



DRIVING QUESTION

Where does a dollar go after it is spent, and how many times does it get spent again?

Students run a copy of the water computer Bill Phillips built in 1949. Water is money. Pumps add spending and drains take it out.

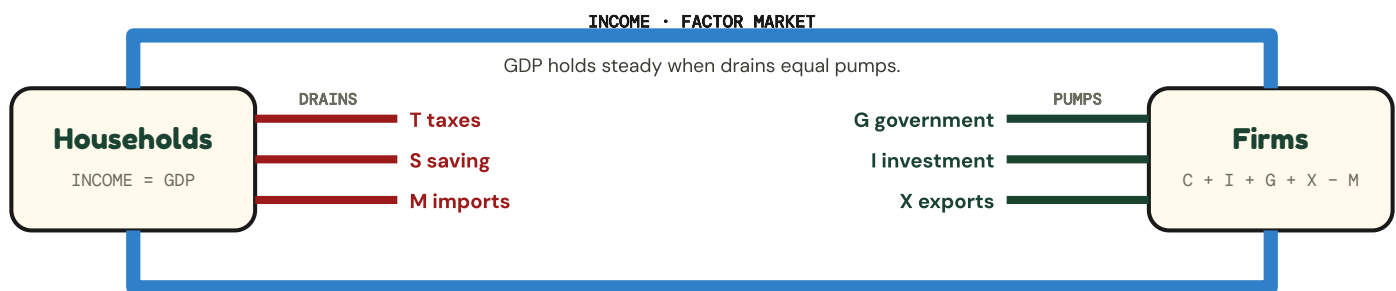
PLAY One device per student or pair, at witsooth.com/games/moniac.html. It also projects well for a whole-class walk-through.

TIME About **25 minutes** for stages 1–3, **30** for stages 4–7, and **25** for the puzzles.

SAVES Progress stays on the device. The game opens at the first unfinished challenge.

CONTROLS Drag a valve. **Fast** speeds the water. **Hint** gives three hints for the whole game. **?** explains the real machine.

THE MACHINE · BY STAGE 7



THE STAGES · PLAY EACH ONE WHEN ITS UNIT COMES UP, OR RUN ALL OF THEM AS REVIEW

#	STAGE	WHAT STUDENTS DO	CED TOPICS
1	The loop	See that spending becomes income. Click the factor–market pipe. Measure GDP once, not twice.	2.1
2	The multiplier	Open the saving drain. Hold GDP still with investment. Find the MPS from a resting machine and the MPC from the recorder. Predict and hit targets.	2.1 · 3.2
3	Government	Close a recession with G, then with a tax cut. Predict a balanced-budget change. Cool an inflationary gap without a deficit.	3.2 · 3.8 · 5.4
4	Jobs and prices	Read unemployment and inflation in a gap. Watch a tax rate soften a crash. Let wages and prices fall until GDP self-corrects.	2.3 · 2.4 · 3.7 · 3.9
5	Money and the Fed	Run deposits through the banks. Cut the Fed rate and wait out the lag. See borrowing crowd out investment.	4.4 · 4.6 · 5.5
6	The long run	The recorder becomes a Phillips curve. Raise money growth, then stop it. Watch investment raise full-employment output.	5.2 · 5.3 · 5.6
7	The world	A second machine appears abroad. Appreciate the dollar. Raise the rate and watch capital flow in. Fix a world recession.	6.1 · 6.5 · 6.6 · 5.1
P	Puzzles	Eight puzzles with a par in moves. Every method is taught in a stage first. Answers are on page 2.	All units



The model inside the machine

$$\text{Next GDP} = C + I + G + X - M$$

One lap is one round of spending.

$$\text{Spending multiplier} = 1 \div \text{MPS}$$

For any change in I, G or net exports.

$$C = \text{MPC} \times (\text{GDP} - T)$$

Households pay taxes, save the MPS share, spend the rest.

$$\text{Tax multiplier} = \text{MPC} \div \text{MPS}$$

One less than the spending multiplier.

Where it differs from the real machine: taxes are a set amount (except stage 4b) and imports do not depend on income, so the multipliers match the AP formulas. One interest rate stands in for both the money-market rate and the loanable-funds rate. Phillips's machine used tax rates and an import leak.

PAUSE POINTS FOR THE WHOLE CLASS

1. **After stage 2.** Investment went up once. Why did GDP stop rising instead of growing forever?
2. **After stage 3.** Why does a 20 tax cut add less GDP than 20 of government spending?
3. **After stage 5.** Investment answered the rate cut several laps late. What does that mean for when the Fed should act?
4. **After stage 6.** Money growth went to 4% and GDP ended where it started. What changed, and what did not?

MISTAKES TO WATCH FOR

- **Adding both pipes for GDP.** Spending and income are the same flow.
- **Using $1 + \text{MPS}$ for taxes.** Households save part of a tax cut first.
- **Ignoring crowding out.** Borrowed G pushes up the rate and pulls I down.
- **Reacting after a shock lands.** With a lag, the move has to come first.
- **Thinking money growth raises real GDP.** In the long run it only raises prices.

PUZZLE ANSWER KEY

#	PUZZLE	PAR	ANSWER	METHOD
1	Mystery MPC	1	I = 130	At rest $S = I$, so $\text{MPS} = 100 \div 400 = 0.25$ and the multiplier is 4. GDP needs 120 more: $120 \div 4 = 30$.
2	Balanced books	1	G = T = 200	Raising G and T together moves GDP by the same amount. GDP needs 100, so raise both by 100.
3	Crowded out	1	G = 140	Each dollar of borrowed G loses half a dollar of I, so it adds $0.5 \times 5 = 2.5$ of GDP. $100 \div 2.5 = 40$. G = 120 stops at 450.
4	Ride the cycle	3	G 100, 60, 80	Move G against each shock by the same amount, on the lap it lands.
5	Beat the lag	1	r = 3% early	The cut is 20, so the rate falls 2 points. Move 2–4 laps before the cut lands. At the cut is too late.
6	Two targets	1	r = 4%, G = 60	Only the rate moves the dollar: 4% gives 95. That adds 20 of spending, or 100 of GDP. Take it back with G – 20 (or T + 25).
7	Wring it out	2	μ 2%, then 0%	Cutting money growth 4 points at once pushes unemployment to 7%. Two steps of 2, about 40 laps apart, peak near 6%.
8	Black box	2	G 60, then 75	A test move of +10 shows rounds of 10, 7.5, 5.6, so the MPC is 0.75 and the multiplier 4. GDP is then 540 and needs 60 more: G + 15.