# Price uncertainty principle

## ——Why the invisible hand is not the price mechanism

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Introduction:

In modern economics, there are many theories that discuss the equilibrium. This convention was originally from two famous economists Leon Walras and Afred Marshall. Walras first described general equilibrium theory in 1874. Afred Marshall put forward the partial equilibrium theory in 1920. However, there was never any observational 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 non-existent. I will prove that there is no price equilibrium point and market prices are always fluctuating.

1. Background

In 1874, the French economist Leon 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 such that they would eventually reach a stable state that he called equilibrium.

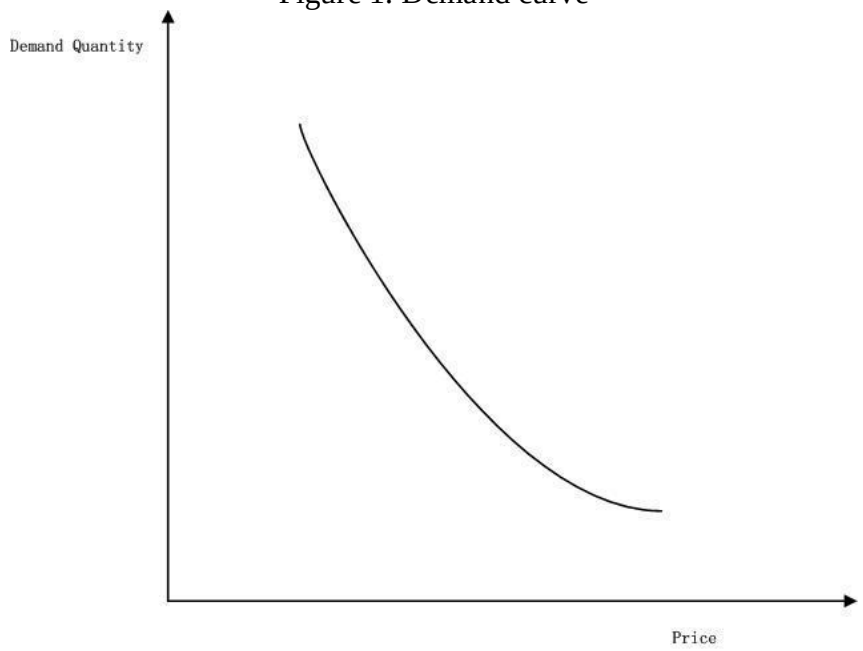
At the same age, another economist Afred Marshall put forward partial equilibrium theory and the price mechanism. He thought that in a partial market (In a partial market, there are just one kind of commodity and one kind of demand) , under the effect of the price mechanism, there would be an partial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

However, neither of these two equilibrium theories could explain the real world. There is no evidence for the existence of these two kinds of equilibrium, so they are just good math models but not science. Only science can describe the real world.

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.

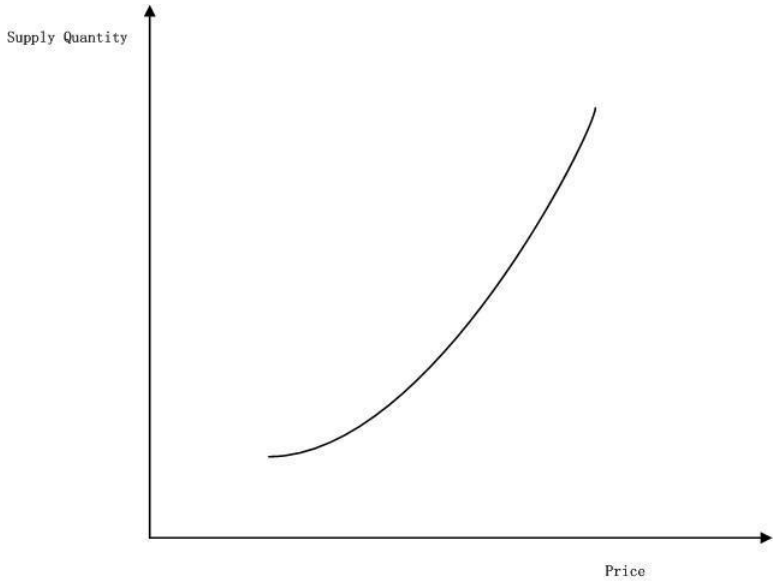
Figure 1. Demand curve




Here is the demand curve.

From Figure 1 we can see that when the price is increasing of one commodity, the quantity demanded is decreasing, and vice versa.[1]

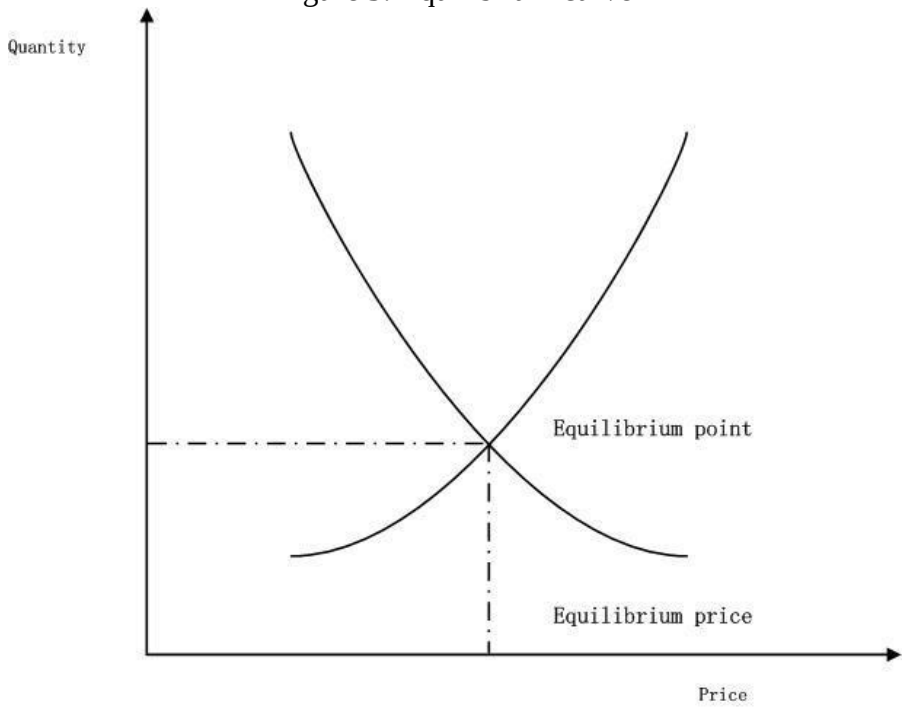
Figure 2. Supply curve




Here is the supply curve.

From Figure 2 we can see that if the price of one commodity goes up, the quantity supplied will increase, and vice versa.[1]

Figure 3. Equilibrium curve



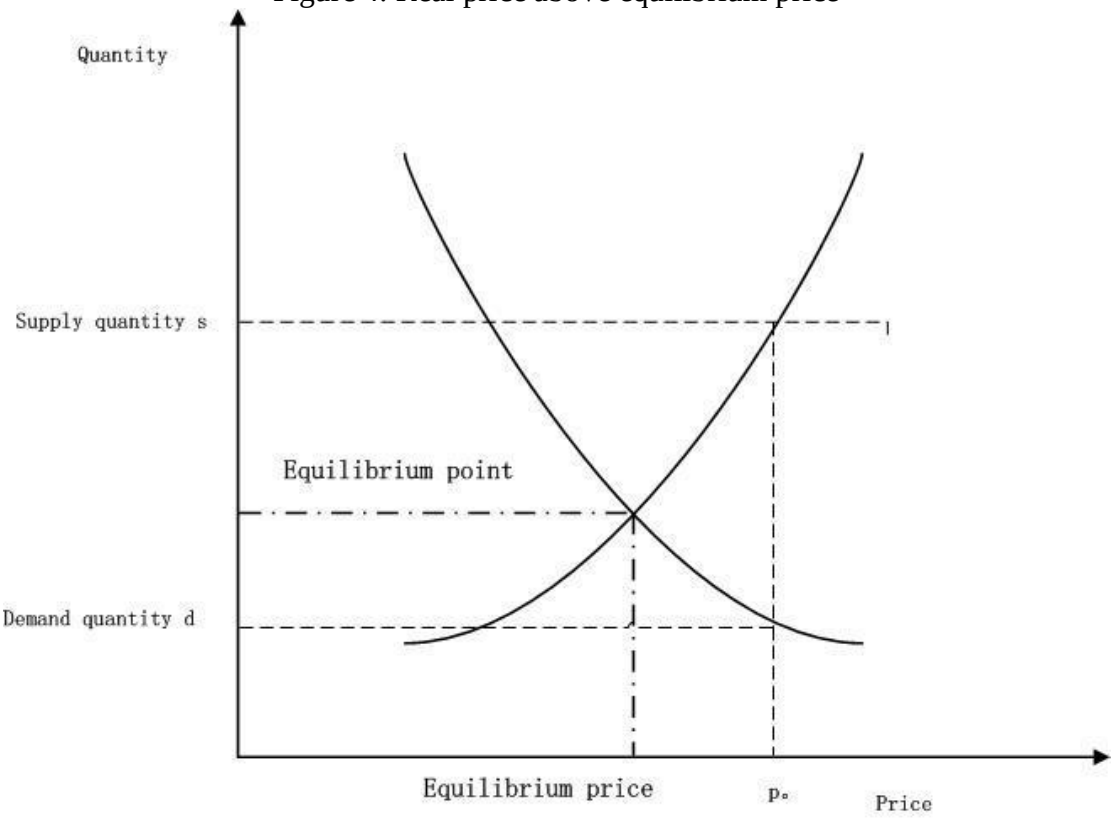

Here is the Equilibrium curve.

From Figure 3 we can see that the equilibrium point is the intersection of the demand curve and supply curve for the same commodity. At this point, the quantity supplied will equal the quantity demanded. And the price at this intersection is called the equilibrium price. In the partial equilibrium theory, it is argued that whenever the price leaves the equilibrium point, there will be a mechanism that pulls it back to the equilibrium point.[1]

For example, Figure 4 shows Marshall's claim that when the real price p。 is above the equilibrium price, the quantity suppliedwill be s, the demand quantity will be d,

and s>d, meaning the supply quantity is above the demand quantity, so 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, and finally they will merge at the equilibrium point.[1]

Figure 4. Real price above equilibrium price




However, this theory the flawed. When the price is high, the sellers will try to maintain this price because then they can earn a higher profit, even if the supply exceeds the demand. If the supplier can sell the product at a higher price, he or she will absolutely do it. That is what merchants do in real general monopoly market. They try to maintain higher price to get higher profit, even if the demand quantity is low.

3. Discussion of price

In a competitive local market, one seller cannot determine price. This is proven by 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 a loss, A has to lower the price to compete with B and C.

Therefore one single seller cannot 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 cannot therefore determine the supply curve and demand curve in

a competitive market.

4. Relationship between supply quantity and demand quantity

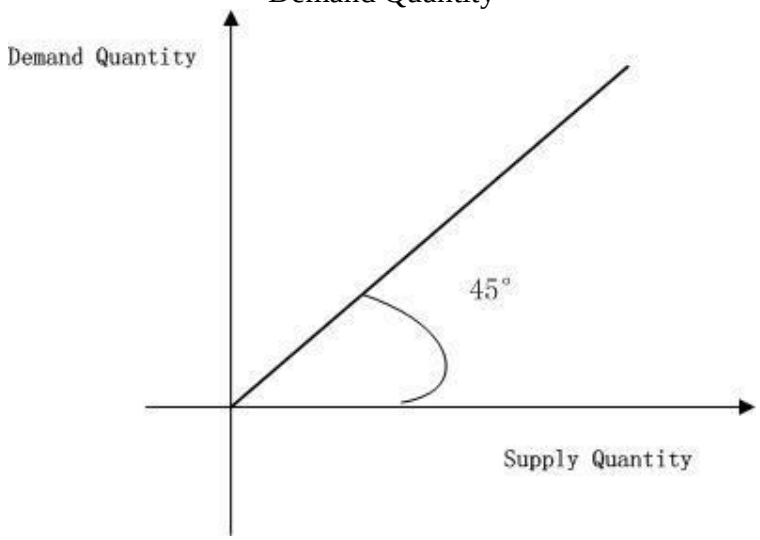
The economy can be in one of three states:
Supply exceeding demand, supply equaling demand, and supply falling short of demand.

Assume the total demand for one certain commodity is a constant variable, represented by the constant N (N>0). Consider that demand is not the demand quantity but instead demand is in a moment the whole demand: the demand of all the people in a local market to buy a certain commodity or service in that market, or the function between the price and demand quantity for that commodity or service. Demand quantity is an instantaneous value: the transaction quantity that really happened in one moment. In my theory, the supply quantity is also an instantaneous value and 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 is taken as an independent variable.

Assume the demand N remains constant, ceteris paribus.

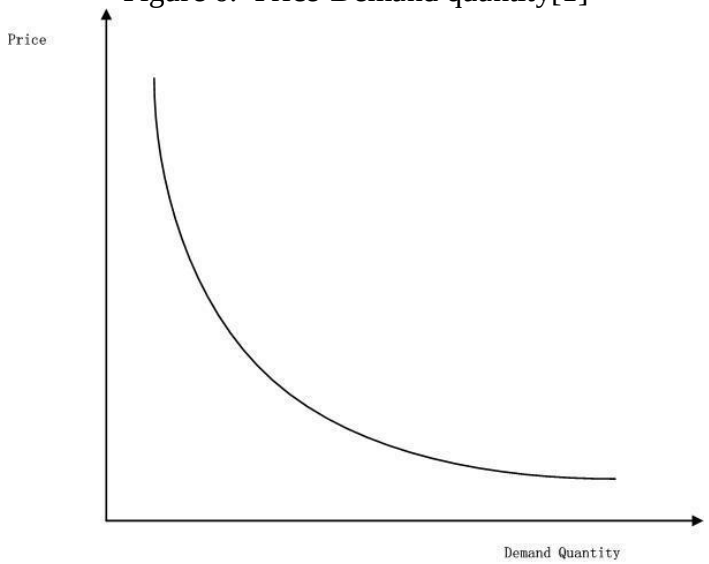
1) When the productive force is very low, that means supply can never satisfy demand. Therefore what is produced will be sold out, as in Say's Law[2]: The supply quantity will determine the demand quantity. This is shown in Figure 5.

Figure 5. Under low productive forces relationship between Supply Quantity and Demand Quantity



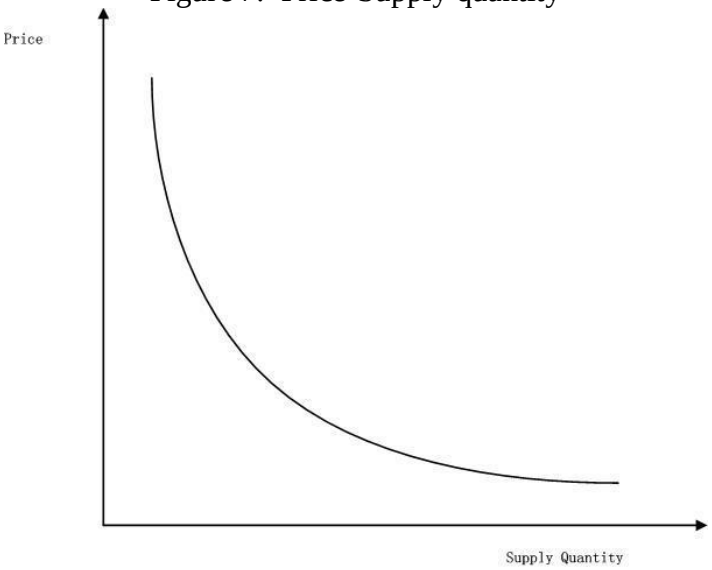

To draw the relationship between price and demand quantity, we can use Marshall's demand curve[1]:

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 supply can exceed demand.

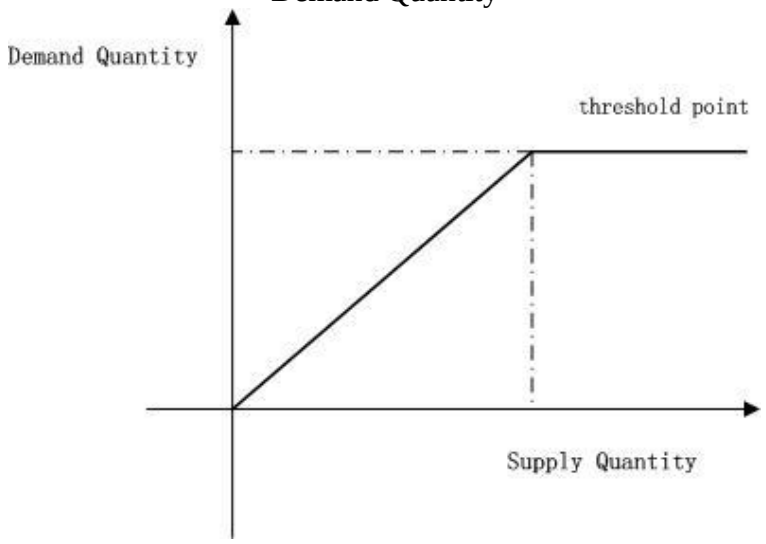
a)When supply exceeds demand, if we increase the supply quantity, the demand quantity will not increase because all demand has been satisfied.

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

c)When supply is below demand, the entire commodity supply will be sold out and, as previously established, the supply quantity will determine the real demand quantity. What need to be clarified is that in this 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, as stated in Say's Law, which claims "supply creates its own demand"[2]. This appears as a curve like in Figure 8:

Figure 8. Under high productive forces relationship between Supply Quantity and

Demand Quantity




From Figure 8 we see 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. Relationship between supply quantity and demand N when productive forces are high

In a partial market there are a group of sellers A selling one product. We assume the demand for this product remains the same all the time and has value N (N>0). That means the relationship between demand quantity and price will be a deterministic function, ceteris paribus.

As discussed previously, below the threshold the demand quantity is the same as the supply quantity. According to Marshall's partial equilibrium, if A raises the price, the demand quantity will decrease; if A lowers the price, the demand quantity will increase[1]. Because the demand quantity is the same as the supply quantity in my theory, 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.

But because in my theory price is dependent variable. We can further conclude that if A raises the supply quantity, the price will go down. If A lowers the supply quantity, the price will go up. That is what happens in reality.

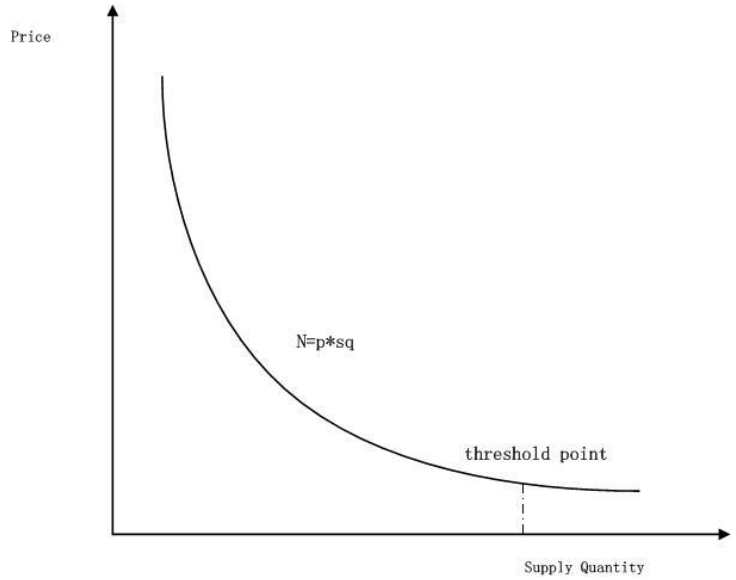
We can firstly use the power function to describe this situation, and then we can extend this to the general case. Assume p is the price and sq is the supply quantity, so we have that

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

Here we use the market price to evaluate the demand N and ignore the influence of other factors, ceteris paribus. We ignore the impact of inflation and other effects.

Therefore we have a curve as shown in Figure 9.

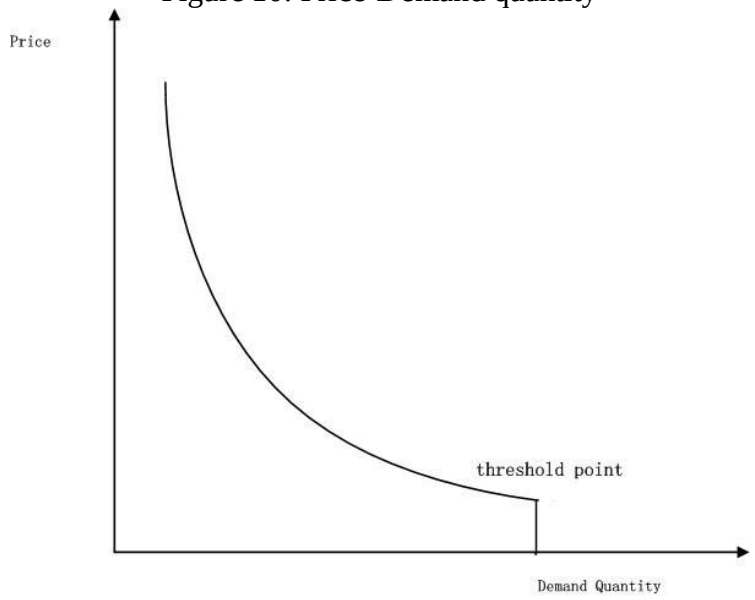
Figure 9. Price-Supply quantity




From the picture, we know that if the supply becomes unlimited, the price will be near 0. We can 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 animals and plants on the whole earth instead of the supply quantity (all the oxygen on the earth). The supply quantity far exceeds the demand quantity. This proves that if the supply quantity far exceeds 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



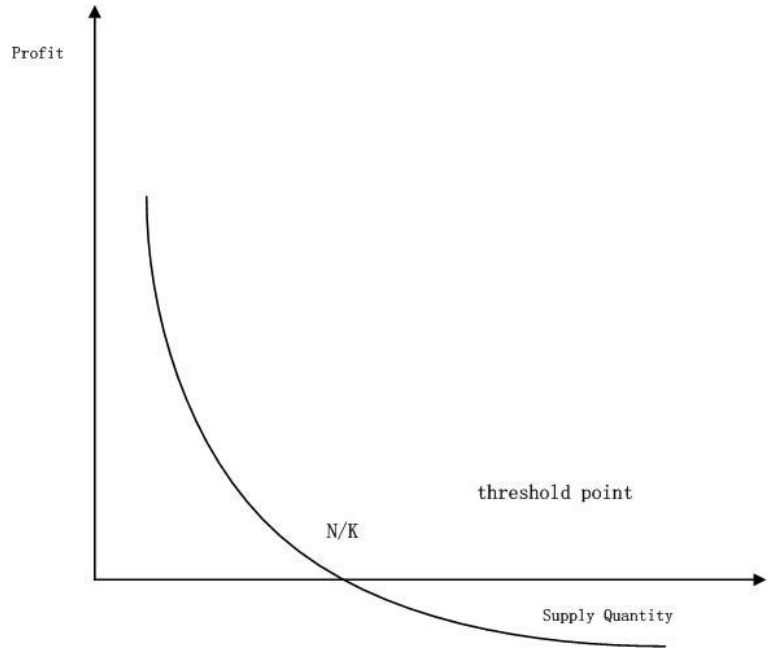

6. Incorporating the concept of cost

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

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

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, so sellers will lose money.

The sellers in the market want to earn money so they are self-interestedly (This is the basic assumption of modern economics: that individuals maximize their utility self-interestedly).
If the total demand N is a constant value, the demand function will not change during the time, ceteris paribus, so we have that the supply quantity will move as following:

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

The conclusion is that the supply quantity will fluctuate along the horizontal axis near point (N/K, 0). 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.

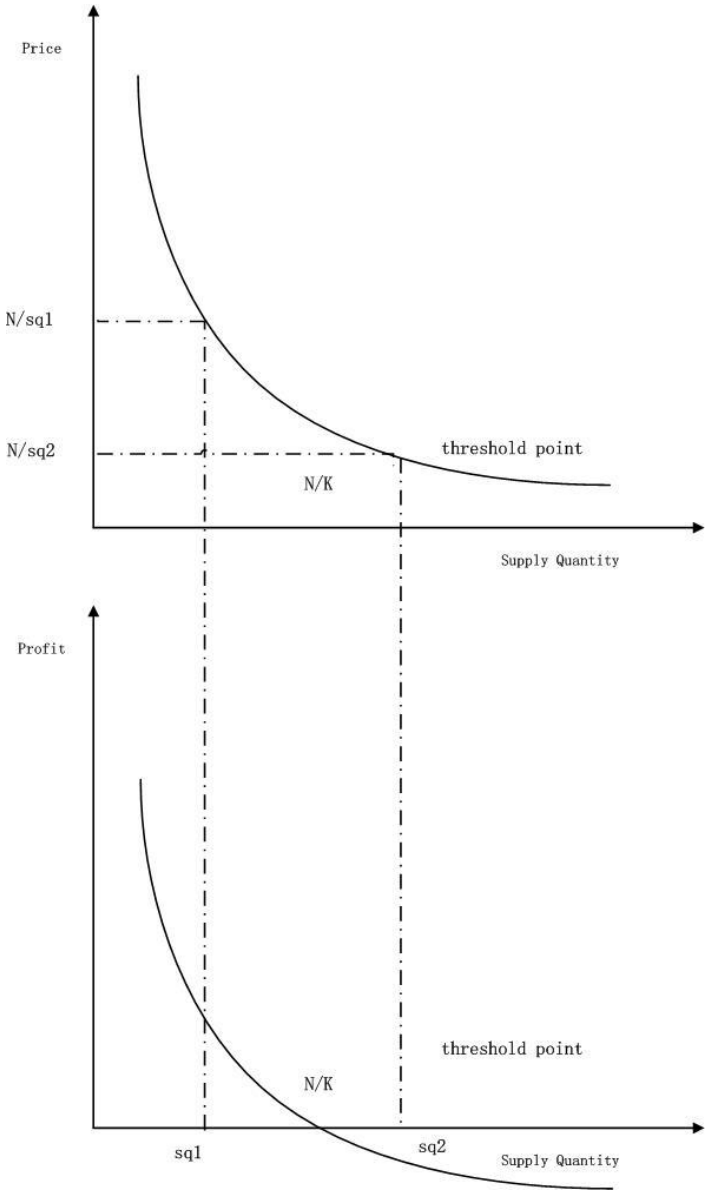
To clarify, the N/K is not the equilibrium point. The supply quantity will not stop at N/K. If the increase of the supply quantity is too rapid, the supply quantity will naturally exceed this value N/K. If the supply quantity stops at this value, as there is no profit for this commodity, some people will reduce production of this commodity, so 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, with a large sale volume. If the total profit is high, then there will be merchants 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 fluctuating randomly, so the price p is fluctuating randomly, too.
Assume sq is fluctuating between sq1 and sq2, then the price p will be fluctuating between N/sq2 and N/sq1. It seems 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), so we have that:

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

where d is the supply quantity addition.

Here sq is too large, $d << sq$, so we can see 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 merchants to produce more to lower the price. So it is easy for the price 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.

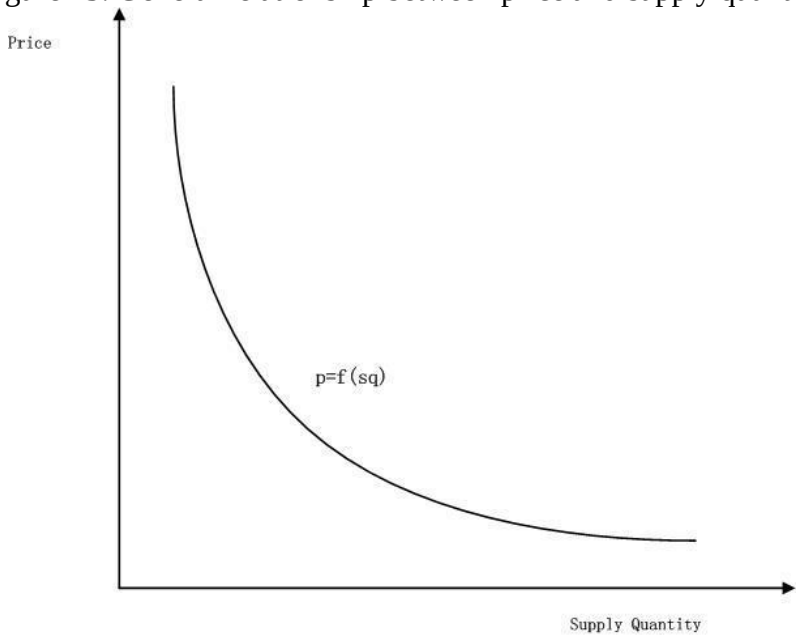
7. General case

The previous conclusion is based on the equation N=p*sq, so here I will prove a more general case. From the previous discussion we 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 relationship between price and quantity demand is a negative correlation. 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 relationship between supply quantity and price is also a decreasing function. Here I define N as the total demand, p as price and sq as the supply quantity. Assume that N is fixed value. We have the function that describes the relationship 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 in Figure 13 below:

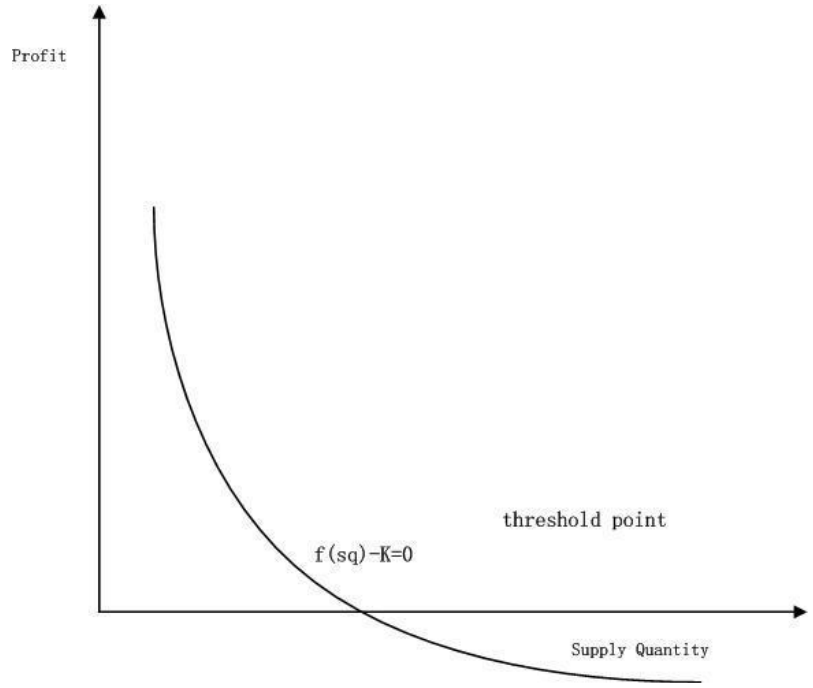
Figure 13. General relationship between price and supply quantity




Assume the cost for the commodity is K, so we have that the profit-supply quantity relationship is

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

Figure 14. General relationship between profit and supply quantity

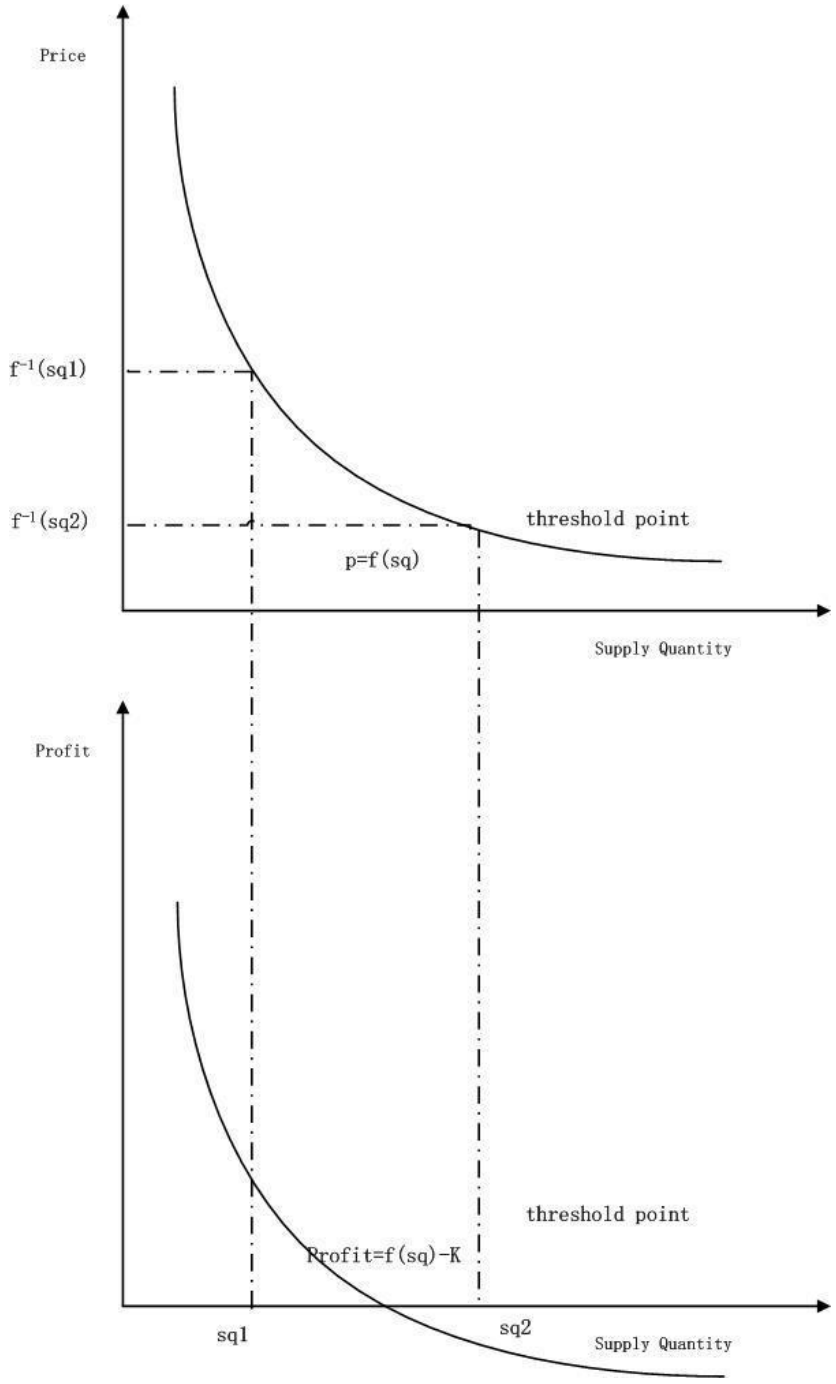



We have that the supply quantity moves as the following :

6) The initial supply quantity is 0. We can conclude that this commodity is very profitable, so the sellers will enlarge the supply quantity of this commodity, meaning 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 unit 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 production of 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 very low value, the profit for each commodity becomes very high again. Producing this commodity is very profitable. Then sellers will enlarge the supply quantity of this commodity.

Assume sq is fluctuating between sq1 and sq2, then the price p is fluctuating 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




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 stops at this value, as there is no profit for this commodity, some people will reduce production of this commodity, so 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 can 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. Why general equilibrium is wrong

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

For the whole market,the supply quantity for 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].

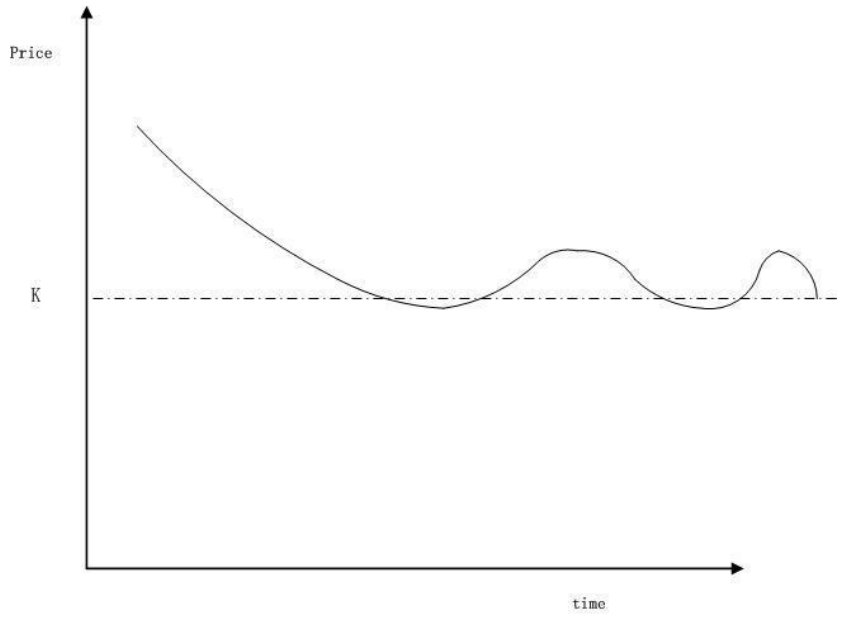
So general equilibrium theory is therefore wrong. The market price is always fluctuating. When an overproduction occurs, it will recover because people in the market want to avoid loss, so they decrease the supply quantity of the commodity that is being overproduced. There is no price mechanism in the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

9. Price-Time graph

In this section, I will describe the relationship between price and time.

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

Figure 16. Price-Time graph

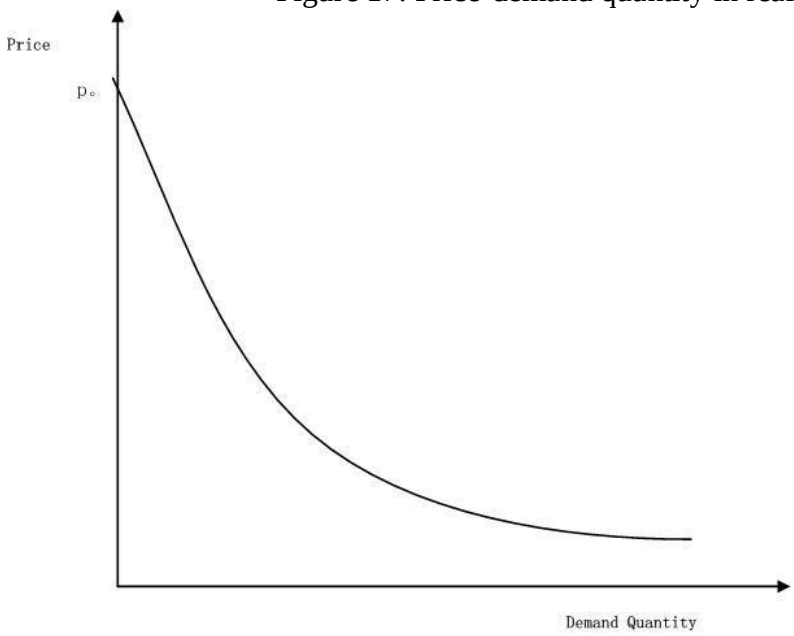



10. Administrative Price

Sometimes the price is not a dependent variable, since 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:

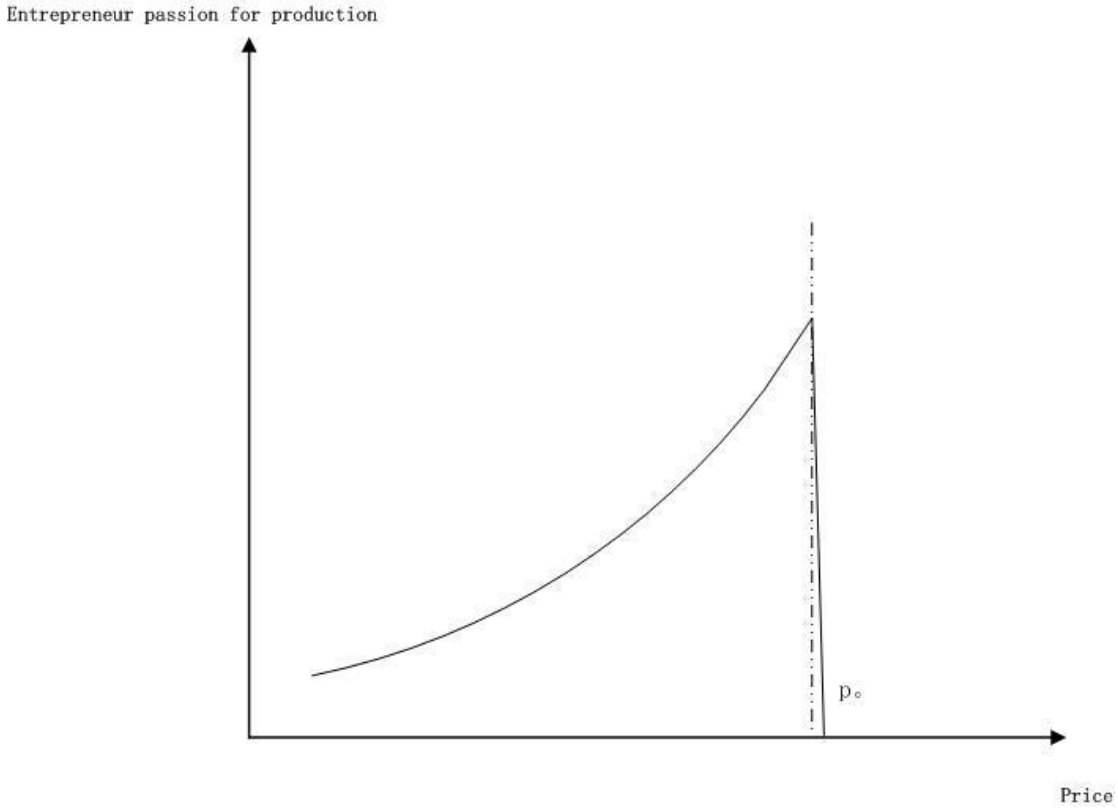
Figure 17. Price-demand quantity in real life




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 discussed earlier, 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.

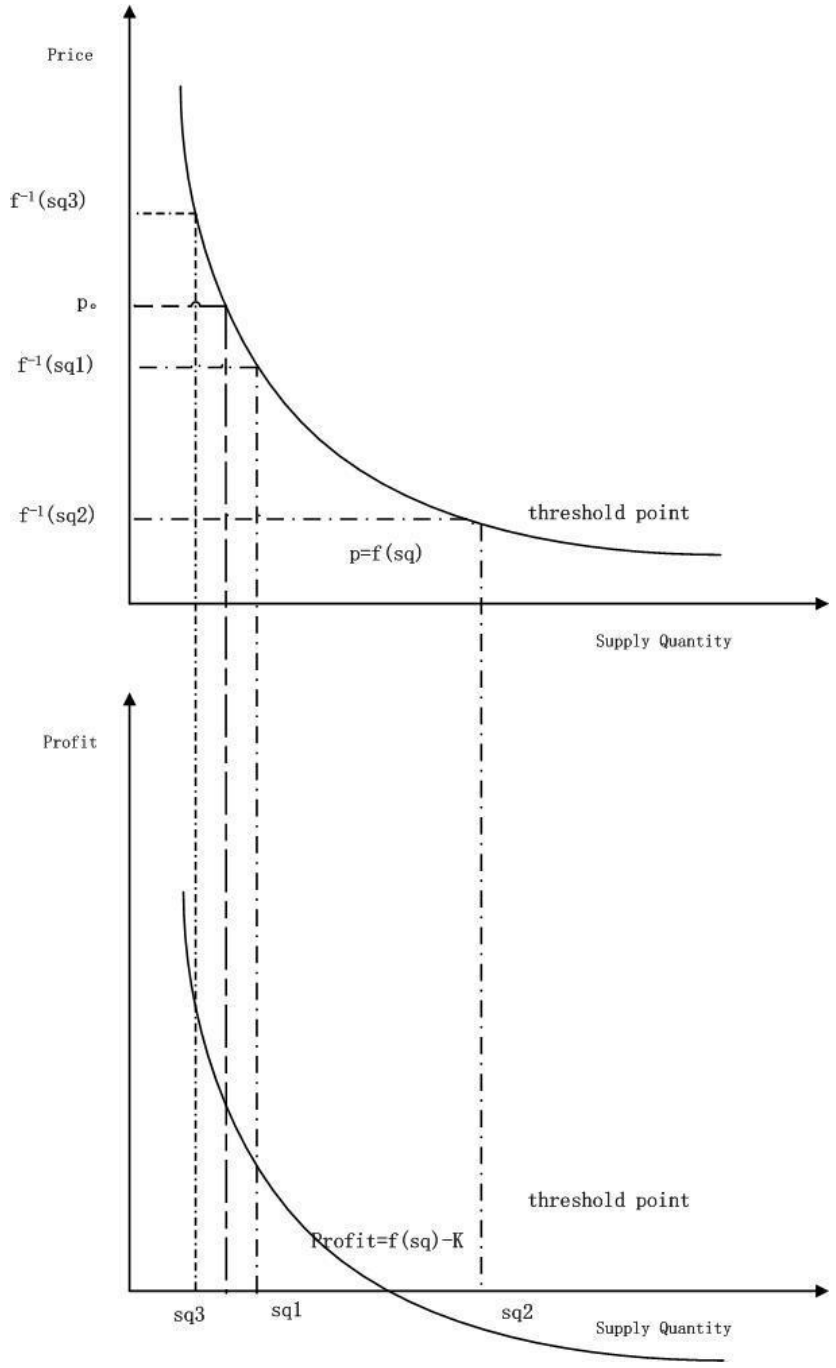
Figure 18. Producing passion-price relation




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 demand quantity is zero because no one can afford this commodity. Then sellers do not have interest in producing this commodity because they can even not profit from this commodity. The interest in producing this commodity becomes zero. Consider for example, hydrogen energy: hydrogen has a high cost, so 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 the possibility of 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 happens 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, and the supply quantity will go down, even to 0.
3) If the price is at $f^{-1}(sq3)$, which is above the threshold price value $p_。$, that means no one can afford it. Then the supply quantity will go down, 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 commodity 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. The other remains 1. The supply quantity of A has exceeding the demand. An overproduction occurs. So sellers who produce A will have less profit, and they will not produce A.

s2)Based on sellers' judgement, 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' judgement, 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 can see 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 judgement 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, so it is an unpredictable variable. So the price is always fluctuating. The price is uncertain.

Citation:
[1] Principles of microeconomics  Mankiw N.G, 2ed 2001
[2] The general theory of employment, interest and money  Keynes