

The Transmission Process

by Allan H. Meltzer*

Carnegie Mellon University

and the

American Enterprise Institute

Our hosts have asked me to speak this evening about the transmission process of monetary policy. I am honored by the request since it comes from a central bank that has an enviable record of conducting monetary policy so as to control inflation. Their success at that endeavor suggests that, formally or informally, they have learned a great deal about tonight's subject. And they have used their knowledge to bring Germany, and now much of Europe, as close to sustained price stability as any large country or region has achieved in many years.

I must confess some vested interests. I first discussed the topic, in a paper with Karl Brunner, more than thirty-five years ago. Brunner and Meltzer (1963). I have returned to the topic many times, most recently in a symposium held only a few years ago. Meltzer (1995) I will refrain from reviewing these earlier studies, although I will refer in passing to some of the main ideas. I will concentrate on two topics. They do not exhaust the subject, but they raise issues that I believe are central.

First, I raise some issues about a current class of models of monetary transmission in which a short-term interest rate represents the transmission process. The class of models is so widely accepted that the conclusions I challenge have become part of the canon. A different class of models -- a more useful one, I believe -- does more than give different answers. Some

* My thanks to Randolph Stempki for his excellent assistance and to Bennett McCallum for helpful discussion.

issues do not arise; they are no longer relevant. And some issues remain relevant but receive a different answer. The role of money is one such issue.

Second, I discuss some of the evidence I have gathered from my study -- *A History of the Federal Reserve* -- the work that has been my main occupation for the past four years. The two pieces are joined, as I hope to show. The evidence from history shows that the transmission process cannot be summarized by a single interest rate. In the final section, I present some econometric evidence to supplement the historical data.

Standard Models of Monetary Transmission

The core or central issue about the transmission of monetary policy is: How does a monetary impulse affect relative prices and real demands as it moves through the economy from its first appearance to its ultimate effect on the main determinants of economic welfare? The standard answer to this question is, now as for some considerable time in the past, that monetary injections change an interest rate in the money market. Because some prices, money wages, or anticipations do not adjust instantly, there are effects on output and employment that, though temporary, may be large and costly. Eventually, relative prices are restored, so the price level changes equi-proportionally. Money is neutral in the long-run.¹

Most of us accept large parts of this story. Real-business cycle theorists would both add and omit, as would other economists. Loan or credit market models make other changes. I shall not dwell on these qualifications, or the relevance of these analyses. Instead, I will use as illustrative a model that represents some of the best recent work on monetary policy to give specificity where it is needed.² Most of my comments apply more generally.

The class of models has two equations, aggregate demand and supply. Aggregate supply is a Phillips-type curve. Important for current purposes is that monetary policy is represented only by the interest rate in the aggregate demand function. An expansive monetary action lowers the nominal interest rate; a contractive action raises the nominal rate. The action is unanticipated, at least as to timing, so the real rate of interest changes with the nominal rate absolutely and relative to the anticipated real rate. In Svensson's (1998) model, that I have used

¹ A similar but more complicated story is told about changes in money growth. Issues about super neutrality are put aside.

² I base my discussion on Svensson (1998). Other references could be used, for example Taylor (1993, 1998).

as a good, clear example, aggregate demand is replaced by the output gap, and the aggregate supply function is adjusted accordingly. This difference is not consequential for my discussion.

The story about transmission embedded in this model is that a change in interest rates changes aggregate demand in the opposite direction. If the interest rate increases, output falls, the output gap increases, so inflation declines, raising the real rate of interest and continuing the process of mutual adjustment of aggregate demand and supply. When the target rate of inflation is reached, the central bank rests, and the economy adjusts to the new equilibrium.

The money stock and the demand for money remain in the background. The central bank sets the interest rate and provides the stock of money required to satisfy demand. The price level is determined with the rate of inflation and output, and so too is the demand for real money balances.

This stripped down model is useful for illustrating the interaction of aggregate demand and supply. As a model of monetary transmission, I believe it is deficient for two main reasons. First, it has implications that are either misleading or wrong. Second, it omits significant parts of the adjustment of relative prices and real wealth to monetary and other shocks and the responses of aggregate demand and output to changes in relative prices and real wealth. These omissions are major parts of the transmission process.

Two False Implications

Many economists have used a model of this kind to discuss monetary policy in the 1930s depression and the long Japanese recession of the 1990s. In both cases, short-term nominal interest rates approached zero. The implication drawn from these experiences is that the monetary authority was powerless because the short-term interest rate was close to zero. The economy was said to be in a liquidity trap. For the Japanese case, see Krugman (1998) and Ito (1998).

A liquidity trap is defined as a condition in which the demand for nominal money balances equals the stock of nominal balances at unchanged prices and interest rates, for all values of the nominal stock. Additions to the nominal stock cannot be transmitted to the real sector or the price level because the interest rate has reached a floor at or near zero.

As is customary in this class of models, assume that all assets are gross substitutes in portfolios. Ignoring transaction and information costs, it doesn't matter which asset the central

bank buys or sells. Whichever asset it buys, the market adjusts the relative prices of all assets to reflect the change in relative supplies.

This is a powerful and useful argument with strong implications. For example, economists use it to show that sterilized foreign exchange market intervention has no effect or to show why unsterilized exchange rate intervention differs from sterilized intervention.

Suppose, now, that with a short-term interest at zero, the Bank of Japan announces that it wants the dollar exchange rate to fall by 50% and that it is prepared to print yen to buy dollars until that occurs. Is there any doubt that the yen would depreciate or that the depreciation would affect spending, output and prices in Japan?

Suppose, instead, that the Bank of Japan makes no announcement but buys dollars with the intention of depreciating the yen by 50%. There may be differences in the timing of responses, but the ultimate effect would be the same: monetary expansion would affect the economy. There would be no liquidity trap whatever the short-term interest rate in the market in which the central bank usually operates.

Two questions occur. First, how can we reconcile our standard assumption of gross substitution with this obvious contradiction. Second, does this argument imply that a liquidity trap is impossible in a multi-asset world?

The liquidity trap, by assumption, makes short-term Treasury bills (or similar security) a perfect substitute for base money or bank reserves. Exchanging one for the other does nothing of interest. Exchanging either money or Treasury bills for some other asset such as foreign money, domestic or foreign long-term bonds, equities, or commodities changes relative prices and real wealth. In this hypothetical case, base money plus bills is a composite good. The composite good is a gross substitute for other assets; increasing either component, or both, is expansive.

For a full liquidity trap to be effective, the composite asset--money plus bills--must be a perfect substitute for all other assets. When the marginal rate of substitution of money for bonds goes to zero, all marginal rates of substitution must go to zero.³ All assets are parts of a single composite good.

³ A more complicated proof of this argument is in Brunner and Meltzer (1968).

If assets other than bills and money remain gross substitutes, a liquidity trap means only that one row and one column in the matrix of marginal rates of substitution has been eliminated. All other marginal rates of substitution remain. Monetary policy remains effective. The standard class of models gives the wrong answer about policy. It implies that a liquidity trap is possible and, for some, is a reality. Krugman (1988), Ito (1988). The alternative denies that a liquidity trap is possible except in the limit when *all* prices are zero.

A closely related proposition has received considerable attention as inflation rates have fallen and remained low in the 1990s. Summers (1991) revived the argument that a zero inflation target is socially costly because it sets a lower bound for nominal interest rates. Monetary policy becomes weak or powerless; it cannot lower the short-term nominal rate or prevent falling prices from raising the real rate of interest. With money wages inflexible downward, unemployment rises. Akerlof, Dickens and Perry (1996) perform the remarkable feat of finding evidence for this proposition using data for a period in which inflation never remained close to zero. And Benhabib, Schmitt-Grohe, and Uribe (1998) argue that it is perilous to use a Taylor rule when inflation is near zero.

A more sophisticated version of Summers' argument uses a stochastic model with non-linearity in the transmission process when inflation is below 2%. Orphanides and Wieland (1998) find that there is no evidence of an operative lower bound in U.S. postwar data. They claim that the lower bound was in effect during the 1930s, so monetary policy was inflexible for part of that decade.

For this claim to be true, the short-term interest rate must be the principal or only means by which by monetary actions are transmitted from the central bank, through the market, to the economy. As my old friend Karl Brunner often said: we know this is false. Monetary actions are effective and powerful in the less developed countries of Africa, Latin America, or Asia where there is no money market. Relative prices respond to monetary impulses in countries without central banks, and without money markets. There is more to the transmission process than the models recognize.

Do these additional channels operate in countries with active money markets? In writing the *History of the Federal Reserve*, I have found three relevant examples from the years 1914 to 1951 that I have researched to date.

Historical Evidence

Each of the examples I consider concerns a period of deflation. Prices fell raising real interest rates through most or all of the recession. Expansive fiscal actions in each episode were either modest or absent. Two of the recessions are considered severe according to rankings by the National Bureau of Economic Research. In each case the economy recovered, and two of the three recessions were of average length.

The common feature that is relevant for the monetary transmission process is that real money balances and real interest rates rose together. In each case there was a common cause: prices fell. In some cases gold inflows or Federal Reserve actions increased the monetary base; in other cases, the monetary authorities were passive or restrictive through most or all of the recession. Differences of this kind are of secondary importance in the three examples (but not in the great depression). The dominant, common impulse in the three examples was deflation.

Two of the three episodes share a second relevant feature; the interest rate on short-term Treasury bills was historically low. During the 1948-49 recession, rates on Treasury bills were about 1%. In 1937-38, bill rates were close to zero. In the third case, 1920-21, short-term rates remained well above zero, but the deflation was sharp and severe, so real interest rates and real money balances rose together.

1937-38

The National Bureau ranks the 1937-38 recession as the third most severe recession in the years after World War I. Real GNP fell 18% and industrial production 32% in the thirteen months from May 1937 to June 1938. Unemployment reached a peak of 20%, not very different from the 25% peak in 1932.

The probable causes of the recession include both fiscal and monetary actions. There is a very large reduction in the government deficit in 1937 and a very large reduction in growth of the monetary base. The main fiscal actions are the end of the soldiers' bonus payment, the enactment of an excess profits tax to pay for part of the bonuses in fiscal 1937, and the start of social security tax collections in fiscal 1936. The soldiers' bonus is the largest item, \$1.7 billion of current spending. It was paid in June 1936, in time for the election later that year. The bonus was paid in bonds, but the bonds could be sold for cash. By December 1936, \$1.4 billion had

been cashed. Gordon's quarterly data show an 18% average rate of increase in real GNP for the last three quarters of 1936.

The most important monetary actions are the beginning of gold sterilization at the end of 1936 and the second and third increase in reserve requirement ratios in March and May 1937. These increases completed the doubling of reserve requirement ratios between August 1936 and May 1937.

During the entire period December 1936 to December 1938 that brackets the recession, interest rates on Treasury bills remained between 0.03% and 0.56%. Long-term nominal rates on Treasury bonds were modestly higher during the recession than before or after, but the difference is small; the range is 2.55% to 2.83%.

Annualized monthly rates of price change are consistently negative from October 1937 to February 1938 and intermittently negative for the rest of 1938. To smooth the data, I used moving twelve month averages of rates of price change. Chart 1 compares the real interest rate to the annual growth of the monetary base.

Insert Chart 1 here

The common element in the two series is the twelve month moving average of the rate of price change. The divergence between the two series reflects some release of sterilized gold into the monetary base in September 1937 and a small volume (\$38 million) of open market purchases in November, principally for seasonal reasons.

Not until February 1938, after nine months of a deep recession, did the Federal Reserve propose countercyclical action, the release of additional gold from sterilization. In April, the Roosevelt Administration announced \$2 billion of additional government spending for construction and relief. As part of this program, the Treasury released another \$1.4 billion from sterilization and the Federal Reserve released \$750 million of reserves by lowering reserve requirement ratios.

Chart 1 shows the sustained rapid increase in the real value of the monetary base beginning in February 1938. Real final sales rose in the following quarter, but inventories fell, so real GNP did not increase until the third quarter.

What does this episode suggest about the transmission of monetary policy? In the months preceding recovery, and in the early months of expansion, the real interest rate rose from 2.9% in January 1938 to more than 6% in September through November 1938. Although

nominal rates remained historically low, real rates were relatively high. In contrast, real money balances accelerate five months before the end of the recession; between February and June, growth of real balances rises from -7.6% to 17.6%. By the end of 1938, growth of real balances reached an almost 25% annual rate.

I draw three conclusions for the transmission process. First, low nominal interest rates misled the Federal Reserve, on this occasion as on others, into believing that monetary policy was expansive. Second, although short-term interest rates stayed at or near zero, monetary policy was not powerless. Desterilizing gold to increase the monetary base raised nominal and real money balances and increased spending. Third, the financial system was not in a liquidity trap. Channels other than the short-term interest rate transmitted monetary expansion to output and the price level.

1948-49

The 1948-49 recession provides a second example refuting the liquidity trap and the reduced effect of monetary policy at low nominal interest rates. The Federal Reserve pegged nominal long-term interest rates below the 2.5% ceiling in effect from 1942 to 1951. Despite the pegging policy, the monetary base fell through most of 1948. The principal reason is that the Treasury used its budget surplus to retire debt held by the Reserve banks. The monetary base fell as a consequence of the Treasury's actions. Although the Federal Reserve complained about being an engine of inflation, prices fell in half the months of 1948 and 1949.

The National Bureau dates the end of the expansion in November 1948 and the recession trough in October 1949. The twelve-month moving average rate of inflation fell from above 9% in June and July 1948 to negative values in May 1949. It remained negative for the rest of that year.

During most of the recession the Federal Reserve was more concerned about a return of inflation than about the recession. The nominal rate on Treasury bills remained between 1.02% and 1.17% throughout the recession.

Chart 2 compares annual growth of the real monetary base to the real interest rate in the two years that include the recession. Data are computed as in Chart 1. As before, the high positive correlation reflects the common effect of the rate of price change on the two series. The high correlation and parallel movement show that until late in 1949, when the recession was almost over, the Federal Reserve took few actions to increase base growth.

Insert Chart 2 here

Real base growth fell to -11% in September 1948, two months before the cyclical peak. Thereafter base growth rose, but did not become positive until April 1949, six months before the

trough. The peak rate of base growth is close to 6% in August 1949, two months before the end of the recession. At that time the real long-term interest rate was above 5%.

Once again, the movement of real base growth is consistent with the beginning and end of recession; the movement of real interest rates is not. Once again, low nominal short-term interest rates do not appear to have weakened the effects of monetary policy. And once again there appears to be more to the transmission process than is contained in standard models.

1920-21

The third episode is the recession from January 1920 to July 1921.⁴ The National Bureau ends the expansion in January 1920 and puts the last month of recession in June 1921. The Federal Reserve undertook larger policy actions, so nominal interest rates and nominal base growth reflect these actions. Inflationary policies in much of Europe and restrictive policies in the U.S. brought an inflow of gold. The base and interest rate changes reflect these influences also.

Nevertheless, real base growth and real interest rates are positively correlated during the recession. Both are negative at the start of the recession, turn

⁴ For this period, the monetary base is high-powered money from Friedman and Schwartz (1963). The price index is not seasonally adjusted.

positive about a year later, and reach a peak at the end of the recession. Judged by base growth, monetary actions are countercyclical in the first half of 1921; judged by real interest rates, these actions are procyclical.

Chart 3 shows these data. The long-term nominal rate remains within a narrow range but is higher at the trough of the recession than at the previous peak. The dominant influence on real rates and real base growth during the recession is the decline in inflation followed by deflation.

Insert Chart 3 here

As in the previous two episodes, interest rates give a misleading signal about the thrust of policy. Real base growth gives a more correct signal. In this recession, the deflation is severe; the peak annualized rate reached 17%, and it was above 10% for ten consecutive months. The real long-term interest rate, $(i-\pi)/(1+\pi)$, is above 25% at the end of the recession. The economy recovered despite, not because of, the level of real interest rates.

The three historical periods raise doubts about the central role assigned to interest rates in the transmission process. They suggest an important role for real balances. I return to these issues below.

The Great Depression

The only other period of U.S. deflation after 1914 is during 1929 to 1933, the great depression. The real interest rate rose from 5% to 15% and remained near 15% through the last two years of the recession. Real base growth rose once bank runs began late in 1930, but this is, of course, misleading. As Chart 4 shows, growth of real balances--measured here by M_1 -- is very different in this period than in other deflationary periods. A principal difference is that monetary contraction was strong enough to offset the effects of deflation on real balances.

Chart 4 here

An Additional Problem

Although the central bank's objective function is not directly part of the transmission process, the three U.S. recessions considered here raise doubts about the choice of objective function used in current analyses. The usual function has two arguments: (1) the difference between the inflation target and the actual or expected inflation rate and (2) the output gap, the difference between actual output and output consistent with the natural rate. Yet, we have seen that faced with deflation and a deep recession (in three of the four episodes) the Federal Reserve was slow to act. And it did not act effectively to end deflation and recession. The objective function fails in these cases as a positive statement of central bank objectives.⁵

My concerns about the standard objective function are not limited to its empirical support, important as that is. I believe that using the output gap as an objective of the central bank is problematic. This gap can arise for reasons unrelated to monetary policy actions, as examples an oil shock, reductions in employment and output in the European Union resulting from provisions of the welfare state, or other real events. My colleague Bennett McCallum suggests that the problem can be overcome by redefining the natural rate to take account of non-monetary effects. In principle, this can be done; in practice it is difficult to do accurately.

The natural rate is not like the gravity constant. We neither measure it precisely nor agree on its value. Opening the objective function to the pull and tug of opinions about the size of the gap carries a risk to economic stability and the apolitical position of an independent central bank. Recent discussion in Europe and the United States shows that there can be differences of opinion about measurement of both potential output and the natural rate of unemployment.

A second problem with the now standard objective function is that it neglects several issues of concern to central bankers. There is no role for a lender of last resort. A run to currency, bank failures, a drain of foreign exchange reserves, a major change in the exchange rate, or a so-called credit crunch enters the bank's objective function only by changing the output gap or inflation. This misstates what central banks do. Properly functioning central banks respond to the increased demand for money before output and prices fall.

Officials of the new European Central Bank emphasize that inflation is their sole objective. Their insistence on this point does not, and should not, preclude concern for the cost

⁵ Some may object that studies of Taylor's (1993) rule support use of the objective function as currently relevant. Orphanides (1998) argues that this evidence is much less compelling if we restrict the Federal Reserve to data available at decision time.

of achieving the zero or target rate of inflation. This cost should appear in the objective function, so that the objective is not just to achieve zero inflation but to do so at minimum social cost.

With cost replacing the output gap in the objective function, the way is open to treat other issues of concern. The implicit cost function used by central banks includes costs of maintaining or restoring financial safety or solvency, avoiding a credit crunch, or increasing unemployment. In practice, even central banks most concerned about inflation do not ignore the social cost of reducing inflation. They proceed gradually, over a period of months or years. And they, properly, do not ignore financial fragility, financial failures, and lender of last resort responsibilities when making decisions. In fact, the opposite seems to be true; some central banks have recently been overly sensitive to financial fragility. The Federal Reserve's decisions to reduce interest rates three times in the autumn of 1998 suggests that financial fragility, or its prospective costs, influences what central banks do. Since these changes were made at a time of high employment and rapid money growth, the experience suggests that, at times, fragility may enter lexicographically in the central bank objective function. The size and direction of change in real money balances may be useful measures of some of the costs of systemic financial fragility.

Econometric Evidence and Interpretation

The three historical episodes discussed earlier suggest that an interest rate does not fully represent the monetary transmission process. Changes in real money balances appear at times to dominate changes in real interest rates as indicators of the direction of change induced by monetary actions.

One interpretation of this evidence follows from the Haberler-Pigou-Patinkin wealth effect. Falling prices raise private sector real money balances, increasing real wealth. Some of the increase is spent on consumption. A second interpretation views the change in real balances as a mixture of a pure wealth effect and the changes in wealth induced by changes in the relative prices of assets and output. Brunner and Meltzer (1963, 1968). On either interpretation, we lose the simplicity of the two equation, aggregate demand-aggregate supply, class of models. If real balances affect aggregate demand, the demand for money and perhaps other parts of the financial structure become relevant for the transmission process. The single interest rate is no longer sufficient to represent monetary policy and financial markets.

Let me turn the issue around. The requirements of the standard model are strong and are, as we have seen, easily falsified empirically using historical episodes. Analytically, the model is very demanding. Not only must the wealth effect remain small and inconsequential for spending, but a single interest rate must represent all relative price adjustment.

An appeal to rational expectations puts additional burdens on credibility. Market makers and participants must rationally anticipate how much output prices will change to restore equilibrium at the natural rate. One data point, one observation on the interest rate, is not sufficient to determine whether the change is permanent or temporary, a change in level or in growth rate, or an error that will be reversed. Even if one believes that adjustment is rapid in markets for actively traded assets, many assets are traded infrequently or not at all.

The transmission of monetary policy involves adjustment of prices of existing hotels to newly produced hotels, existing plants and equipment to newly constructed plants and equipment, new cars to used cars, new houses to existing houses, and, of course, money wages to prices

I do not propose adding equations for each of these variables. That would take us toward large-scale econometric models, a technology that has not contributed greatly to our understanding of monetary policy. But there is also considerable evidence that the expectations theory of the term structure or interest arbitrage theories of the exchange rate are far from adequate. This latter evidence suggests, again, that a single interest rate does not summarize adequately responses in asset and output markets.

Recent analyses of the credit channel exploit differences in information to develop an additional transmission channel for monetary actions. Bernanke and Gertler (1995). The credit channel operates parallel to the interest rate (or monetary) channel, and the two interact. Empirical support for this channel has not been persuasive; the hypothesized effect is probably swamped by the endogenous response of bank loans to the monetary base and other determinants of aggregate demand. The use of costly information to separate parts of the transmission process is a step forward, however. It may find a better use distinguishing markets for bonds and real capital or distinguishing different types of capital.

How well do real money balances capture the many channels of monetary transmission? Koenig (1990) tested a two-stage model of changes in consumption with changes in real money balances, real interest rates, income, and other variables as arguments of the consumption

function. Consumption includes only purchases of non-durables and services. The interest rate is adjusted for inflation. All variables other than the interest rate and a dummy variable are in logarithms. The dummy variable takes a value of unity in 1980 and after to represent financial deregulation. All economic variables are used as first differences.

Using data for the period from second quarter 1951 through first quarter 1986, Koenig found that changes in real money balances had a significant positive effect on changes in consumption. To test his finding, Koenig introduced lagged values of changes in durable goods, income, consumption, and stock prices sequentially as additional explanatory variables. None was significant at the 5% level; in all cases the change in real money balances remained positive and significant.⁶

Koenig finds evidence of a relatively strong real balance effect. A 10% change in real balances, *ceteris paribus*, results in a 2-1/2 to 3% change in spending on consumption. This result is in addition to any effect of real balances on the real interest rate and, thus, indirectly on consumption. Koenig found the latter effect relatively small, however. He used a short-term interest rate.

In the three historical episodes discussed earlier, real balances rose in each recession. In two of the recessions, the increase was more than 13.5% from peak to trough. In 1948-49, the increase was less than 1% from peak to trough but 3 to 4 times larger if measured one month before the trough. If Koenig's estimates apply to these out of sample cycles, they imply a 3-1/2 to 4% increase in consumption spending in the two earlier recessions. This result is economically meaningful.

To test this hypothesis, I attempted first to replicate Koenig's results. Then I extended his sample period by 30%, an addition of 42 quarterly observations. Most of the attempts at replication supported his hypothesis; in fact, the only important change strengthens his findings.

Koenig presents several different two stage least square estimates. I was able to replicate many of his findings. Table 1 reports only a small part of the results, but many of the results are of interest principally because the main results are robust to changes in the arguments included in the estimation. All results are two stage least squares estimates.

⁶ Definition of variables is in Koenig (1990, pp. 422-24) We have used his definitions wherever possible, but we are uncertain about his measurement of interest rates--end of quarter, quarterly average, etc. Interest rates are after tax rates, where tax rates are marginal rates from Barro and Sahasakul (1983). We assumed constant marginal rates after 1980.

Table 1 here

Table 2 shows some results for the extended sample. The first two columns use changes in real M_1 balances, as in Koenig's work. The last two columns replace M_1 with the St. Louis monetary base, the variable I used in the historical data after 1935.

Table 2 here

Other estimates using lagged values of money, real income, stock prices, and other variables give similar results. The only change that made a substantial difference was omission of the dummy variable used to shift the intercept after 1980.

These findings suggest, again, that the transmission of monetary impulses involves more than is found in the standard class of models. Changes in real money balances, operating as a wealth effect or as a proxy for changes in both relative prices and real wealth supplement the effect of interest rate changes.

Table 1
Response of Consumption to Real Balances
And Other Variables
1951:2 - 1986:1

	Koenig (1990)		Replication	
Constant	0.0058*	0.0056*	0.0064*	0.0061*
	(0.0005)	(0.0006)	(0.0004)	(0.0007)
Dummy	-0.0048*	-0.0047*	-0.0056*	-0.0055*
	(0.0012)	(0.0012)	(0.0011)	(0.0012)
Δr	0.1948	0.1949	0.4490*	0.4458*
	(0.1247)	(0.1235)	(0.1740)	(0.1738)
$\Delta \ln m$	0.2851*	0.2738*	0.3046*	0.2907*
	(0.0588)	(0.0624)	(0.0851)	(0.0910)
$\Delta \ln c(t-1)$		0.0307		0.0258
		(0.0754)		(0.0778)
R^2	0.37	0.37	0.37	0.37
DW	1.94	1.99	1.99	2.02

Standard errors in parentheses

*Significant at 5% level

Table 2
Response of Consumption to Real Balances:
Extended Sample
1950:4 - 1995:4

	m = real m_1		m = monetary base
Constant	0.0064* (0.0005)	0.0060* (0.0007)	0.0060* (0.0005)
Dummy	-0.0044* (0.0009)	-0.0042* (0.0010)	-0.0049* (0.0010)
Δr	0.3212* (0.1293)	0.3090* (0.1333)	0.3105* (0.1369)
$\Delta \ln m$	0.2688* (0.0583)	0.2542* (0.0590)	0.3193* (0.0925)
$\Delta \ln c(t-1)$		0.0419 (0.0747)	
R^2	0.13	0.15	0.14
DW	1.91	1.99	1.98

Conclusion

Viewed one way, the point of this paper is an old one, one that is well-known as the Pigon-Haberler-Patinkin real wealth effect. The conclusion in that case would be that the wealth effect is more relevant in a dynamic context than current, standard analysis recognizes.

An alternative interpretation is that the dynamic real wealth effect includes more than the direct effect of changes in real money balances. If anticipated returns and anticipated inflation affect prices of assets with low transaction costs more rapidly than the prices of new production, many changes in relative prices of assets to output are part of the transmission process. As home prices change relative to foreign prices, the real exchange rate changes. This change is supplemented by a change in the nominal exchange rate in a fluctuating rate regime.

The standard model includes a type of Phillips curve, so prices do not adjust instantly to changes in money. Hence real balances change cyclically. The consumption equation in the text suggests that the effects of monetary change are not fully expressed by a change in a single short-term interest rate. A recent study of forecast performance in Germany suggests that this finding is not limited to the United States. Kirchgassner and Savioz (1998).

Rather than rely on a single regression equation, I have used data from periods of deflation to show that changes in real interest rates cannot explain some major episodes in monetary history. In 1920-21, nominal interest rates were higher at the trough than at the preceding peak. Prices fell sharply, so real interest rates were higher still. Postwar fiscal policy was contractive.

Why did the economy recover? Falling prices raised existing real wealth and increased the gold flow to the United States. Real money balances rose rapidly. The same process worked to end the 1937-38 recession and, more modestly, the 1948-49 recession. Even in the 1929-33 depression, real balances played a role. This time, the money stock fell in most periods by more than the price level, so the real wealth effect did not sustain expansion.

Evidence from periods of deflation is useful because deflation raises both real interest rates and real money balances. Change in interest rates and money have different implications; one points to expansion and an end to recession, the other to continued, possibly deeper recession. In periods of inflation, real interest are often low in recession, while real money balances may fall. Monetary expansion reduces interest rates and raises real balances. Both transmission processes are at work, so it is more difficult to reliably separate their relative

importance. Econometric work of the past quarter century testifies to the difficulty of distinguishing the two effects when prices are rising.

Secular and permanent changes in real balances supplement the cyclical changes that I have stressed. The introduction of the Euro is one such permanent change. The breakdown of Bretton Woods, financial intermediation, and other long-term changes affected relative demands for real balances. Such changes have persistent effects that, at times, dominate short-term changes. Currency crises also are transmitted through changes in demand for real balances as well as through interest rates and exchange rates. The current standard model neglects these secular changes in the demand for real balances.

Central bankers choose to conduct their operations by changing an interest rate, usually a short-term rate. This need not be harmful. The central bank must adjust the interest rate enough to prevent deflation and inflation, having regard to the cost of maintaining zero expected inflation. Whether making a discretionary judgment or following a rule, history suggests that the bank will avoid large, costly errors if it does not ignore the role of changes in nominal money and in real balances when making its decisions.

Bibliography

- Barro, Robert J. and Sahasakul, Chaipat, (1983). "Measuring the Average Marginal Tax Rates from the Individual Income Tax", *Journal of Business*, 56: (October), pp. 419-52.
- Benhabib, J., Smith-Grohe, S., and Uribe, M., (1998). "The Perils of Taylor Rules", (unpublished). C.W. Starr Center for Applied Economics, New York University (November).
- Bernanke, Ben S. and Gertler, Mark, (1995). "Inside the Black Box: the Credit Channel of Monetary Policy Transmission", *Journal of Economic Perspectives*, 9: pp. 27-48.
- Brunner, Karl and Meltzer, Allan H., (1963). "The Place of Financial Intermediaries in the Transmission of Monetary Policy", *American Economic Review*, 53: (May), pp. 372-82.
- Brunner, Karl and Meltzer, Allan H., (1968). "Liquidity Traps for Money, Bank Credit and Interest Rates", *Journal of Political Economy*, 76: (Jan.), pp. 1-37.

- Friedman and Schwartz, (1963). *A Monetary History of the United States, 1867-1960*. Princeton: Princeton University Press for the National Bureau of Economic Research.
- Ito, Takatoshi, (1998). "Japan and the Asian Financial Crisis: The Role of Financial Supervision in Restoring Growth". Presented at a conference on the "The Japanese Financial System". New York: Columbia University, October 1-3.
- Kirchgassner, Gebhard and Savioz, Marcel, (1998). "Monetary Policy and Forecasts for Real GDP Growth: An Empirical Investigation for the Federal republic of Germany", (unpublished). University of St. Gallen.
- Koenig, Evan F., (1990). "Real Money Balances and the Timing of Consumption", *Quarterly Journal of Economics*, (May), pp. 399-425.
- Krugman, Paul, (1998). "Japan's Trap", Krugman web page, MIT (May).
- Meltzer, Allan H., (1995). "Monetary, Credit, and (other) Transmission Processes", *Journal of Economic Perspectives*, 9: pp. 49-73.
- Orphanides, Athanasios, (1998). "Monetary Policy Evaluation with Noisy Information", (unpublished) Board of Governors of the Federal Reserve System, (October), Finance and Discussion Series, 1998-50.
- Orphanides, Athanasios and Wieland, Volker, (1998). "Price Stability and Monetary Policy Effectiveness when Nominal Interest Rates are Bounded at Zero", (unpublished). Board of Governors, Finance and Discussion Series, 1998-35.
- Summers, Lawrence, (1991). "How Should Long-Term Monetary Policy Be Determined?", *Journal of Money, Credit and Banking*, 23: (August, part 2), pp. 625-31.
- Svensson, Lars, (1998). Monetary Policy Issues for the ESCB, presented at the Carnegie-Rochester Conference, November.
- Taylor, John B., (1993). Discretion versus Policy Rules in Practice, *Carnegie-Rochester Conference Series on Public Policy*, 39: pp. 195-214.
- Taylor, John B., (1998). *Monetary Policy Rules*. Chicago: University of Chicago Press, (forthcoming)..