July 31, 2000

An Investigation of Money Supply Shock Asymmetry Using Disaggregate Data

M. Stokes Malone
Department of Economics
East Carolina University
M.S. Research Paper

Abstract

This paper is an empirical investigation of money supply shock asymmetry using disaggregated output data covering the 1962:02-1999:11 sample period. A two-step estimation procedure is employed. The first step estimates the positive and negative shocks to M2 money growth. These shocks are then used as independent variables in the second-step estimation for 10 different disaggregated measures of industry-level output in addition to total industrial production. Shocks to the federal funds rate are also used to identify the direction of monetary policy. The sample period is also divided into pre- and post-1979:10 samples to account for the monetary policy regime change. The results indicate symmetry for the hypothesis tests that use shocks to the M2 money supply. These results are confirmed using innovations to the Federal funds rate.

**The author would like to thank Dr. Randall Parker for his input and assistance.

I. Introduction

The subject of money supply shock asymmetry has been entrenched in economic debate since the Great Depression when "tight" monetary policy thrust the economy in a downward vortex, yet “easy” monetary policy failed to move the economy toward recovery. There have been numerous periods in the past seventy years that the economic literature has alternated in the belief regarding whether monetary shock asymmetry actually exists in some statistically significant form, with the post-World War II evidence being the strongest in support of asymmetry. All of the existing research has concentrated on segregating money supply shocks into their positive and negative components and then testing for asymmetry using aggregate level measures of output such as industrial production or real GDP. However, there is no study that investigates the question of asymmetry between positive and negative innovations to the money supply using industry-level measures of output. Gauger (1988) employs industry-level output measures to test for the effects of anticipated and unanticipated money shocks, but does not examine the asymmetry question regarding positive and negative money supply shocks, although strongly suggesting this research be conducted.

The purpose of this paper is to identify the positive and negative shocks associated with the growth rate of the M2 money supply and the Federal funds rate, and then test whether the shocks are asymmetric using 10 different industry-level measures of output in addition to total industrial production.

This topic is of particular interest because it is useful to know if monetary policy has differing effects in times of economic recession or expansion. This reasoning is rather like the colloquial interpretation of monetary policy, "you can pull on a string and get results but can not push on a string." Knowing how the economy will react in the face of positive and negative shocks to the money supply, monetary policy may be more effective in tempering periods of recession and promoting periods of economic growth.

The paper proceeds as follows: Section II reviews the existing literature on monetary shock asymmetry. In Section III discusses the data and develops the econometric specifications used in this research. Section IV presents the results and their interpretation. Finally, Section V concludes.

II. Literature Review

The belief that the effects of monetary policy were potentially asymmetric emerged as a result of the economic experiences of the 1930s where "tight" monetary policy is believed to have been largely responsible for the deepest slide in the history of the American business cycle but “easy” monetary policy seemed feeble in promoting recovery for the remainder of the Depression after the cyclical trough of March 1933.

The existence of monetary asymmetry can be explained by several different theoretical mechanisms. First, the aggregate supply function may be convex, or in the strictest form a "backward L", in which case negative money shocks will and positive money shocks will not, have an impact on output or other measures of real economic activity. Keynes argued similarly when he suggested that aggregate economic activity during the Depression was largely demand determined. Empirical evidence supporting this idea is presented in Fackler and Parker (1992) for the Depression and by Karras (1996 a, b) for the post-WWII era. This convexity can be generated by the assumption of asymmetry in wage and price flexibility.

Second, Ball and Mankiw (1994) suggest a model where asymmetry in price flexibility can also explain monetary asymmetry. According to Ball and Mankiw (1994), continuously adjusting prices in response to shocks in spending is costly for firms. When trend inflation is present, positive shocks to spending have a greater influence on price adjustment than do negative shocks. Firms will be more willing to pay the menu cost and adjust their desired relative price in line with their actual relative price when positive shocks to spending are coupled with trend inflation. When negative shocks to spending are present with trend inflation, on-the-other-hand, they may cancel each other thus leading firms to avoid paying the menu cost associated with adjusting prices downward due to the convergence of their desired relative price with their actual price. This would produce an asymmetric output response on the part of firms.

Third, the literature on credit constraints provides another explanation for monetary asymmetry. Though this is a vast literature, the works of Bernanke (1983), Bernanke and Gertler (1990), and Bernanke, Gertler, and Gilchrist (1996) are particularly important. Monetary asymmetries and credit constraints are more closely linked with the position of the business cycle than the first and second theories of asymmetry explained above. Specifically, tight monetary policy that drives up interest rates may have the effect of increasing the likelihood of bankruptcy for certain classes of borrowers. If tight monetary policy in periods of economic growth and strong credit demand impairs the ability of certain borrowers to obtain credit, any subsequent downturn could be magnified due to the credit constraint becoming binding. On-the-other-hand, easy monetary policy that lowers interest rates during periods of slow economic growth and weak credit demand would not have the same effect since certain classes of borrowers may not desire to obtain funds, thereby having no effect upon the strength of any subsequent expansion.

Lastly, monetary asymmetry can result from asymmetric expectations of consumers and firms over the course of the business cycle. This is explained further in this section in the discussion of Morgan (1993).

Empirical results regarding the existence and importance of monetary asymmetries were first reported by Cover (1992). He explains how the existing literature investigated the relative importance of expected and unexpected changes in the money supply, but did not distinguish between positive and negative money supply shocks. If monetary asymmetries are important empirically, then existing studies use money supply equations that are mis-specified. Cover (1992) confirms the existence of monetary shock asymmetry in that negative money supply shocks do, while positive money supply shocks do not, have important influence on output over the 1951:1-1987:4 period. Cover (1992) also finds these results to be robust to a number of modifications in the money and output equations. Specifically, the results do not vary importantly when the estimation is conducted using non-linear joint estimation of the money and output equations and also when the sample is divided into pre- and post-October 1979 sub-samples to account for the monetary policy regime change. Cover (1992) also comments that the results imply that policy-makers can influence the average growth rate of output by reducing the average size of unexpected decreases in the money supply.

Morgan (1993) also examines the asymmetry question using two measures of policy intentions: (1) the Federal funds rate and (2) the Boschen and Mills index of monetary policy. This index is constructed using a narrative approach examining the policy records of the Federal Open Market Committee from 1953 to 1991. The results indicate that there is evidence of asymmetry using both policy measures. There is one additional explanation for asymmetry offered in this article not discussed above. The explanation is based upon the expectations of consumers and firms over the course of the business cycle. That is, if there are pessimistic expectations and a loss of confidence by firms and consumers during recessions, this makes expansionary monetary policy during recessions less effective. Analogously, optimistic expectations by firms and consumers mitigate the impact of contractionary monetary policy during expansions. The asymmetry arises if firms and consumers are more pessimistic during recessions than they are optimistic during expansions. The major point of the article was to confirm the existence of monetary asymmetries in that "tight" monetary policy substantially and significantly reduced output, while "easy" monetary policy usually had an insignificant effect.

Karras (1996a) indicates that negative money supply shocks have a stronger influence on output than positive shocks. There are several null hypotheses that are the focal point of the article. These null hypotheses range from testing if the coefficients of the positive or negative shocks are jointly zero, to testing whether the coefficients on the positive money shocks equal those of the negative shocks, that is a test of asymmetry. The findings from this research are that asymmetry is supported by every specification and estimation method utilized. Karras (1996a), like Cover (1992), also checked the robustness of these results by altering the specification in several ways. Karras (1996a) used the two-step OLS procedure, nonlinear least squares and multivariate maximum likelihood and found the results to be invariant to the estimation technique employed. Moreover, when interest rate shocks are the instrument used to identify monetary policy moves, it is found to be consistent with asymmetry in that positive interest rate shocks (caused by negative money shocks) cause a significant reduction in output while negative interest rate shocks (caused by positive money shocks) have insignificant effects on output.

Karras (1996b) examines the asymmetry question using international panel data. The evidence strongly supports the belief that asymmetry is not restricted to the U.S. economy, but rather is an international phenomenon.

Gauger (1988) focuses on testing anticipated and unanticipated money shocks using disaggregate industry level production data as the measure of output. Gauger suggests that aggregate level examination of monetary shocks may lead the researcher to make incorrect conclusions about disaggregate level real impacts. Results from the disaggregate level evaluation find that anticipated money is non-neutral, and that the impacts on output of anticipated money are significant more frequently than are the impacts of unanticipated money on output.

Bernanke and Blinder (1992) test a model of monetary policy transmission. The main questions asked in this article are; does monetary policy affect the real economy, and if so what is the transmission mechanism by which these effects occur? Bernanke and Blinder (1992) specified and estimated a structural economic model that studied the relationships among money, credit, and income. They also tried to isolate a direct measure of Federal

Reserve policy. They were in search of a variable whose innovations, or residuals, could be interpreted as “policy shocks.” They used the Federal funds rate as their indicator of Federal Reserve policy. Through the use of the Federal funds rate they were able to trace the monetary transmission mechanism by examining the responses of bank balance-sheet variables to shocks in the Federal funds rate. The conclusions drawn from this research indicate that the Federal funds rate is a good indicator of monetary policy. The authors suggest that the Federal funds rate may be more immune to endogenous responses to contemporaneous economic conditions compared to the growth rate of the money supply. The results are also consistent with the theory that monetary policy works in part by affecting the composition of bank assets. "Tight" monetary policy results in a short-run sell-off of banks’ security holdings, with little effect on loans. However, “tight” monetary policy has a lagged effect on loans, and eventually banks will terminate expired loans and refrain from making new ones. This reduced supply of loans can thereby depress economic activity.

The final article of this literature review is Parker and Rothman (2000). The purpose of this research is to examine money supply shock asymmetry for two main periods, the interwar and pre-World War I (WWI) periods. The interwar period is broken down into two sub-samples: the first being 1920:02-1933:03, and the second 1933:04 - 1941:12. The pre-WWI period is approached in a similar fashion with the first sub-sample being 1875:1 - 1893:4 and the second 1894:1 - 1914:2. The authors feel that this research is important because a majority of the previous work on this subject has been restricted to the post-World War II (WWII) era. The results of the extant literature are conflicting and do not allow for a consensus to be drawn about the existence of monetary shock asymmetry in the pre-WWII era.

The conclusions are that the samples, which include the pre-WWI and interwar period, fail to reject the null hypothesis of symmetry in monetary shocks. The authors also offer an explanation as to why the 1933:04 – 1941:12 sub-sample presents evidence for monetary shock asymmetry. They believe that this result may be due to the National Recovery Act and the fact that the nominal interest rate during this period was close to its lower bound of zero. However, the confirmation of monetary asymmetry for the 1933:04 - 1941:12 period should not be viewed as a historical precedent for the asymmetries that appear to have emerged in the post-WWII era.

III. Model Specification

A two-stage regression procedure was used in the estimation of the money growth and output equations. The first equation regresses the growth of the M2 money stock (m_t) on lags of itself and lags of the growth of the Federal Reserve index of industrial production (y_t), lags of the growth in the producer price index (p_t), and lags of the Federal funds rate (i_t) as in equation (1):

$$m_t = \alpha_0 + \sum_{j=1}^{q} \alpha_i^m m_{t-i} + \sum_{j=1}^{q} \alpha_i^y y_{t-i} + \sum_{j=1}^{q} \alpha_i^p p_{t-i} + \sum_{j=1}^{q} \alpha_i^i i_{t-i} + u_t \,, \qquad (1)$$

where u_t is the money supply shock. The residuals from the money growth equation are then segregated into their negative and positive money shock components and are computed as $u_t^- = -½\,[\text{abs}(u_t) - u_t]$ and $u_t^+ = ½[\text{abs}(u_t) + u_t]$, respectively.

The second equation regresses the growth in output on lags of itself and the contemporaneous and lagged values of the positive and negative money shock residuals u_t^+ and u_t^- estimated from equation (1). The output equation is:

$$y_t = \beta_0 + \sum_{j=1}^{q} \beta_i^y y_{t-i} + \sum_{j=0}^{q} (\beta_i^+ u_{t-i}^+ + \beta_i^- u_{t-i}^-) + e_t \,. \qquad (2)$$

The appropriate lag length was chosen for equations (1) and (2) by estimating the two-stage regression at each lag, using lags 1 through 12. In this process the lag length was chosen for the money growth equation first. The decision criterion was to choose the money growth equation that produced the lowest Akaike information criterion (AIC) value of the entire 12 lag lengths estimated for this equation. Following the determination of the "best" lag length for the money growth equation the next task was to repeat this process for the output equation, or the second part of the two-stage regression. The model was estimated again using the chosen lag length in the money growth equation, and then changing the lag length of the output equation to reflect the use of each of the 12 lags individually. The lag length that produced the lowest AIC value for the output equation was determined to be the appropriate lag length.

The model in this research focused on the use of disaggregate data as the measure of output. To this end, 10 different subcomponent series of the Federal Reserve index of industrial production were used. The output variables considered were as follows: aircraft and parts, primary metals, iron and steel, fabricated metal products, electrical machinery, motor vehicles and parts, chemicals and products, textile mill products, apparel products, and utilities. The empirical exercises were also conducted on the total industrial production series following Gauger (1988). The process of choosing the appropriate lag length for the money growth and output equations was repeated for each of the 11 variables of industrial production. Each of the 11 variables was considered independently from the others, and an appropriate lag length was chosen for the money growth equation and the output equation regarding each industrial production variable.

As an alternative to the traditional estimation of the money growth equation, a second model was estimated using the Federal funds rate as the instrument to identify monetary policy moves. The first stage of this second model appears in equation (3):

$$r_t = \Theta_o + \sum_{j=1}^{q} \Theta_i^m r_{t-i} + \sum_{j=1}^{q} \Theta_i^y y_{t-i} + \sum_{j=1}^{q} \Theta_i^p p_{t-i} + \sum_{j=1}^{q} \Theta_i^i m_{t-i} + \omega_t , \qquad (3)$$

where ω_t represents the shocks to the Federal funds rate. The residuals from the Federal funds equation are then segregated into their positive and negative shock components (ω^+ and ω^-) and are computed as $\omega_t^- = -½[\text{abs}(\omega_t) - \omega_t]$ and $\omega_t^+ = ½[\text{abs}(\omega_t) + \omega_t]$, respectively.

The use of the Federal funds rate as a Federal Reserve policy indicator is repeated throughout the literature, and its use is suggested by Bernanke and Blinder (1992), Gauger (1988), Cover (1992), Karras (1996a), and Parker and Rothman (2000). Innovations in the Federal funds rate were then used as explanatory regressors in the output equations, and as in equation (4):

$$y_t = \Phi_0 + \sum_{j=1}^{q} \Phi_i^y y_{t-i} + \sum_{j=0}^{q} (\Phi_i^+ \omega_{t-i}^+ + \Phi_i^- \omega_{t-i}^-) + \kappa_t . \qquad (4)$$

The full sample covers the 1962:02 - 1999:11 period. As a further check on the robustness of the results, the data were divided into 2 sub-samples. The first sub-sample was from 1962:02 - 1979:09. The second sub-sample consisted of the remaining dates 1979:10 - 1999:11. The breakpoint between the two sub-samples follows standard procedure in the literature and was chosen in accordance with Cover (1992) and Karras (1996a). The end of the first sub-sample and the beginning of the second sub-sample marked a change in the monetary policy regime, from targeting the Federal funds rate to targeting the money stock, and eventually to inflation targeting. Again, this method of using the full sample and two sub-samples is used for estimation of the money growth and output equations, and for the Federal funds rate and output equations.

IV. Empirical Results

The first set of results deals with the full sample for the money growth and output equations, and the results are reported in Table 1. This table presents p-values for Wald tests for the five null hypotheses of interest. These five null hypotheses are: (1) the coefficients on positive monetary shocks are jointly equal to zero; (2) the coefficients on positive monetary shocks sum to zero; (3) the coefficients on negative monetary shocks are jointly equal to zero; (4) the coefficients on negative monetary shocks sum to zero; and (5) the coefficients on positive and negative monetary shocks equal one another and are symmetric in their effect on output.

The results, using a 5% significance level, for the full sample indicate that only 1 out of the 11 industrial production measures has a significant value associated with the null hypothesis of symmetry. The index for apparel products is the sole variable in the full sample that rejects the null hypothesis of symmetry. Also, of the 44 remaining p-values in Table 1 that refer to the other four null hypotheses only 4 are significant at the 5% level. The overall results for the full sample indicate that the null hypotheses largely cannot be rejected, and there is substantial support for monetary symmetry.

Table 2 presents the results of the first sub-sample. This sub-sample represents the money growth and output equations for the period 1962:02 -

1979:09. At the 5% significance level the results indicate that the null hypothesis of symmetry cannot be rejected. All of the 11 industrial production variables used in this sub-sample have a p-value that is insignificant for this particular hypothesis. For the other 4 hypotheses only 2 p-values out of the remaining 44 are significant. These significant p-values are from the variables primary metals and utilities, and indicate that in these 2 cases the null hypothesis that the positive monetary shocks are jointly equal to zero can be rejected. However, the coefficients for the positive monetary shocks for utilities sum to a theoretically implausible negative number. Following Cover (1992), these results are interpreted as evidence that positive and negative monetary shocks do not have strong effects on output in the first sub-sample, and are not asymmetric.

The results for the second sub-sample, 1979:10 - 1999:11, are reported in Table 3. The results for this sub-sample reveal that only 2 variables out of the 11 have p-values that are significant with respect to the null hypothesis of symmetry. These 2 variables are aircraft and parts and apparel products. Also, throughout the remainder of the table only 10 p-values out of the possible 44 remaining are significant. An interesting feature of this table is that the 2 variables that report significant p-values at the 5% significance level for the null hypothesis of symmetry also report significant p-values for the null hypotheses that the negative monetary shocks are jointly equal to zero, and that they also sum to zero. This supports the conclusion that in the second sub-sample only negative monetary shocks have strong effects on output for these two production indexes. However, closer examination of the coefficients for negative money shocks for the production index for apparel products sum to a theoretically implausible negative number. Consequently, the rejection of the null hypothesis of symmetry does not follow and the results for the second sub-sample are interpreted as strong evidence supporting monetary symmetry.

As a check on the robustness of these results, an alternative model was estimated over the 3 sample periods and replaces money growth with the Federal funds rate in the first stage of the two-stage regression. Thereafter, positive and negative shocks to the Federal funds rate are used as regressors in the output equations. Table 4 reports the results for the full sample. The p-values associated with the 11 industrial production variables indicate that 7 reject the null hypothesis of symmetry at the 5% level. These 7 are primary metals, iron and steel, fabricated metal products, electrical machinery, motor vehicles and parts, chemicals and products, and the total index. The other p-values in the table associated with the 4 other null hypotheses show 16 of the 44 p-values are significant at the 5% level.

These results are more supportive of monetary asymmetry than those using shocks to money growth. However, these results may not be as telling as they initially appear. Beginning with primary metals, iron and steel, electrical machinery, chemicals and products, and the total index the other p-values that are significant other than the test of symmetry are associated with negative interest rate shocks. Nevertheless, the coefficients of the negative interest rate shocks sum to a theoretically implausible positive number. This fact, coupled with the result that the p-values for the positive interest rate shocks are largely insignificant, suggests that neither the positive nor the negative interest rate shocks for these variables have a strong effect on output. Fabricated metal products on-the-other-hand has p-values that are significant for the null hypotheses associated with both positive and negative interest rate shocks. The coefficients associated with the positive interest rate shocks sum to a theoretically plausible negative number. This suggests that for this variable positive interest rate shocks do have a strong effect on output, and negative interest rate shocks do not. The final variable that has a significant p-value for the null hypothesis of symmetry is motor vehicles and parts. The only other instance in which this variable has a significant p-value is for the null hypothesis that the negative interest rate shocks sum to zero. However, the coefficients for the negative interest rate shocks sum to a theoretically implausible number. Despite the significant p-value for the null hypothesis of symmetry the conclusion must be drawn that negative interest rate shocks do not have a strong effect on output when the relevant variable is motor vehicles and parts.

The results presented above negate the initial robustness of the result that 7 out of the 11 variables reject the null hypothesis of symmetry.

Consequently, the end result is that the full sample does not provide statistically substantial evidence against symmetry.

The results of the first sub-sample are presented in Table 5. For the first sub-sample only 1 of the 11 variables has a significant p-value for the null hypothesis of symmetry. For the remaining p-values in the table, which exclude those associated with the null hypothesis of symmetry, only 4 of 44 are significant. Therefore, the results for the first sub-sample neither provide strong evidence that the positive or negative interest rate shocks have a significant impact on output nor that they are asymmetric.

Table 6 presents the results for the second sub-sample. This sub-sample is found to have 7 of its 11 p-values associated with the null hypothesis of symmetry to be significant. The variables that produce these significant p-values are primary metals, iron and steel, fabricated metal products, electrical machinery, motor vehicles and parts, chemicals and products, and the total index. Four of these variables out of the 7 are found to have significant p-values for both positive and negative monetary shocks. These 4 variables are primary metals, iron and steel, fabricated metal products, and the total index. However, the coefficients associated with the negative interest rate shocks for each of these variables sum to a theoretically implausible positive number. Following Cover (1992), the interpretation of this is that only positive interest rate shocks have a significant effect on output and are asymmetric with respect to negative interest rate shocks. The variable electrical machinery has significant p-values for only the positive interest rate shocks, which have coefficients that sum to a theoretically plausible number. This indicates that the rejection of the null hypothesis of symmetry in this case. The remaining 2 variables are motor vehicles and parts, and chemicals and products. The p-values for these variables are only significant for negative interest rate shocks, given their significance for the null hypothesis of symmetry. The significant p-values associated with these 2 variables are negated because their coefficients sum to a theoretically implausible number. Consequently, the conclusion drawn for these 2 variables are that neither positive nor negative interest rate shocks have a strong effect on output.

The second sub-sample provides the most robust evidence against symmetry of any of the other models or samples used in this analysis, with 5 of the 11 regressions rejecting symmetry and being appropriately signed. However, it is concluded that this is not strong evidence in favor of the asymmetry hypothesis.

IV. Conclusions

When shocks to money growth are used to identify the direction of monetary policy, there appears to be little evidence against the null hypothesis of symmetry for all samples examined. In the sparse instances where the null hypothesis of symmetry is rejected the remaining statistics fail to support the rejection with few exceptions.

When shocks to the Federal funds rate are used to identify the direction of monetary policy, similar results occur for both the full sample and the first sub-sample. When studying the full sample each time the null hypothesis of symmetry is rejected the finding is negated due to the coefficients of either the positive or the negative monetary shocks summing to a theoretically implausible number, with the exception of one instance.

When considering the first sub-sample there is little evidence against the null hypothesis of symmetry. There is only 1 variable out of the 11 industrial production variables that rejects the null hypothesis of symmetry, and that variable is electrical machinery. This variable has significant p-values for the null hypothesis of the positive monetary shocks summing to zero, and the null hypothesis of negative monetary shocks summing to zero. However, the coefficients for the negative monetary shocks do not sum to a theoretically plausible number, and in accordance with Cover (1992) are deemed to have little effect on output. The coefficients of the positive monetary shocks on-the-other-hand do sum to a theoretically plausible number. However, the p-value associated with the null hypothesis that the negative monetary shocks are jointly equal to zero is insignificant, and as a result the rejection of the null hypothesis of symmetry is not robust.

As mentioned earlier, the second sub-sample provides the most robust evidence against the null hypothesis of symmetry. However, in the best case, only 5 of the 11 tests of symmetry are rejected.

In closing, the literature on this subject has suggested that a study of monetary shock asymmetry be conducted at the disaggregate level. This is precisely what is done in this research using sub-components of the Federal Reserve index of industrial production. Past researchers in the area of monetary shock asymmetry have conjectured that a study of this type would reveal that asymmetry does in fact exist. Taken as a whole, this research suggests there is little strong evidence of monetary asymmetry at the disaggregate level. These results mirror those of Gauger (1988) who found little support for the significance of unanticipated money shocks at the disaggregate level.

Table 1
Money Growth for the Full Sample Period

Sample Period	Industry	Null Hypothesis				
		$\beta_i^+ = 0, \forall_i$	$\sum\beta_i^+=0$	$\beta_i^-=0, \forall_i$	$\sum\beta_i^-=0$	$\beta_i^+=\beta_i^-, \forall_i$
Full Sample 1962:02 – 1999:11	Aircraft and Parts	.4913	.2353	.1649	.0839	.0669
	Primary Metals	.0180	.0613	.5829	.4503	.1141
	Iron and Steel	.0229	.0727	.4677	.2251	.0659
	Fabricated Metal Products	.2517	.0797	.4036	.8490	.2417
	Electrical Machinery	.1021	.1306	.0900	.4473	.6868
	Motor Vehicles and Parts	.5913	.2043	.8077	.3838	.1833
	Chemicals and Products	.6069	.1879	.7547	.5114	.7360
	Textile Mill Products	.9399	.2808	.8309	.8298	.4261
	Apparel Products	.2503	.0740	.7039	.1545	.0431
	Utilities	.0031	.1599	.0017	.4041	.7115
	Total Index	.7391	.2241	.8860	.9187	.4299

Table 2
Money Growth for the First Sub-Sample

Sample Period	Industry	Null Hypothesis $\beta_i^+ = 0, \forall_i$	$\sum\beta_i^+ = 0$	$\beta_i^- = 0, \forall_i$	$\sum\beta_i^- = 0$	$\beta_i^+ = \beta_i^-, \forall_i$
First Sub-Sample 1962:02 – 1979:09	Aircraft and Parts	.4449	.9264	.8672	.4250	.6385
	Primary Metals	.0332	.4550	.8566	.9586	.5998
	Iron and Steel	.0818	.3724	.9363	.8225	.4749
	Fabricated Metal Products	.5939	.5032	.9170	.5559	.8772
	Electrical Machinery	.9699	.9358	.5693	.1562	.4887
	Motor Vehicles and Parts	.7419	.2719	.5374	.4824	.2616
	Chemicals and Products	.7897	.4970	.9529	.6639	.8085
	Textile Mill Products	.1953	.9611	.1216	.2467	.5270
	Apparel Products	.2363	.2507	.4287	.1956	.1443
	Utilities	.0462	.1865	.1732	.4234	.1672
	Total Index	.6938	.4722	.4298	.2112	.2492

Table 3
Money Growth for the Second Sub-Sample

Sample Period	Industry	Null Hypothesis				
		$\beta_i^+ = 0, \forall_i$	$\sum\beta_i^+ = 0$	$\beta_i^- = 0, \forall_i$	$\sum\beta_i^- = 0$	$\beta_i^+ = \beta_i^-, \forall_i$
Second Sub-Sample 1979:10 – 1999:11	Aircraft and Parts	.3740	.3013	.0268	.0320	.0366
	Primary Metals	.0016	.0057	.0702	.0978	.8527
	Iron and Steel	.0021	.0055	.8136	.9776	.1697
	Fabricated Metal Products	.8570	.7814	.8758	.9349	.8430
	Electrical Machinery	.0018	.1012	.4249	.4899	.7571
	Motor Vehicles and Parts	.0823	.0256	.5744	.5232	.1150
	Chemicals and Products	.6365	.5815	.5686	.2921	.6156
	Textile Mill Products	.8922	.8503	.7934	.5066	.6925
	Apparel Products	.0565	.2128	.0008	.0008	.0019
	Utilities	.2625	.2106	.8444	.8191	.6392
	Total Index	.0902	.7406	.1506	.7352	.9328

Table 4
Federal Funds Rate for the Full Sample

Sample Period	Industry	Null Hypothesis				
		$\beta_i^+ = 0, \forall_i$	$\sum\beta_i^+=0$	$\beta_i^-=0, \forall_i$	$\sum\beta_i^-=0$	$\beta_i^+=\beta_i^-, \forall_i$
Full Sample 1962:02 – 1999:11	Aircraft and Parts	.3588	.6866	.2906	.1610	.2384
	Primary Metals	.1729	.5686	.0000	.0005	.0037
	Iron and Steel	.2161	.5284	.0000	.0027	.0096
	Fabricated Metal Products	.0003	.0209	.0000	.6843	.0439
	Electrical Machinery	.5952	.3084	.0047	.0059	.0066
	Motor Vehicles and Parts	.6097	.4456	.1122	.0196	.0337
	Chemicals and Products	.6431	.2908	.0001	.0003	.0009
	Textile Mill Products	.0785	.0667	.0001	.3365	.5854
	Apparel Products	.2275	.4059	.0009	.1891	.5791
	Utilities	.5962	.1621	.7162	.8429	.2433
	Total Index	.4858	.2602	.0000	.0016	.0026

Table 5
Federal Funds Rate for the First Sub-Sample

Sample Period	**Industry**	**Null Hypothesis** $\beta_i^+ = 0, \forall_i$	$\sum\beta_i^+ = 0$	$\beta_i^- = 0, \forall_i$	$\sum\beta_i^- = 0$	$\beta_i^+ = \beta_i^-, \forall_i$
First Sub-Sample 1962:02 – 1979:09	Aircraft and Parts	.9112	.3934	.5475	.2788	.2192
	Primary Metals	.8531	.5934	.7251	.4719	.4403
	Iron and Steel	.6753	.4148	.9098	.6669	.4650
	Fabricated Metal Products	.8381	.9013	.3492	.2336	.3706
	Electrical Machinery	.1037	.0201	.0754	.0100	.0022
	Motor Vehicles and Parts	.0874	.1241	.0025	.0775	.6930
	Chemicals and Products	.2525	.4401	.1297	.0422	.3075
	Textile Mill Products	.8785	.3859	.1404	.2825	.2137
	Apparel Products	.9020	.8879	.1741	.0646	.1899
	Utilities	.6985	.4256	.4331	.2018	.1981
	Total Index	.9438	.9414	.1311	.1154	.3028

Table 6
Federal Funds Rate for the Second Sub-Sample

Sample Period	**Industry**	**Null Hypothesis** $\beta_i^+ = 0, \forall_i$	$\sum\beta_i^+=0$	$\beta_i^-=0, \forall_i$	$\sum\beta_i^-=0$	$\beta_i^+=\beta_i^-, \forall_i$
Second Sub-Sample 1979:10 – 1999:11	Aircraft and Parts	.7595	.6367	.7417	.4601	.4506
	Primary Metals	.0010	.0241	.0000	.1139	.0095
	Iron and Steel	.0012	.0238	.0000	.1330	.0106
	Fabricated Metal Products	.0190	.0200	.0000	.0000	.0000
	Electrical Machinery	.0320	.0055	.1516	.1001	.0028
	Motor Vehicles and Parts	.1489	.0997	.0959	.0397	.0198
	Chemicals and Products	.5823	.2995	.0042	.0013	.0102
	Textile Mill Products	.3168	.8765	.1923	.1045	.2963
	Apparel Products	.0857	.1309	.3770	.2671	.6660
	Utilities	.8552	.4865	.9225	.8981	.5579
	Total Index	.0020	.0463	.0012	.0006	.0008

References

Ball, Laurence, and N. Gregory Mankiw (1994), "Asymmetric Price Adjustment and Economic Fluctuations," *Economic Journal*, 104, 247-261.

Bernanke, Ben S. (1983), "Nonmonetary Effects of the Financial Crisis in Propagation of the Great Depression," *American Economic Review*, 73, 1983, 257-276.

Bernanke, Ben S., and Alan S. Blinder (1992), "The Federal Funds Rate and the Channels of Monetary Transmission," *The American Economic Review*, 82, 901-921.

Bernanke, Ben S., and Mark Gertler (1990), "Financial Fragility and Economic Performance," *Quarterly Journal of Economics*, 105, 87-114.

Bernanke, Ben S., Mark Gertler, and Simon Gilchrist, "The Financial Accelerator and the Flight to Quality." *The Review of Economics and Statistics*, 78, February 1996, 1-15.

Cover, James Peery (1992), "Asymmetric Effects of Positive and Negative Money-Supply Shocks," *Quarterly Journal of Economics*, 107, 1261-1282.

Gauger, Jean (1988), "Disaggregate Level Evidence on Monetary Neutrality," *The Review of Economics and Statistics*, 676-680.

Karras, Georgios (1996a), "Why are the Effects of Money-Supply Shocks Asymmetric? Convex Aggregate Supply or 'Pushing on a String'?," *Journal of Macroeconomics*, 18, 605-619.

Karras, Georgios (1996b), "Are the Output Effects of Monetary Policy Asymmetric? Evidence from a Sample of European Countries," *Oxford Bulletin of Economics and Statistics*, 58, 267-278.

Fackler, James S., and Randall E. Parker (1992), "Accounting for the Great Depression: A Historical Decomposition," *Journal of Macroeconomics*, 193-220.

Morgan, Donald P. (1993), "Asymmetric Effects of Monetary Policy," *Federal Reserve Bank of Kansas City, Economic Review*, 21-33.

Parker, Randall E., and Philip Rothman (2000), "An Examination of the Asymmetric Effects of Monetary Supply Shocks in the Pre-World War I and Interwar Periods," *East Carolina University, Department of Economics,* 1-18.