

## Equation of Exchange

### Introduction and Description

This lesson describes and explains the relationship between the money supply and gross domestic product. The equation of exchange is an identity and provides an understanding of the relationship between money and economic activity. The students demonstrate an understanding of the equation of exchange and the change in velocity over time in Activity 36.

### Objectives

1. Define the equation of exchange.
2. Define the variables in the equation of exchange.
3. Explain how changes in the money supply are translated into changes in nominal GDP, prices and output.

### Time Required

One class period or 45 minutes

### Materials

Activity 36

### Procedure

1. Present the equation of exchange:  $MV = PQ$ .  
This equation shows the relationship among the money supply, income velocity, the price level and real output. Define each of the terms in the equation. Stress that the equation of exchange is an accounting definition or an identity: It is always true.
2. There is evidence that income velocity ( $V$ ) is highly predictable with its value remaining in a very narrow range over a multiyear period. Thus, changes in the money supply ( $M$ ) result in changes in nominal GDP ( $P \times Q$ ). Depending on the state of the economy, the changes in the money supply can result in changes in prices only, in output only or in some combination of price and output.
3. Discuss the factors that affect income velocity and determine whether changes in the money supply are translated into changes in prices and/or output in the short run. Shift the aggregate demand curve over the three shapes of the aggregate supply curve. If the aggregate supply curve is horizontal, an increase in the money supply will cause the aggregate demand curve to shift to the right, and only output will increase. If the aggregate supply curve is vertical, an increase in the money supply will cause the aggregate demand curve to shift to the right, and only the price level will increase. If the aggregate supply curve is positively sloped, an increase in the money supply will cause the aggregate demand curve to shift to the right, and the economy will experience increases in both the price level *and* output.
4. Have the students complete Activity 36. Review the answers with the students. Please note that the students may get slightly different numbers for the  $PQ$  in Figures 36.1 and 36.2 if they multiply  $P \times Q$  or  $M \times V$ .

## The Monetary Equation of Exchange

### Part A

1. Define (in your own words and in one or two sentences each) the four variables in the equation of exchange.

*M = M1, stock of money*

*V = income (GDP) velocity of circulation or average number of times \$1 is spent on final goods and services in a particular time period*

*P = average price level of final goods and services in GDP, also known as the GDP deflator*

*Q = real output, the quantity of goods and services in GDP*

2. The product of velocity (V) and the money supply (M) equals PQ. How can PQ be defined?  
*It can be defined as nominal GDP; Q is the current output at current prices (P).*
3. Suppose velocity remains constant, while the money supply increases. Explain how this would affect nominal GDP. *Nominal GDP (PQ) would increase. If the economy is not at full employment, both P and Q could increase. If the economy is operating at full employment, only P would increase. This action could lead to extreme inflation if the economy is at full employment.*
4. During the past 30 years, the use of credit cards has increased, and banks and financial institutions increasingly use computers for transactions. Explain how these changes might affect velocity.  
*V would increase. A given stock of M could “work harder” and finance more transactions more quickly.*
5. As the result of legislative and regulatory reform throughout the 1980s and 1990s, banks and other financial institutions began paying interest on a significant proportion of the checkable deposits in the M1 definition of the money supply. Explain how these changes might be expected to affect the velocity of M1. *V would decrease. People would be more willing to hold (not spend) M if it paid interest.*

### Part B

The following tables give data on money supply, prices, real GDP and velocity for the U.S. economy for 14 recent years. Because of rounding, some totals may not come out exactly.

6. Complete the tables by filling in the blanks.



Figure 36.1  
**M1 Chart**

Year	M1 (billions of \$)	V	P Implicit Price Deflator for GDP	Q Real GDP (billions of \$)	PQ Nominal GDP (billions of \$)
1987	\$750	6.36	0.780	\$6,114	\$4,768.90
1988	786	6.48	0.800	6,370	5,096.00
1989	792	<b>6.93</b>	<b>0.830</b>	6,592	5,489.00
1990	824	7.00	0.860	6,707	5,768.00
1991	896	6.71	0.90	6,677	6,009.30
1992	1,024	6.18	0.920	6,880	6,329.60
1993	1,129	5.88	0.940	7,063	6,639.20
1994	1,150	6.13	0.960	<b>7,348</b>	7,054.30
1995	<b>1,125</b>	6.57	0.980	7,544	7,393.10
1996	1,080	<b>7.23</b>	1.000	7,813	7,813.00
1997	1,073	<b>7.76</b>	1.020	8,160	8,323.20
1998	1,097	7.99	1.030	8,510	<b>8,765.30</b>
1999	1,125	<b>8.28</b>	1.050	8,876	9,319.80
2000	1,088	<b>8.98</b>	1.0691	9,320	9,768.90

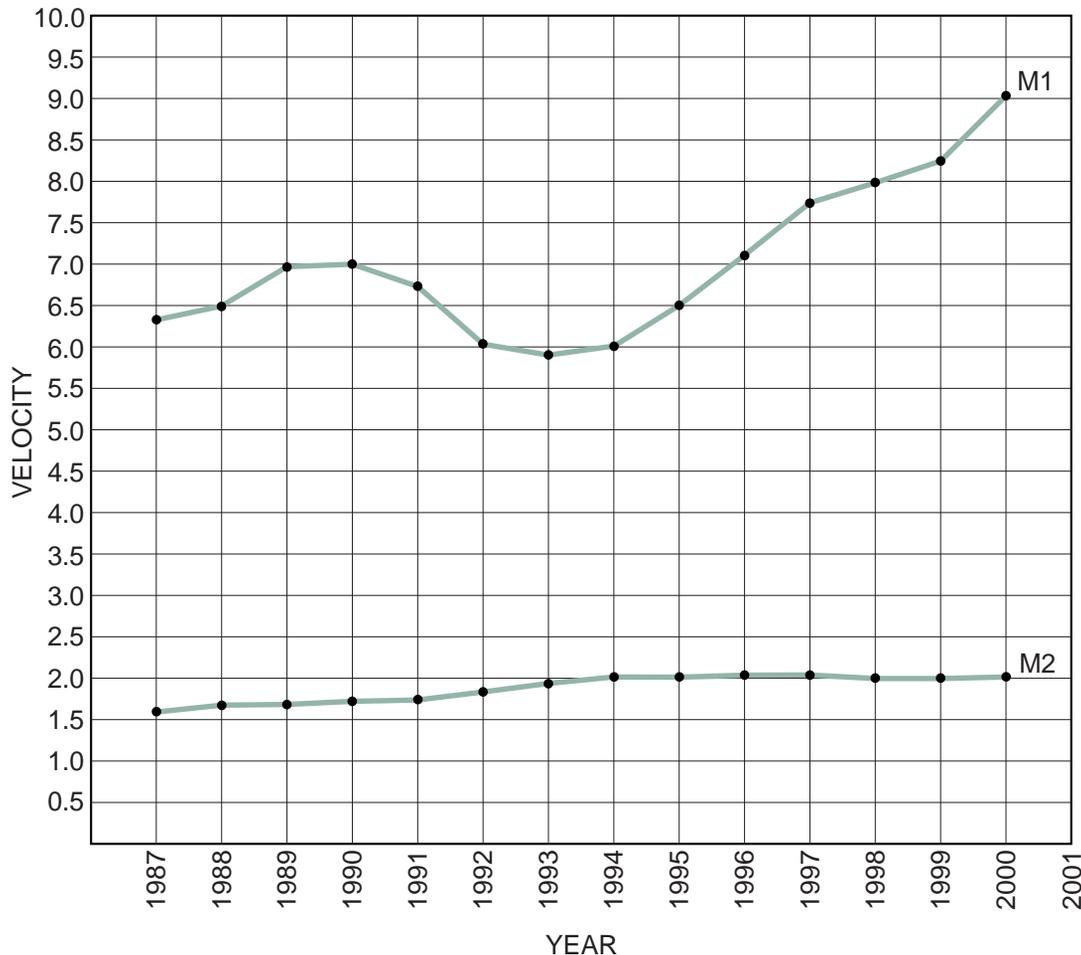


Figure 36.2  
**M2 Chart**

Year	M2 (billions of \$; Dec. figures)	V	P Implicit Price Deflator for GDP	Q Real GDP (billions of \$)	PQ Nominal GDP (billions of \$)
1987	\$2,830	1.68	0.78	\$6,114	\$4,769
1988	2,994	1.70	0.80	6,370	5,096
1989	3,158	<b>1.74</b>	<b>0.83</b>	6,592	5,489
1990	3,277	1.76	0.86	6,707	5,768
1991	3,377	1.78	0.90	6,677	6,009
1992	3,431	1.84	0.92	6,880	6,330
1993	3,484	1.91	0.94	7,063	6,639
1994	3,500	2.02	0.96	7,348	7,054
1995	3,642	2.03	0.98	7,544	<b>7,393</b>
1996	3,815	2.05	1.00	7,813	7,813
1997	4,032	2.06	1.02	<b>8,155</b>	8,318
1998	<b>4,395</b>	2.00	1.03	8,510	8,790
1999	4,653	<b>2.00</b>	1.05	8,876	9,299
2000	4,945	2.01	<b>1.07</b>	9,319	9,963

7. What might one infer from the changes of the 1980s and 1990s about the classical assumption that institutional factors determine velocity? *V does not remain constant when institutional factors change. In fact, it is increasing.*

8. Use the grid below and the M1 and M2 data to graph the income velocity from 1987 to 2000.



(A) What trends do you see? *Velocity is increasing slowly.*

(B) What is the difference in the value of M1 velocity and M2 velocity? Explain why they are different. *M1 velocity is much larger than M2 velocity. M1 is used for transactions, whereas a significant proportion of M2 is used for saving so it does not change on a daily or weekly basis.*

9. For a given money supply growth, a(n) (increase / decrease) in velocity will (increase / decrease) inflationary pressure. (Underline the correct word(s) in parentheses.)