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# Asymmetric Effects of Monetary Policy

By Donald P. Morgan

**D**oes tight monetary policy slow the economy more than easy monetary policy accelerates the economy? Recent U.S. experience suggests that may be the case. When monetary policy was tight in 1988 and 1989, the economy seemed to slow in response. Yet when monetary policy was eased in 1990, the economy did not respond accordingly.

The suggestion that monetary policy has such asymmetric effects is not altogether new or unorthodox. Indeed, mainstream economists adopted this view for several decades after the Great Depression, when easy monetary policy seemed powerless to revive the economy. Recent studies have revived interest in the asymmetric effects of monetary policy. Theoretical research has suggested reasons why tight policy may have more impact than easy policy. And empirical studies, which use monetary growth to identify the stance of policy, have produced evidence of asymmetry.

Of course, not all changes in monetary growth may reflect changes in policy. Recent growth in M2, for example, has been very slow even though monetary policy, judging from the statements of policymakers themselves, has been decidedly

easy. Moreover, various measures of money can give contradictory indications of the stance of monetary policy. So studying only the monetary aggregates may lead to the wrong conclusions about the stance and the impact of policy.

This article looks for evidence that monetary policy has asymmetric effects using two alternative measures of the stance of policy: (1) the federal funds rate and (2) a narrative index based on the statements of policymakers. The article finds some evidence of asymmetry using both measures of policy. The first section of the article traces the history and possible causes of asymmetry. The second section presents some evidence that the impact of monetary policy is asymmetric.

## ROOTS OF ASYMMETRY

The notion of asymmetry was born in the Great Depression. That event convinced many that easy policy was powerless against recessions, even if tight policy could check a boom. One reason heard then for asymmetry is still heard today: a loss of confidence by firms and consumers during recessions makes monetary policy less effective. Two other reasons given today are credit constraints that augment only tight policy, and prices that are less flexible downward than upward.

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### *History of asymmetry*

Economists have entertained the possibility of asymmetry off and on for decades. Until the end of the 1920s, most believed the impact of monetary policy was symmetric. It was thought that policymakers controlled a lever that could lower or raise the level of economic activity equally well. By raising interest rates, the Federal Reserve could slow the economy, and by lowering rates, the Fed could stimulate the economy. The apparent success of monetary policy in turning around mild recessions in 1924 and 1927 bolstered faith in the effectiveness of easy policy (Hansen).

This faith in easy policy was shaken by the Great Depression, which convinced many economists that only tight policy was effective. After the economy turned down in 1929, short-term nominal interest rates soon declined to less than 1 percent. The low level of interest rates convinced the Federal Reserve it was pursuing an easy monetary policy. Yet the Depression persisted until 1934, leading many to conclude that easy policy was futile, "like pushing on a string."<sup>1</sup>

According to monetary historians, the notion of asymmetry was widely adopted in the 1940s and 1950s (Mayer, Johnson). This view was also held by some within the Federal Reserve. A vice president of the Federal Reserve Bank of New York, for example, began an article in 1951, stating, "Two decades ago it still bordered on heresy to suggest that central bank control over interest rates was useless . . . Today that heresy has become widely accepted as dogma" (Roosa, p. 1).

Belief in asymmetry diminished in the 1960s and 1970s, after Friedman and Schwartz reexamined the monetary history of the Great Depression. Their analysis showed that monetary policy was not easy in the early 1930s, but actually was tight. So rather than proving monetary policy was impotent, they argued, the Great Depression was "tragic testimonial" to its power. This observation seemed to effectively weaken the primary evidence that easy policy was ineffective. By 1969,

Mayer concluded: "Belief in asymmetry of monetary policy has lost much of its support" (p. 150).

The loss of support for asymmetry, however, may have been premature. After all, Friedman and Schwartz's observation about the Great Depression proved only that tight policy was effective, not that easy policy was equally effective. And the recent sluggish recovery has once again shaken some observers' faith in the power of easy policy.<sup>2</sup> Moreover, recent theoretical research suggests reasons why easy policy may be less effective than tight policy.

### *Reasons for asymmetry*

*Changing outlook.* One reason monetary policy might have asymmetric effects is because business and consumer confidence changes over the business cycle. This changing outlook could lead to asymmetry if firms and consumers are more pessimistic during recessions than they are optimistic during booms, or if the outlook of firms and consumers simply matters more during recessions.

It is easy to see how pessimism may thwart easy policy. If firms have a dim outlook on their business prospects, lower interest rates may not stimulate borrowing and investment. Similarly, if employment prospects are bleak, lower interest rates will not boost consumer spending on durables.

Pessimism was, and still is, a commonly invoked reason why easy policy may be weak. During the Great Depression, pessimism was thought to discourage borrowing and lending, thus countering the supposedly easy policy. The saying then was "You can lead a horse to water . . ." And just a year ago, Federal Reserve Board Chairman Greenspan pointed to the low "state of consumer and business confidence" as a reason the economy had responded sluggishly to easy policy (p.1).

Yet pessimism by itself cannot explain why easy policy is less effective than tight policy. During booms, the outlook of firms and consumers

changes from pessimism to optimism. And optimism presumably weakens the impact of tight monetary policy, just as pessimism weakens the impact of easy policy.

For a changing outlook to explain asymmetry, pessimism must weaken easy policy more than optimism weakens tight policy. This requirement would be satisfied if the outlook itself changes asymmetrically over the business cycle, that is, if firms and consumers are more pessimistic during recessions than they are optimistic during booms. This requirement would also be satisfied if the outlook simply matters more during recessions, meaning that firms and consumers worry more about the outlook and pay less attention to interest rates during recessions than during booms.

While both of these conjectures about business psychology might be true, they are still weak reeds to rely on for explaining asymmetry. There are, however, more compelling reasons.

*Credit constraints.* Monetary policy may also be asymmetric due to the interaction of credit constraints and the demand for credit. Credit constraints arise if tight policy makes banks less willing to lend to some borrowers.

Tight monetary policy can lead to credit constraints if banks are unwilling to lend to riskier borrowers when market rates are high. As tight policy pushes up market rates, banks' cost of funds increases because banks must raise deposit rates along with market rates. All else equal, banks would simply pass on the higher cost of funds to borrowers by raising loan rates. But all else is not equal because higher loan rates can increase the risk of bankruptcy by increasing the borrower's obligation to the bank. If higher loan rates threaten to increase bankruptcy risk too much, banks may ration the quantity of credit available to riskier borrowers, leaving them credit constrained.

The interaction of such constraints and the demand for credit can skew the impact of monetary policy. By driving up market rates, tight monetary policy tightens the credit constraint on

some borrowers. Given a growing economy and strong demand for credit, the constraint effectively limits spending by these borrowers. This *binding* constraint augments the impact of tight monetary policy, leading to a larger decline in borrowing and spending than would result from higher market interest rates alone. On the other hand, easy policy relaxes credit constraints by lowering market rates. Relaxing the constraints, however, will not necessarily boost borrowing and spending if a slowing economy has reduced the demand for credit. In other words, if the credit constraint is no longer binding before policy is eased, relaxing the constraint will not augment easy policy.<sup>3</sup>

This reasoning suggests that if the credit constraints bind only when policy is tight and the demand for credit is strong, then tight policy will be more powerful than easy policy.<sup>4</sup> This explanation of asymmetry seems more compelling than the changing outlook story because it has been sketched out in theoretical models and has some indirect empirical support.<sup>5</sup>

*Prices less flexible downward.* Another explanation for asymmetry involves the relative flexibility of prices. Monetary policy will have asymmetric effects on real output if prices are less flexible downward than upward. In that case, tight policy will cause output to fall with little change in prices, while easy policy will cause prices to rise with little change in output. Recent theoretical research suggests that prices may be inflexible downward because firms are already inclined to raise their prices to keep up with trend inflation regardless of whether policy is tight or easy.

These theories all begin with the assumption that it is costly for firms to adjust prices simply because firms must issue new price lists to their customers. Such "menu" costs make it expensive for firms to continuously adjust prices to their desired level. To economize, firms will set an initial price based on expected growth in spending for some period, say, a year. In the meantime, firms' desired price may change because of unexpected changes in spending. Firms may therefore

choose to adjust prices periodically when their initial price is too far from their desired price.

Trend inflation in this scenario will lead firms to adjust their prices asymmetrically in response to changes in monetary policy. Suppose policy was eased to a certain degree during the year, causing spending to rise. Although the higher spending would increase a firm's desired price above its initial price, the difference might be too small to justify the cost of adjusting prices. Trend inflation also increases the desired price, however, because firms wish to keep their individual prices in line with the general price level. The higher spending, together with inflation, might very well lead firms to increase prices rather than output.<sup>6</sup>

Reversing this logic reveals how trend inflation makes firms less likely to lower prices when monetary policy is tightened to the same degree. Although the resulting decline in spending inclines firms to lower prices, inflation inclines them to raise prices. The overall effect may wash, so that instead of cutting prices in response to lower spending, firms reduce output. Trend inflation can therefore cause prices to be less flexible downward than upward, which in turn leads to asymmetric effects of policy on output.

This explanation of asymmetry seems the most compelling both theoretically and empirically. While the discussion above simply traces the story, the explanation has been fully developed in several models (Tsiddon; Ball and Mankiw; Caballero and Engel). And empirical tests support the models. Caballero and Engel, for example, gathered data on 37 countries with low to moderate inflation rates. They found that as inflation rises across countries, the impact on output of unexpected increases in spending falls, just as the models predict.<sup>7</sup> Caballero and Engel, however, studied the effect of spending changes in general, not just changes due to monetary policy.<sup>8</sup> So the question remains whether monetary policy in particular has asymmetric effects.

## EVIDENCE OF ASYMMETRY

Evidence that monetary policy has asymmetric effects was found by recent studies using the monetary aggregates to identify the stance of policy. Additional evidence is presented here when policy is identified using the federal funds rate and an index based on policymakers' statements.

### *Evidence using the aggregates*

A recent study by Cover found evidence that monetary policy has asymmetric effects. Using quarterly data beginning in 1949, Cover estimated the effect of changes in M1 on output growth.<sup>9</sup> He discovered that declines in money growth usually had a substantial and statistically significant effect on output. In contrast, he found that increases in money growth usually had a small and statistically insignificant effect on output.

Others have subsequently researched Cover's findings using different sample periods and different data. One researcher found the same results even if the sample excluded the Volcker era of 1979 to 1987, which included a period of severely tight policy.<sup>10</sup> Delong and Summers found similar results using annual data back to the turn of the century. This author found very similar results using the broader monetary aggregates, M2 and M3, which sometimes—as is the case recently—diverge from the narrower M1 aggregate.<sup>11</sup> These various extensions suggest Cover's results do not merely reflect his choice of sample period, data frequency, or monetary aggregate.

A potential problem remains, however. All these extensions identify the stance of policy using the monetary aggregates, which can be misleading because not all changes in monetary growth reflect changes in policy. Current slow growth in M2 and M3, for example, may largely reflect portfolio shifts to higher yielding stock and bond funds, rather than tight policy. And over the longer sample periods covered in the studies just discussed,

variation in money growth could simply reflect changes in current output rather than changes in policy. If so, estimates of the impact of money growth on output will be inaccurate because the estimates will also measure the reverse impact of output on money growth. This identification problem has led researchers to consider alternative measures of the stance of policy.

### *Evidence using alternative policy measures*

Some researchers now advocate using the federal funds rate to identify the stance of policy (Bernanke and Blinder). Others are returning to an older, narrative approach in which the stance of policy is identified by the statements of policymakers themselves (Romer and Romer).

*The federal funds rate.* The funds rate is a natural way to identify the stance of policy because policymakers have targeted this rate on and off for the last 30 years. Changes in the funds rate appear to have an asymmetric impact on output, just as changes in money growth do. The evidence is weaker, though, when the sample excludes the period in the early 1980s when policymakers dropped the funds rate target.

Measuring the stance of policy directly with the federal funds rate raises problems, however, because not all changes in the funds rate reflect changes in policy. For example, if the economy is growing rapidly and other market rates are on the rise, policymakers may let the funds rate drift up in step, even though they are not actively tightening policy. Similarly, policymakers may let the funds rate drift up with inflation, even though they are not tightening policy.

Identifying changes in the funds rate that reflect changes in policy calls for a two-stage regression procedure.<sup>12</sup> In the first stage, the level of the funds rate is regressed on its own lagged values, on current and lagged values of output growth and inflation, plus a constant and a trend variable.<sup>13</sup> The variations in the funds rate not

explained by those variables, the residuals, are used to identify the stance of policy. The positive residuals represent tight policy because the residuals measure how much the current funds rate exceeds the level predicted by current and lagged values of output and inflation. The negative residuals represent easy policy, when the funds rate is lower than would be expected given current and lagged values of output and inflation.

In the second-stage regression, the real growth rate of output (the change in the log) is regressed on a constant and trend variable, lagged output growth, and lagged values of positive and negative residuals of the funds rate as shown in the equation below.

$$\Delta \log Y_t = a + b * Trend + \sum_{i=1}^8 C_i * \Delta \log Y_{t-i} + \sum_{i=1}^8 d_i * FF_{t-1} + \sum_{i=1}^8 e_i * FF_{t-i} + n_t.$$

The cumulative impact of policy on output is measured by the sum of the coefficients on the positive and negative residuals of the funds rate. Because changes in the funds rate in one direction tend to move output in the opposite direction, the estimated sums are expected to be negative.<sup>14</sup> The equation was estimated with quarterly data over two sample periods. The full sample spanned 1963:2 through 1992:3. The second sample excluded 1979:4-1982:4, the period in which the Federal Reserve deemphasized the funds rate.

Changes in the funds rate clearly had an asymmetric impact on output over the full sample period (Table 1). The impact of increases in the funds rate is large and highly significant. The impact of decrease in the funds rate is small and insignificantly different from zero. And as the bottom line indicates, the difference in the impact is statistically significant.

The evidence of asymmetry is considerably weaker when the sample period excludes 1979:4-1982:4. Over this subsample, both increases and

Table 1

**Impact of the Federal Funds Rate on Output**

	Full sample period 1963:2 - 1992:1	Excluding 1979:4 - 1982:4
FF <sup>+</sup>	-1.09*** (.33)	-1.75*** (.52)
FF <sup>-</sup>	-.08 (.32)	-1.00** (.50)
FF <sup>+</sup> - FF <sup>-</sup>	-1.01** (.48)	-.75 (.68)

Notes: Shown are sums of coefficients from regression of output growth on positive and negative residuals of federal funds rate. Residuals are calculated from a first-stage regression of the funds rate on constant, trend, eight lags of funds rate, and current and eight lags of output growth and inflation (see text for explanation). Standard errors are in parentheses. \*\* and \*\*\* indicate significance at 5 percent and 1 percent, respectively.

decreases in the funds affect output significantly and the impacts do not differ significantly. Arguably, however, there is some evidence of asymmetry even in this subsample. Increases in the funds rate are *more* significant than are decreases, and increases also appear to have a much larger impact, even if the difference is not statistically significant.<sup>15</sup>

Because asymmetry can be a visual concept, the empirical results are depicted in chart form. Chart 1 plots the cumulative impact on output of a change in the funds rate of one percentage point for one quarter.<sup>16</sup> For the full sample period, an increase in the funds rate has a substantial and persistent effect on output (Panel A). One year after the increase, output is 0.6 percent below its initial level, and after two years output is more than 1 percent lower. A decrease in the funds rate, in comparison, has a small and temporary effect on output. One year after the decrease, output is less than 0.4 percent above its initial level, and

after two years output returns to its initial level.

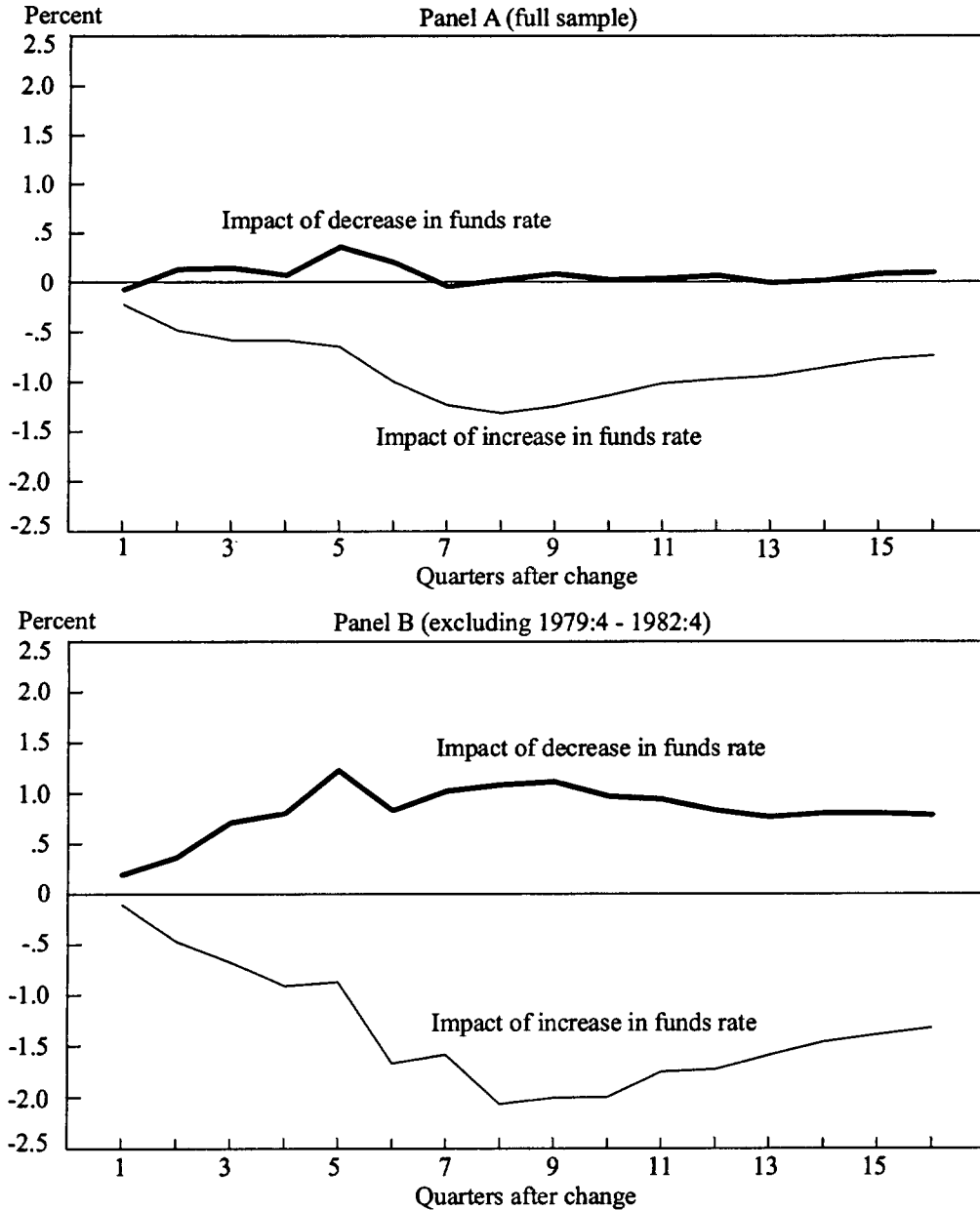
When the sample excludes 1979:4-1982:4, the asymmetry is less striking (Panel B). As with the full sample, increases in the funds rate seem to have a large impact, with output falling 2.0 percent below its initial level two years after the increase. Decreases, however, have a larger and more lasting impact on output compared to the full sample. The peak impact occurs a little more than a year later, when output is almost 1.5 percent below its initial level.

Thus, the pattern of results using the funds rate to identify policy, though not uniformly strong, tends to reinforce the evidence of asymmetry using the monetary aggregates.<sup>17</sup> The following section uses an altogether different narrative approach to identify policy, based on policymakers' statements.

*The narrative approach.* This approach requires researchers to read the recorded statements of policymakers and to index the stance of policy according to those statements. Using such

Chart 1

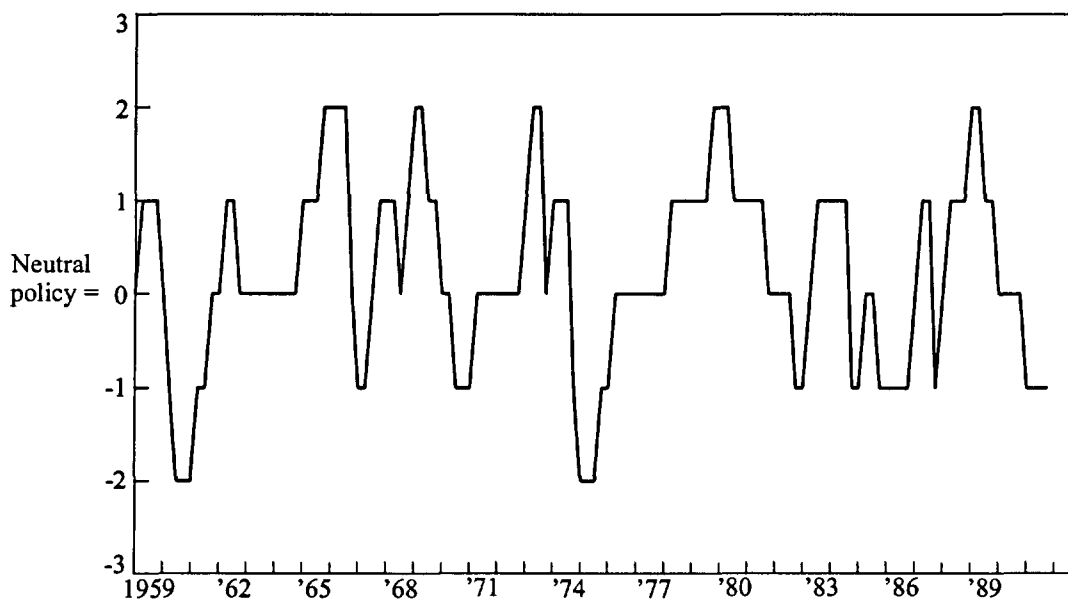
**Asymmetric Impact of Changes in the Federal Funds Rate on Output**



Note: Shown is the cumulative change in output from its initial level following a one percentage point change for one quarter in the federal funds rate. See text and endnote 16 for explanation.

Source: Author's calculations.

Chart 2

**Boschen-Mill Index of Monetary Policy**

Note: Value of index at end of quarter. 2 = very tight, 1 = tight, -1 = easy, -2 = very easy. Also see endnote 19.  
Source: Boschen and Mill.

an index recently constructed by John Boschen and Leonard Mill, this section finds results similar to those above.

To construct their index, Boschen and Mill perused the policy records of the Federal Open Market Committee (FOMC) from 1953 through 1991.<sup>18</sup> Based on their reading of the record, the authors classified the stance of policy into five categories: very tight, tight, neutral, easy, and very easy. They assigned each category a respective value of 2, 1, 0, -1, and -2. The Boschen-Mill index is plotted in Chart 2.<sup>19</sup>

The narrative approach is less subjective than it appears. Boschen and Mill found that their index was significantly correlated with five other indexes constructed by different researchers over

the last several years. This finding implies that different readers of the policy record form the same impression about the stance of monetary policy. So despite its apparent subjectivity, this approach should be a useful alternative to the funds rate or the aggregates in investigating the impact of monetary policy.

The investigation still requires the two-stage procedure used with the federal funds rate. The same procedure is necessary because monetary policy, even measured by the index, often responds to changes in output. So in order to accurately estimate the impact of policy on output, it is first necessary to identify changes in policy that are not due to changes in output.<sup>20</sup> As before, this identification is accomplished with a first-stage



Table 2

**Impact of Boschen-Mill Index on Output**

	Full sample period 1963:2 - 1992:1	Excluding 1979:4 - 1982:4
BM <sup>+</sup>	-1.58* (.87)	-2.24*** (.74)
BM <sup>-</sup>	-.21 (.93)	1.78 (1.12)
BM <sup>+</sup> - BM <sup>-</sup>	-1.79 (1.55)	-4.02*** (1.49)

Notes: Shown are sums of coefficients from regression of output growth on positive and negative residuals of the Boschen-Mill index. Residuals are calculated from first-stage regression of the index on a constant, trend, eight lags of index, and current and eight lags of the output growth and inflation (see text for explanation). Standard errors are in parentheses. \* and \*\*\* indicate significance at 10 percent and 1 percent.

regression of the index on its own lagged values, plus current and lagged values of output and inflation, which might be correlated with the index and with output.<sup>21</sup>

In the second stage, output growth is regressed on positive and negative residuals from the first-stage regression, which represent tight policy and easy policy. The second-stage regression, which took the same form as the equation above, was also estimated over two sample periods: the full sample, 1963:2-1992:2, and the subsample that excluded 1979:4-1982:4.<sup>22</sup>

Policy also appears to have asymmetric effects when measured by the Boschen-Mill index (Table 2). Over the full sample, increases in the index had a large and marginally significant impact on output, while decreases had an insignificant impact. The bottom line, however, indicates that the impacts do not differ significantly.

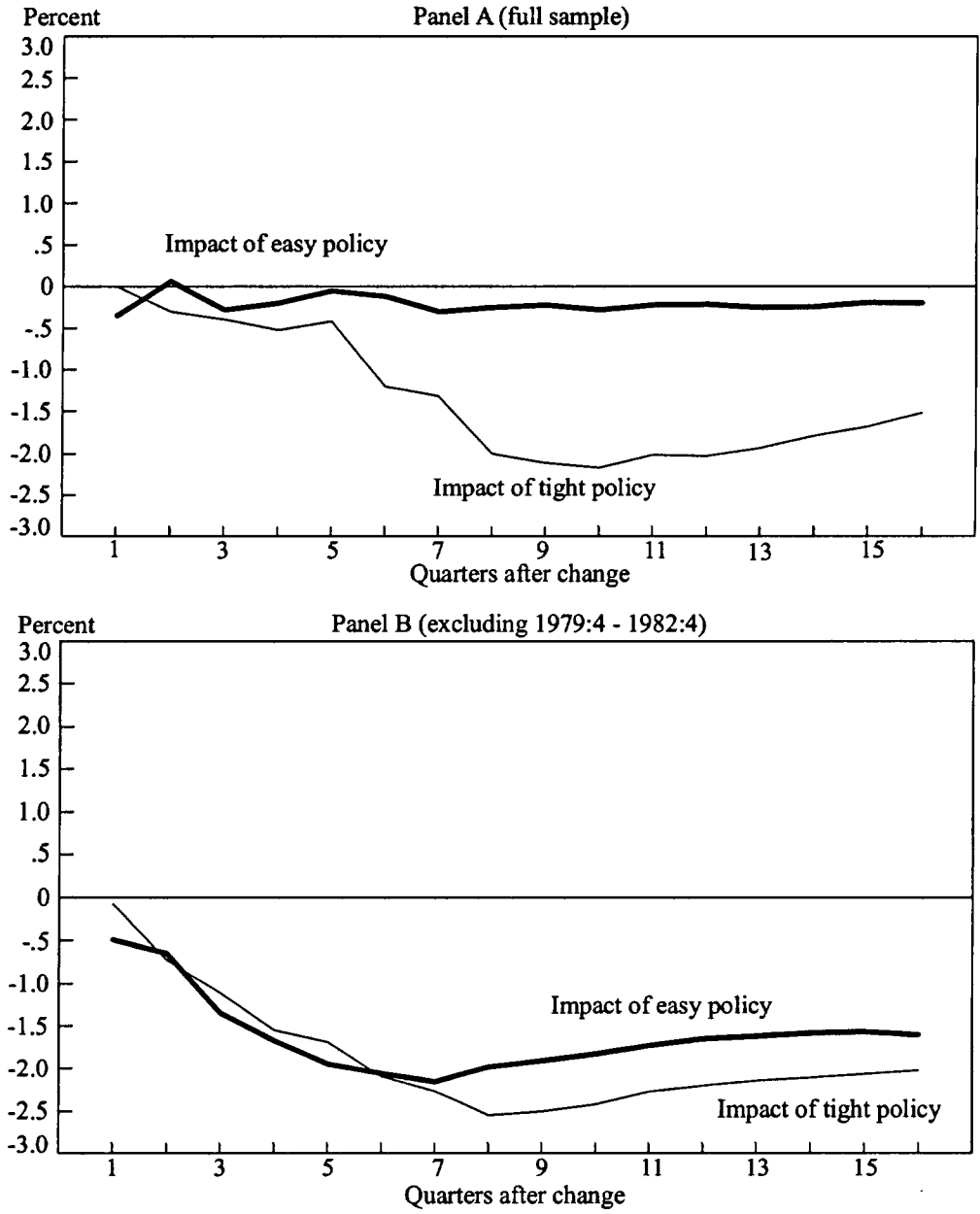
Unlike with the funds rate, the evidence of asymmetry is stronger when the sample excludes

1979:4-1982:4. Increases in the index had a very significant impact on output, while decreases in the index had an insignificant impact. Moreover, the difference in the impact is highly statistically significant. The stronger evidence with the index over the subsample is notable because the evidence with the funds rate was weaker over this sample period.

A picture illustrates the asymmetric impact of changes in the Boschen-Mill index on output (Chart 3). Over the full sample (Panel A), a one-unit increase in the index for one quarter, representing tight policy, has a dramatic and lasting effect on output. In contrast, a one-unit decrease, representing easy policy, has virtually no effect on output. When the sample excludes 1979:4-1982:4, an increase in the index reduces output dramatically (Panel B). Although a decrease in the index appears to reduce output, recall that the impact of a decrease in the index was insignificantly different from zero in Table 2.

Chart 3

*Asymmetric Impact of Changes in the Boschen-Mill Index Output*



Note: Shown is the cumulative change in output from its initial level following a one percentage point change for one quarter in the federal funds rate. See text and endnote 16 for explanation.

Source: Author's calculations.

## SUMMARY

The view that monetary policy has asymmetric effects, once the mainstream view after the Depression, has undergone a revival. Recent experience in the United States suggests that easy policy may be weaker than tight policy, and recent theory suggests reasons why this may be so. Empirical research, using the monetary aggregates to identify policy, has produced evidence of asymmetry.

The results presented in this article provide some additional evidence of asymmetry using two

alternative measures of policy: (1) the federal funds rate and (2) a narrative index of policy. Although this evidence is not equally strong across measures and across sample periods, the same patterns recur. Tight monetary policy,<sup>1</sup> however measured, substantially and significantly reduced output in either sample period, while easy monetary policy usually had an insignificant effect on output. These results, together with recent theory and experience, make a case for further research on the possibility of asymmetric effects of monetary policy.

## ENDNOTES

<sup>1</sup> Alfred Hansen, a prominent Harvard economist of that era wrote, "The monetary weapons can, indeed, be applied effectively to check an expansion" (p. 71). Later, in the same chapter on monetary policy in the Depression, he concluded, "But the decade of the thirties offers abundant evidence that cheap money alone is not adequate" (p. 82).

<sup>2</sup> Of course, the slow growth of M2 in the last several years leads monetarists to conclude that policy has been tight rather than easy during the current recovery.

<sup>3</sup> For convenience, the text assumes that banks quantity ration credit at some point instead of raising loan rates. The equilibrium quantity of loans in that case is simply the quantity supplied at the point where the loan supply curve bends backward (Keeton). When policy is tightened, the equilibrium quantity of loans falls by the full amount of the shift in loan supply. Of course, easy policy presumably returns the loan supply curve to its original position. Nevertheless, the equilibrium quantity of loans will be less than before policy was tightened if loan demand has fallen in the meantime, and now intersects the original loan supply curve below the point where it bends backward, i.e., if there is no longer credit rationing at the new equilibrium.

<sup>4</sup> Quantity rationing seems sufficient but not strictly necessary to explain asymmetry. The same information problems that lead to quantity rationing will lead banks to charge a steep risk premium over market interest rates for a given loan size. Even if firms can borrow at that rate, they may still be "credit constrained" because the premium will lead firms to forego profitable spending that cannot be financed internally (Fazzari, Hubbard, and Peterson). Moreover, the risk premium will increase with the size of the loan, implying a convex loan supply curve. As a convex loan supply curve

shifts back and forth (due to changes in policy), the equilibrium quantity of loans changes more when loan demand is high than when loan demand is low.

<sup>5</sup> The discussion in the text relies on the interaction of credit constraints and the demand for credit to explain asymmetric policy effects. A closely related idea is developed in a model by Jackman and Sutton, in which a credit constraint causes asymmetry through permanent income effects. Higher interest rates force constrained consumers to reduce spending by the full amount that their loan payments increase. Lower rates relax the constraint, but spending increases less than proportionately because consumers spread out their spending across time. A somewhat related idea is suggested in Bernanke and Gertler's model, in which firms may be credit constrained because of low collateral. When firms are fully collateralized, and hence unconstrained, sharp declines in investment spending are more likely than sharp increases. Indirect evidence of such asymmetries comes from Kashyap, Lamont, and Stein, who find that firms' spending on inventory appears credit constrained only when policy is tight. More indirect evidence comes from Gertler and Gilchrist, who find that shocks to the federal funds rate have larger effects on spending (particularly by small firms) when output growth is below average.

<sup>6</sup> This discussion is partial equilibrium in the sense that inflation is taken as given in analyzing an individual firm's pricing decisions. The studies being discussed, however, determine inflation endogenously as a function of individual firm's decisions.

<sup>7</sup> More precisely, the model predicts that the degree of asymmetry increases with the average inflation rate across countries: the impact of negative spending shocks increases

with inflation *and* the impact of positive spending shocks decreases with inflation. This is precisely what Caballero and Engel found. Ball and Mankiw's model predicts that the distribution of real growth rates of output will be skewed to the left because output is more likely to fall after a decline in spending than it is likely to rise after an increase in spending. They cite evidence of such skewness from Sichel in support of this prediction.

<sup>8</sup> And because the degree of asymmetry increases with the inflation rate, the question remains whether policy has asymmetric effects in the United States, a country with a relatively low inflation rate.

<sup>9</sup> To be precise, Cover estimated the impact on output of *unexpected* changes in money: changes not predicted by lagged output, interest rates, and other variables. Using unexpected changes is a way of excluding changes in money growth due to changes in demand, rather than changes in supply.

<sup>10</sup> The anonymous referee of Cover's article at the *Quarterly Journal of Economics* found the same result excluding the Volcker period.

<sup>11</sup> The results are available upon request.

<sup>12</sup> Controlling for feedback between policy and output is usually accomplished with a vector autoregression (VAR). The nonlinearity implicit in this model precludes straightforward use of a VAR. The two-stage procedure used here, however, is akin to a VAR in which output is ordered before policy. Cover also used a two-stage procedure. However, he excluded current output growth from the first stage and included current money shocks in the second stage. This is equivalent to ordering policy before output in a VAR, which is not the usual prior. Moreover, it could have biased his results because money demand very likely depends on current income.

<sup>13</sup> The first-stage regression was:

$$FF_t = a + b * trend + \sum_{i=1}^8 b_i * FF_{t-i} + \sum_{i=0}^8 C_i * \Delta \log Y_{t-i} + \sum_{i=0}^8 d_i * inflation_{t-i} + e_t .$$

The sample period was 1961:2-1992:3. Using the change in the funds rate instead of the level did not alter the results. Including the deficit in the first-stage regression tended to strengthen the results. That specification was not reported, however, in order to maintain symmetry with the first-stage specification of the Boschen-Mill regression (to follow), in which the deficit seemed not to belong.

<sup>14</sup> Herein, the terms "increases" and "decreases" are used to refer to positive and negative residuals of the first-stage regression and not simply to positive and negative changes in the observed series.

<sup>15</sup> That the evidence of asymmetry is weaker when the sample excludes 1979:4-82:4 may or may not be surprising, depending on one's priors. Given the evidence over the full sample, one might have expected even stronger evidence after excluding a period in which the Federal Reserve was clearly not targeting the funds rate (implying that funds rate shocks did not necessarily represent changes in policy). On the other hand, one may have expected weaker evidence after excluding a period in which the funds rate was allowed to fluctuate more than ever before.

<sup>16</sup> For simplicity, the federal funds rate is assumed to change for only one quarter, after which it returns to its initial level. Even such a temporary change in the funds rate will have persistent effects on output growth because, according to the regression equation, the past level of the funds rate affects the current growth rate of output. The impact of a change in the funds rate is calculated using the estimated coefficients in the regression equation and includes the indirect effects due to lagged changes in output growth. This "dynamic multiplier" is not to be confused with an impulse response function.

<sup>17</sup> Roughly the same pattern of results was obtained if the deficit was included in the second-stage regression. With 12 lags included, easy policy was sometimes significant after two years. It is hard to believe, however, that a decrease in the funds rate this quarter would directly affect output more than two years from now. And even if it did, such a long lag still seems to preclude a useful stabilization role. Moreover, the restriction that the regression equation had only eight lags versus 12 lags could not be rejected.

<sup>18</sup> The records included the FOMC directives and the associated policy discussions in the minutes of the FOMC meetings.

<sup>19</sup> The series constructed by Boschen and Mill was monthly. For compatibility with quarterly data, however, this article uses the value of the index on the last month of the quarter. Boschen and Mill also used negative values to indicate tight policy and positive values to indicate easy policy. For comparability with the results using the funds rate (which increases when policy is tight), this article uses the opposite signs: positive values represent tight policy and negative values represent easy policy.

<sup>20</sup> This issue arises in any study in which the data investigated do not result from controlled experiments. For

example, if psychologists wish to investigate whether alcohol causes depression, they must first determine that their subjects were not drinking because they were depressed in the first place. Psychologists can pre-screen their subjects and reject those who give depression as a reason for their drinking. This pre-screening is analogous to the first-stage regression here (and with the funds rate), which “rejects” changes in policy due to changes in output growth. But other than declining output growth, or a recession, why would policy ever be eased? Perhaps because of public pressure, or because of a shift by existing policymakers toward complementary goals, such as calming financial markets, or because new policymakers with different goals joined the FOMC. All of

these reasons could lead to a change in policy that was not directly in response to a change in output growth.

<sup>21</sup> Inflation was included in the first-stage regression to maintain symmetry with the funds rate specification and because Boschen and Mill did so. The results do not change significantly, however, when inflation is excluded from the first stage.

<sup>22</sup> Although the Boschen-Mill policy index runs only through 1991:4, the second-stage regression uses only lagged policy so the estimation runs through 1992:1.

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