Inventory Investment

By inventories I will principally discuss inventories of finished goods, that is goods which are ready to use but which are stored in warehouses or on display in stores. There are also inventories of raw materials stored by firms which are going to use them not sell them. There are also work in progress inventories such as half finished cars on assembly lines.

Inventory investment is only about one % of G.N.P. but is extremely important in business cycles. The variance of detrended inventory investment is typically equal to roughly one third of the variance of detrended GNP. Typically inventories are decreased during recessions and this is one of the principal reasons why demand for goods is lower during recessions.

The question is why would firms want to do this ?

The traditional explanation for inventories is the production smoothing model of inventories. According to this theory, the marginal cost of production increases with the level of production or in other words there are decreasing returns to variable factors in the short run. Therefore firms produce goods at an even rate and supply goods during periods of unusually high demand out of inventories.

This theory holds that the whole purpose of inventories is to make the variance of production lower than the variance of final sales.

In fact, the variance of production is greater than the variance of final sales. As mentioned above changes in inventories are one of the principal causes of the variance in production. This makes it difficult (but not impossible) to argue that the whole purpose of inventories is to reduce the variance in production.

An alternate theory of inventories (analyzed by, for example Olivier J. Blanchard and for another by James Kahn) is that there is a desired ratio of inventories to sales. The reason why firms might wish to maintain such a ratio is to avoid running out of goods and having to turn customers away. That is they wish to avoid stockouts. This theory explains why inventories would be high during periods of high demand, so long as firms can forecast demand in advance.

In particular, if shocks to demand are positively correlated over time, production will rise more than one for one in response to an increase in demand. Production will be increased both to meet the new higher expected demand and to rebuild inventories depleted by the shock.

For this theory to be credible it is necessary to explain why inventories as high as those observed are necessary for such a purpose. If goods were homogenous, if for example all cars were identical, high inventories would not be necessary. However if goods are differentiated and consumers are willing to pay a little bit more for e.g. a car of the desired colour, then inventories of the size observed might be profit maximizing.

The stockout theory is supported by the fact that a substantial fraction of finished goods inventories are held by retailers e.g. unsold finished cars are on dealers display lots.

An interesting Application of the Target Inventory Model

Assume that the desired level of inventories (N) is equal to
a constant c times final sales (X)

1) $N_t^* = X_t c$.

Production (Y) is equal to final sales plus the growth of inventories

2) $Y_t = X_t + N_t - N_{t-1}$

this is just an identity. Then assume a modified old style Keynesian demand function, so demand is equal to a constant plus a constant times lagged income = lagged production

3) $X_t = a + bY_{t-1}$

This is different from the permanent income hypothesis and requires consumers to be irrational or liquidity constrained.

This implies
4) $Y_t = a + bY_{t-1} + (a + bY_{t-1})c - (a + bY_{t-2})c$
that is
5) $Y_t = a + (1+c)bY_{t-1} - cbY_{t-2}$.

This second order difference equation can generate cycles