Previously, we looked at high inflation countries, where inflation was so high that changes in most variables (interest rates and GDP) were small enough that they could be ignored. Only growth in prices, money, and expectations mattered. In countries (including most developed countries) where inflation is lower, we must consider how inflation and money creation affects all variables in the economy.

Definition 28 *GENERAL EQUILIBRIUM: Equilibrium in all markets.*

We have already seen the money market. We will also add an investment-savings market, a goods market, and a labor market. A general equilibrium is when we have equilibrium in all four markets. We can thus determine how a change in money supply, for example, affects other markets such as the market for investments and goods.

I Aggregate Demand

Definition 29 *AGGREGATE DEMAND: Relationship between price and quantity demanded such that there is equilibrium in the money market and the investment savings market.*

A LM Curve

Definition 30 *LIQUIDITY OF MONEY (LM) curve: Set of points R, y such that the money market is in equilibrium for a given price.*

We will now assume all goods, including investment and government spending, must be purchased with cash. Thus we replace C in the money demand equation with $y = C + I + G$.

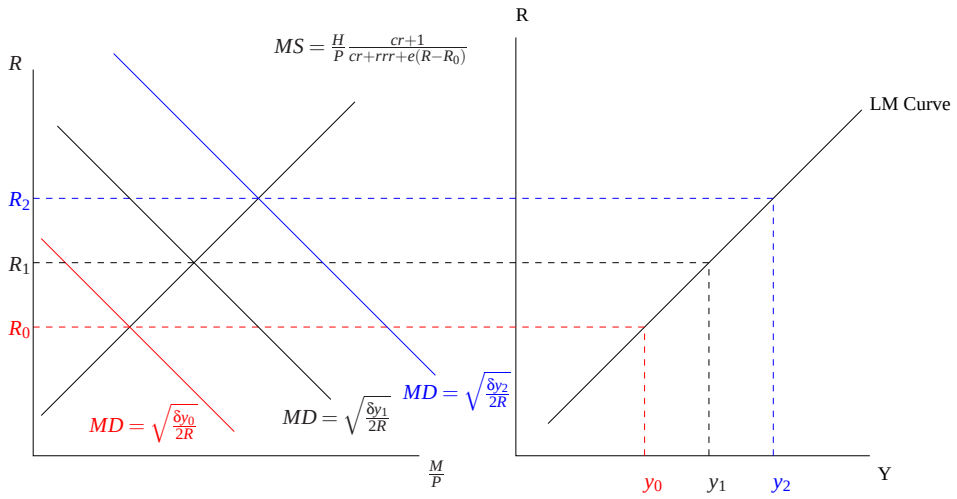

Figure 18: Derivation of the LM curve.

Intuition of the LM curve: As income increases, consumers demand more money to finance purchases. To keep money market in equilibrium with fixed prices requires an increase in R. The increase in R will reduce money demand (more withdraws) and increase money supply (decrease reserves) until we have money supply equal to money demand (equilibrium in the money market).

We move along the LM curve as R and y change. We shift the LM curve as H, P, cr, rrr, and e change.

B IS Curve

Definition 31 *INVESTMENT SAVINGS (IS) curve: Combinations of R and y which maintain equilibrium in the investment savings market.*

$$\text{Savings} = \text{Private Savings} + \text{Gov. Savings} \tag{64}$$

Both private individuals and government may save. The government saves when it takes in more tax revenue than it spends, just like a household saves when it takes in more income than it spends. Let T be total taxes and G be government spending, then:

$$= (y - T - C) + (T - G) \tag{65}$$

$$\text{Savings} = y - G - C \tag{66}$$

Next recall from Eco 212 that total spending equals GDP which equals income. So:

$$y = C + I + G. \tag{67}$$

Combining the above equations we see that:

$$\text{Savings } = y - G - (y - I - G) = I. \tag{68}$$

The above equation says that investment equals savings. An increase in income increases savings. Supply of loans exceeds demand, and therefore the interest rate must fall. To get equilibrium R falls and so savings falls and investment demand increases as consumers and firms find it less expensive to borrow. Thus y and R are inversely related.

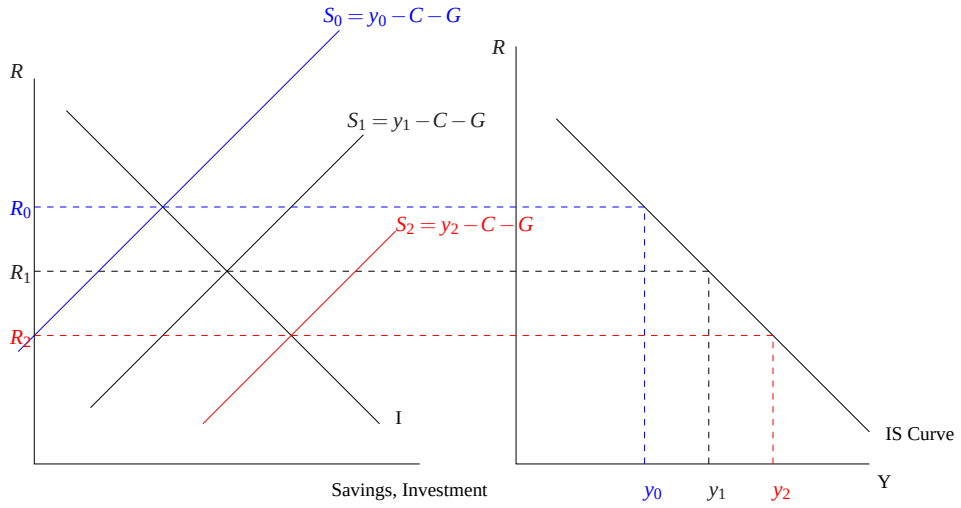

Figure 19: Derivation of the IS curve.

Remember that I here is investment spending demand: demand for goods by firms, including housing. Investment demand includes demand for new factories, new equipment, and housing demand. Change R and Y cause a movement along the IS curve. The IS curve shifts in response to fiscal policy changes such as changes in G and T. This class covers monetary theory and thus we will shift only the LM curve.

C Aggregate Demand

We have put two markets, the money and investment-savings market, on one graph. Now we need to add the goods market. The relationship between P and Y is derived from the IS and LM curves. A change in prices does not affect real demand for investments, or real

savings. According to the BT model, a change in prices does not affect real money demand. Real money supply, however, falls with an increase in the price level.

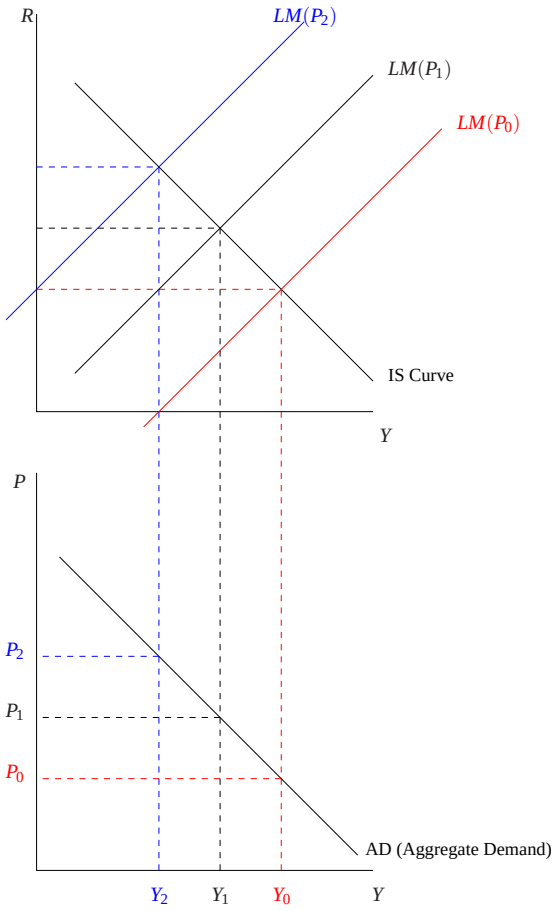

Figure 20: Derivation of the AD curve.

We move along the AD curve when P and Y are changed. Policy variables shift the AD curve: R_0, H, rrr, etc. Changes in parameters also shift the AD curve such as cr, e, etc.

INTERPRETATION. The interpretation is NOT an increase in prices cause goods to become more costly so buy less of those goods and more of other goods. There are no substitution effects here. Rather, an increase in prices means that the real money supply falls, so a higher interest rate is required to keep the money market in equilibrium. An increase in R means less demand for investment spending: new houses, new businesses, and new equipment. Therefore income, Y, falls. The fall in income falls primarily on construction workers, real estate agents, equipment suppliers, etc.

II Classical Aggregate Supply

A Production

Assume that capital and technology are fixed in the short run. We are now in short run-business cycle theory. Further, assume that labor (n), capital (K), and technology (z) are used to produce the consumption goods. The output of the economy is then:

$$Y = F(n, K, z) \tag{69}$$

So we need to understand how the labor market works to get aggregate supply.

B Labor Market

The cost of labor is the real wage: $\frac{W}{p} = w$. Competitive firms demand labor until the additional production from a unit of labor does not justify the cost. On the other hand, workers supply labor if the wage is high enough to forgo goofing off. As the wage rises, working becomes more attractive.

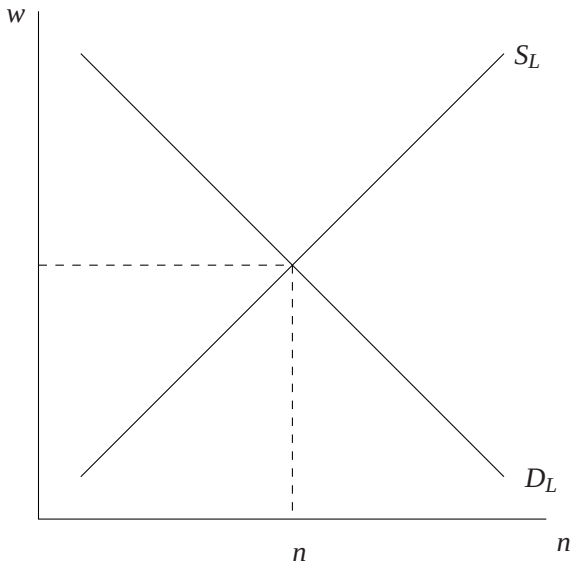

Figure 21: The labor market.

C aggregate supply

To get the relationship between P and Y, we need only derive the relationship between P and n. So let's increase P and see what happens to n.

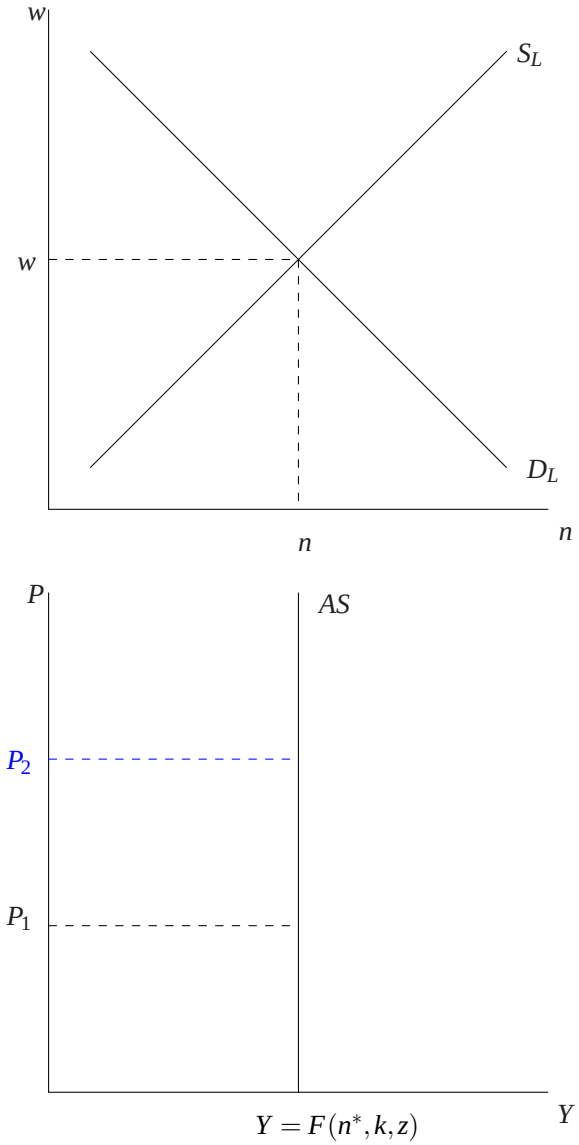

Figure 22: Derivation of the classical AS curve.

Net effect of an increase in prices is an increase in the nominal wage. There is no effect on real productivity or real desire for leisure. Thus there is no change in the decisions of the firm and the same output is produced.

III Keynesian Aggregate Supply

The main difference from the classical model is the behavior in the labor market. We will make two assumptions.

- Nominal wages are fixed (perhaps due to a wage contract).
- Equilibrium labor is equal to labor demand.

Explanation in the book: "For a variety of institutional reasons..., wages in actual industrialized economies do not fluctuate from day to day or month to month in response to shifts in labor supply or demand. Many workers...are in long-lasting employment agreements that specify wage rates for a year in advance. The quantity of work that they perform in any month is then determined by employers."

Example: Dr. Dave's wage (say per class taught) is specified in February for the fiscal year beginning in August. Dave commits to be employed and cannot renegotiate if unexpected inflation reduces the buying power of his wages. Since the employer is getting a good deal in this case, the employer could require Dave to teach more classes, taking advantage of the low wage per class.

Under the Keynesian model we have a positive relationship between prices and aggregate supply.

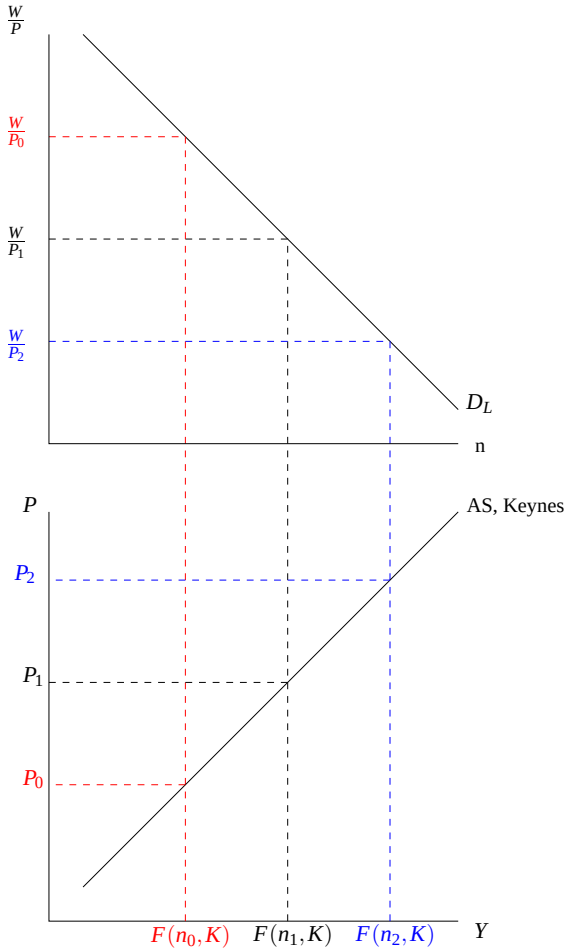

Figure 23: Derivation of the Keynes AS curve.

IV Monetary Policy

A Classical Model

First, suppose an increase in high powered money, H.

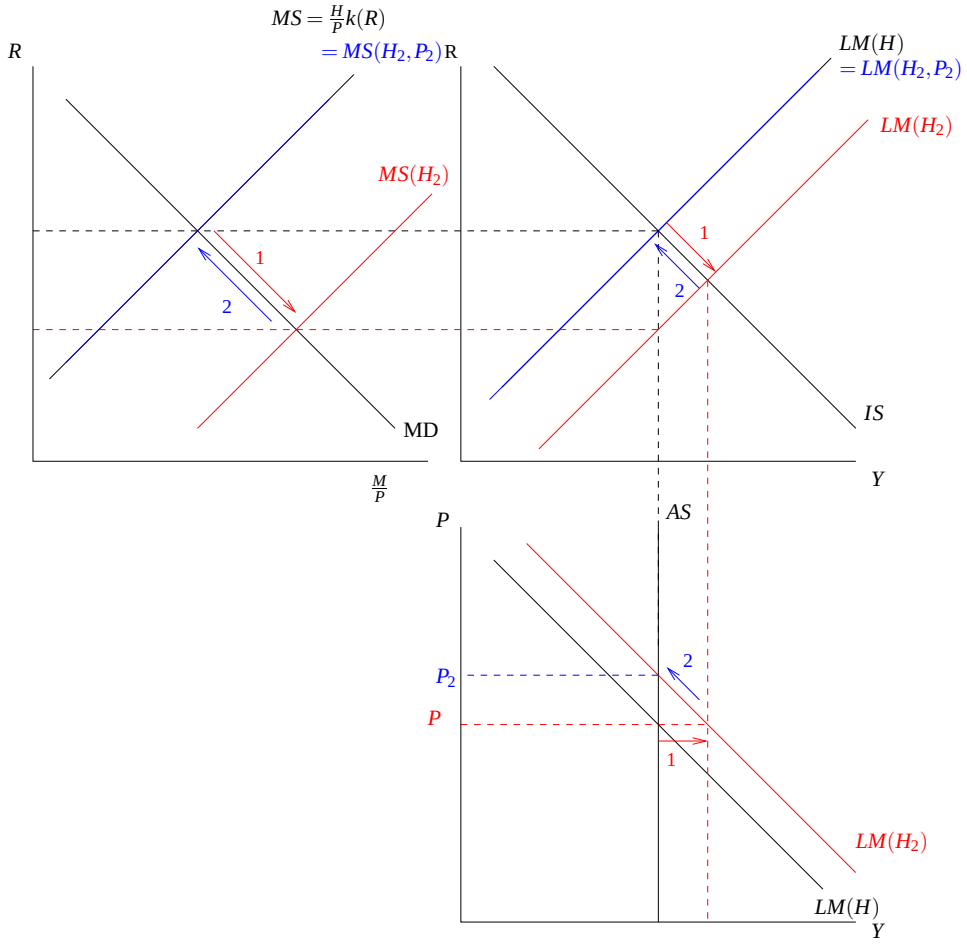

Figure 24: The effect of an increase in H with the classical AS.

Intuition: An increase in H results in an increase in the MS. A decrease in R is required to induce enough money demand to keep the money market in equilibrium. This is a shift in the LM curve (shift number 1 on the IS-LM graph). A decrease in R causes investment demand to increase (move along IS curve). The increase in investment demand increases aggregate demand, which is a shift to the right of AD curve (shift number 1 on the AD-AS graph). We have $AD > AS$ so prices are bid up. An increase in P decreases the real money supply. An increase in R is required to reduce money demand and bring the money market back to equilibrium (shift number 2 on the LM curve). But then investment demand falls and AD falls (second move on the AD-AS graph). At the end, there is no net change in any real variables, only H and P (not even the real MS and MD changes).

Definition 32 *SUPER NEUTRALITY OF MONEY: Change in MS has no effect on real variables.*

This makes sense, if we replace all of the green one dollar bills with red two dollar bills, we should expect to see only prices change.

B Keynesian Model

The difference is the response of supply.

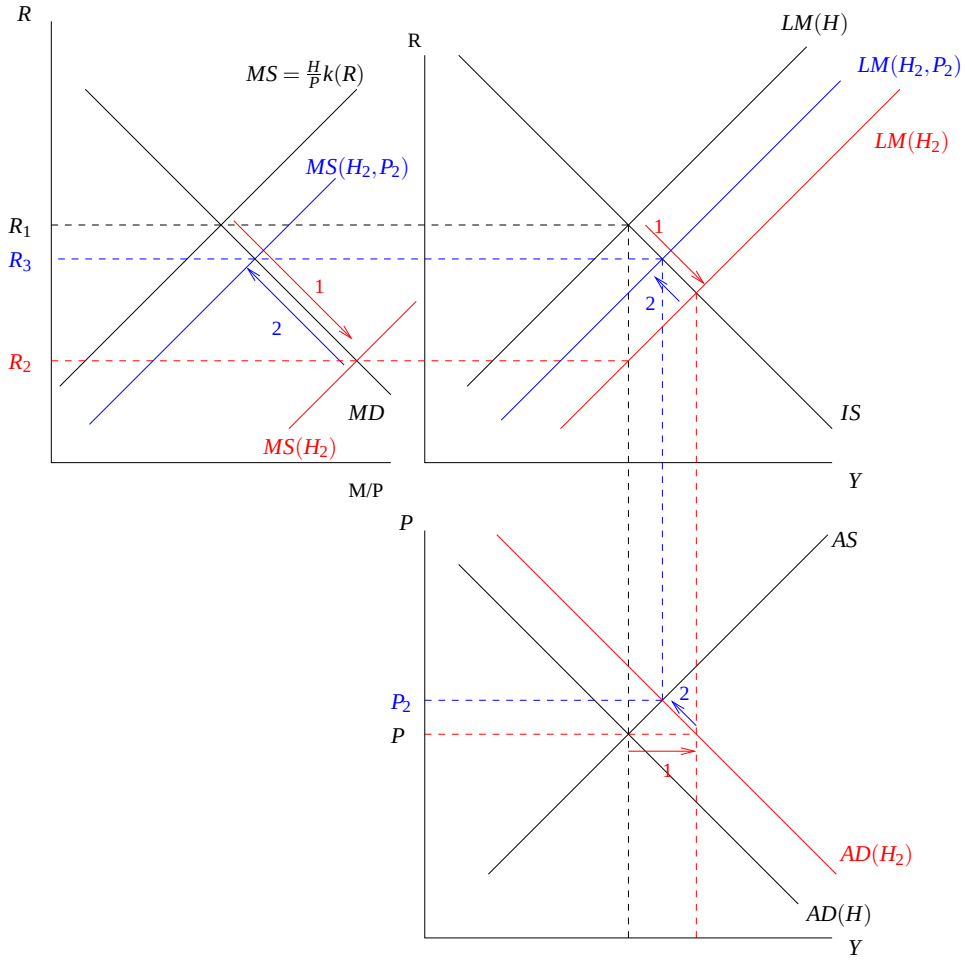

Figure 25: The effect of an increase in H with the Keynes AS.

Intuition: An increase in H results in an increase in the MS. A decrease in R is required to induce enough money demand to keep the money market in equilibrium. This is a shift in the LM curve (shift 1 on the IS-LM graph). A decrease in R causes investment demand to increase. The increase in investment demand increases aggregate demand, which is a shift to the right of AD curve (shift number 1 on the AD-AS graph). We have $AD > AS$ so prices are bid up. However, as prices rise, labor demand increases, and so labor input increases

and more is produced. To some degree, this mitigates the need for prices to rise. Prices do rise some, leading to some decrease in the real money supply, and therefore some increase in R (second shift of the LM curve), some decrease in investment demand and therefore some decrease in total demand (second move on the AD-AS graph).

C short vs. long run

Monetary policy may generate short run gains in Y at the expense of long run inflation. Hence it is essential to keep the FED independent.

V Policy Effectiveness

Monetary policy relies on low R to stimulate investment demand. Would like a big decrease in R and therefore a big increae in Y for a small change in monetary policy (ie in the high powered money). Here we are working in the Keynesian framework, as monetary policy is always ineffective in the classical framework.

A Money demand is sensitive to R

In the bottom panels of the graph below, large changes in Y are required to get any change in R. Therefore the LM curve is flat.

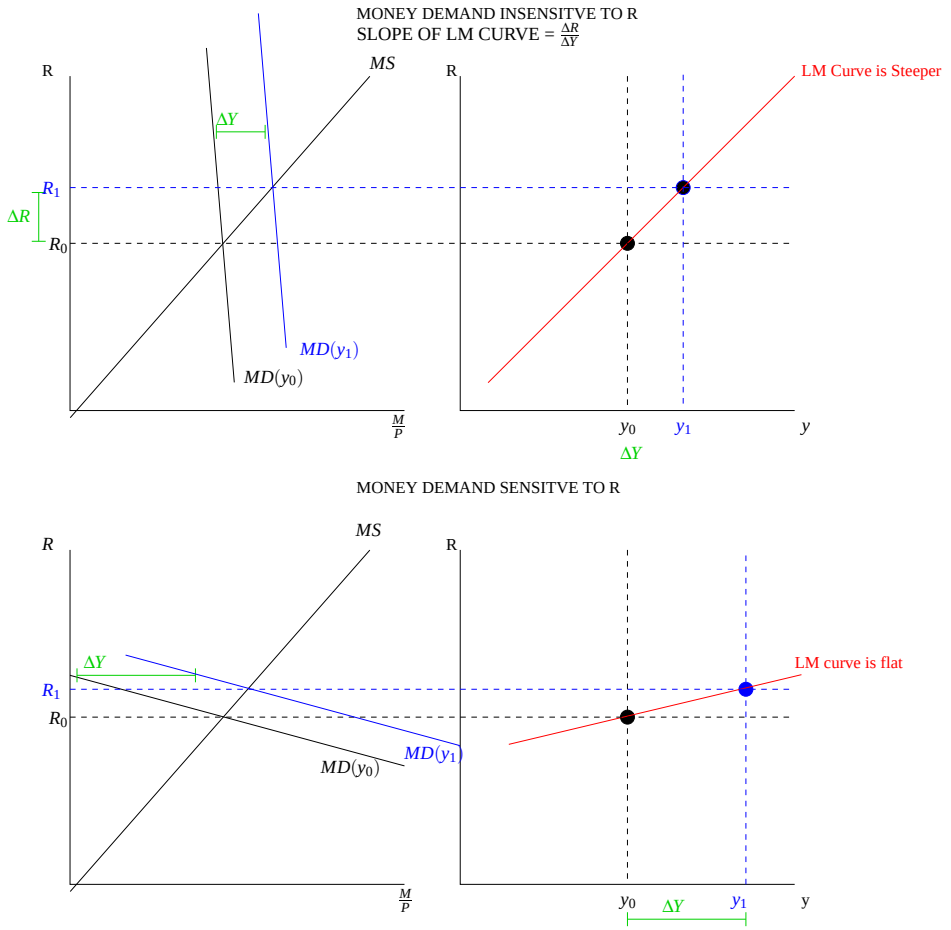

Figure 26: Slope of the LM curve depends on the slope of money demand.

B Money demand is NOT sensitive to R

In the top two panels we see that a change in Y generates a reasonable change in R. The LM curve here is steeper.

C Effectiveness of monetary policy

Monetary policy is much less effective when money demand is sensitive to interest rates:

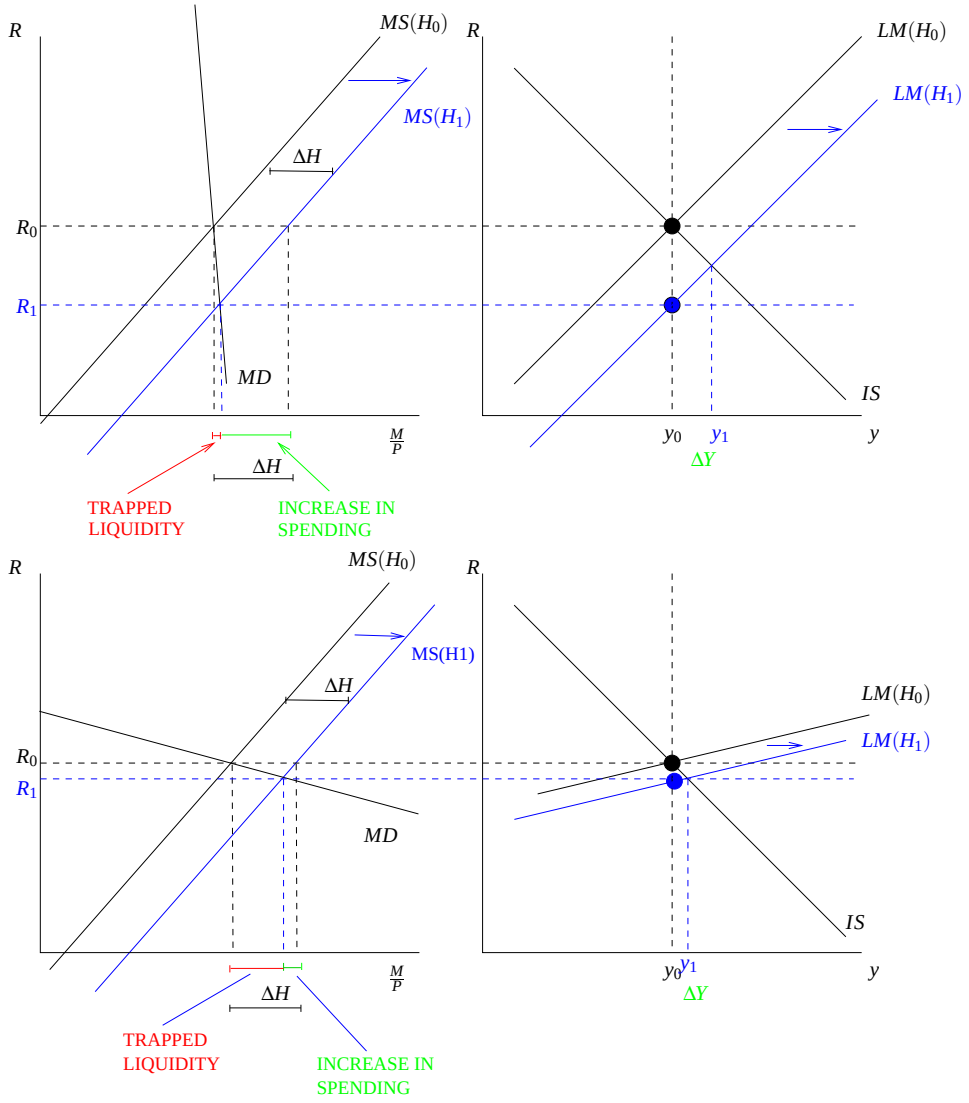

Figure 27: Effectiveness of monetary policy depends on the slope of money demand.

We see that when money demand is insensitive to R monetary policy is effective. Why? An increase in the money supply means R must decrease in order to bring the money market into equilibrium. But if consumers do not care much about interest rates, a huge drop in R is required to get consumers to hold more cash. But then investment demand gets a big boost, leading to a large increase in output.

Conversely, if money demand is very sensitive to R, only a small fall in interest rates brings money demand up to money supply. Thus there is very little change in investment demand.

Definition 33 *MONETARISM. Belief that monetary policy is more effective than fiscal*

policy.

Definition 34 *KEYNESIANISM. Belief that monetary policy is not very effective relative to fiscal policy.*

Definition 35 *LIQUIDITY TRAP. When almost all of an increase in H is not spent.*

Response of money demand to R is so high that almost all of an increase in the money supply ends up as increases in money balances rather than C or I. Example is the Great Depression. Huge increases in H, but people hid money in mattresses as confidence in the banking system was low. Therefore, there is no increase in C and I.

Liquidity traps often occur when a recession is caused by a fall in investment demand caused by a problem with the banking system. Leading to the great depression, stocks were bought with loans from banks. When stocks crashed, loans for stock purchases went bad and banks went under. Consider now an increase in the money supply. Becauase interest rates are falling, households are moving money from interest bearing accounts to cash in their wallets. This effect is magnified because of lack of confidence in the stock market. Cash, even when held in your wallet, is considered very safe in a low inflation environment. Thus households hold cash rather than lend through the interest bearing account.

D Liquidity trap through flat money supply

A liquidity trap can also result from a flat money supply curve. An increase in the money supply causes a decrease in interest rates. But suppose a small decrease in interest rates causes banks to hold vastly more excess reserves, thus "trapping" most of the increase in money supply in excess reserves. Interest rates do not fall much, and the normal channel for monetary policy (a decrease in interest rates increases loans which increase investment demand), does not work.

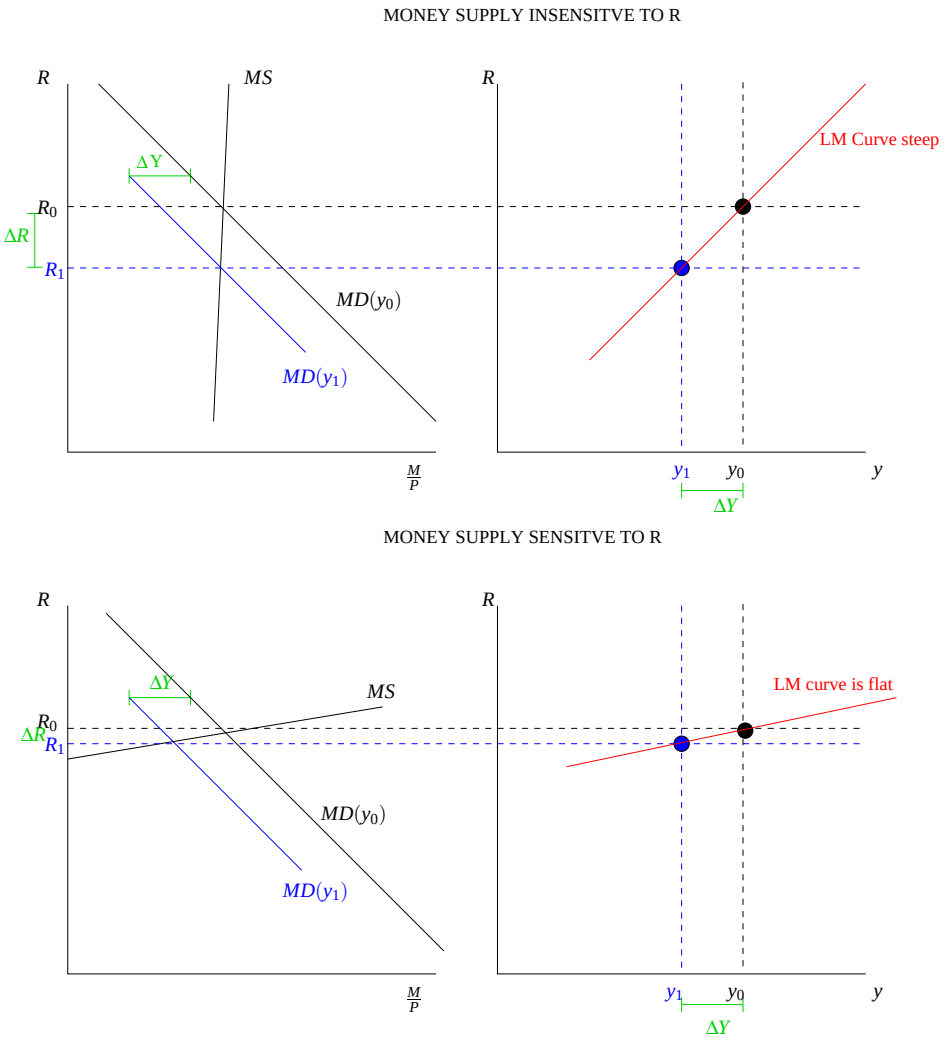

Figure 28: Effectiveness of monetary policy depends on the slope of money supply.

A liquidity trap arising from a flat money supply curve can arise two ways. The first is an increase in the currency to deposit ratio. In this case, an increase in the money supply ends up trapped mostly in people's wallets. If the banking system is in trouble, households hold cash in wallets and mattresses rather than in the troubled banking system. But then banks were unable to make loans. The normal channel for monetary policy, low interest loans from banks, is unavailable. In the great depression, bank failures led many to hold their wealth as cash in their mattresses.

A similar problem occurred in Japan in the 1990's. A real estate crash meant that many banks went under. Households held cash (the currency to deposit ratio rose from 0.68 to 0.85, causing the M2 multiplier to drop from 13 to 8), even when nominal rates went to

zero, and investment spending did not rise. The problem was made worse because housing is included in investment demand. Thus the lack of borrowing for real estate investments caused the price of real estate to fall further, causing more loans to go bad and more banks to go under.

The current current sub-prime crises was also caused by a fall in investment demand caused by trouble in the banking system, but households did not remove money from the banking system. Instead, banks fear of a run caused them to hold vastly more excess reserves than usual. Increases in money supply were trapped in excess rerves and loans did not take place.

In summary liquidity traps result from:

1. Lack of confidence in interest bearing accounts causes households to shift vastly more money to cash and checking when interest rates fall. Money demand is flat and the increase in money supply is trapped in cash in wallets and checking.

2. Lack of confidence in banks causes a rise in the currency to deposit ratio. Households shift money from checking to cash in wallets and mattresses. The money multiplier falls, money supply is flat, and the increase in money supply is trapped in cash in wallets and mattresses.

3. Fear of a bank panic causes banks to increase excess reserves. The money multiplier falls, money supply is flat, and the increase in money supply is trapped in excess reserves.

In all cases, loans fall and investment spending (particularly housing) does not increase despite low interest rates.