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ECN 314S History of Modern Macroeconomics 31 August 2017

Wicksell's Cumulative Process and Natural Rate of Interest

Nominal and Real Rates of Interest

Wicksell starts with a distinction (due to Fisher) between the *nominal* (or *market*) *rate of interest* and the *real rate of interest*. Suppose that you have \$100 and that a bank account or other asset earns 7 percent per year interest. Then, at the end of a year, you would have \$107. In general, if the market rate of interest is r expressed as a decimal (so that 7 percent is written 0.07), then if one puts an amount X_t into an interest-bearing asset at time t, a year later (time $t + 1$), one would have

(1) $$X_{t+1} = (1 + r)X_t.$$

Suppose, on the other hand, that an asset promises to pay a certain number of dollars at the end of a year (X_{t+1}), what would it be worth today? In that case, we can solve (1) for X_t:

(2) $$X_t = X_{t+1}/(1 + r);$$

so, for example, if r = 5 percent; and you are scheduled to receive \$25 in a year, it is worth

$$X_t = 25/(1.05) = \$23.81,$$

that is, if you pay \$23.81 for the right to receive \$25 one year in the future, you would earn the market rate of interest. In this case, X_t is called the *present discounted value* (or just *discounted value*) of X_{t+1}. The term "discounted" refers to the fact that money today is worth less today than money in the future – not because the value of the dollar in terms of purchasing power is less, but because one has only to set aside a lower amount at interest in order to have the higher amount in the future. The market interest rate measures the opportunity cost of holding money.

If we know both X_t and X_{t+1}, then we can solve for the implied market rate of interest:

(3) $$r = (X_{t+1}/X_t) – 1.$$

But, of course, the value of money may itself change if there is inflation. So, for example, if there is 2 percent per year inflation of the consumer price index, one dollar one year from now will buy only about 98 cents worth of today' goods. The real value of the dollar, measured at today's prices will be 2 percent less. In general, we can compute the real value from the inflation rate (i), again expressed as a decimal. Letting $\$_tY$ be the value in time t dollars of any number of dollars Y, we find that the real value in time t dollars of X_t dollars (i.e., at time t) is $\$_tX_t = X_t$. In other words, when measured in time t dollars, the real value of money at t is the same as its nominal value. However, to find the real value in time t dollars of money at a different time, say a year later (t+1), we have to account for the effect of inflation:

(4) $$\$_tX_{t+1} = \$_{t+1}X_{t+1}/(1 + i).$$

So, for example, when there is 2 percent inflation, \$44 a year from now would be worth only

$$\$_t 43.14 = \$_{t+1} 44/(1.02)$$

in terms of what you would get for your money at today's prices.

Combining these ideas, we can ask what would be the real rate of interest on money saved today – that is, how much in terms of today's consumption goods could we buy in the future, given the market rate of interest, which implies that every dollar put aside today gives us *more* dollars in the future, and the rate of inflation, which implies that every future dollar buys *less* than today's dollar. Thus, if the market rate of interest is 6 percent and the inflation rate is 3 percent, then roughly a dollar today would give you \$1.06 in a year; but, since each dollar would buy 3 percent less, that \$1.06 would purchase only the same goods at about \$1.03 would today. Thus, the real rate of interest would be about 3 percent. By analogy with (3), we can determine the real rate of interest (*rr*) by using only money values expressed in the dollars of a single time period (*time t*):

(5) $$rr = \frac{\$_t X_{t+1}}{\$_t X_t} - 1 .$$

By definition, $\$_t X_t = X_t$, and from (4), $\$_t X_{t+1} = \$_{t+1} X_{t+1}/(1 + i)$. So, substituting we get

$$rr = \frac{(\$_{t+1} X_{t+1})/(1+i)}{X_t} - 1 .$$

Noting that $\$_{t+1} X_{t+1} = X_{t+1}$ by definition and substituting from (1), we get an exact expression for the real rate of interest:

(6) $$rr = \frac{[(1+r)X_t]/(1+i)}{X_t} - 1 = \frac{(1+r)}{(1+i)} - 1 .$$

Note that (6) implies $(1+r) = (1+rr)(1+i) = 1 + rr + i + (rr \times i)$. Since both *rr* and *i* are typically small fractions, their product is even smaller, so that the term $(rr \times i)$ can generally be neglected. A very good approximation for the real rate of interest is

(7) $$rr \approx r - i ;$$

that is, the *real rate of interest* (*rr*) = *nominal rate* (*r*) – *inflation rate* (*i*).

The Economic Mechanisms

Wicksell assumes three important relationships:

- First, he assumes that increases in the stock of money over the needs of commerce lower the *nominal* rate of interest, while decreases in money raise it.

- Second, he assumes that increases in the *real* rate of interest lower the level of real investment in the economy; while decreases in real rates of interest raise it.
- Third, he assumes that increases in real investment in the economy put upward pressure on prices (i.e., cause inflation); while decreases in real investment reduce price pressure.

The Natural Rate of Interest

Wicksell imagines an economy that is growing steadily at a constant price level. If the rate of investment is proportioned to the needs of capital to just support that growth in the economy, then there is no upward pressure on prices. Since the inflation rate is zero, $r = rr$; the nominal and real interest rates are the same. Whatever interest rate holds the economy in this position (or, more generally, at any constant rate of inflation), Wicksell calls the *natural rate of interest* (r_N).

The Cumulative Process

If money expands at the same rate as production in the economy, then it is just adequate to the needs of the economy and the interest rate (r) remains constant at the natural rate ($r = r_N$). What happens if money expands faster than needed? Then, r falls below the natural rate. At the original rate of inflation, the real rate of interest $rr = r - i$ falls. The lower real rate of interest increases the rate of inflation. But the higher rate of inflation implies that rr falls even further, which promotes even more investment, which raises the rate of inflation even more; and then the whole process repeats, producing ever higher rates of inflation. This is Wicksell's *cumulative process.* And it works in both directions. If starting from a stable economy, money decreased, it would start a *deflationary* cumulative process.

Under a gold standard, Wicksell held that the cumulative process would be self-limiting. An inflationary cumulative process would lead to higher domestic prices and imports would rise and exports fall as people sought more favorable prices abroad. As a result of the unfavorable balance of trade, gold would flow out of the country, lowering the domestic money supply back into the direction of the stable economy.

But Wicksell also imagined a *pure credit economy* in which the money supply was all bank money without any real anchor. In such an economy, credit could be created endogenously as firms took out loans to finance investment, and there would be no automatic stabilizer to the system. Such a system could be stable in his view only if there were an active monetary policy that adjusted the stock of credit money to mimic the behavior of gold. Wicksell likened the credit economy to a ball on a flat, frictionless plane. If it were sitting still it would stay there. But nudge it and it would roll away with nothing to stop it. In contrast, the gold standard was like a ball in a bowl; nudge it and it would eventually reverse direction toward the bottom of the bowl.