Price uncertainty principle

——Why the price mechanism is not the invisible hand

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Introduction:

In modern economy science, there are many theories that discuss the equilibrium. This convention was originally come from two famous economists Walras and Afred Marshall. Walras firstly finished the general equilibrium theory in 1874 in the book *the mere economics to iustice*. While Afred Marshall put forward the partial equilibrium in 1920. However, by observance, there was never the evidence for the existence of equilibrium.

In this paper, I will put forward a new price theory, which is named Price Uncertainty Principle. I will point out the flaws of these two equilibrium theories and discuss why the price mechanism is not the invisible hand, then further discuss why partial equilibrium and general equilibrium are not existent. I will prove that there is no equilibrium point for the price and prices are always fluctuant in the market.

1. Background

In 1874, the French economist Walras put forward the general equilibrium theory. In his theory, he argued that in a free market, the supply and demand interacted with each other, finally they would reach a state that was called equilibrium.

At the same age, another economist Afred Marshall put forward partial equilibrium theory and price mechanism. He thought that in a partial market, under the effect of price mechanism, there would be an partial equilibrium where supply quantity equals demand quantity.

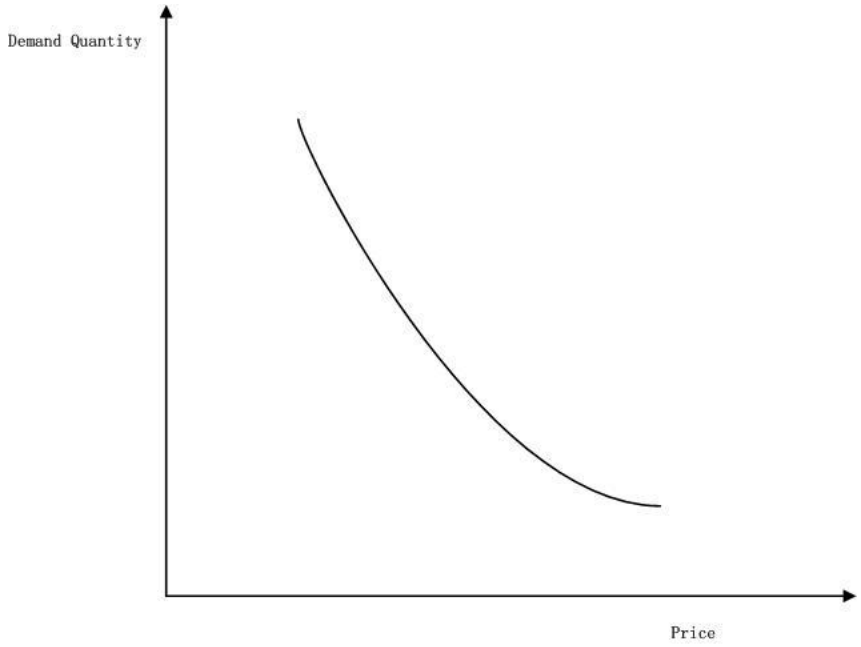
The sad thing is that both of these two equilibrium theories could not explain the real world, there is never evidence for the existence of these two kinds of equilibrium, they are just good math models but not science. Science can describe the real world.

So we need to make our mind jump out of the old thoughts.

2. Partial Equilibrium Theory

Firstly I will briefly introduce how the theory of partial equilibrium explains price change and the flaw of partial equilibrium theory.

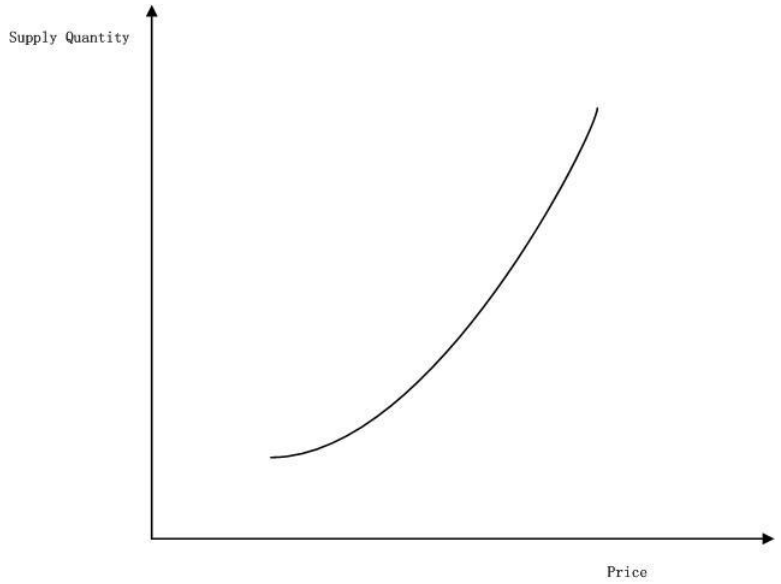
Figure 1. Demand curve



Here is the demand curve.

From the picture we could know that toward one commodity when the price is increasing, the quantity demand is going down. And vice versa.[1]

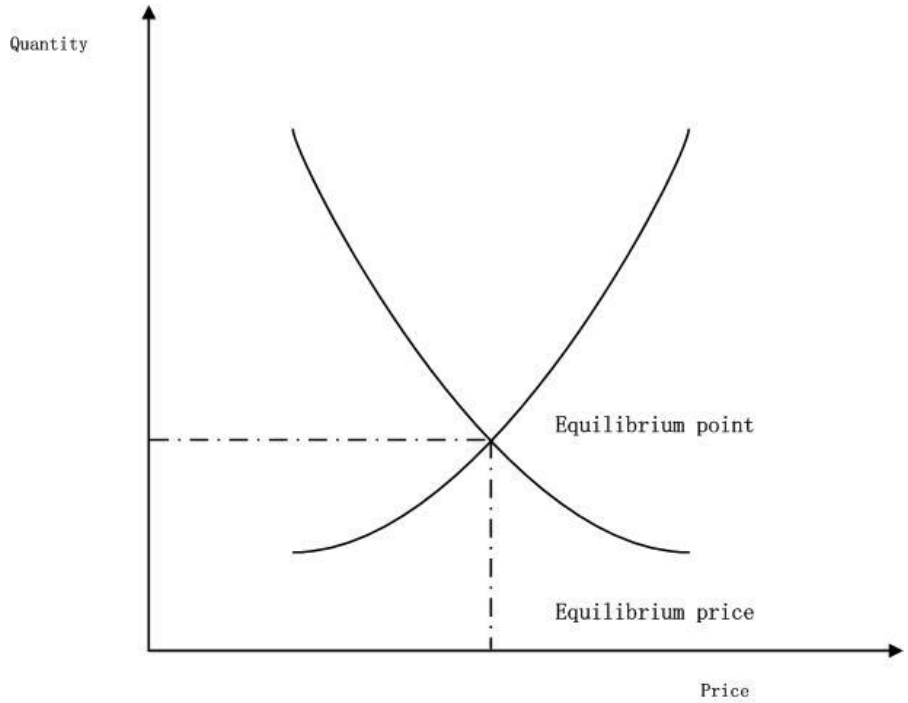
Figure 2. Supply curve



Here is the supply curve.

From the picture we could know that toward one commodity if the price goes up, the quantity supply will go up. And vice versa.[1]

Figure 3. Equilibrium curve

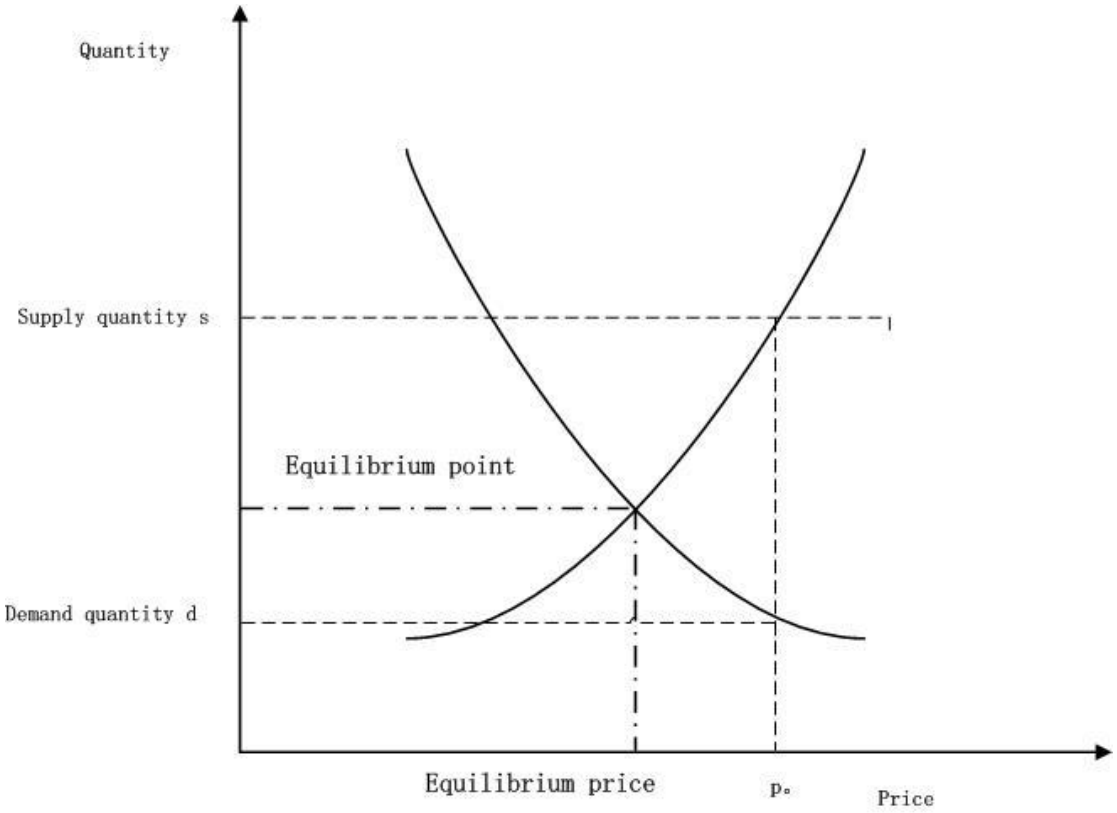


Here is the Equilibrium curve.

From the picture we could know that Equilibrium Point is the intersection of demand curve and supply curve for the same commodity. At this point, the supply quantity will equal the demand quantity. And the price for this intersection is called the Equilibrium Price. In the partial equilibrium theory, it argues that whenever the price leaves the Equilibrium Point, there will be a mechanism that try to pull it back to the Equilibrium Point.[1]

For example, in the following graph, Marshall claims that when the real price $p_。$ is above the equilibrium price, the supply quantity will be s, the demand quantity will be d, s>d, the supply quantity is above the demand quantity, then the sellers will lower the supply quantity and price, at the same time, the demand quantity will go up because the price is going down, finally they will merge at the equilibrium point.[1]

Figure 4. Real price above equilibrium price



Here is the flaw: in fact, when the price is high, the sellers will try to maintain this price because the sellers can get higher profit. Even if the supply exceeds the demand. If the supplier can sell the product at a higher price, he or she will do it absolutely. That is what merchants do in a monopoly market. They try to maintain higher price to get higher profit, even the demand quantity is low.

3. Discussion toward the price

In a competitive local market, one seller could not determine the price. We can prove this by using the following example:

Assume there are three sellers A, B and C selling the same product in a local market. At the beginning, they sell the same product using the same market price. Ceteris paribus.

Then if A raises the price, people will choose to buy commodities and services from B and C. Then A will not be able to sell his or her products. In order to avoid loss, A has to lower the price to compete with B and C.

Then we prove that one single seller could not determine the market price if there is competition in the local market.
So we reach a conclusion that in a competitive market, the price is a dependent variable. The price could not determine the supply curve and demand curve in a competitive market.

4. Relation between supply quantity and demand quantity

We all know three terms in the economy:
Supply exceeding demand, supply equaling demand, supply falling short of demand.

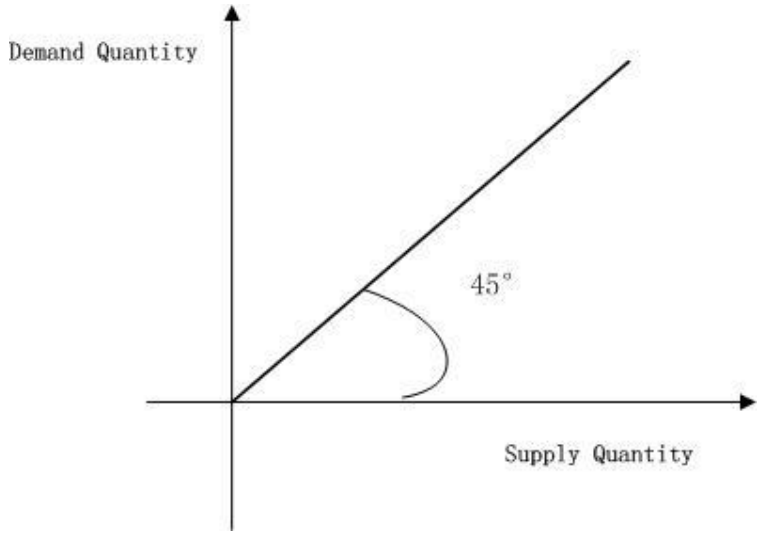
Assume the total demand toward one certain commodity is a constant variable, we assume it to be constant N (N>0). Besides, one concept I need to clarify is that in my theory demand is not the demand quantity. In my theory demand is in a moment the whole demand, which is the demand of all the people in a local market to buy certain commodity or service in that market or the function between the price and demand quantity for that commodity or service. Demand quantity is the transaction quantity really happened in the moment, it is an instantaneous value. In my theory, the supply quantity is also an instantaneous value.

Because the price is a dependent variable. I will analyze the relationship between two other variables, supply quantity and demand quantity. (Supply quantity is the quantity of commodities that are being sold in the market in the moment). During my discussion, the supply quantity will be used as an independent variable.

We assume the demand N remains the same all the time (It is better for our discussion). Ceteris paribus.

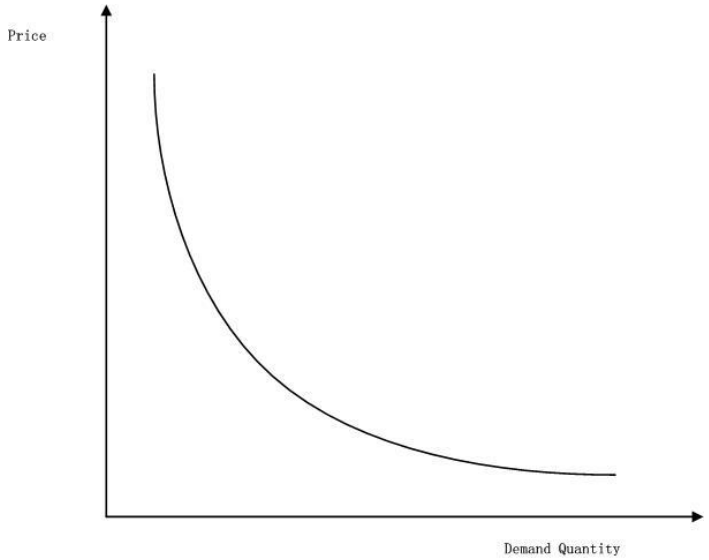
1) When the productive force is very low, that means the supply can never satisfy demand. So we have what is produced will be sold out, just like Say's Law[2]. The supply quantity will determine the demand quantity. We will have graph like following:

Figure 5. Under low productive forces Supply Quantity-Demand Quantity



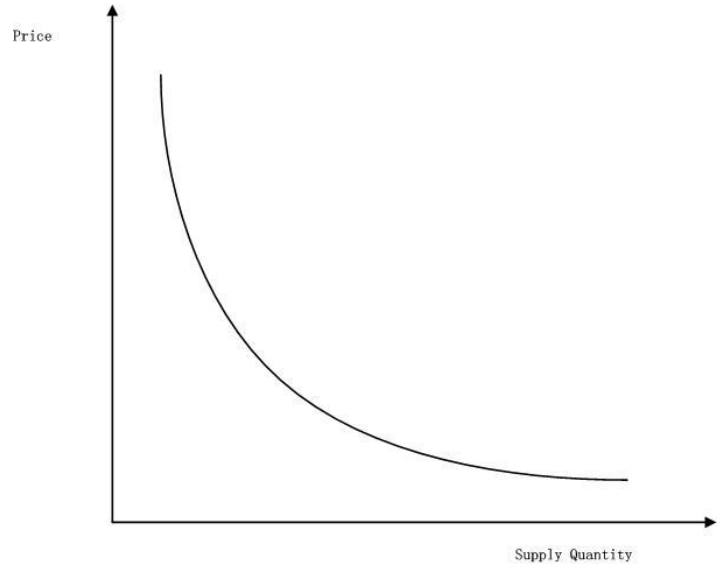
To draw the relation between price and demand quantity, we can directly use Marshall's demand curve[1]:

Figure 6. Price-Demand quantity[1]



As the demand quantity is the same as the supply quantity, we will have following:

Figure 7. Price-Supply quantity



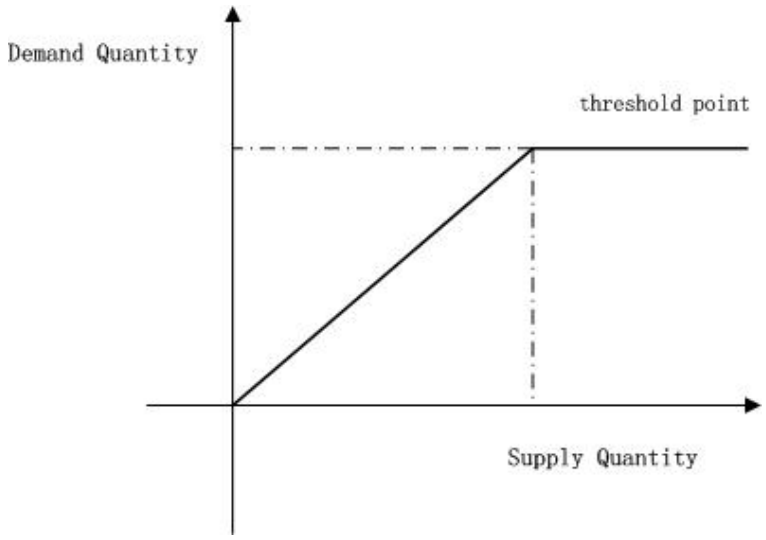
2)When the productive force is extremely high, that means the supply can exceed demand.

1))We have that when supply exceeds demand, if we increase the supply quantity, the demand quantity will not increase because all demand has been satisfied.

2))When supply equals demand, this is a threshold value.

3))When supply is below the demand, we know that all our commodity supply will be sold out. We have that the supply quantity will determine the real demand quantity. What I need to clarify here is that in the moment the transaction quantity equals supply quantity as well as demand quantity. Whenever a commodity is put in the market, it will be sold out as soon as possible. Just like the Say's Law, which claims "supply creates its own demand"[2]. So we could draw curve like following:

Figure 8. Under high productive forces Supply Quantity-Demand Quantity



From the picture we know that under the threshold, the supply quantity is the same as the demand quantity. Above the threshold, if the supply quantity increases, the demand quantity will not increase.

5. Relation between supply quantity and demand N when the productive forces are high

In a monopoly market, assume that there is just one seller A selling one product. We assume the demand for the same product remains the same all the time and is value N (N>0). That means the relation between demand quantity and price will be a deterministic function. Ceteris paribus.

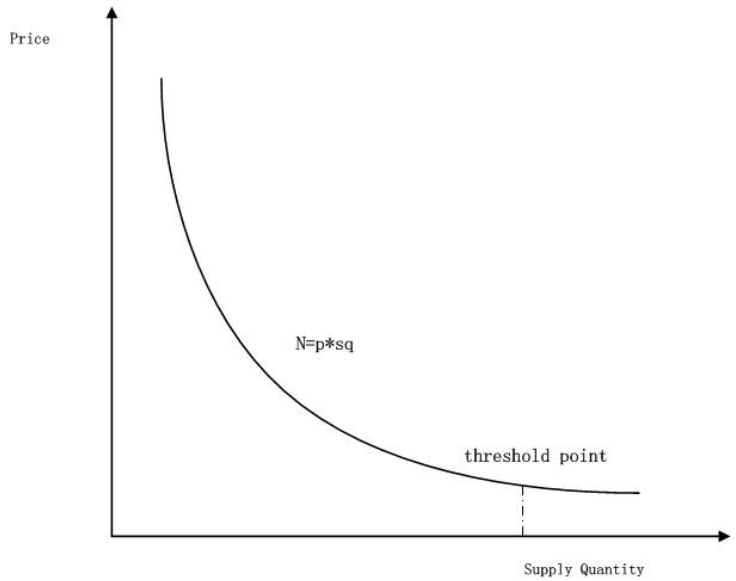
As we discuss previously, we know that below the threshold, the demand quantity is the same as the supply quantity. Besides, according to Marshall partial equilibrium, if A raises the price, the demand quantity will go down; if A lowers the price, the demand quantity will go up[1]. Because the demand quantity is the same as the supply quantity, we can say that, if A raises the price, the supply quantity will go down; if A lowers the price, the supply quantity will go up.

We can further conclude that if A raises the supply quantity, the price will go down. If A lower the supply quantity, the price will go up. That is what happens in the real life.
We can firstly use the power function to describe this, then we can extend this to the general case. Assume the p is the price, sq is the supply quantity, we have that

$$N=p*sq \text{ or } p=N/sq$$

Here we use market price to evaluate the demand N and ignore the influence of other factors, Ceteris paribus. So we ignore the impact of inflation and other facts.
Then we have curve like following.

Figure 9. Price-Supply quantity

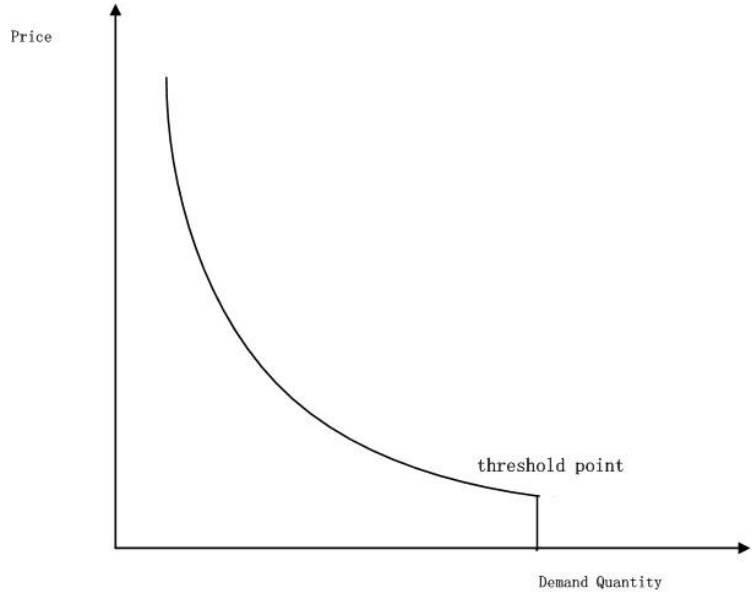


From the picture, we know that if the supply goes into unlimited, the price will be near 0. We could find evidence for this in real life. Like oxygen, the price for oxygen

is 0. While everyone has demand for it. And the demand quantity for oxygen is dependent on the number of the whole animals and plants on the earth instead of the supply quantity (The whole oxygen on the earth). The supply quantity is far beyond the demand quantity. This proves that if the supply quantity is far beyond the demand, the demand will determine the real transaction quantity or demand quantity.

If we use dq to represent demand quantity, we can infer the relationship between demand quantity and price:

Figure 10. Price-Demand quantity



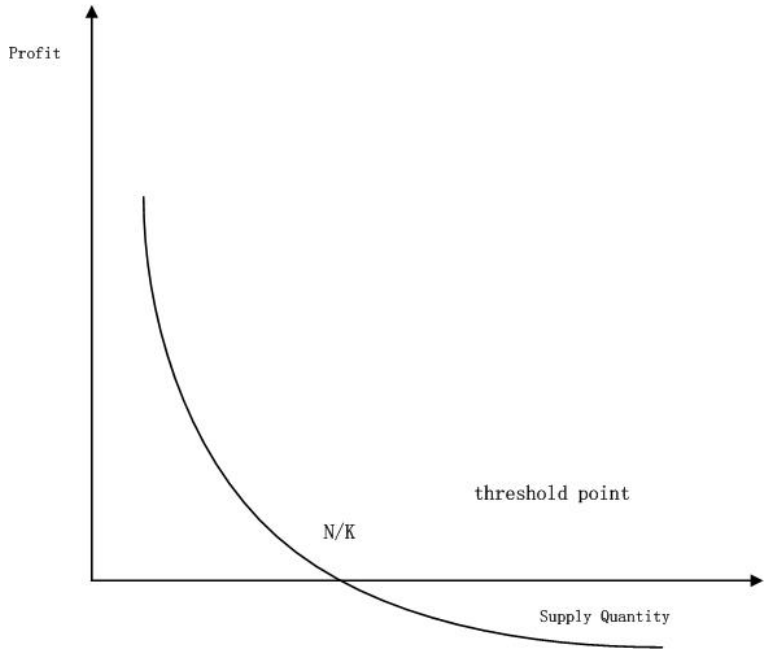
6. Bring in the concept of cost

Assume there is just one kind of commodity, the cost for each of this commodity in the market is K, we will have profit S for one commodity is:

$$S=p-K=N/sq- K$$

We can draw following graph:

Figure 11. Profit-Supply quantity



If S=0, sq=N/K.
We have that if sq<N/K, there will be profit, so the sellers can earn money. If the sq>N/K, there will be loss, then sellers will lose money.

Considering the fact that the sellers in the market they want to earn money, they are selfish (This is the basic assumption of modern economy).
If the total demand N is constant value, the demand function will not change during the time, ceteris paribus, we have that the supply quantity will move like this:

1) The initial supply quantity is 0. We could conclude that this commodity is very profitable, then the sellers will enlarge the supply quantity of this commodity, so the supply quantity will increase.
2) The supply quantity is increasing, during the process, the point is moving right along the curve in the picture Figure 11, the price of this commodity is decreasing. the profit for one of this commodity is decreasing.
3) After the supply quantity is above N/K, we have that the profit of this commodity is negative, the price is very low. Then sellers who produce this commodity will lose money. So sellers will reduce manufacturing this commodity. The point will move left along this curve. The supply quantity will go down.
4) Then the supply quantity will decrease to some value below N/K.
5) When the supply quantity decreases to some vey low value, the profit for each commodity is very high. Producing this commodity is very profitable. Then sellers will enlarge the supply quantity of this commodity.

The conclusion is that the supply quantity will fluctuate along the horizontal axis. Then we can infer that the price will fluctuate along the vertical axis.

In real life, it is more common that when the supply quantity is large enough (but not

above N/K), the profit of this commodity is too low then nobody wants to produce it, then the supply quantity will go down.

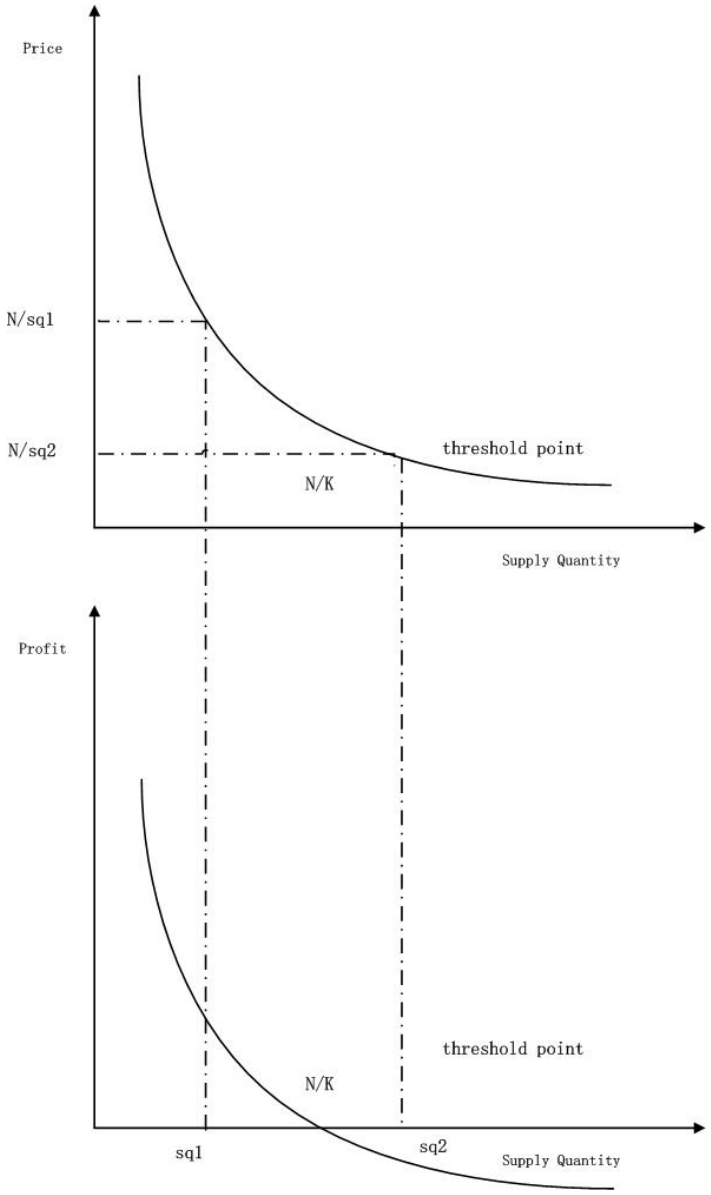
To clarify here is that the N/K is not the equilibrium point. The supply quantity will not stop at N/K. If the increase of supply quantity is too rapid, the supply quantity will naturally exceed this value N/K. If the supply quantity stop at this value, as there is no profit for this commodity, some people will reduce producing this commodity, then the supply quantity will decrease.

The price mechanism is not the invisible hand, the real invisible hand is people's desire for money and profit, if there is no profit, no one will want to produce the commodity. Then we can understand why sometimes sellers prefer to sell the product at a lower profit, large sale volume. If the total profit is high, then there will be merchant who will do it.

There is no order for this movement. The real supply quantity is uncertain, it is totally determined by the judge of sellers toward demand. Or we can say it is totally determined by the judge of the entrepreneurs.
If the entrepreneurs think that producing this commodity can make them earn a lot of money, they will produce a lot.

From the equation p=N/sq, we know that sq is vibrating randomly, so the price is vibrating randomly, too.
Assume sq is vibrating between sq1 and sq2, then the price p will be vibrating between N/sq2 and N/sq1. It seems just like there is an equilibrium point but in fact there is no equilibrium point. It is just a kind of unordered fluctuation.

Figure 12. Price fluctuation Interval



We can also infer that if sq (supply quantity) is too large, we enlarge the supply quantity from sq to (sq+d), we have that:

$$p=N/(sq+d)$$

d is supply quantity addition.

Here sq is too large, $d << sq$, we can know that d has little impact toward the price. That is the reason for the price rigidity. That is why we see the price in the real world is sometimes stable. Because the number of commodities are extremely large. Small changes will not impact the price. It is easy for merchants to produce less to get higher profit, but it is difficult for merchant to produce more to lower the price. So the price is easy to go up and difficult to go down.

Apart from that, in the real market, the demand is also changing all the time. That means the curve N is also changing all the time. If we add other factors such as inflation, the fluctuation of price is even more severe. So the price is further changing

randomly.

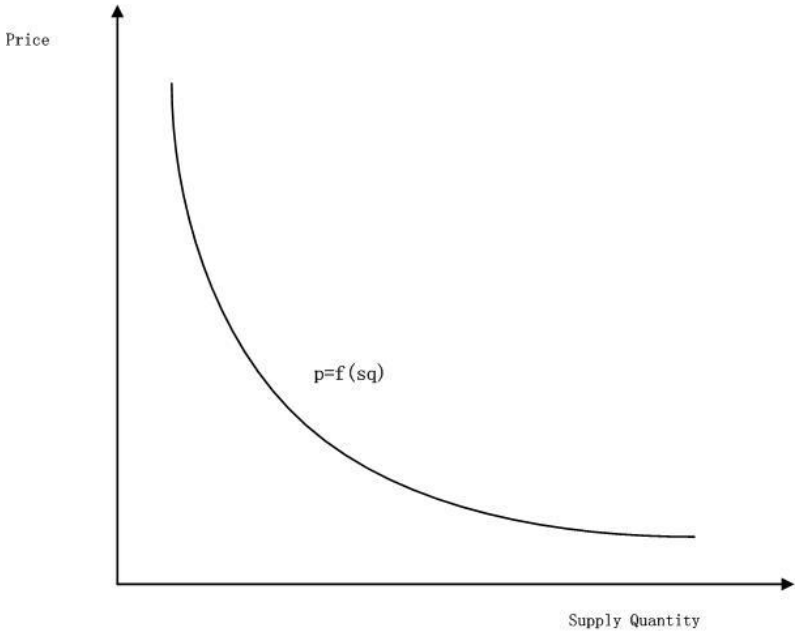
7. General case

The previous conclusion is based on the equation N=p*sq, here I will prove a more general case. From previous discussion we could know that when the price goes up, the quantity demand will go down; when the price goes down, the quantity demand will go up. So the relation between price and quantity demand is a decreasing function. Besides, when the supply quantity doesn't satisfy the demand, the supply quantity equals demand quantity, this is the Say's Law[2]. When the supply exceeds demand, the demand quantity will stay the same. So we know that the relation between quantity supply and price is also a decreasing function. Here I define N is the total demand, p is price and sq is the supply quantity. Assume the N is fixed relation. We have the function that describe the relation between p and sq is p=f(sq), f(sq) is a decreasing function, $f'(sq)<=0$.

[Here I will use the concept of inverse function, toward p=f(sq), $sq=f^{-1}(p)$, as f(sq) is a decreasing function, $f^{-1}(p)$ will be an increasing function.]

Assume the curve is like below:

Figure 13. General relation between price and supply quantity

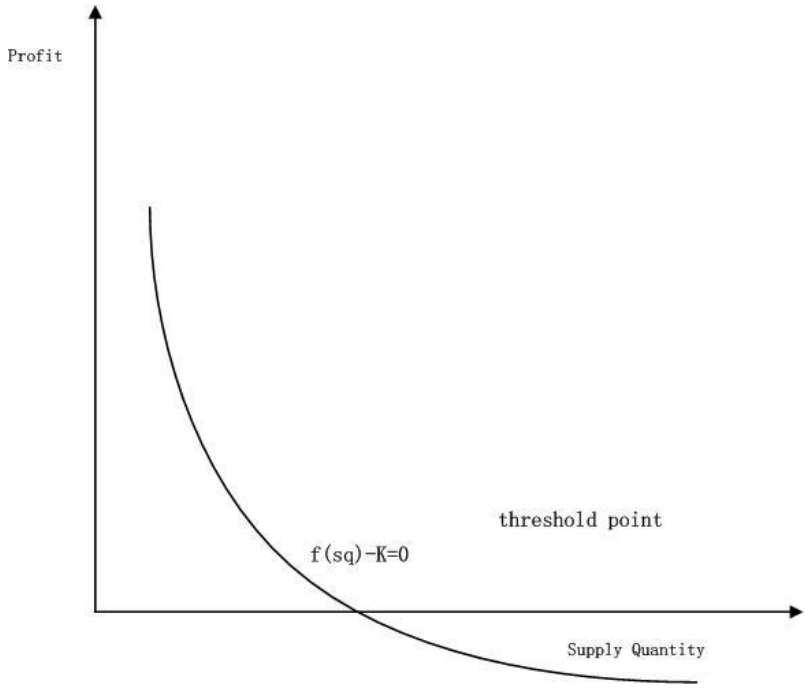


Assume the cost for the commodity is the K, we will have that the profit-supply quantity relation is

$$profit=f(sq)-K=g(sq)$$

We will have that the profit-supply quantity relation is like following:

Figure 14. General relation between profit and supply quantity

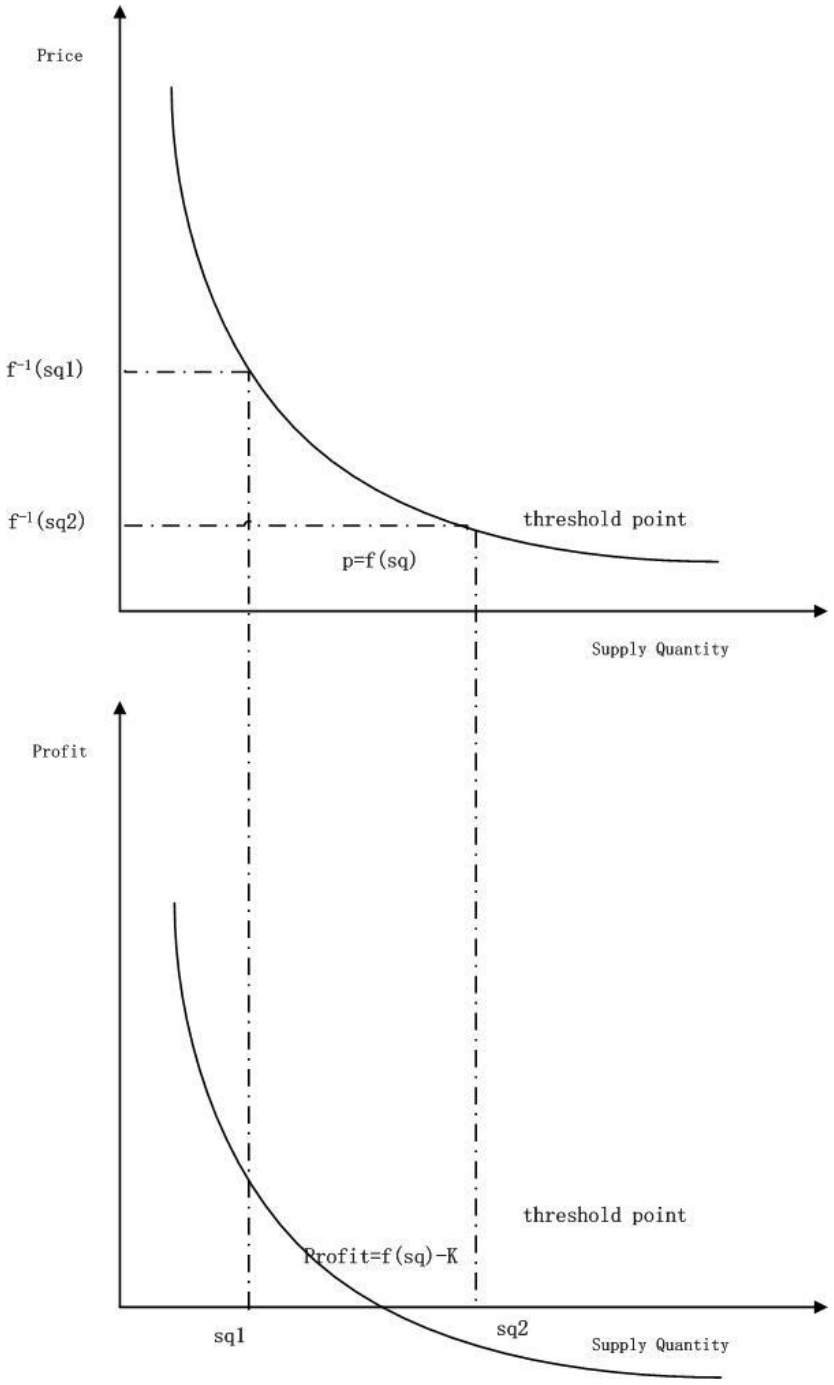


We have that the supply quantity moves like this:

6) The initial supply quantity is 0. We could conclude that the this commodity is very profitable, then the sellers will enlarge the supply quantity of this commodity, so the supply quantity will increase.
7) The supply quantity is increasing, during the process, the point moves right along this curve, the profit for one of this commodity is decreasing. The price of this commodity is decreasing.
8) After the supply quantity is above $f^{-1}(K)$, we have that the price is very low, the profit of this commodity is negative. Then sellers who produce this commodity will lose money. So sellers will reduce manufacturing this commodity. The supply quantity will go down.
9) Then the supply quantity will decrease to some value below $f^{-1}(K)$.
10) When the quantity decreases to some vey low value, the profit for each commodity becomes vey high again. Producing this commodity is very profitable. Then sellers will enlarge the supply quantity of this commodity.

Assume sq is vibrating between sq1 and sq2, then the price p is vibrating between $f^{-1}(sq2)$ and $f^{-1}(sq1)$. It seems just like there is an equilibrium point but in fact there is no equilibrium point. It is just a kind of unordered fluctuation.

Figure 15. General price fluctuation Interval



What I will claim here is that the $f^{-1}(K)$ is not the equilibrium point. The supply quantity will not stop at $f^{-1}(K)$. If the increase of supply quantity is too rapid, the supply quantity will naturally exceed this value $f^{-1}(K)$. If the supply quantity stop at this value, as there is no profit for this commodity, some people will reduce producing this commodity, then the supply quantity will decrease. According to p=f(sq), there is no equilibrium point for sq, so there is no equilibrium point for price.

Then we could discuss the maximum profit. We have the profit for one product is

$$profit=f(sq)-K=g(sq)$$

We have

$$\text{total profit}= \Omega(sq)=(f(sq)-K)*sq$$

$$d(\text{total profit})=d\Omega(sq)=f(sq)+f'(sq)*sq-K$$

if there are supply quantity value sq。, which is between 0 and $f^{-1}(K)$, $d\Omega(sq_{。})=0$, toward sq between (0, sq), $d\Omega(sq)>0$, toward sq between (sq, $f^{-1}(K)$), $d\Omega(sq)<0$, we will have that sq。could be the maximum profit point.

8. Discussion why general equilibrium is wrong

Toward the price of one commodity, I have proved that there is no equilibrium point.

Toward the whole market. The supply quantity toward each commodity is always changing. The demand for each commodity is also changing. So the price for each commodity in the market is always changing. The supply quantity is sometimes above the demand. Sometimes the supply quantity will determine the demand quantity (Say's Law)[1].

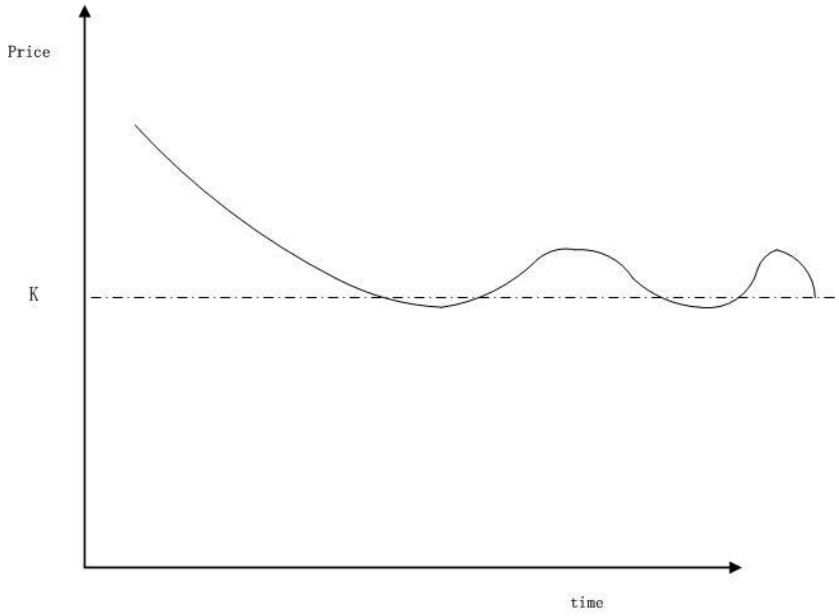
So the general equilibrium theory is wrong. The market price is always fluctuating. When an overproduction occurs, it will recover because people in the market they want to avoid loss, so they decrease supply quantity of the commodity that is under overproduction. There is no price mechanism in the real world.

9. Price-Time graph

In this part, I will draw the relation between the price and the time.

As we discussed previously, at first, the profit of the commodity is so high, so sellers will compete with each other to produce this product, during the period, the supply quantity goes up, the price goes down, the profit of this commodity goes down. When the profit is below zero, there is no profit for this commodity, sellers will reduce the production of this commodity, the supply quantity will go down, the price of this commodity will go up, then the price will fluctuate randomly in a free market as time passes.

Figure 16. Price-Time graph

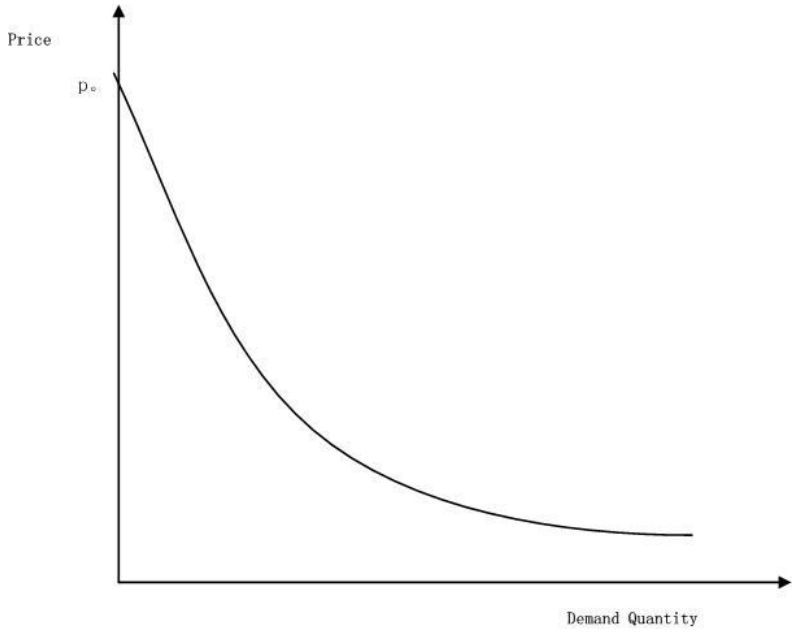


10. Administrative Price

Sometimes the price it is not a dependent variable, it could be controlled by the monopoly market or the government. What would happen if the price is controlled by the government.

Here we will use a more realistic price-quantity demand graph:

Figure 17. Price-demand quantity in real life

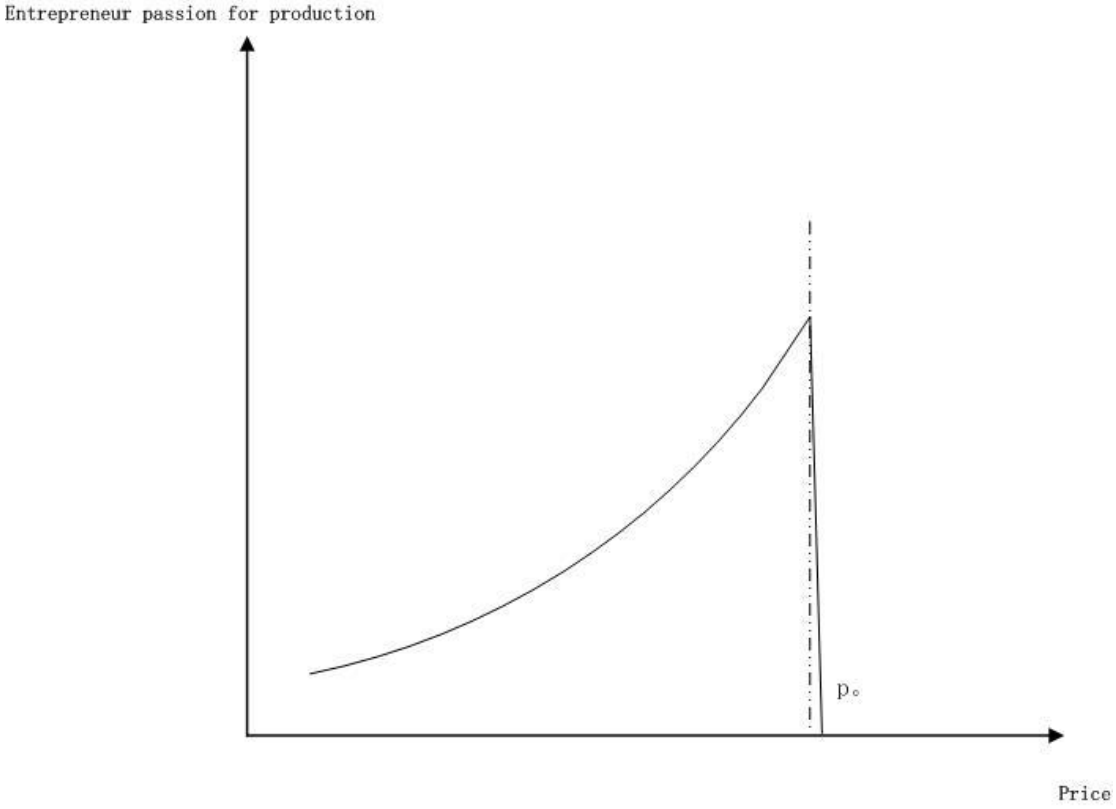


If the price is above the p。, the price is too high for people to afford, so no one could buy it, the demand quantity is 0.

As we have talked, if the sellers can get more benefit from a commodity, we can infer

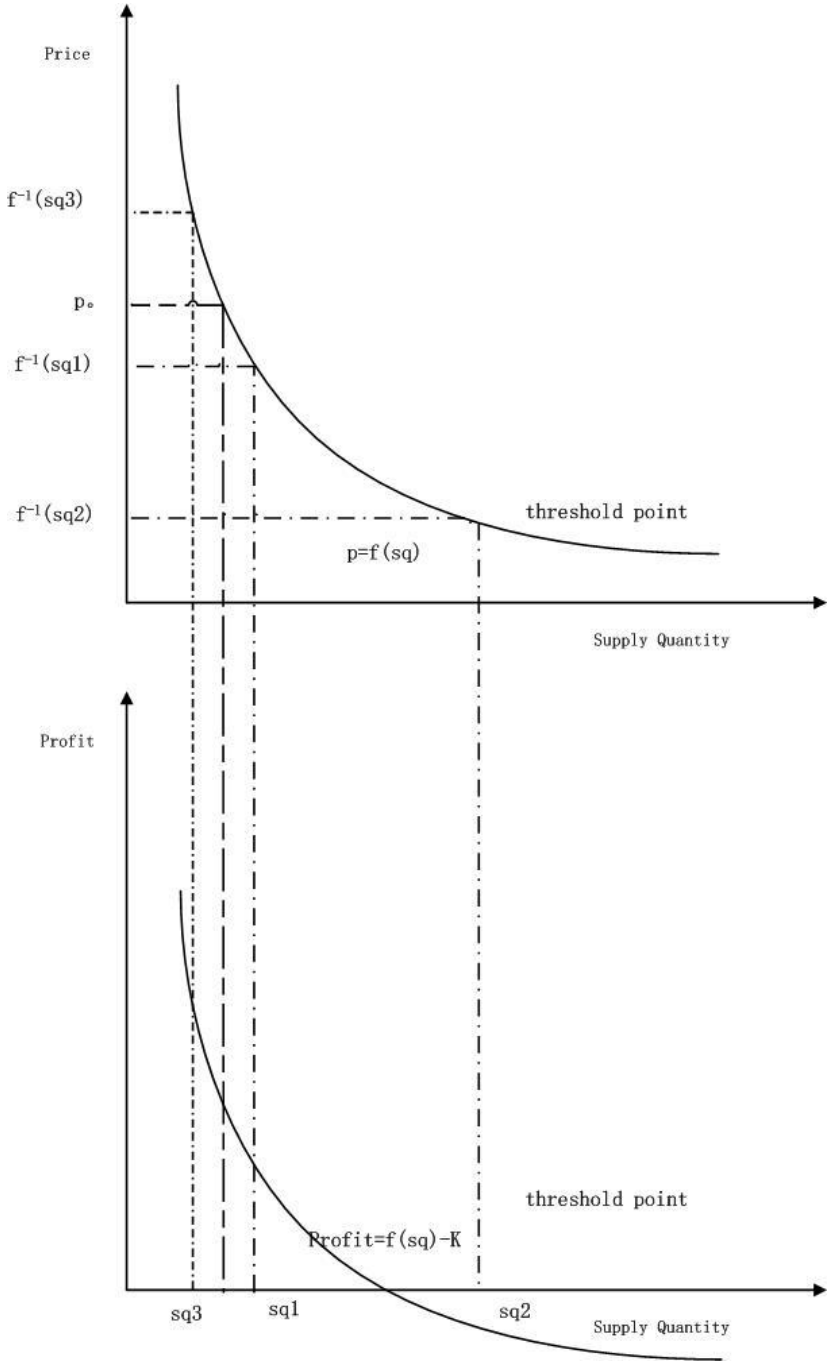
that sellers have a higher passion to produce this commodity, and vice versa, so we can draw the following graph.

Figure 18. Producing passion-price relation



1) When the price is low, the entrepreneurs don't want to produce this commodity.
2) As the price is going up, entrepreneurs' passion to produce it is increasing.
3) When the price is above threshold p。, the quantity demand is zero because no one can afford this commodity. Then sellers doesn't have passion to produce this commodity because they can even not profit from this commodity. The passion to produce this commodity becomes zero, just like hydrogen energy, hydrogen has high cost, it is very hard for general public to put it into business. It is possible that entrepreneurs will spend money on researching it based on his judge toward future business. But in the whole, the supply quantity will be very low or even zero after the price is above p。.

Figure 19. Supply quantity under administrative price



1) We can use the upper graph to discuss this situation, if the price is controlled by the government at the price value $f^{-1}(sq1)$, at this price, there is too much profit for the sellers. So sellers will enlarge the supply quantity. Then the price will stay the same value (sq1) and the supply quantity will continually go up. That is what happened in the monopoly market. Sellers hoard goods and sell them at a high price.
2) If the price is controlled by the government at the price value $f^{-1}(sq2)$, as there is no profit, the sellers won't produce it, the supply quantity will go down and even to 0.

3) If the price is at the $f^{-1}(sq3)$, which is above the threshold price value $p_{。}$, that means no one can afford it. Then the supply quantity will go down and even to 0 as there is no profit for this commodity.

11. Example

Assume there is a competitive market. There are five commodities in the market. Assume at first the demand for each commodities is 2 and all the demands are constants. The relation of demand, supply quantity and price is N=p*sq, besides, we assume the inflation rate keeps the same all the time.

There are many sellers selling different commodities. Assume the supply quantity for each commodity is initially 2.

We have that all price is initially 1.

s1)Based on sellers' judge toward the market, some sellers begin to sell more products A. Assume the quantity supply for A becomes the value 3.

We have that A's price will become the number 2/3. Other remains 1. The supply quantity of A has exceeding the demand. An overproduction occurs. So sellers who produce A will have less profit, they will not produce A.

s2)Based on sellers' judge, some sellers begin to sell more products B. Assume the quantity supply for B become the value 4.

We have that B's price will become 1/2. People will produce less B because B is not profitable

Assume there is just 1 quantity of A in the market. The price for A is 2. All other prices will be 1.

s3)Based on sellers' judge, some sellers begin to sell more products C. Assume the quantity supply for C become the value 3.

We have that C's price will become the number 2/3. Assume the supply quantities of A is 0.5 and the supply quantities of B is 1, We have A's price is 4 and B's price is 2. So A and B become profitable, more people devoted themselves to produce A and B.

s4)Assume A's supply value becomes 1.5 and B becomes 2. C's supply quantity becomes 2.

We have that B's price will become the number 1. C has 2 in the market, C's price will be 1. A's price will be 4/3. All other prices will remain 1.

Table 1. Price Variation Table

Price	s0	s1	s2	s3	s4
A	1	2/3	2	4	4/3
B	1	1	1/2	2	1
C	1	1	1	2/3	1
D	1	1	1	1	1
E	1	1	1	1	1

From this analysis, we could know that there is no equilibrium point in the market. The price is changing randomly. And there is no price mechanism for surplus supply and surplus demand to equal each other. What forces people to produce is their desire to earn money, that is the real mechanism. there is a state that supply quantity will equal demand, but it is not a stable state and the market will not stop there.

12. Conclusion

Based on the judge of entrepreneurs toward the market, entrepreneurs will determine the supply quantity. this is an unpredictable variable. Besides, the demand is changing all the time in the market, it is an unpredictable variable. So the price is always fluctuating. The price is uncertainty.

Citation:
[1] Principles of microeconomics Mankiw N.G, 2ed 2001
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