Discussion of the Evans Paper

STEVEN BRAUN

Aggregate supply is an old idea. Although discussed by Keynes and the early Keynsians, most recent econometric models can justly be criticized for not adequately developing the supply side. It is therefore exciting to review a supply-side model created by one of the most prominent model-builders. The Evans model was commissioned by the Senate Finance Committee as an attempt to incorporate supply-side effects which were not in existing econometric models. My remarks are based on a version of the model furnished to me courtesy of Dr. Evans (Evans, 1980).

Theory suggests a number of channels through which, in the long run, a reduction in various tax rates might substantially increase aggregate supply. This would make possible a higher level of real output without inflationary consequences. Four of these channels have been built into the Evans model. They are:

1. Because workers bargain for after-tax wages, a reduction in personal tax rates decreases wage demands;
2. Because income taxes reduce the incentive to work, a reduction in the personal tax rate increases *both* the participation rate and hours worked;
3. Because business taxes reduce the incentives to invest, reductions in these taxes will increase the stock of business capital; and
4. Because interest rewards savings behavior, a rise in the after-tax rate of interest will increase savings.

Although theory suggests the possible existence of these channels, it has little to say about their strength. Earlier model builders have found substantial empirical support only for the third channel—business taxes. Evidence for the others have been mixed at best and most other models do not contain them.

Steven Braun is Economist, Wage, Prices and Productivity Section, Board of Governors of the Federal Reserve System. The views contained in this paper do not necessarily reflect the views of the Board or its staff. The author is grateful for discussions with Albert Ando and Jared Enzler, and thanks Ron Sege for research assistance.

Dr. Evans differs from others in claiming to have been able to measure these channels and he finds their strength to be considerable. I find this evidence unconvincing.

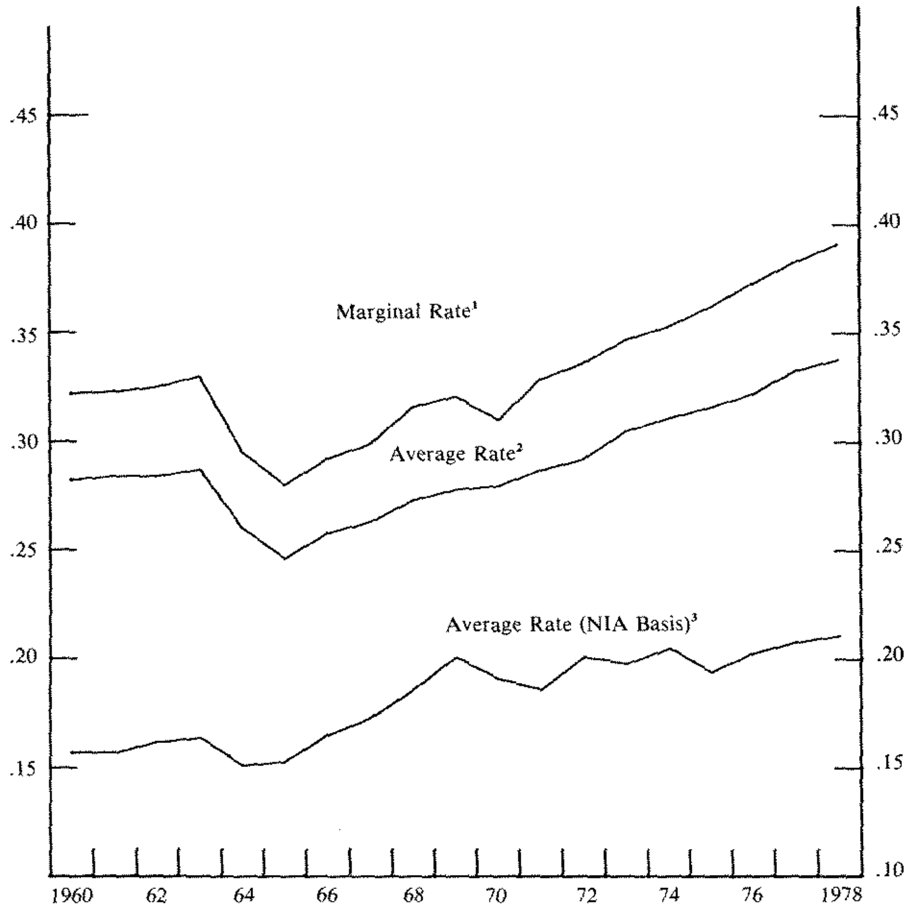
Let us begin by introducing one of the devils of the supply-side pantheon. Figure 1 shows the average and marginal tax rates computed by Dr. Evans from the IRS tables. Except for the 1964 tax cut these variables show a strong upward trend—a fact which is important in understanding this model. For comparison purposes I have computed an average tax rate based on data from the national income accounts. Since this series allows for the standard and personal deductions, which are excludable from income used above, the tax rate level is lower, and its trend is slightly less steep.

Now let us turn to some key equations which incorporate the various supply-side channels. Let me begin with the wage equation (which is the first equation in the Appendix). This wage equation is for the most part a rather standard looking inflation augmented Phillips curve. The rate of wage change depends on (ignoring the various dummy variables) the inverse of the unemployment rate, the rate of change in the CPI, the rate of change of output, and the level of the average personal tax rate. Presumably, the idea is that workers bargain for after-tax wages. But if this were true, the *growth* of taxes rather than the level of taxes should be included. The effects of this misspecification produce odd simulation results. A one time reduction in tax rates will affect the rate of wage growth not only in the following years, but for eternity. Using the coefficients of this equation, I have calculated that a reduction in the tax bill of, say, 3 percent will lower wages also by 3 percent after 6 years. But after 12 years, wages decline by 6 percent—twice the reduction in taxes! This equation is going to make the Kemp-Roth tax cut look very good! Notice that the effect of prices on wages is very low (0.6) implying that workers suffer from money illusion so that even in the long run, a permanent higher level of inflation could lower unemployment. It appears that the tax rate is picking up some of the trend in inflation.

Labor force participation rate equations are perhaps the most visible and the oldest of the supply-side features. Because of conflicting income and substitution effects, the sign of the wage variable could go either way. However, an upward sloping supply curve is plausible. Evans' participation equations (an example of which appears in the Appendix) does not seem to produce credible evidence for this proposition. Since one of the independent variables is the real after-tax wage bill, an increase in employment

FIGURE 1

Average and Marginal Personal Tax Rates



[1]Computed by Evans from IRS, *Statistics on Income*. This series includes state and local taxes and social security taxes.

[2]Computed by Evans from IRS, *Statistics on Income*. This series includes state and local taxes and social security taxes.

[3]Average tax rate computed on an NIA basis:

$$\frac{\text{(tax and nontax payments)} + \text{(personal contributions for social insurance)}}{\text{(personal income)} + \text{(personal contributions for social insurance)}}$$

has the same elasticity as an increase in real after-tax wages. We all know what the trends are in employment and participation. Thus the coefficient of the wage rate in this equation is guaranteed to show the correct sign. Notice also that the level of unemployment does not enter this equation, only its first difference. Will the participation rate snap back to trend when the unemployment rate stops growing?

The effect of tax rates on labor supply in this model is only partially captured in the labor force participation equations. Claiming that increased taxes reduce hours worked, Evans models a tax effect in the total manhours equation (shown in the Appendix). Here taxes are shown to reduce hours worked. This is a curious equation. If the level of productivity were included, rather than its growth rate, this equation would be close to an identity. However, productivity enters only through its growth rate. Because the omitted variable, the level of productivity, also has an upward trend just as the tax rate does, it is likely that the negative sign on the tax rate occurs because it is picking up the trend of the omitted variable.

Even this negative sign is curious. For a given level of output, a decrease in the tax rate will decrease manhours worked. Since output is also in the equation, and therefore held constant, this means that productivity has fallen. Thus, productivity falls when the tax rate falls. I seriously doubt that this is the effect that Dr. Evans wanted to show. I understand that the model presented to the Senate Finance Committee does not simulate. Surely, this equation must generate some problems.

Consider how this equation interacts with the participation equations. When the tax rate rises, manhours fall, causing the wage bill to fall. This in turn causes the participation rate to fall. So while it is claimed that the participation equations only captures part of the effect of higher taxes, we see that in simulations, this will not be true.

The productivity equation is discussed at length in Evans' paper in this volume. However, this equation is really superfluous since productivity is implicitly computed in the total manhours equation. Besides the growth of productivity appearing in the manhours equation and the capacity equation, I do not see how else the productivity variable is utilized. If it were utilized, it would be inconsistent with the manhours equation. (By the way, why does the *level* of secondary workers and the *level* of government regulation affect the *growth* of productivity?)

This model claims the ability to evaluate the effectiveness on investment of several forms of corporate income taxation. Reducing the corporate tax rate, for example, is found to be more effective per Treasury dollar than increasing the investment tax credit. I find these results to be based on a peculiar structure of the investment sector (see Appendix). The demands for new orders is separately influenced by four elements of the cost of capital: an index of industrial prices, the corporate tax rate, the depreciation allowance, and the investment tax credit. Then a single cost of capital variable affects how new orders are translated into investment. This raises problems of double counting the effects of these taxes. Since consumer expenditures are also in both equations, there seems to be double counting here too. These extra terms in the investment equation raise the possibility that investments may occur without antecedent new orders. I know of no theoretical explanation for this peculiar structure, nor has one been offered.

The effect of the interest rate on savings has long been a puzzle. As Keynes recognized, "Some of the subjective motives towards saving will be more easily satisfied if the interest rate rises, others will be weakened."[1] Since Dr. Evans claims a substantial effect, let us examine his equation (the fourth equation in the Appendix). Consumption is a function of lagged consumption, current and lagged income, and the after-tax real rate. However, wealth is omitted, and this omission is serious in interpreting the effects of changes in interest rates. Since the savings rate falls when wealth rises relative to income, and since wealth rises when the interest rate falls, the interest rate in this equation may be merely picking up the wealth effect. So after examining this equation, one still does not know whether the income or substitution effect dominates.

With these remarks in mind, it is time to ask how this model can help analyze aggregate supply. Reducing the personal income tax to reduce wage demands is dependent on an equation in which tax levels influence wage growth. Reducing personal taxes to increase labor force participation is dependent on an equation that cannot distinguish an increase in wages from an increase in total manhours. Reducing personal taxes to add to labor input is dependent on an equation that omits the level of productivity. Reducing the corporate tax rate to spur investment seems to be dependent on an investment sector that counts this parameter twice.

[1] John M. Keynes, *The General Theory of Employment, Interest, and Money*, Harcourt, Brace & World Inc., 1964, p. 93.

Reducing taxes on saving to encourage saving seems dependent on an equation that confuses the wealth effect with the interest rate effect.

Each of these prescriptions seem to be directly connected with an error in the model. What then have we learned about the world?

References

Evans, Michael K. "Supply-Side Model." Evans Economics, Inc., mimeo, 1980.

Evans, Michael K. "An Econometric Model Incorporating the Supply-Side Effects of Economic Policy." In this volume, 1981.

Keynes, John M. *The General Theory of Employment Interest and Money*. Harcourt, Brace, & World Inc., 1964.

APPENDIX

EVANS SUPPLY-SIDE MODEL[1] (selected equations)

Wage Equation (page 8.11)

$$\underset{}{WRM4} = \underset{(-3.1)}{-.9} + \underset{(2.3)}{.004}\ STRIKES + \underset{(3.3)}{.008}\ DWPP + \underset{(7.1)}{.6}\ CPI415$$

$$+ \underset{(3.5)}{.3}\ AVGSUM18 + \underset{(5.2)}{.1}\ XIPM4 + \underset{(3.0)}{.8}\ UNI18$$

$R^2 = .83$

WRM4 = percentage change[2] of the average hourly wage in manufacturing
STRIKES = Dummy variable, auto and steel strikes
DWPP = Dummy variable, wage-price freeze
CPI415 = percentage change[2] in the CPI, (distributed lag)
AVGSUM14 = sum of average personal tax rates, (distributed lag)
XIPM4 = percentage change[2], index of industrial production

$$UNI18 = 1/(\sum_{i=1}^{8} UN8), \text{ where } UN8 = \text{unemployment rate if} < 8$$
$$= 8 \text{ if unemployment rate} \geq 8$$

Labor Force Participation Rate (Females, 25-54), (page 7.53)

$$LFPF2554 = \underset{(14.2)}{.335} + \underset{(3.7)}{.036}\ WMARG14 - \underset{(-4.8)}{.02}\ UN13 + \underset{(3.0)}{.82}\ CPI41$$

$$+ \underset{(6.0)}{1.3}\ CPI45 \qquad R^2 = .85$$

LFPF2554 = Labor force participation rate, females 25-54
WMARG14 = (real wage and salary disbursements)(1-marginal tax rate), (distributed lag)
UN13 = $UN_{-1} - UN_{-3}$
CPI41 = percentage change[2] in the CPI, lagged (−1)
CPI45 = percentage change[2] in the CPI, lagged (−5)

[1]Based on Evans, 1980. The page numbers from this document are as indicated.
[2]These are not simple percentage changes. Rather, they are defined as,

$$X\% = \frac{X - (1/4)\sum_{1}^{4} X_{-i}}{(1/4)\sum_{1}^{4} X_{-i}}$$

Manhours (manufacturing), (page 7.69)

$$\text{EHMFG40} = \underset{(26.)}{33313} + \underset{(14.8)}{101}\ \text{XIPMS} + \underset{(6.1)}{64}\ \text{XIPM14}$$
$$- \underset{(-23.4)}{41965}\ \text{AVGSUM18} - \underset{(-7.9)}{1458}\ \text{PRODQ18}$$
$$- \underset{(-2.1)}{9.5}\ \text{KPPROD18}$$

$R^2 = .97$

EHMFG40 = manufacturing manhours
XIPMS = index of industrail production, manufacturing
XIPM14 = distributed lag of XIPMS
AVGSUM18 = sum of average personal tax rates, (distributed lag)
PRODQ18 = annual percentage change in private nonfarm business productivity (distributed lag)
KPROD18 = (manufacturing capital stock) − (pollution control capital stock), (distributed lag)

Consumption, (page 3.19)

$$C = \text{constant} + .336\ C_{-1} + .296\ Y + .299\ Y_{-1} - 2.04\ r$$

(estimated by principal components, long-run MPC = .89), $R^2 = .997$

C = total consumption expenditures per capita, 1972$
Y = disposable income per capita, 1972$
r = after tax real rate of return

Investment Sector
New Orders Equation, (page 4.68)

$$\text{NOR} = \underset{(.7)}{3.4} + \underset{(5.0)}{.4}\ \text{PWINOR} + \underset{(22.8)}{.1}\ \text{CDNOR} + \underset{(8.0)}{3.6}\ \text{IHSL1}$$
$$+ \underset{(9.0)}{45.}\ \text{DCPNOR} + \underset{(5.8)}{.08}\ \text{XIPDSENO} - \underset{(-6.3)}{35.6}\ \text{EFFTAX}$$
$$+ \underset{(2.5)}{6.4}\ \text{ZENOR} + \underset{(1.4)}{6.3}\ \text{DITC2}$$

$R^2 = .994$

NOR = New orders, all manufacturing
PWINOR = WPI, industrial commodities, (distributed lag)

CDNOR = consumption expenditures, durables and non-durables, (distributed lag)
IHSL1 = total housing starts, (distributed lag)
DCPNOR = index of capacity utilization (special functional form).
XIPDSENO = industrial production index, defense and space equipment
EFFTAX = corporate tax rate
ZENOR = tax savings from depreciation allowance
DITC2 = investment tax credit, (distributed lag)

Investment Equation, (page 4.80)

$$IPE = \underset{(4.6)}{-12.5} + \underset{(17.1)}{1.3\ NORL6} - \underset{(-6.1)}{1.8\ CREDL5} + \underset{(8.4)}{.09\ CDNL} - \underset{(5.9)}{\Sigma\, a_i\, RCCPL3_{-i}}$$

$R^2 = .992$

IPE = business fixed investment, producers durables
NORL6 = new orders, all manufacturing, (distributed lag)
CREDL5 = index of credit rationing, (distributed lag)
CDNL = consumption expenditures, durable and non-durables, (distributed lag)
RCCPL3 = cost of capital, (distributed lag)