Macroeconomics Lecture Notes

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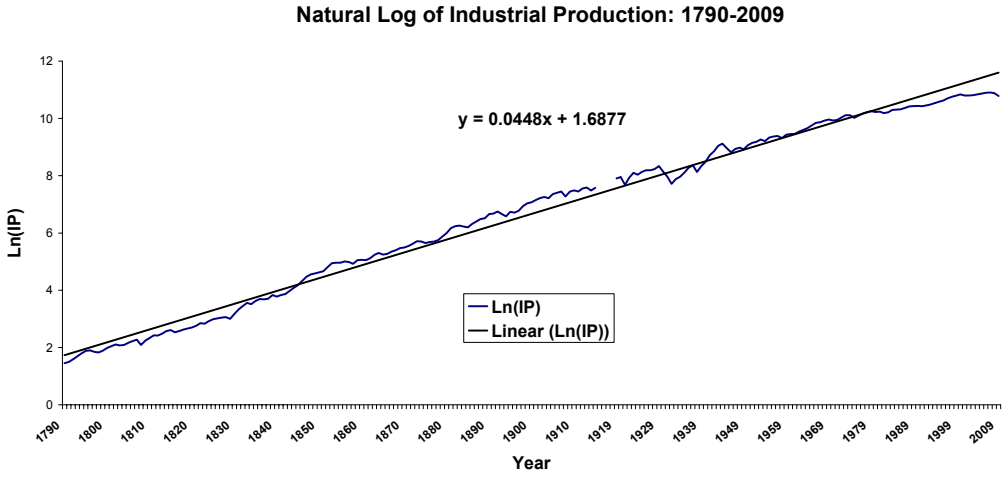
The macro economy and its performance

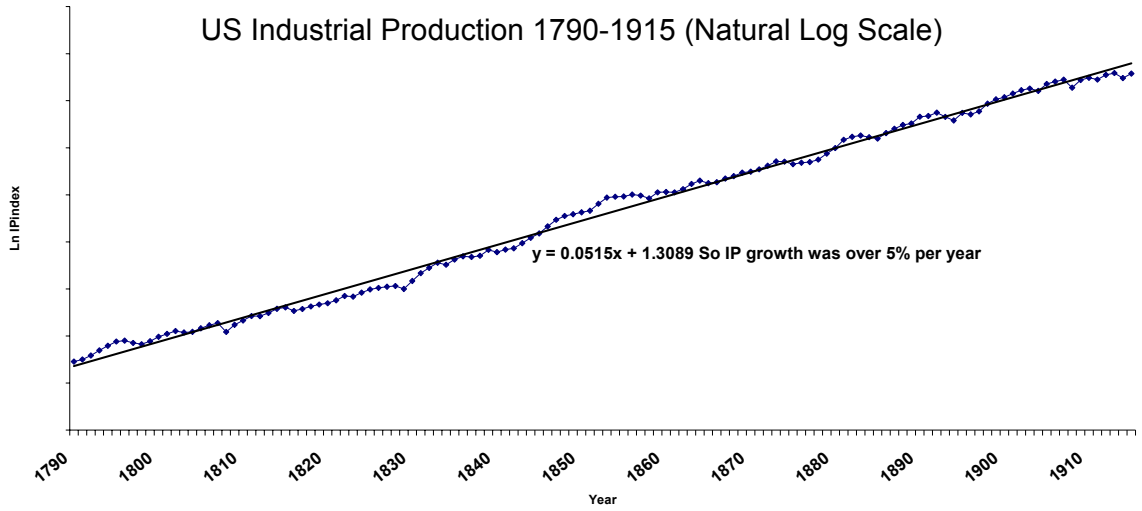
Before there was a Keynes, there was an economics. And it was good. And it was found useful for explaining economic fluctuations. And then the Great Depression fell upon the Land, and economics was at a loss to explain the events that befell us.

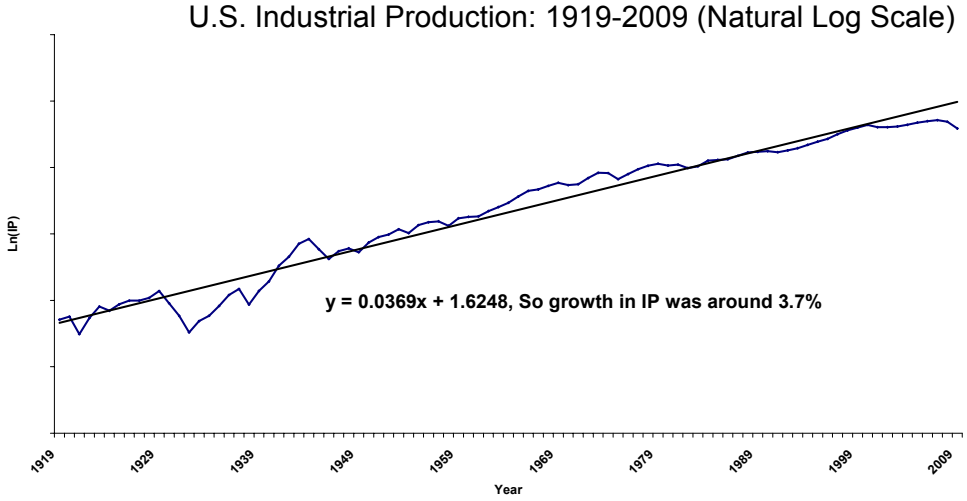
It is hard, even in these troubled economic times to appreciate the severity of the depression, which lasted through the entire decade of the 1930's. The figure below shows industrial production in the United States from 1775 through 2000. The data have been linearized by taking the natural log of the actual series. The use of industrial production as a proxy for a more general output series is necessitated by the lack of GDP data before 1929 and to the frequency of this series: monthly rather than quarterly. Also, when a time series is made into natural log form, the slope of the line is the growth rate. Thus the average annula growth of real GDP for 1790 to 2009 was about 4.5%.



Using the same trend line for the pre- and post-World War I periods clearly reveals that economic growth in the United States has slowed considerably in recent years. According to the graph the United States has been in recession since the 1970's. While I'm not sure many Americans might not agree with such an assessment, we should revise our estimates of where the U.S. economy would be if it were on trend.

Now, choosing a break point is not easy, but inasmuch as the data have a natural break during the four WWI years, when reliable data were not collected, let us, create two series, one pre- and one post-WWI. The two figures below show these two series with their own trend lines.





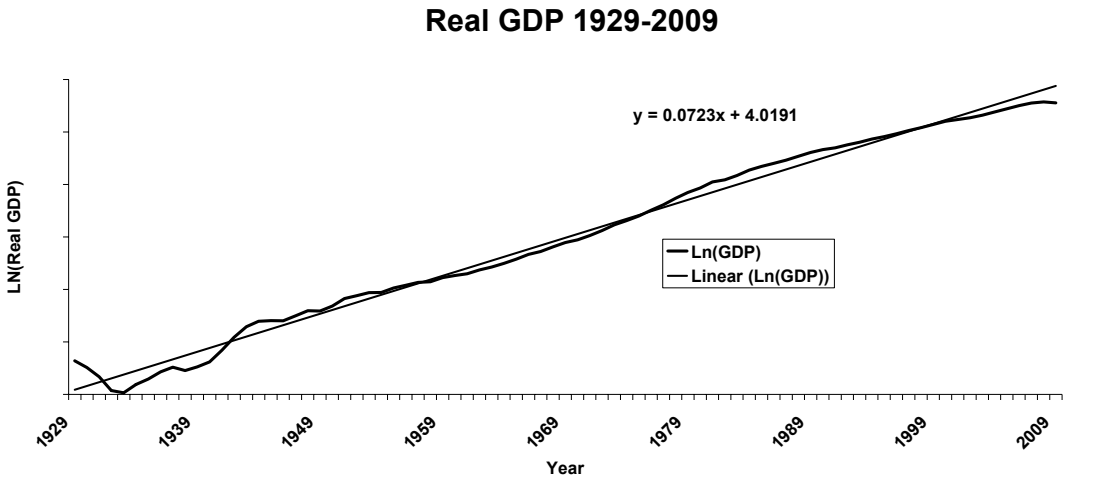
Clearly, growth in industrial production has slowed, not only since the First World War, but much more so in very recent years. But while the fall off in industrial production if recent years has been offset by growth in other sectors, the 1930's period was clearly a very severely depressed period and industrial output was a very accurate proxy for the macro economy.

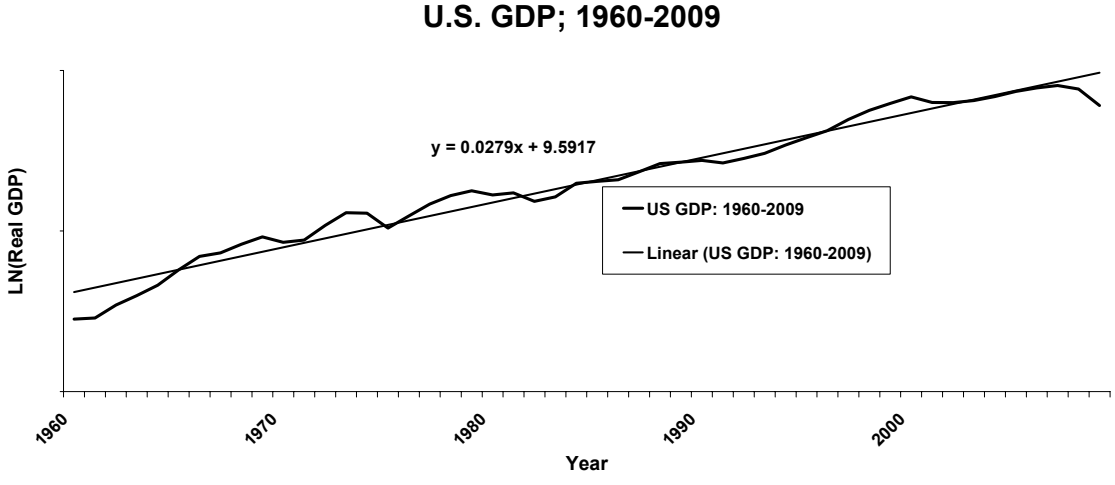
In modern times it makes much more sense to look not at industrial production, the series of choice for "ancient" U.S. history, but to real gross domestic product, GDP for short, which is available since 1929. In the figure below, we still see a deep recession in the 1930's as well as a clear slowdown in United States GDP growth beginning in the 1990's. Note that the 1929-2009 period experienced extraordinary growth of over 7% for the

entire period, in line with what is being experienced by Japan for 1960 to 1995 or China today.

The reason the growth is so much higher from 1929 to 2009 than from 1919 to 2009 must be due to the very low level of the starting point of the latter series, namely, the beginning of the Great Depression. This is an important lesson when calculating growth rates; you should be careful to begin and end at points on the trend line. If the starting period was below trend and the ending period above, you will over-estimate the growth rate and vice versa.

Clearly, the U.S. is currently in a slow-growth period. To see just how slow our growth has been, I fit a trend line for the 1960-2009 years (see the graph) and obtained a trend growth rate of just 2.8%. With a population growth rate of over one percent per year, per capita GDP growth is less than 2%. We also see how severe the current downturn that started in 2008 is.





In this series of lectures, I will discuss the macroeconomic theory that has been developed to explain macroeconomic growth and fluctuations, how economists apply

these theories to explain those economic fluctuations and trends, and compare and contrast empirical tests that have been used to test the various theories.

Note: While most of the analysis will be on the United States economic performance, that is not to suggest that the theories are relevant only to the US and/or Western countries. The main reasons for this ethnocentricity are data availability and the great number of economic articles and studies published on these countries. Hopefully, more analysis will be performed on other countries as more and more reliable data become available.

Earlier world growth trends

It might be useful to examine how major a change the world experienced since the industrial revolution compared to earlier years. Fortunately Angus Maddison examined world data back to the beginning of the Christian era and came up with the estimates of GDP per capita shown on the chart below.

Level and Rate of Growth of GDP per capita; world and major regions, 0-1998 AD

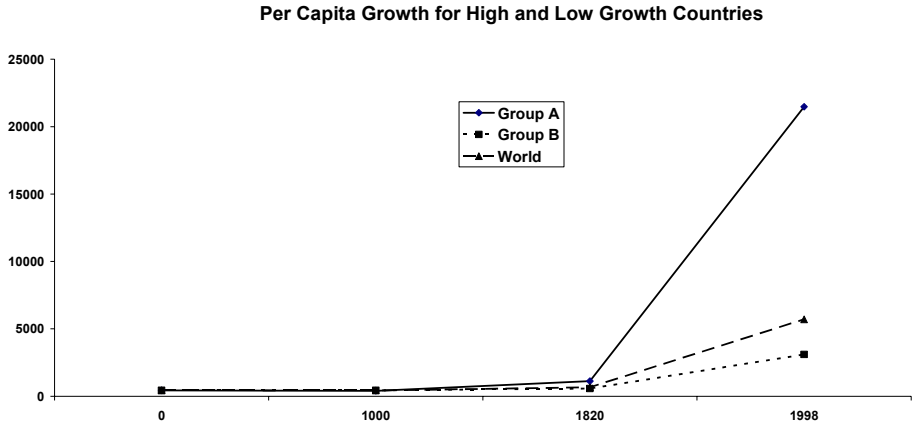
	GDP per capita				GDP per capita growth rates		
Year	0	1000	1820	1998	0-1000	1000-1820	1820-1998
Regions							
Western Europe	450	400	1232	17921	-0.01%	0.14%	1.50%
Western Off-shoots	400	400	1201	26146	0.00%	0.13%	1.73%
Japan	400	425	669	20413	0.01%	0.06%	1.92%
Group A	443	405	1130	21470	-0.01%	0.13%	1.65%
Latin America	400	400	665	5798	0.00%	0.06%	1.22%
Eastern Europe & CIS	400	400	667	4354	0.00%	0.06%	1.05%
Asia	450	450	575	2936	0.00%	0.03%	0.92%
Africa	125	416	418	1368	0.12%	0.00%	0.67%
Group B	444	440	573	3102	0.00%	0.03%	0.95%
World	444	435	667	5709	0.00%	0.05%	1.21%

Based on the work of Angus Maddison, *The World Economy in Millenial Perspective* (2001)

Notably, there was little if any growth between 0 and 1000 and European growth rates were actually negative. Surprisingly, Africa had a fairly robust growth of .12% per year per person. The next 820 years, however, saw considerable improvement in the Group A countries, particularly in Europe and its colonial empire, which experienced .14% growth comparable to that of Africa in the earlier period.

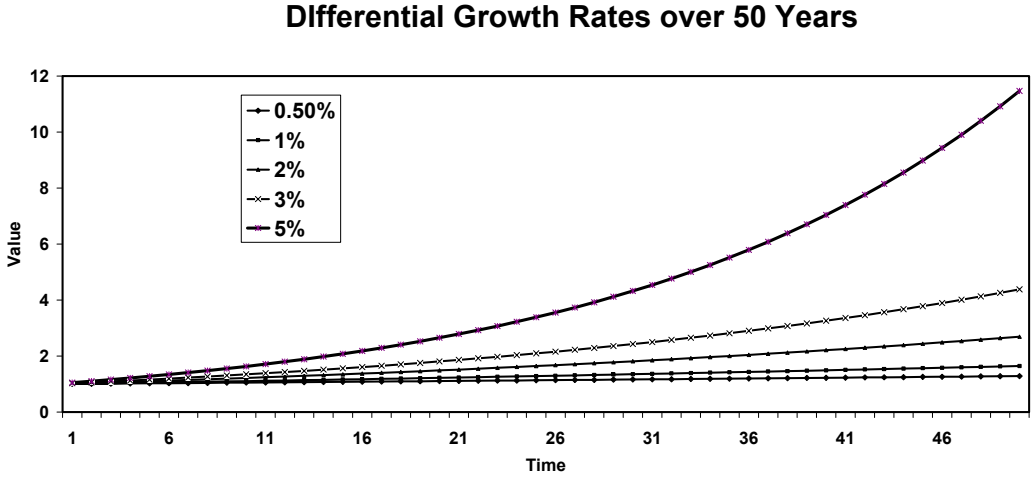
The last 180 years, however, Group A countries experienced very rapid growth of 1.65% per capita per year. The figure below shows the data from the chart in a graphical view that let's us see th dramatic changes that have occurred as a result of the industrial

revolution.



To appreciate just how much difference there is between 1% and 2%, say, the following graph shows over a 50-year period the impacts of rates of .5%, 1%, 2%, 3% and 5%. The rule of 70 provides a convenient heuristic for estimating how long it takes a series to double in value. Dividing 70 by .5 we find that it takes 140 years, or nearly three times the 50 years on our graph. After 50 years it is only 1.28 its initial value or 28% improved.

But 70/5 = 14 years at 5%, so in 42 years the series will have doubled three times to be 8 times its original value. After 50 years we see the series has increased to almost 11.47 times its original value or an improvement of 1047%.



Because of the long-term importance of even small improvements in economic growth rates, much of recent economic analysis has concerned itself with determining why countries grow as they do. And more importantly, in light of the slowdowns in growth experienced by the OECD countries, what are the reasons for the poor performance of these economies. Even before the recent collapse of the financial markets, the growth trends among the more developed economies have been rather anemic. It can only be

hoped that these countries will return to the kinds of economic policies that got them where they are today.

Unfortunately, the prospects are not good as one country after the other seems to be relying on policies that may have gotten them where they are today. Hopefully, this series of lectures will help clarify the debates that are currently raging even among economists, many of whom are advocating policies that seem to have failed us for so long. For a look at the kind of rhetoric that is being used, I refer you to last year's exchange in the New York Times Op-Ed pages between Paul Krugman and John Cochrane. **http://faculty.citadel.edu/silver/IF/IM/Krugman_attacks_Cochrane_answers.htm**

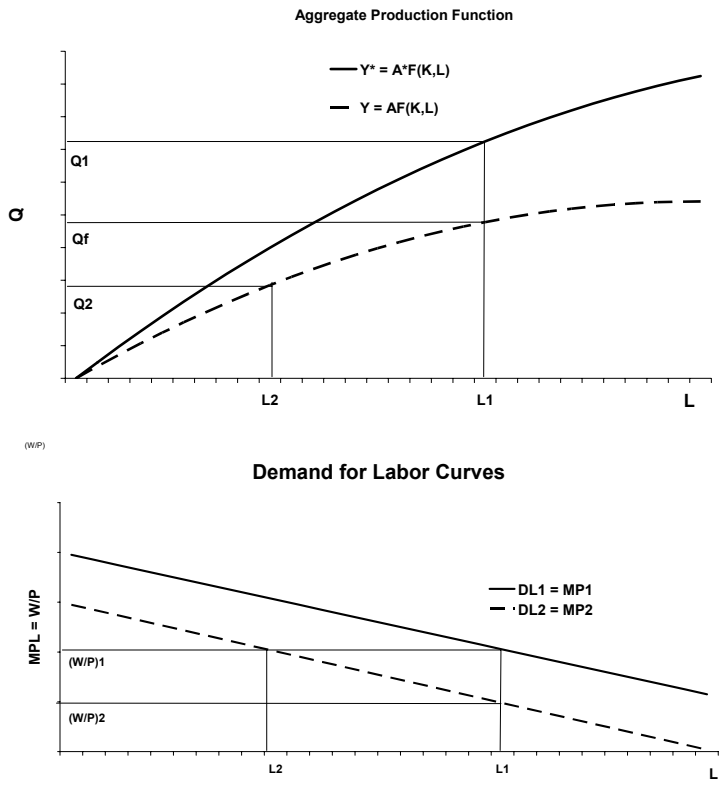
The organization of this series of lectures follows more or less in chronological order to the development of macroeconomic theory and is as follows: classicl/neo-cleassical theory; Keynesian theory; monetarism; and rational expectations/real business cycle theory. Hopefully by the end of these lectures you will appreciate the major elements and underlying assumptions that underpin each of the theories and, more importantly, the differences in their implications in the formulation and implementation of macroeconomic policy.

The Classical Model

The basis of the classical macroeconomics model is the aggregate supply curve, which, assuming it looks similar to a firm's supply curve, will appear as the aggregate production function shown in the graph below. And assuming the quantity of capital K is fixed, aggregate supply or AS is just a function of the amount of labor L employed. It should be understood that both capital and labor are flows, as is output Y, and that K therefore represents not the quantity of capital available but the amount of capital used, or depreciated, during the period.

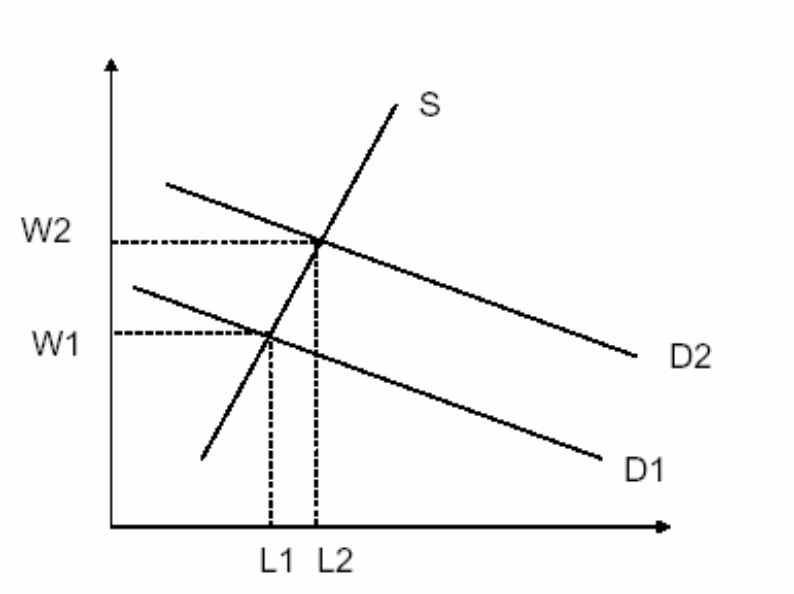
The higher AS curve has greater marginal physical product of labor MPL, which is the slope of the AS curve at any level of labor. The associated MPL curves are shown in the second graph.

Any upward shift in this AS curve, caused by an increase in capital or through a positive technology "shock", leads to greater output per worker and therefore higher marginal productivity of labor. And any negative supply shack will lower the AS curve and the associated MPL curves. And since the real wage equals the MPL at equilibrium, the MPL curve is also the demand for labor curve.



After the negative supply shock, the demand for labor has shifted downward so that $L_2 < L_1$ units of labor are demanded and output falls from Q_2 to Q_1. Only if the real wage drops to $(W/P)_2$ from $(W/P)_1$ can the economy absorb the previous level of labor. Total output, however, is still reduced as a result of the shock and labor experiences a loss of income of $(W/P)_2 - (W/P)_1$ times the number of hours worked.

Depicted below are two MP_L curves which at equilibrium equal the demand for labor curve, since firms, and the economy, are assumed to set the real wage equal to the MP_L. The supply of labor is an increasing function of the real wage (assuming no money illusion), so that the actual level of employment will be less than the level before the shock. The new level depends on labor's elasticity of supply; the more elastic the greater the reduction in labor supplied and the change in aggregate supply. So in reality, the total output would be reduced (or increased) for two reasons: the reduction (increase) in productivity per unit of labor and the reduced (increased) number of hours worked because of the lower (higher) real wage rate.



http://www.albany.edu/~aj4575/LectureNotes/Lecture34.pdf

The upward shift of the AS curve over time through increases in technology is the fundamental explanation for how the economy expands and workers are made better off. The existence of unemployment is explained by the fact that, in addition to the workers that actually take jobs at the market real wage rater, there are others that are drawn into the labor market and seek employment, but have yet to find a job they will accept. Thus, all unemployment is voluntary. If these unemployed workers decide to take a job then their presence will depress the real wage rate so that some of them will take jobs, others will decide to continue to remain unemployed or will give up their jobs to look for others, and still others or drop out of the labor force altogether.

Say's Law

The British economist Jean-Baptiste Say stated in his Treatise of Political Economy that the only reason workers are willing to give up their free time to work and earn income is to buy the goods and services produced by the economy. This idea that the fruits of labor necessarily produce goods and services desired by consumers and firms, C + I, is known as Say's Law and is most often cited as "Supply creates its own demand".

There is an obvious fallacy in this statement; since production decisions and purchasing decisions are independent, each worker does not produce directly the goods and services he or his firm wishes to purchase. But the idea that on gross, all output will be purchased is somewhat elegant. And let us suppose that too much of a particular good is produced; then prices will adjust, the market will clear, producers take a loss this period and adjust their production the next period. Or inventories build up of that good, which signals producers to shift production to other goods whose prices have risen. Unintended inventories have a signaling effect that let producers know that they mad a mistake.

In any event, the value of the goods and services produced just equals the incomes earned in their production, so there is adequate purchasing power to buy the output in each time period. This was the elegance of the classical model, and it was considered adequate to the task of explaining how the macro economy worked. Unfortunately, it was unable to explain periods of recession and these did occur with sufficient regularity to question the classical model.

Most, however, did adjust rather quickly. For example, the post World War I recession, while very deep, righted itself within two years. This was fairly typical of the fluctuations experienced up until 1930.

There are, however, several assumptions that need to be addressed. One of these is the assumption that the AS curve looks just like a firm's production function. In fact, due to rigidities and market imperfections, this may not be the case. This was one of the major critiques of the classical model by the Keynesians.

Paul Samuelson in his Ph.D. dissertation, later published in 1947 in "Foundations of Economic Analysis", pointed out the fallacy of composition when trying to aggregate microeconomic units to explain the macro-economy. This helped propel the new Keynesian economic policy position to the mainstream of accepted economic policy, and its relatively painless prescriptions for mitigating a macroeconomic downturn made it easy and justifiable for policy-makers to engage in discretionary expansionary fiscal policy.

Many economists view this as the great harm of Keynesianism: a blind faith in a doctrine that is not appropriate at all times. During supply shocks, policy-makers should hold firm on fiscal and monetary policy and "wait out" the shock. Any counter-cyclical policies that attempt to negate the shock will be useless. The issue of whether *all* business cycles are of the supply-shock variety is a major issue in modern economic debate; adherents to the view that most cycles are the result of supply shocks are known as real business cycle (RBC) theorists and advocate for steady and firm controls of monetary and fiscal policy. The RBC argument for policy restraint is referred to as the "policy ineffectiveness proposition" or PIP.

Others argued that fiscal policy by itself is useless. Monetarists such as Milton Friedman argued that fiscal policy is effective only to the extent that it is accompanied by expansionary monetary policy. Thus, they argue, that without monetary easing, which very often accompanies expansionary fiscal policy, the additional spending may merely "crowd out" private expenditures, particularly investment, thwarting the efforts of policy makers.

All of these points of view will be addressed in the sections that follow. First we will discuss the economics of Keynes.

Keynes

By the time he wrote his most important work, The General Theory of Employment, Interest, and Money, published in 1936, John Maynard Keynes was already recognized as probably the leading and most influential economist of his time. His many previous works included: commentary on the consequences of the peace following the First World War, which essentially predicted a second war; treatises on probability and money that are still cited for their prescience; and numerous scholarly articles and opinion pieces in the popular press of the time.

To paraphrase an old commercial for an investment firm, when Keynes spoke, people listened. Investors would watch closely to see what investments Keynes made and try to follow his lead. He was a relative rarity: an economist that made money in the financial markets. And he was very concerned about the long term consequences of the continued deflation and recession of the 1930's. He feared for the continued survival of the capitalist system and sought to explain how to restore full employment equilibrium to the economic system of the time.

It was in this effort that Keynes published the General Theory, arguably the most influential economics book of all time. Only the Wealth of Nations has had as profound an effect on the way people viewed the economic world and influenced the actions of policy-makers world wide.

Let us assume a closed economy with no, or very limited, government spending. This is a realistic view of the pre-World War II U.S. economy. The European countries relied more on trade than the United States, but they too were primarily autarkic in nature. In such an economy then, aggregate demand can be given by $E = C + I$, where E is aggregate expenditures, C is household spending, or consumption, and I is spending by firms, or investment.

We include in investment the desired investment expenditures by firms as well as both intended inventory adjustments and unintended increases in inventories. It is these unintended inventory build-ups that cause investment expenditures to be far more volatile than consumption expenditures and, as we will see later, exacerbate economic fluctuations over the business cycle.

One of Keynes' most important contributions was the specification of the consumption function, which relates household expenditures to income. If we specify a linear function of the form $C = a + cY$, then $E = a + cY + I$. Another important characteristic of Keynes' model is to consider investment to be primarily independent of the interest rate; that is, the "animal spirits" of entrepreneurs are far more important in determining the level of investment than the cost of capital. It's not that Keynes felt that firms did not take interest costs into account in their investment decisions; it just is not nearly as important under most scenarios as the prospects of large profits from investment.

Another interpretation of why he chose to exclude the interest rate in the borrowing decision is related to the economic circumstances he was dealing with. During times of recession and depression, interest rates are often so low that the cost of capital, so long as it cannot be negative, is irrelevant. Clearly, in good times firms do look for investment opportunities that yield a positive return above the interest rate. But Keynes was looking at a world in which firms would not invest even if they were allowed to borrow interest free.

Finally, at equilibrium, aggregate demand AD = E = Y = AS. So, at equilibrium, $Y_e = a + cY_e + I_0$. Solving for Y_e gives the result $(1 - c)Y_e = a + I_0$. So, $Y_e = 1/(1-c)*(a + I_0) = k(a + I_0)$, where Y_e is equilibrium output and $k = 1/(1+c)$ is the so-called Keynesian multiplier. The constant c, which is between 0 and 1, is referred to as the marginal propensity to consume (MPC) and 1 – c is the marginal propensity to save (MPS).

Now Y_e can be any level depending on all of the exogenous factors: a, c, I_0. The effect of a one unit change in either a or I_0 is $k = 1/(1+c)$. Thus, the economy can be at less than full employment equilibrium so long as investment I_0 and autonomous consumption a are insufficient for full employment.

You might wonder then what happens if a or I_0 increases when the economy is already at full employment. Since an economy can not remain for very long above its full employment level, such increases will result in inflation and not real output increases. Thus, at levels of AS below Y_e any increase in AD increases real output at the current price level and increases in AS above Y_f result in higher prices with no increase in real output.

Now if we start at full employment equilibrium, an increase in a or I_0 will lead to an unsustainably high level of real output that will eventually lead to inflation as wages and prices are pushed upward. This was later referred to as demand-pull inflation. On the other hand, if investors become wary of investing perhaps due to a perception of greater risk in the economy, then Y_e will be less than full employment output Y_f.

To Keynes this was the primary source of instability in the macro-economy. While classical economics argued for a self-correcting mechanism through changes in wages, prices and the interest rate, often expressed as Says Law that assumed supply creates its own demand, Keynes believed that these could prove inadequate or too slow or too inflexible in times of severe recession. In particular, in times of deflation, wage and price "stickiness" and the inability for interest rates to go negative, equilibrium might prove impossible to achieve in any reasonable amount of time.

When reproved by his classical friends, most importantly Arthur Pigou, for his unwillingness to allow market adjustments to return the economy to full employment equilibrium, Keynes reportedly answered the classical claim "In the long run the economy will adjust", with the reply "But in the long run, we are all dead".

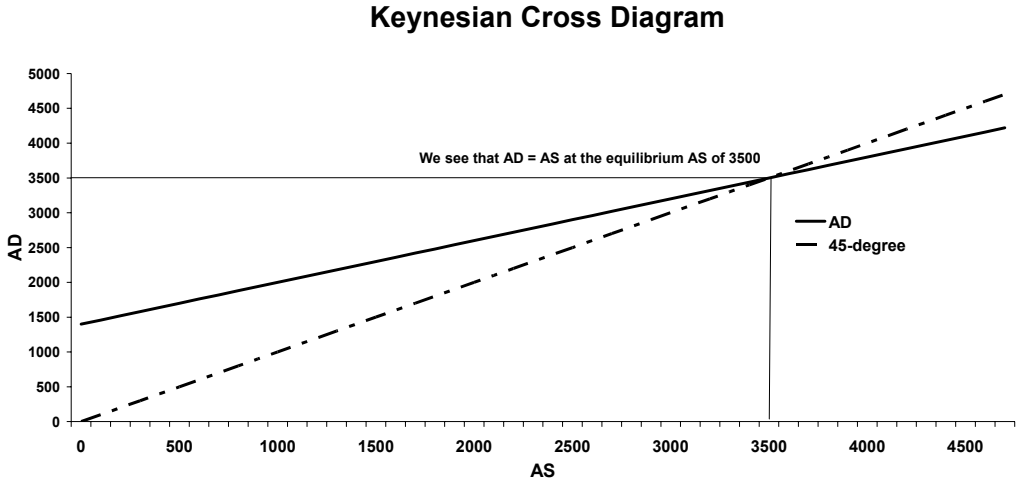
Instead Keynes opted for an alternative way of restoring full employment equilibrium; he suggested that the government, through discretionary fiscal policies of tax reductions and spending increases could restore the economy to full employment. For example, if firms cut back on their investment expenditures, the government could simply replace the shortfall. Thus, if investment falls government could increase its expenditures by the amount is this decline. The obvious extension of the model is as follows $Y = a + cY + I + G$, where G is the level of government expenditures. Solving this model yields the following equilibrium level of Y:

$Y_e = [1/(1+c)] (a + I + G) = k (a + I + G)$.

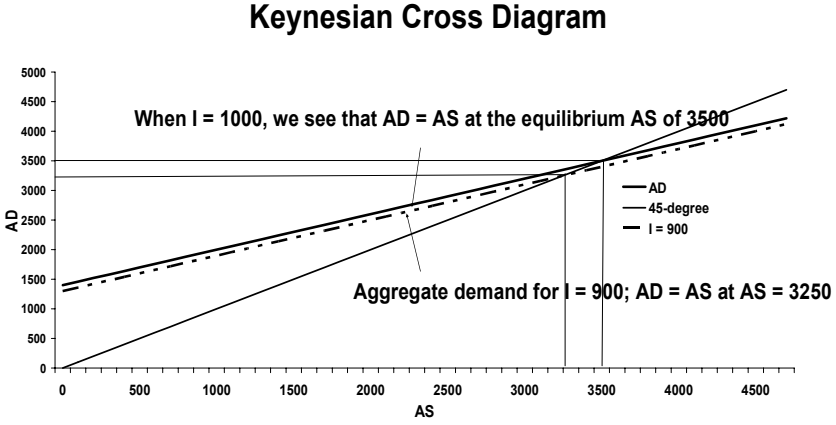
Letting $dG = -dI$ assures that we return to whatever Y_e we started at. So if Y_e initially is at Y_f and then AD falls by d(AD), Y_e falls by k*AD and an increase in G of dAD, the size of the "deflationary gap", this additional fiscal stimulus will bring the economy back to Y_f. Similarly if AD increases by d(AD) from its full-employment AD, then we need to reduce G by d(AD), the so-called "inflationary gap". These adjustments to aggregate demand can also be accomplished through tax cuts or increases, as we shall see later.

This is the Keynesian solution to stimulating the economy in recession and cooling off an overheated economy. In practice, however, there are a number of issues to be resolved, such as timing and lags, measurement of the Y_f, measuring the size of the multiplier, the effects of other forms of governmental intervention – regulatory measures, tax rates, uncertainty, etc. – that may make knowledge of the exact size of the gaps unknowable. These issues will be discussed later in the critiques of the Keynesian model.

The so-called Keynesian Cross diagram is a diagrammatic way to show how at the equilibrium aggregate supply AD = AS. On the diagram below we plot AS on the horizontal axis against AD = C + I on the vertical axis. We also plot the 45^o line to show all points at which AS = AD. In this example we have started with the following numbers: a = 400, c = .6, and $I_0 = 1000$. Then $Y = C + I = 400 + .6Y + 1000 = 1400 + .6Y$ and solving for Y gives $[1/(1-c)] (a + I_0) = (1/.4)(1400) = 2.5*1400 = 3500$, and k = 2.5.



Now if I_0 declines to 900, AD will decline by k*d(AD) = - 250, so AD = 3250. This is shown on the Keynesian cross diagram below. To restore the equilibrium level of AD to the desired 3500 we need add G = 100 and we will be back to the original AD curve.



One critique of the Keynesian solution is the so-called Ricardian Equivalence Theorem which states that rational economic agents will view government spending without equivalent taxes as a liability that they will have to bear in the future. In order to pay these taxes, they should put aside an equal amount in the form of treasure security purchases to have the principal plus interest to pay for this liability. Such behavior is considered "rational" and is espoused by rational expectation theory (RET).

Well, it so happens that even if the government finances the additional expenditures with additional taxes equal to the additional government expenditures, we see that there is still a positive effect on equilibrium output. To see this, let us suppose that the impact of the additional tax is to reduce disposable income Y – T, where T = G. [For ease of exposition we assume that G = 0 initially and rises to a level necessary to restore full employment output.]

Now our model is $Y = a + c(Y - T) + I_0 + G$, where T = G. Then solving for Y_e we get

$Y_e = [1/(1-c)](a - cT + I_0 + G) = [1/(1-c)] (a + I_0 + G - cG) = [1/(1-c)][a + I_0 + (1-c)G] = [1/(1-c)] (a + I_0) + G$, since T = G. Thus, the "balanced budget multiplier" is 1; if the government spends an amount just equal to $Y_f - Y_e$ equilibrium is restored at full employment. To see this, let us use the numbers from our earlier example in which dAD = -100. Then dG = dT must equal k(100) = 250, which gives the following numbers:

$Y = 400 + .6(Y - 250) + 900 + 250 = 1550 - 150 + .6y = 1400 + .6Y$. This is the same as before at full employment and solving gives us $Y_e = 3500$.

In lieu of a lump-sum tax increase to balance the budget, a more realistic model would make taxes a function of income. For example, suppose we had a flat tax rate of say 20% on all income (output); then T = .2Y. Letting the tax rate be t, our model becomes

$Y = a + c(Y - tY) + I + G = a + cY - tcY + I + G = (a + I + G) + c(1-t)Y$ and $Y_e = [1/(1 - c(1-t))] (a + I + G)$. Now since $1 - c + ct > 1 - c$, the new multiplier is reduced. This is because we have added a "leakage" to the expenditure stream that is pro-cyclical. So the greater Y, the more that leaves the expenditure stream. If the tax revenues are spent, it returns as part of G, but if it adds to the surplus, then it is a drag on the economy. The point is, we do not know what actually happens to the tax revenues.

By now you should be getting a feel for how the Keynesian model works. Things like consumer spending and investment are "good" in that they add to the expenditure stream – these are referred to as "injections" – and things that we might generally think of as good or virtuous, like saving or taking in more tax revenue to pay for government programs are called leakages and are bad for the economy. In fact, Keynes himself referred to the "paradox of thrift"; people doing virtuous things like saving, are actually harming the economy.

The final extension of the Keynesian model adds injections and subtracts leakages; we add in the foreign sector. We open our economy to exports, which are injections, and to imports, which are leakages. While it is true that imports inject goods and services, they are a leakage to the expenditure stream and vice versa for exports. The full model should reflect reality, so let's suppose: our $T = t_0 + t_1Y$, reflecting a negative t_0 for those that fall below the lowest tax bracket (in fact it's a negative income tax for such people); I, G and X do not depend on our output (government spends whatever it wants, and foreigners imports from us depend on *their* incomes); and imports are a linear function of our income.

Now we have $Y = a + c(Y - t_0 - t_1Y) + I_0 + G_0 + X_0 - m_0 - m_1Y$. As before, we collect all the Y terms, move them to the left side of the equation and solve for Y_e. Thus,

$Y = a + c(Y - t_0 - t_1Y) + I_0 + G_0 + X_0 - m_0 - m_1Y = (a+I_0+G_0-m_0-ct_0) + Y(c(1-t_1) - m_1$
Thus, $Y(1-c(1-t_1)+m_1) = (a+I_0+G_0-m_0-ct_0)$, so $Y_e = [1/(1-c(1-t_1)+m_1)](a+I_0+G_0-m_0-ct_0)$ and the Keynesian multiplier is further reduced by m_1.

The cynics among you might ask why we don't make government injections a positive function of Y like, consumption; there are many economists – not just Republican politicians – that accuse government of spending whatever it gets, and often even more than it takes in, so we should cut taxes to stop spending.

To get a feel for the magnitude of the multiplier, let's suppose the average marginal tax on income t_1 is .2 (exclusive of the t_0); m_1 is .1 and c is .6 as before. Then
$k = 1/(1-.6(1-.2) + .1) = 1/(1 - .48 + .1) = 1/.62 \approx 1.6$, considerably smaller than the 2.5 we had earlier.

Keynes and the IS-LM model

A very useful tool used in determining the macroeconomic general equilibrium results, the so-called IS-LM analysis finds the combinations on output y and interest rate r at which both the real output and money markets are at equilibrium. Where the two loci intersect the economy is at general equilibrium.

The Goods-services market

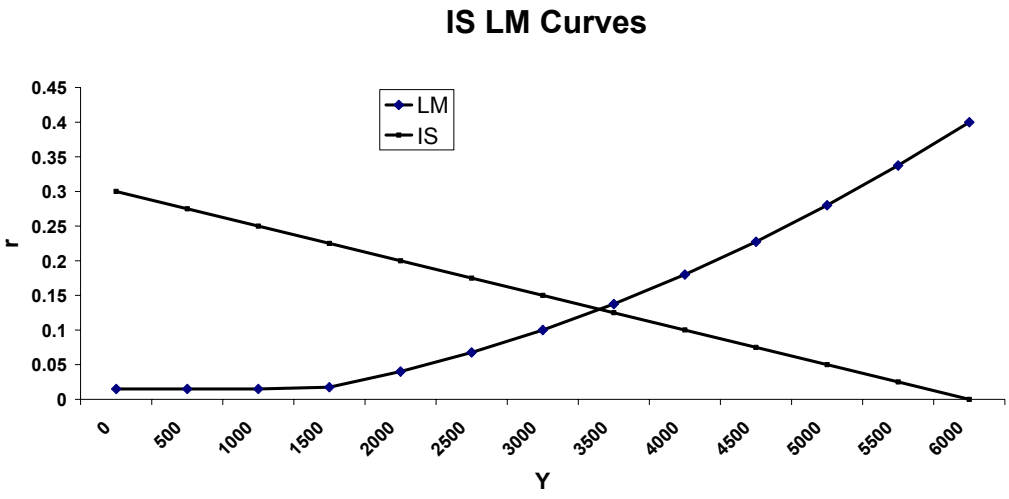
From the first model above we see that $Y = C + I = C + S$; that is, output leads to factor payments, which in turn, result in income to households that must than decide whether to spend their income or save it. Setting expenditures in the goods and services market equal to household disposition of income, I = S. So the IS curve is then the locus of points in Y-r space that equate these two.

So we need to find all points such that $I - S = 0$. Starting from any such point, we move to another point such that the change in $I - S$ also = 0. Now I is often assumed to depend at leas somewhat on the interest rate r but not on Y. While Keynes concluded that the most important determinant of investment is animal spirits, he knew that, at least in normal times, firms look at the cost of capital when deciding on which projects to invest in and how many.

Saving depends on both Y and r. Clearly, since MPC c is between 0 and 1, the MPS = 1 – c also is non negative and so depends on income. If MPC = .6, then MPS is .4 and therefore for every dollar of additional income, 60 cents is spent and 40 cents saved. And also, people will save more as the opportunity cost of consumption, the lost interest they could earn by saving, rises. Thus, an increase in Y has a positive effect on saving and an increase in r has a positive effect on saving and a negative effect on investment.

We show this as follows: $S_y > 0$, $S_r > 0$, and $I_r < 0$. [$S_y = \delta S/\delta Y$, meaning the change in S per one unit change in Y holding all other variables, in this case r, constant. See my calculus handbook for a further explanations on differentiation.] In calculus we say that the partial derivatives of saving with respect to Y and r are both positive and the partial derivative of investment with respect to r is negative. So if Y changes by dY, the total change in $S = S_y*dY$ at the margin. So the total effect, called the total differential of S, dS, is made up of two parts; namely, $dS = S_y dY + S_r dr > 0$ for positive dY and dr since both Y and r affect S positively.

The differential for I, $dI = I_r dr < 0$ for positive dr. From any point on the IS locus to any other point $d(I - S) = 0$, so $I_r dr - (S_y dY + S_r dr) = 0$. Now collecting dr terms on the left and dS on the right, we get $(I_r - S_r)dr = S_y dy$ and $dr/dy = S_y/(I_r - S_r) < 0$, since the denominator is clearly negative and the numerator is positive. Graphically the IS curve is the downward-sloping line in the chart below.



Monetary equilibrium requires the demand for money equal the supply of money. Households and firms will hold more cash, defined as non-interest earning, very liquid assets, the lower the interest rate – the opportunity cost of holding cash – and the greater the level of income, from the transactions demand. Keynes referred to the interest rate effect as the speculative demand for money and pointed out that as interest rates continued to fall, any later increase would lower the prices of interest-bearing assets. Thus, at very low rates, when prices on interest-bearing funds, such as bonds, would be relatively high, people prefer to hold cash that they can then use to purchase bonds when rates rise again.

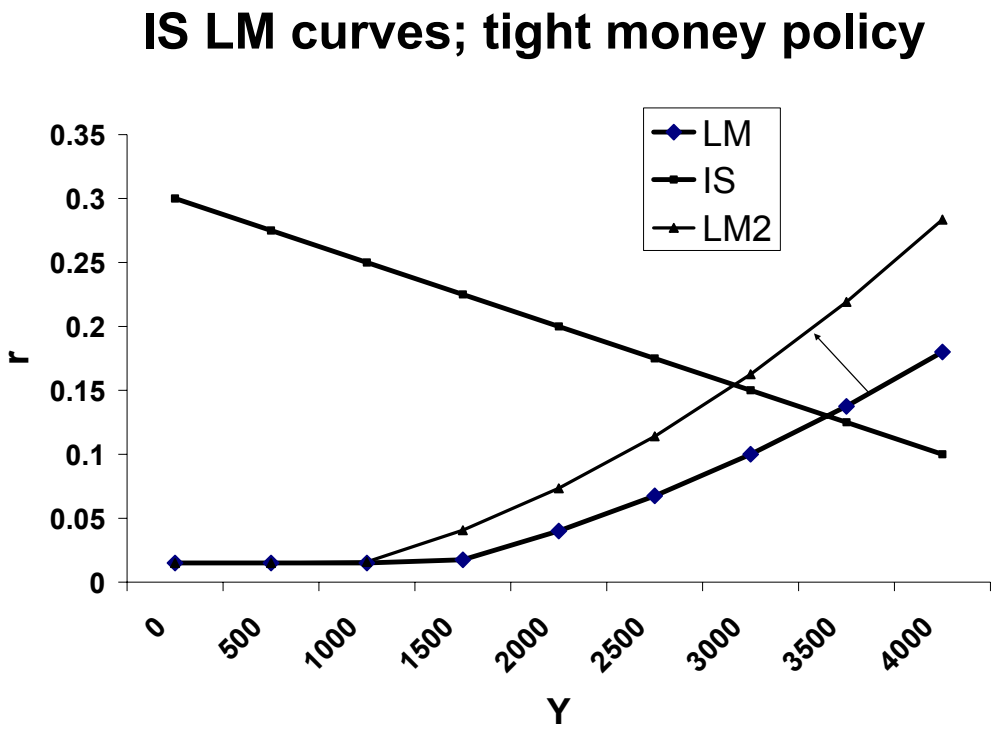
The supply of money is assumed to depend positively on interest rates; as the price of holding cash idle increases, banks and other money lenders will be willing to lend more of their reserves to borrowers. The excess demand for money is $M_d(y,r) - M_s(r) = 0$ at equilibrium and the locus of points where this excess demand remains 0 is given by $d(M_d(y,r) - M_s(r)) = 0$; thus, $m^d_y dy + m^d_r dr - m^s_r dr = 0$. Collecting terms and solving for

dr/dy yields $dr/dy = -m^d_y/(m^d_r - m^s_r) > 0$ since $m^d_y > 0$, $m^d_r < 0$ and $m^s_r > 0$. The LM curve is indeed rising in the figure above.

To understand the IS curve, suppose the Fed increases interest rates by restricting credit. The rise in rates would discourage investment and thus decrease the demand for loanable funds. The rate increase also increases saving. Both of these create excess supply of loanable funds; only a sharp decline in income could offset the increase in savings caused by the rate increase. To maintain equilibrium in the loanable funds market requires a rise in rates and a decline in output; thus, the IS curve is downward sloping.

As for the LM curve, a rise in the interest rate creates excess supply of money which must be matched by an increase in the demand for money. Since the rate increase also reduced the demand for money the only way to increase the quantity demanded is through an increase in income sufficient to match the excess supply of liquidity. Thus, the LM curve is upward sloping.

Now let us see how macroeconomic policies affect these curves. Suppose the Fed wishes to tighten up on credit, perhaps to combat inflation. It might sell bonds, reducing the supply of base money, which in turn reduces the money supply. At any level of output only an increase in the interest rate can reduce the excess demand for money. The new LM curve will therefore be to the left of the original LM curve, say LM2.



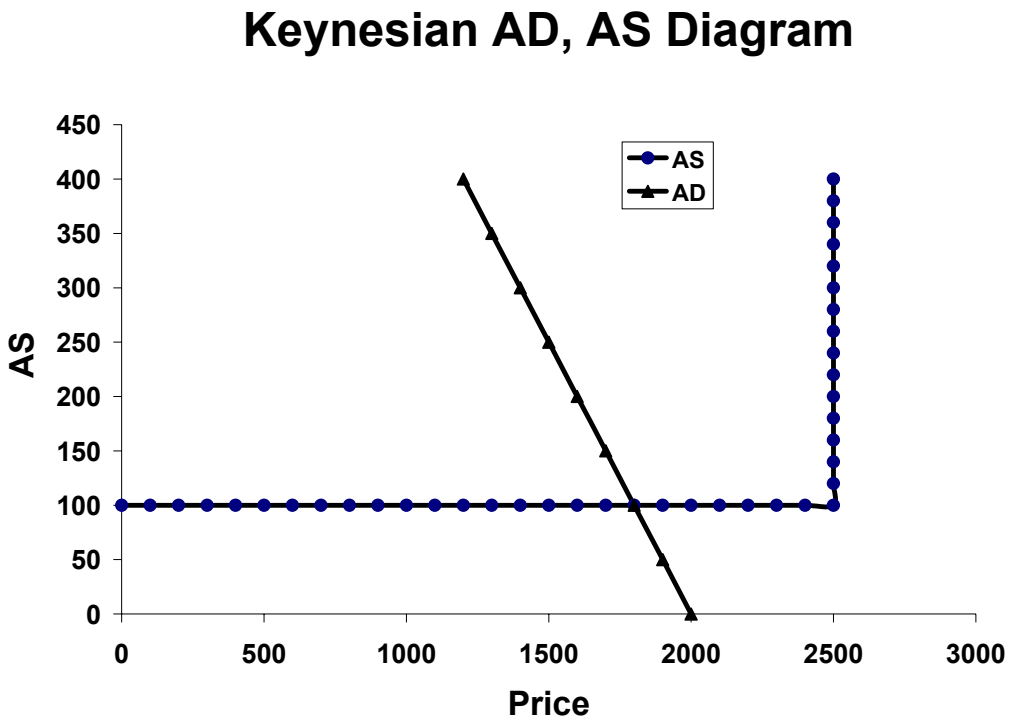
This, in turn will reduce investment and the quantity of loanable funds demanded. To match this reduction, income must fall, which reduces saving by the public. We see in

the graph the movement along the IS curve; a rise in r_e and a decline in Y_e. This is exactly what is observed in the real world.

Another view of the Keynesian cross

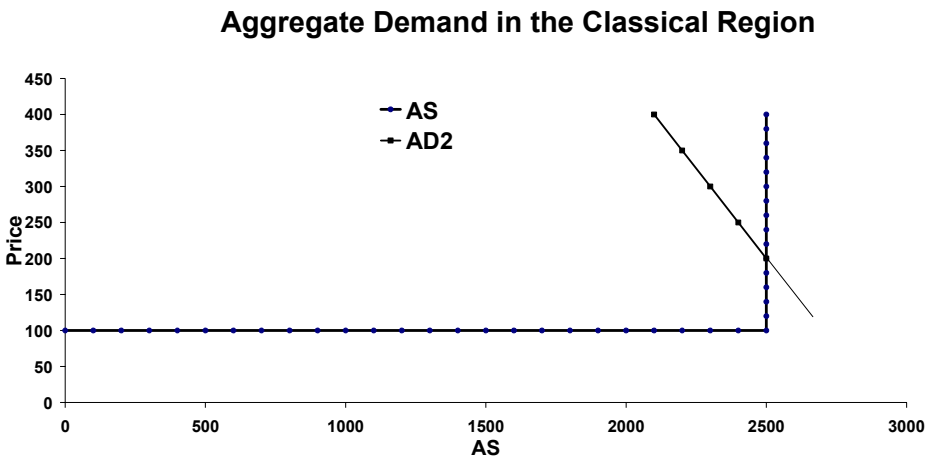
The way Keynes looked at the economy is as two distinct regimes: normal and inflation-prone, and Depressed and deflation-prone. In the former regime aggregate supply is at full-employment level and attempts to expand it through either monetary or fiscal policy will lead to higher prices and no additional real output. Under this regime the economy is very classical. This is represented on the figure below by the vertical portion of the AS curve.

The latter regime is one in which prices remain constant and output expands in response to stimulative fiscal and (maybe) monetary policy. The reason we say monetary policy might not help is that, if we are in the liquidity trap section of the LM curve, interest rates will not fall and encourage investment. This scenario is represented by the horizontal section of the AS curve in the figure.



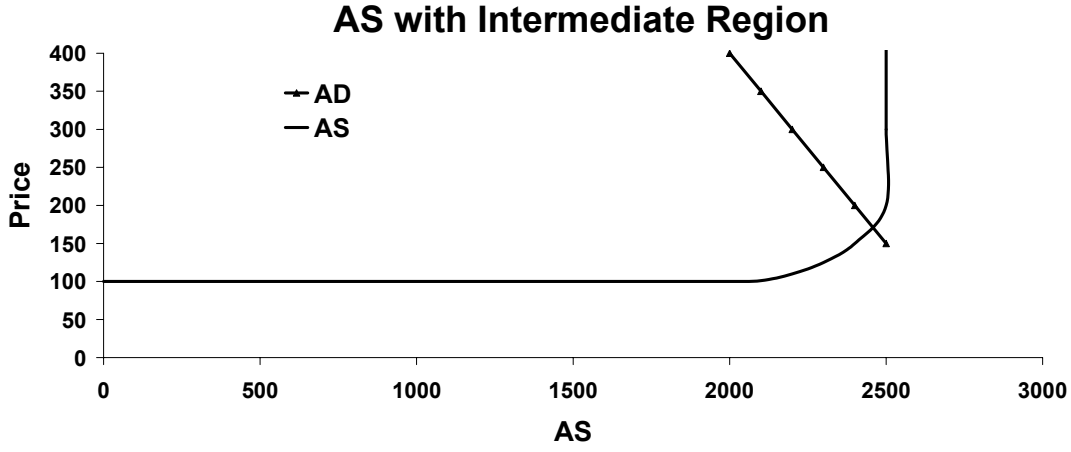
The aggregate demand curve is assumed to decline with price; that is, as the price of domestic output rises, the quantity demanded of domestic goods declines. This must be viewed as the substitution effect; as domestic output prices rise, purchases of home goods declines in favor of foreign goods. In the figure we show AD intersecting AS in the Keynesian (deflationary) section of the AS curve. Although we show prices as remaining constant, we may think of this as the part of the curve where prices may actually fall.

Stimulative aggregate demand policies will increase aggregate demand at each price level; it shifts AD to the right. Suppose it shifts AD to the AD2 in the figure below.



One of the deficiencies of the depictions above is that the vertical axis is *price level* rather than *inflation rate*. In fact it is not the level of prices that stays the same once the economy is in the classical region but the rate of inflation. In the non-inflationary, Keynesian portion of the AS curve the price level is constant and inflation is zero (or possibly negative). But the diagram is still useful for policy analysis. Thus, only if the AD curve crosses the AS curve at the bottom of the vertical part of the AS curve will the economy avoid inflation but be at full employment.

In reality, the economy actually may experience inflation before it achieves full employment. If this happens than the depiction of a sharp break point between the horizontal and vertical portions of the AS curve is not quite accurate. A better view of reality would be more in line with the AS curve shown in the figure below.



In the section on the monetarist view, in its discussion of the Phillips curve, we will see that the intermediate region of the AS curve is a reflection of the Phillips curve, which found empirically a trade-off between inflation and unemployment. In the intermediate region of the Keynesian AS curve, more inflation is associated with increased output, which is achieved by increasing employment and reducing the unemployment rate.

Money in Classical Economics and the Keynesian Model

As we have introduced money, this is a good time to discuss Keynes' view on money and its effect on real variables. Unlike the classical school that assumed a dichotomy between money market and the product market, Keynes believed that monetary policy could be used effectively, in most cases, to affect real variables. The IS-LM framework above was how he viewed the chain of events from monetary changes to aggregate demand.

But Keynes was far less sanguine about the ability of discretionary monetary policy to regulate the level of aggregate demand. His reasons have to do with the speculative demand for money that can lead to money hoarding in times of severe economic instability and especially deflation. To understand the differences between the quantity theory view of money and Keynes' view, we first need to examine the classical money demand equation and the classical dichotomy. This will also be useful in understanding the monetarist view as well.

In that model, $M_d = kPY$, where k is the "transactions" demand for a dollar of nominal output. In this equation, called the Cambridge equation of exchange, M_d is money demand, P is the price level and Y is total real output of the economy. Irving Fisher more correctly specified his equation as $M_d = kPT$, where T = total volume of real transactions. These include not just purchases of final output but all intermediate transactions as well. If what we are measuring is transactions demand for money, then all transactions should be included. Thus, Fisher's k will be smaller than the classical Cambridge equation k.

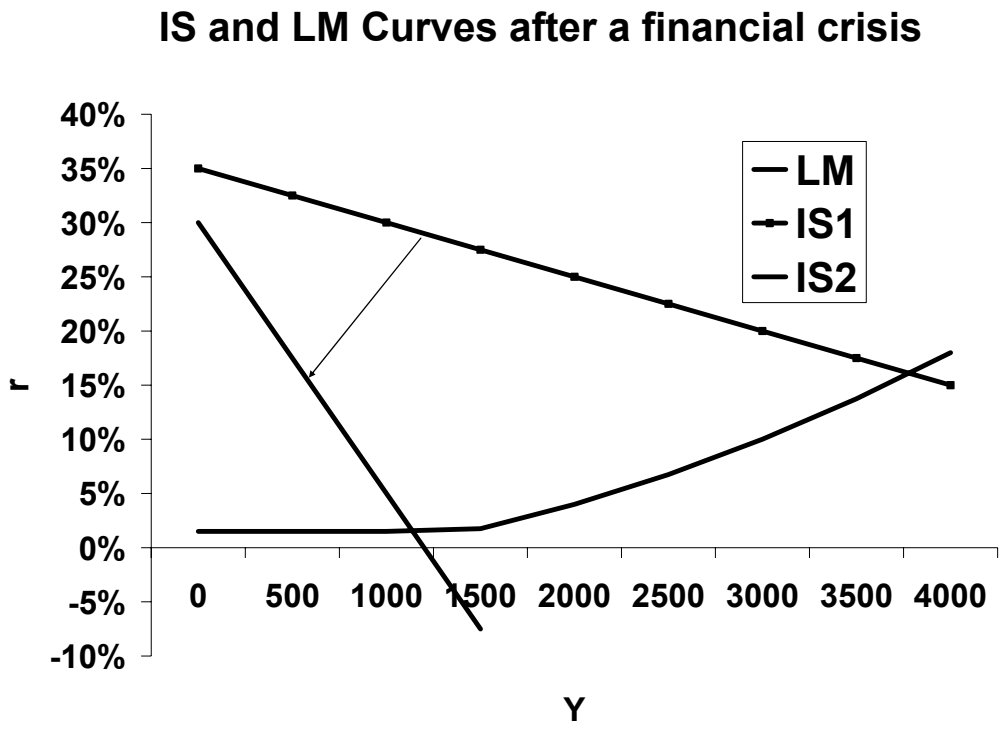
Another, perhaps better known version of the equation of exchange is MV = PY; so the k in the Cambridge equation is 1/V, where V is the velocity of money. In either version, however, the important point is that V and k are both considered to be relatively stable. Keynes argued that this constant is very unstable over the business cycle; V increases in the expansionary stage and decreases in contractions. Classical theory assumed that an increase in M would affect nominal aggregate demand PQ, but that the effect would be only on prices.

It is useful, in discussions about the quantity equation to write the equation in a different form. Taking natural logs of both sides we get ln(MV) = ln(PQ). And ln(MV) = ln(M) + ln(V) Now the total differential of the ln(M) + ln(V), d(ln(M) + ln(V)) = δln(M)/δM*dM + δln(V)/δV*dV = dM/M + dV/V = %change in M + %change in V = m + v, where we define x as the %change in X. So m + v = p + q. Thus, according to classical theory, v =

q = 0, and an increase of 10% in the money supply would merely raise the aggregate price level 10% and leave real output the same as before.

Keynes argued instead that the speculative demand for money is very sensitive to the interest rate. He pointed to the inverse relationship between bond rates and bond prices. As rates rise, bond prices drop, so at very low rates of interest any rise in rates will result in substantial capital losses to bond holders, so the public wants to hold cash. And at high interest rates bond prices are low, but if rates fall their prices will rise, so people want to be invested in bonds.

Now suppose aggregate demand falls dramatically as a result of some shock to the system, in particular a financial crisis such as the one experienced in 1929. Now this will shift the IS curve inward and if it shifts far enough could intersect the LM curve in its horizontal portion. This is the section of the LM curve at which rates are so low and the economy is experiencing deflation. The figure below illustrates this condition.



Under this scenario no amount of monetary stimulus that pushes out the LM curve will affect aggregate demand. Interest rates cannot fall below the minimum level already experienced and Y remains at the depressed level. Keynes' explanation went as follows. The linkage between money and real output depends first of all on increased money supply reducing the interest rate. This may not happen if rates are already near zero. This scenario in which rates are so low that borrowers prefer to hoard rather than spend is commonly referred to as the liquidity trap. Then lower interest rates encourage investment, which in turn increases aggregate demand and then through the multiplier

effect further expands output. To Keynes, there were just too many ifs and the process could take too long.

Fiscal policy on the other hand, and particularly increases in government spending, is direct and provides immediate impact to the expenditure stream.

Monetarism and the Monetarist Attack on Keynes

Stating around 1950 a group of economists led by James Tobin of Yale University began to question the classical view on money, in particular the classical dichotomy. These monetary economists believed strongly that changes in the money supply can affect real variables and not merely the aggregate price level.

One of these economists was Milton Friedman of the University of Chicago. But unlike Tobin, who felt that discretionary monetary policy was a useful tool for policy makers, Friedman argued that such power in the hands of government officials is, at best, not useful due to reasons we will elaborate on next, and at worst, dangerous. Instead, he argued, the monetary authority should allow growth in the money supply sufficient to maintain a target rate of inflation. Further, that this targeted inflation rate should be rather constant and that the public know what the targeted rate is.

The main tenet of monetarism is the all inflationary periods are accompanied by expansionary supply of money and all deflations with contractions of money supply. In his famous work with Anna Schwartz, *A Monetary History of the United States, 1867-1960,* Friedman demonstrated that this proposition held for all periods of inflation and deflation experienced in the U.S. If this is the case, then the key to a well-functioning economy is to maintain a steady growth in the money supply. Friedman likened the economies historical performance to a driver that intermittently floors the accelerator until the car begins speeding, and then jams his foot on the brakes to slow it down. Isn't it much better simply to maintain a constant speed by holding the accelerator pedal at just the right point?

To understand why Friedman and other monetarists argued against discretionary monetary policy, it is helpful to look at the quantity theory of money and the monetary equation MV = PQ. As M changes, at least one of the other three variables must also change. Monetarists argued that V tends to be relatively stable; thus PQ will change. The classical school argued that only P will change; an expansion of M will merely raise prices.

Monetarists, on the other hand, argue that Q may also change in response to changes in M. While one might believe this is a good thing, monetarists argue that the rise in Q is only temporary and that in the long run its only effect is a rise in the price level. And while this by itself might not be a problem, monetary officials will in all likelihood revert to a second round of price increases and then a third, etc. So why do the authorities revert to using monetary expansions to create temporary increases in output?

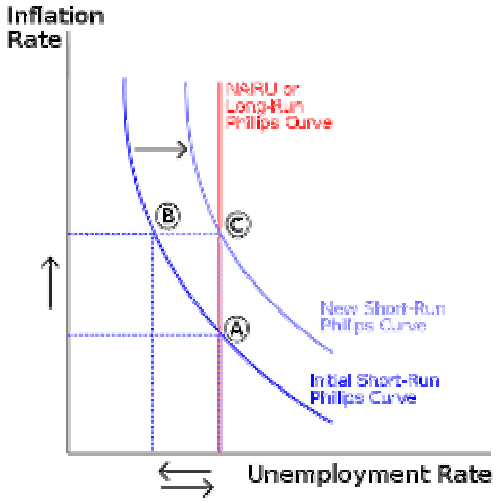
To understand this, it is very important to know about the Phillips Curve. In 1958 William Phillips, a New Zealand born economist, wrote a paper titled *The Relationship between Unemployment and the Rate of Change of Money Wages in the United Kingdom 1861–1957*. In the paper, Phillips showed that increases in wages were negatively associated with unemployment. Many economists took this to mean there is a trade-off between inflation and unemployment; one could lower the unemployment rate be accepting more inflation. For a fuller discussion about the Phillips Curve, read for example http://en.wikipedia.org/wiki/Phillips_curve.

As Friedman and others pointed out, it is fallacious to assume raising prices will lower unemployment. Just because we observe an apparent trade-off does not mean that a rise in inflation *caused* the fall in unemployment. Causality may be just the opposite: as the economy improves and the labor market tightens, wages rise, which then causes cost-push inflation.

Furthermore even if increased prices did temporarily lower unemployment say by reducing the real wage and encouraging firms to employ more labor, this depends on workers' suffering from money illusion. But as workers realize that the higher money wages do not purchase more goods than at the previous wage and price level, they will exit the labor market and the unemployment rate will return to its previous level.

Now the danger is that efforts to permanently suppress unemployment will necessitate continued increases in the price level, ie. inflation, which will be anticipated by workers, who will demand continual wage increases to maintain the purchasing power of those wages. Only if the inflation rate and wage inflation rate are equal will equilibrium be maintained. But the unemployment rate will be at the original, or natural rate.

This phenomenon of a short-run negative relationship between inflation and unemployment but a constant long-run unemployment rate, is known as the Natural Rate Hypothesis, and is the current thinking about the Phillips Curve; the long-run Phillips curve is vertical as is seen the in graph below.



Initially, a rise in inflation causes movement from the initial point A to point B as unemployed workers accept jobs at the higher money wage rate. But once they realize that the inflation rate has increased (not money wages, but inflation rate), they will demand higher wages based on the new inflation rate or else leave the labor force and move from B to C. Thus, at the new inflation rate, unemployment will return to the natural rate. Only an increase in the inflation rate itself can cause unemployment to fall.

Because higher rates of inflation are necessary to reduce unemployment, that is an acceleration of prices, this is referred to as the accelerationist hypothesis. This is where discretionary monetary policy leaves the realm of useless and enters the realm of downright dangerous. The natural conclusion is ever-increasing inflation, which inevitably leads to hyperinflation.

But what do monetarists have to say about fiscal policy? The initial argument against it is that deficit financing of increased government spending requires the Treasury to issue bonds. Sales of these bonds raise the market rate of interest which, in turn, "crowds out" private investment. In the limit, this crowding out effect just offsets the added spending by the government.

But suppose the increased spending is just offset by increased taxes. Recall that the balanced budget multiplier is not zero but one. The argument that is leveled against non-deficit government spending is that it might be offset by reduced private spending if individuals and firms view public expenditures as a substitute for private expenditures. For example, suppose the government provides free health care for the country's citizens. Now that means individuals can reduce private spending for health care by the amount spent by the government. Thus, there are no additional expenditures generated by health care provided "free" (but as Friedman liked to say, "There's no free lunch"). The difference is that the government rather than individuals makes the decision on how to provide the coverage. Which is better? That's for society and the political system to decide.

So what should government spend money on? Public goods like infrastructure, defense, police, etc., and necessary regulatory activities like on anti-trust. In addition to his writings in the area of monetarism, Friedman was a strong advocate for free markets and abhorred the idea of government intervention into the economy unless absolutely essential. He even wanted to proscribe the activities of the Fed precisely because of the perverse effects their actions could have if left unchecked. Basically, he was asking, "So who regulates the regulators?"

In his later years, Friedman became increasingly enamored with rational expectations theory (RET). To understand why, let us look at his earliest arguments against the Phillips curve. In these writings he assumed expectations are formed adaptively; that is, the forecast for next period is the current value: $F_t = X_t$, where X_t is the current value of X and F_t is the current forecast of next period's X.

As an example, suppose the expected value of next period's price index equals its value this period. Now let's suppose $P_0 = 100$ and $P_1 = 110$. Now if we forecast $F_1 = 110$ and P_2 winds up being 120, boy are we stupid! In the immortal words of The Who, "We won't get fooled again", or "Fool me once, shame on you; fool me twice, shame on me". So what is F_2? By now you are probably thinking 130, and you'd be right. This is the rational expectations, non-accelerationist answer. Whatever the policy-makers use to decide their next move, the public *on average* will forecast correctly.

But suppose you're wrong, that P_3 winds up being 140? So now we see historically the following series: $P_0 = 100$ $F_0 = 100$; $P_1 = 110$, $F_1 = 110$; $P_2 = 120$; $F_2 = 130$, $P_3 = 140$. Now, we've got a problem. What should F_3 be? Note that the last *change* in P was 20. If we go with $F_3 = 140 + 20 = 160$, why not instead go with $F_3 = 140 + 30 = 170$, just in case the Fed decides to *accelerate* price changes? This is where the accelerationist RET comes into play.

This does not mean, as Krugman states, that forecasts are always right. In fact, they are always wrong. They're just not consistently wrong the same way. They don't consistently under- or over-estimate the future value. Statistically, $E(F_t) = X_{t+1}$; on average the forecast made this period equals the value next period. So that is the authorities try to fool us by accelerating inflation, we see this acceleration and accelerate our forecasts as well. Otherwise, our forecasts would always lag the actual price level. Unfortunately, is the monetary authority comes to its senses and decides to act responsibly, we will wind up over-estimating inflation and negotiate a wage or set our prices too high and wind uo unemployed or holding unanticipated inventories.

Once you accept RET the conclusion is clear; the government is impotent in its attempts to control the economy. The public, in trying to protect itself from any damage caused by these efforts, will adjust its expectations. It will demand higher wages to protect against inflation, it will save more to protect against the higher future tax burden from deficits, and it will cut back on spending in the amount of current taxes used to provide the goods and services provided by the government. This is the "policy ineffectiveness proposition" mentioned earlier as applied to the real business cycle approach. The same is true for rational expectations.

But what's worse is that the uncertainty created by not knowing what will happen to prices is a drag in and of itself. It adds inefficiency into the system, which in turn reduces potential output. Thus, monetarists and RET both argue for rules, that these rules be made public, and, most importantly, that policy makers live by those rules as much as possible.

Friedman's 1968 paper on the natural rate of unemployment was written just as the United States and the rest of the OECD countries were entering into the period that became known as stagflation, a period of both high unemployment and high inflation. The original Phillips curve predicted a fall in unemployment as prices rose, so the stagflation gave great impetus to RET theory that argued against a trade-off and increasing inflation with unacceptable unemployment.

Friedman argued for a constant growth rate of the nominal money supply. In order to avoid possible deflation and its complications such as possible negative real interest rates, he opted for 3%. Since this is the long-run growth rate of real GDP, whenever $m = v = q = 3\%$, $p = 0$. If $q < 3\%$, we get some inflation and if $q > 3\%$, we get some deflation, but that's OK since it occurs with robust real growth, and that's good.

The timing of the article and the events on the ground was a clear demonstration of the veracity of monetarism and rational expectations in the view of the vast majority of economists of the time. It became almost heresy to see things differently; pure Keynesianism was on the defensive and needed a new vision to explain these events.

A new version of the monetary rule that is being advocated by a group of monetarists, including a former colleague of mine, Scott Sumner of Bentley College, states that the Fed should target nominal GDP (NGDP) growth. Sumner cites Lars Svensson as one of the key proponents of inflation targeting as a way to increase aggregate demand and spur the economy.

Sumner advocates a 5% to 6% growth in NGDP; if achieved, then prices would rise by more than 6% unless output expands. Such a huge increase in prices with certainty would compel consumers to buy now rather than wait and pay much higher prices in the future and will be a strong signal to producers that they will be able to sell their products at a (nominal) profit. The main issue is how to achieve such a rapid growth in NGDP. For more on this approach, check out Sumner's blog at http://www.themoneyillusion.com/ .

New Keynesian Economics

A group of economic theoreticians that wished to believe that fiscal policy could be effective developed alternative theories and models to explain the events of the 1970's and 1980's. Their models introduced rigidities and market imperfections that made it impossible for the economy to achieve full-employment equilibrium by itself. They also accept the idea of rationality of expectations, but despite these, they still maintain that involuntary unemployment is possible because rigidities and imperfect markets interfere with the normal mechanisms that bring the economy back to its general equilibrium.

It is useful here to give an example of how this would work. It has been long recognized that prices and wages may by "sticky" in short run. Workers may believe that they are worth a particular wage, perhaps because the last time they looked at what someone with their skills made it was more than the current wage being offered. We could interpret this to mean that these unemployed workers are "unwilling" to accept the job at the current market wage. That may not be the case, however. If the unemployed workers *knew* that the wage they were offered reflected the actual market conditions, they would accept it. Absent that knowledge, however, they may just continue to search for a better offer.

As for prices, firms may inaccurately price their product, not realizing that the current equilibrium price has fallen. Just think about the housing market the last two years. How

many homes were on the market at prices well above the true market price simply because sellers and their real estate agents priced them incorrectly? And how much should they drop the price the sell them? And will the bank holding the mortgage allow the short sale?

And the same thing can happen in reverse; how often during a housing bubble are buyers warned by their agents that they had better "high-ball" since there may be a number of offers above the asking price? Therefore, New Keynesians argue that macroeconomic stabilization by the government (using fiscal policy) or by the central bank (using monetary policy) can lead to a more efficient macroeconomic outcome than a laissez faire policy would.

The new classical economists reject this solution for two reasons: governments have never proved superior to the market in setting prices and wages, and that New Keynesian models consistently under-estimate the observed fluctuations in the economy over the business cycle.

Summary of the Effects of Policies

The effects of discretionay monetary and fiscal policies for each of the three main schools of thought outlined above – classical (RET), Keynesian, and monetarist – is summarized in the table below. For instance, Monetarists believe that expansionary monetary policy (M increases), while it may have a positive impact on real output in the short run, leads only to inflation in the long run, but expansionary fiscal policy has no effect on either real output or inflation in the long or short run.

	Monetarists		Keynesians		Rational Expectations	
Policy Effects	$\bullet$ M↑	$\bullet$ G ↑	$\bullet$ M↑	$\bullet$ G ↑	$\bullet$ M↑	$\bullet$ G ↑
S. R. $\bullet$ P	↑	→	→	↑ or →	↑	→
S. R. $\bullet$ Y	↑	→	→	↑	→	→
L. R. $\bullet$ P	↑	→	→	→	↑	→
L. R. $\bullet$ Y	→	→	→	↑	→	→

More Reading

New Classical Economics:

Robert Lucas' Critique on the use of large macroeconomic models rather than basing prediction s by aggregating micro-foundation models.

http://en.wikipedia.org/wiki/Lucas_critique