1-1-1991

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JANUARY 1991, VOL. 1, NO. 1

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INTRODUCTION

The 1981-82 recession reached its trough in November of 1982 and was followed in 1983 and 1984 by a stronger than usual recovery of output and a better than expected performance by inflation. While it is generally agreed that the recession was a result of the Federal Reserve's attempt to check the accelerating inflation of the late 1970s and early 1980s, there appear to be no consensus as to the causes of the subsequent recovery. Some argue that the recovery was a manifestation of the supply-side, incentive effects of the tax cuts that were legislated in 1981. Others point to the demand-side effects of tax cuts and budget deficits as the chief cause of the recovery. Yet others believe that the recovery was a consequence of the change in the Fed's targeting procedures in October of 1982 which resulted in a significant increase in the rate of growth of money stock.

To date, there has been only one empirical study of the cause of the recovery. Using a Saint Louis-equation type model, Feldstein and Elmendorf [1989] found that on the demand side a major contributing factor was the shift to expansionary monetary policy that began in late 1982. The only contribution fiscal policy made was through the effect of budget deficits and investment tax incentives on the rate of inflation by way of their impact on the exchange rate of the dollar.

The present paper is also concerned with the forces that led to the recent recovery, but at a different level and using a different analytical framework. The purpose is to determine the extent to which innovations in aggregate demand and supply contributed to the recovery, without regards to the sources of these innovations. This is done using a variant of the new classical model [e.g., Lucas, 1973; Barro, 1976, 1978] similar to that used by Cutler [1989] to analyze the U.S. business cycles. From this model, reduced-form equations for output and inflation are derived and estimated. The results are used to calculate contributions of aggregate demand and supply surprises to output growth and inflation rate in the 1983-84 period.

The results suggest that the overall recovery was more due to supply shocks than aggregate demand surprises. While innovations in both aggregate demand and supply were responsible for the recovery of real output, the contribution of supply shocks was greater. The effects of supply shocks were even more profound in the case of inflation; in every quarter of the recovery period these shocks resulted in a reduction in the inflation rate, whereas innovations in aggregate demand actually led to an increase in the rate of inflation in this period.

THE MODEL

In the new classical framework, one assumes competitive conditions and optimizing behavior to derive the economy's aggregate demand and supply functions. The result is the following aggregate demand equation[1]

1. $Y_t^d = \tau + X_{t-1} - \Theta P_t + U_t^d$,

where Y_t^d is quantity of output demanded, τ is a constant, X_{t-1} is a scale variable, Θ is the price elasticity of demand, P_t is the general price level, and U_t^d is a stochastic error term which is assumed to be independently normally distributed with zero mean and variance σ_d^2. Aggregate supply is the sum of trend and cyclical outputs, the latter being a function of the difference between expected and actual prices, and its own lagged values[2]

2. $Y_t^s = (\alpha + \beta t) + \delta(P_t - P_t^e) + \mu_1 Y_{t-1}^c + \mu_2 Y_{t-2}^c + U_t^s$,

where δ is price elasticity of supply[3], and the random disturbance term, U_t^s, is $IN(0, \sigma_s^2)$. Assuming market clearance and endogenous expectations, Equations 1 and 2 can be used to derive reduced-form equations for inflation and output[4]

3. $\dot{P}_t = \tau - (1-\mu_1-\mu_2)(\alpha + \beta t) - (\mu_1+2\mu_2)\beta + (1-\mu_1)Y_{t-1} - \mu_2 Y_{t-2} + \varepsilon_t^p$,

4. $Y_t = (1-\mu_1-\mu_2)(\alpha + \beta t) + (\mu_1+2\mu_2)\beta + \mu_1 Y_{t-1} + \mu_2 Y_{t-2} + \varepsilon_t^y$.

It is easy to verify that the stochastic components of these equations, ε_t^p and ε_t^y, are related to aggregate demand and supply disturbances as follows,

5. $\varepsilon_t^p = (U_t^d - U_t^s)/(\Theta+\delta)$

6. $\varepsilon_t^y = (\delta U_t^d + \Theta U_t^s)/(\Theta+\delta)$.

Equations 5 and 6 are solved for of aggregate demand and supply disturbances given below,

7. $U_t^d = \varepsilon_t^y + \Theta\varepsilon_t^p$,

8. $U_t^s = \varepsilon_t^y - \delta\varepsilon_t^p$.

Equations 3 and 4 are to be estimated first and the results used to solve equations 7 and 8 for aggregate demand and supply shocks. However, because Equation 8 depends on the unknown parameter δ, which does not enter the reduced-form equations for inflation and output, somehow it must be estimated before the values of demand and supply shocks can be determined.[5] This is done as follows. Use Equations 5 and 6 to obtain the variances and covariance of unanticipated inflation and output given below,

9. $Var(\varepsilon_t^p) = [Var(U_t^d) + Var(U_t^s)]/(\Theta+\delta)^2$

10. $Var(\varepsilon_t^y) = [\delta^2 Var(U_t^d) + \Theta^2 Var(U_t^s)]/(\Theta+\delta)^2$

11. $Cov(\varepsilon_t^y, \varepsilon_t^y) = [\delta Var(U_t^d) - \Theta Var(U_t^s)]/(\Theta+\delta)^2$.

These are three equations in the three unknowns δ, $Var(U_t^d)$, and $Var(U_t^s)$, which can be solved using the estimated residual variance-covariance matrix associated with the reduced-form equations for inflation and output. Once the estimated value of the supply parameter δ is determined, Equations 7 and 8 can be solved for the values of demand and supply surprises.

EMPIRICAL ANALYSIS

Equations 3 and 4 were estimated using Seemingly Unrelated Regression and quarterly data for the 1947.1-1989.2 period.[6] The results are in Table 1.

TABLE 1
Estimates of Parameters and Residual Variance-Covariance of Equations 3 and 4
(Asymptotic t-Ratios in parentheses)

α	β	τ	μ_1	μ_2	$Var(\varepsilon_t^p)$	$Var(\varepsilon_t^y)$	$Cov(\varepsilon_t^p,\varepsilon_t^y)$
7.127	0.007	0.019	1.096	-0.140	4.85E-05	0.0001	3.79E-06
(175.85)	(22.55)	(18.92)	(26.96)	(-3.46)			

Using the residual variances and covariance in Table 1, Equations 9-11 were solved for the parameter δ and variances of demand and supply shocks. The results are 2.081, 0.00016, and 0.0003, respectively. These were used to solve Equations 7 and 8 for aggregate demand and supply shocks.

We are now in a position to use these results to examine contributions of demand and supply surprises to output and inflation in the recovery period. Because we are interested in the rate of change of output, we use the figures in Table 1 to express the estimated reduce-form equation for output in log-differenced form. The final step is to calculate contributions of various factors to the observed rate of growth of output in each of the eight quarters of the recovery period. These are reported in Table 2.

TABLE 2
Contributions of Demand and Supply Shocks to Output Growth

PERIOD	$\dot{Y}_t$	$\beta(1-\mu_1-\mu_2)$	$\mu_1\dot{Y}_{t-1}$	$\mu_2\dot{Y}_{t-2}$	$\delta\dot{U}_t^d/(1+\delta)$	$\dot{U}_t^s/(1+\delta)$
82.4-83.1	0.0086	0.0003	0.0017	0.0011	0.0041	0.0014
83.1-83.2	0.0223	0.0003	0.0094	-0.0002	0.0096	0.0032
83.2-83.3	0.0147	0.0003	0.0244	-0.0012	-0.0055	-0.0033
83.3-83.4	0.0176	0.0003	0.0161	-0.0031	0.0045	-0.0002
83.4-84.1	0.0254	0.0003	0.0193	-0.0021	0.0045	0.0034
84.1-84.2	0.0133	0.0003	0.0278	-0.0025	-0.0097	-0.0026
84.2-84-3	0.0064	0.0003	0.0146	-0.0036	-0.0048	-0.0001
84.3-84.4	0.0041	0.0003	0.0071	-0.0019	-0.0018	0.0005
Total	0.1124	0.0024	0.1204	-0.0135	0.0009	0.0023

According to the figures in the last two columns of Table 2, in four of the eight quarters, aggregate demand and supply made positive contributions to output growth. In each of the first two quarters, aggregate demand's contribution was about three times that of aggregate supply. Overall, though, the contribution of aggregate supply to output growth was more than 2.5 times that of aggregate demand (0.0023 versus 0.0009). Thus it appears that, while in the early stages of the recovery aggregate demand played a more significant role, in the later stages this effect was reversed and overtaken by favorable supply effects. Now consider contributions to the performance of inflation by unanticipated shifts in aggregate demand and supply. Once again, we determine these using the information in Table 1. The results are reported in Table 3.

TABLE 3
Contributions of Demand and Supply Shocks to Inflation

PERIOD	$\dot{P}_t$	$\tau-\alpha^*$	$-\beta^*t$	$(1-\mu_1)Y_{t-1}$	$-\mu_2Y_{t-2}$	$U_t^d/(1+\delta)$	$-U_t^s/(1+\delta)$
82.4-83.1	0.0079	-0.3007	-0.0437	-0.7727	1.1272	-0.0007	-0.0015
83.1-83.2	0.0084	-0.3007	-0.0440	-0.7735	1.1274	0.0039	-0.0047
83.2-83.3	0.0078	-0.3007	-0.0443	-0.7757	1.1286	0.0013	-0.0014
83.3-83.4	0.0116	-0.3007	-0.0446	-0.7771	1.1317	0.0035	-0.0012
83.4-84.1	0.0103	-0.3007	-0.0449	-0.7788	1.1338	0.0056	-0.0046
84.1-84.2	0.0080	-0.3007	-0.0452	-0.7812	1.1362	0.0009	-0.0020
84.2-84-3	0.0078	-0.3007	-0.0455	-0.7825	1.1397	-0.0014	-0.0019
84.3-84.4	0.0073	-0.3007	-0.0458	-0.7831	1.1416	-0.0023	-0.0024
Total	0.0691	-2.4056	-0.3580	-6.2246	9.0662	0.0108	-0.0197

$\alpha^* = \alpha(1-\mu_1-\mu_2) + \beta(\mu_1+2\mu_2)$, $\beta^* = \beta(1-\mu_1-\mu_2)$

The last two columns of Table 3 indicate that, while in every quarter of the recovery period aggregate supply shocks helped to reduce the inflation rate, the favorable (negative) impact of aggregate demand was limited to the three quarters corresponding to the early and late stages of the recovery. In fact, the sum of demand effects is positive indicating that the overall effect of unanticipated demand shifts on inflation was actually detrimental.

The results in Tables 2 and 3 represent contemporaneous effects of unanticipated shifts in aggregate demand and supply. As Cutler [1989, p. 255] points out "[a] shortcoming of [this] descriptive technique is that the accumulated effects of the supply and demand disturbances are imbedded in the past values of real output and are obscured. An alternative approach is to compute the accumulated effects of supply and demand disturbances over the [recovery]." Given that Y_t depends on Y_{t-1} and Y_{t-2}, following a shock to demand or supply, output returns to its natural level along a path determined by $1/(1 - \mu_1 L - \mu_2 L^2)$, where L is a lag operator.[7] Based on this, the accumulated output effects of innovations in aggregate demand and supply over the recovery period are 0.1441505 and 0.2806343, respectively. These results suggest that the accumulated effects of unanticipated shifts aggregate supply was nearly twice that of aggregate demand, a result that is consistent with our earlier finding (Table 2) regarding the sum of contemporaneous output effects of aggregate demand and supply surprises.

FOOTNOTES

1. Throughout, all variables are expressed in logarithms.

2. When models of this type are applied to annual data [e.g., Lucas, 1973], only once-lagged value of output is included in the aggregate supply equation. Because we will be using quarterly data, we follow Cutler [1989] and include twice-lagged output as well; this should increase the efficiency of the resulting estimators.

3. The parameter δ is actually a scaled price elasticity of supply, where the weight is a function of the variances of sector-specific demand and supply functions relative to the variances of aggregate demand and supply functions.

4. Because of the twin assumptions of market clearance and endogenous (rational) expectations, only unanticipated changes in aggregate demand and supply can have any real effects.

5. Note that in Equation 7, the parameter Θ will be known prior to solving Equations 7 and 8 since it enters the reduced-form equations for output and inflation.

6. Following Cutler [1989, note 2, p. 250], the parameter Θ was restricted to unity, a restriction that could not be rejected.

7. For more on this, see Cutler, note 6, page 255.

REFERENCES

Robert J. Barro, "Rational Expectations and the Role of Monetary Policy," Journal of Monetary Economics, January 1976, pp. 1-32.

-------, "Unanticipated Money, Output, and the Price Level in the U.S.," Journal of Political Economy, August 1978, pp. 549-80.

Harvey Cutler, "Aggregate Supply and Demand Disturbances, and the Business Cycle," Journal of Macroeconomics, Spring 1989, pp. 247-59.

Martin Feldstein and Douglas W. Elmendorf, "Budget Deficits, Tax Incentives and Inflation: A Surprising Lesson From the 1983-84 Recovery," NBER Working Paper No. 2819, January 1989.

Robert E. Lucas, Jr., "Some International Evidence on Output-Inflation Tradeoffs," American Economic Review, June 1973, pp. 326-35.