real bills doctrine?

The discovery of the so-called *scissors effect* permitted the reconciliation.[15] That effect referred to the tendency of compensating changes in discount-window borrowing

[15] The appellation is due to Harold Reed (1930, p. 28) who coined it

to offset open market operations leaving total reserves unchanged (see Friedman and Schwartz 1963, pp. 251, 272, 296; Yohe 1990, p. 483; Stewart 1926, p. 749). Fed officials discovered this phenomenon in 1922-23. To their amazement, they found that open market sales, by removing reserves, tended to induce member banks to come to the discount window to recoup the lost reserves. Conversely, open market purchases, by increasing reserves, enabled member banks to reduce their indebtedness to the Fed by the full amount of the purchases. In both cases, compensatory changes in member bank borrowing tended to counteract the reserve effects of open market operations. Borrowed reserves R_B varied inversely with open market operations *omo* (as measured by changes in the Fed's holdings of government securities) in a one-for-one relationship:[16]

$$(10)\quad R_B = -\,omo$$

or

$$(11)\quad R_B/omo = -1.$$

The scissors effect prompted two interpretations of open market operations consistent with the real bills doctrine. According to the first, such operations constituted a *test* of whether reserves and the deposit money they supported were in excess of the needs of trade (see Board of Governors 1923, pp. 13-14). Open market operations were taken at the initiative of the Fed. But the initiative to borrow or repay at the discount window came from member banks seeking to accommodate the needs of trade. If so, then the extent to which banks borrowed to replace reserves lost through open market sales measured the true, or real bills, demand for such reserves. And the open market operations themselves tested, or revealed, the extent of this demand.

[16] On the one-for one, or dollar-for dollar, relationship between discount-window borrowing and open market operations, see Yohe (1990, p. 483) and Meltzer (1997, p. 184).

Let the Fed apply the test by withdrawing, via open market sales, reserves from the banking system. If banks replenished all the lost reserves through increased borrowing at the discount window, this response proved that reserves and deposits were not excessive. Reserves were not excessive because banks, in borrowing them, had to rediscount real bills equal to them in dollar value. That banks were willing to do so was proof positive that the reserves and deposits were not excessive to the needs of trade. Only if banks failed to recoup, via the rediscount of real bills, all the reserves lost through open market sales would such reserves be proved excessive.

The second interpretation was the more extreme of the two.[17] It held that open market operations could be employed to *control* the volume of discount window borrowing. For if such borrowing varied in an inverse, dollar-for-dollar ratio with open market operations as the $R_B/omo = -1$ scissors effect implied, then the Fed could control the numerator by regulating the denominator. Via open market sales, the Fed could compel banks to borrow just as surely as it could, through open market purchases, spur them to repay their indebtedness. True, the very notion of the Fed controlling discount-window activity through open market operations clashed with the passive-accommodation principle of the real bills doctrine. Nevertheless, other strands of the doctrine were preserved. The Fed was still obliged to rediscount upon demand all the eligible paper offered it at any level of open market operations. Moreover, banks still eliminated their reserve deficiencies and excesses by rediscounting and repurchasing, respectively, real bills at the discount window. Finally, business loan demands still drove

[17] Karl Brunner and Allan Meltzer christened this interpretation the "Riefler-Burgess doctrine" after Winfield W. Riefler and W. Randolph Burgess, the two Fed economists who gave it its classic exposition. Governor Benjamin Strong of the New York Fed was a staunch proponent of the Riefler-Burgess doctrine.

the generation of credit and money with the Fed supplying the necessary borrowed reserves, albeit using open market operations to force banks to borrow. On these grounds, at least, the real bills doctrine was upheld.

3.8. Key Indicators Established

The upshot was to render member bank borrowing and market interest rates the chief indicators of policy. Both were seen as measuring the degree of policy tightness or ease produced by open market sales and purchases, respectively. With respect to the borrowing indicator, the inverse one-for-one relationship between it and open market operations guaranteed that it would be an accurate indicator of the thrust, or pressure, exerted by the latter. Thus, when restrictive open market sales pressured banks to borrow, the magnitude of the borrowing would capture the degree of restriction. Conversely, when expansionary open market purchases spurred banks to repay their indebtedness, the resulting reduction in borrowing would indicate the extent of the ease. The inverse relation ensured as much.

As for market rates, they sent the same signal as member bank borrowing. They did so because borrowing was the chief influence determining them. When borrowing was high, banks, being reluctant to remain continually in debt with the Fed, would be under great pressure to reduce their indebtedness. [18] To obtain the funds to do so, they would call in outstanding loans and curtail further lending. The resulting reduction in loan supply would raise market interest rates. The greater the indebtedness and thus the

[18] Fed economists, notably Riefler (1930) and Burgess (1927), cited a so-called tradition against borrowing or reluctance to borrow that was supposed to make banks eager to repay their indebtedness. Allegedly, such reluctance held even when borrowing was profitable, that is, when a positive spread between bank loan rates and the discount rate indicated that the expected rate of return on the use of borrowed reserves exceeded the cost of such reserves. See Meltzer (1976, pp. 464-65) for a concise summary of the reluctance hypothesis.

urgency to repay it, the greater the upward pressure on rates and so the higher their level. Contrariwise, when borrowing was low and banks had repaid their indebtedness, they would be willing to expand their lending. The resulting expansion in loan supply relative to loan demand would put downward pressure on rates. In this way, market interest rates, varying directly as they did with the scale of member bank borrowing, supplemented the latter as an indicator of the degree of policy ease or tightness (see Meltzer 1976, pp. 464-65).

3.9. Signals Flashed by the Indicators Early in the Depression

Relying on these indicators -- member bank borrowing and market interest rates -- the Fed judged its policy to be remarkably easy in the initial phase (1929-1931) of the Great Depression. The indicators signaled as much. By mid-1931, member bank borrowing and market rates, respectively, had fallen to one-fifth and one-third of their October 1929 levels (Wheelock 1998, pp. 130-31, 133). By all accounts they were extremely low, suggesting that the Fed had already done all it could do to arrest the depression. It was these indicators that the Fed used to justify its policy of inaction.

By contrast, the rival quantity theory indicators -- money stock, price level, and real interest rates -- were flashing the opposite signal. Thus Lauchlin Currie's pioneering series of the M1 money stock showed, for 1930 and 1931, falls of 3.7 and 6.3 percent, respectively. Currie's figures, later confirmed by Clark Warburton (1945, 1946), Lloyd Mints (1950, p. 38; 1951, p. 193), and Friedman and Schwartz (1963), were reported in his Harvard PhD thesis, which he wrote in 1929-30 and submitted in January 1931, and in his 1934 *The Supply and Control of Money in the United States*. Currie's figures were

fully available to the Fed at the time and indeed could have been computed from data it regularly collected from the banking system.

Likewise available were measures of the price level. They had, by 1931, fallen by more than one-tenth of their 1929 level. As for the real interest rate, as measured by the difference between the yield on short-term government bonds and the CPI inflation rate, it had, by mid-1931, risen to a level of 10.5 percent, more that six percentage points above its 1929 level. Clearly here was evidence that monetary policy was extremely tight, not easy, and that expansionary measures should be taken immediately to prevent further contraction in real activity. But the Fed either disregarded these signals or interpreted them as indicating that the money stock was behaving correctly. Indeed, it interpreted falls in the money stock as entirely appropriate given the fall in prices and output. Monetary contraction in response to the decline in nominal income was precisely what the real bills $M = PQ$ equation called for.

4. CONCLUSION

History would have been different had the Fed incorporated quantity theoretic insights into its analytical policy framework in the 1920s and early 1930s. For the quantity theoretic model of the business cycle featured statistical indicators that would have signaled that monetary policy was too tight and in need of easing in the early years of the Great Depression. Acting on those indicators, the Fed could have eased policy and so prevented the depression, or at least mitigated its severity. Instead, Fed officials adhered to an entirely different framework whose indicators signaled that policy was remarkably easy and that the central bank had already done all it could do to arrest the

slump. Accordingly, the Fed did nothing and let the economy slide further into the depression.

The Fed's failure to act shows that its adherence to the real bills doctrine had deleterious consequences. These consequences might have been avoided had the Fed selected, at the outset, the state-of-the-art quantity theory framework rather than the flawed real bills one. The moral is clear: policy measures and measurement, no matter how precise and accurate, can cause great harm when embodied in a theoretically flawed framework.

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