An Attempt to Construct an Economic System with Reference to Physics

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Abstract: Starting from Adam Smith, economics has gone through many stages in its development for more than 200 years, and many different schools of economics have emerged, which have very different views, some of which are even diametrically opposed to each other. In order to make the economic theory have a more scientific and coordinated development, minimize the controversy and contradiction between different schools of economics; this paper absorbs the theories of famous economists, using analogical thinking, with reference to the more mature discipline, physics, to try to build a system of economics. After some basic quantities for correspondence, this paper tries to integrate different schools of economic theory, through the appropriate models. A good explanation for price fluctuations is provided, and tax friction is added to further validate the model; finally, some conclusions are introduced through the system and expanded accordingly. The establishment of this system can help to realize the unification of the dimension in economics, so as to understand the essence of economics more clearly, and it is expected to bring economics closer to science.

Keywords: Physics; Economics; Analogy; System; Model; Price Volatility

1. Introduction

The development of economic theory has mainly gone through the following stages:

Classical Economics Stage: In 1776, Adam Smith, the founder of classical economics, published “An Inquiry into the Nature and Causes of Wealth of Nations”, which systematically elaborated for the first time the basic principles of economics, including the division of labor, the market mechanism, the theory of price, etc.; proposed that while individuals in the market pursuing their own interests, the “invisible hand” will guide the optimal allocation of resources, thus promoting the overall welfare of society. [1] It marked the independence of economics from philosophy and ethics, becoming an independent discipline.

Neoclassical economics stage: In the early 1870s, the British economists William Stanley and Jevons, the Swiss economist Leon Vallas and the Austrian economist Karl Mengele, each independently proposed the subjective utility theory of value and the method of marginal analysis in different countries at almost the same time, discovering the principle of diminishing marginal utility. It lasted until the formation of the British neoclassical economist Alfred Marshall's system of economics in the early 20th century, which eventually became the “neoclassical system of economics”. [2]

Keynesian Economics Stage: Keynes, the famous British economist, published “General Theory of Employment, Interest and Money” in 1936, which was the first systematic study of the laws of operation of the overall economy, especially the determinants of employment, output and price levels; at its core was the theory of effective demand, which stated that the level of total output and employment in the economy depended on aggregate demand. [3] The theory provided important guidance for economic policy in the 20th century, especially in dealing with economic crises and unemployment, and opened up a new field of modern macroeconomics, laying the foundation for the establishment of macroeconomics.

Neoclassical Synthesis Stage: Represented by Friedman, the monetarist theory and policy propositions were put forward, re-emphasizing the central position of money in the economy and criticizing the excessive government intervention in the economy; it has had a far-reaching impact on the modern economic policy, especially in the formulation and

implementation of monetary policy. [4] When Keynesian policies failed, Friedman's theory of monetarism provided new ideas for the adjustment of economic policies.

Behavioral economics stage: represented by Daniel Kahneman's “Thinking, Fast and Slow”, which reveals the operating mechanism of human thinking, studies irrationality and psychological factors in human behavior, and provides important theoretical support for individual decision-making, organizational management, and public policy. [5]

However, most of the existing economic theories are qualitative or semi-quantitative with econometric tools, therefore, if we can construct a system of economics that can be quantified, it will greatly accelerate the development of economic research.

2. System Setup

In the following I will mimic the framework in physics to innovatively reconstruct a quantifiable system of economics:

First we start with Newton's first law and explore how it can be emulated to rationally explore the relevant laws in economics (Newton's first law, also known as the law of inertia, refers to the fact that any object has to remain at rest or in a state of uniform linear motion until an external force forces it to change its state of motion. [6])

There is a state in physics called equilibrium, and in contrast, we know that there is an equilibrium state in economics, the equilibrium state of supply and demand, which describes a situation in which the supply of a good or service in a market reaches a state of equilibrium with the demand for that good or service. Similarly, any commodity market will remain in equilibrium until “external forces” force it out of equilibrium.

So what is this so-called “external force” in economics?

At the beginning of the equilibrium, i.e., the “external forces” of supply and demand cancel each other out (the combined external force in economics is zero), the price should remain unchanged. In conjunction with Newton's first law, any object that is not subject to an external force or to an equilibrium force (zero combined external force) will always be at rest or in uniform linear motion (constant velocity). Therefore it is reasonable to believe that prices are related to the equivalent velocity/equivalent rate in economics.

So, is this equivalent velocity the price? If not, what is this equivalent speed? To clarify these questions, we first need to think about what factors prices are ultimately related to.

The law of value, as set forth in the classics of economics, states that prices fluctuate up and down around value, so we can define the value quantity of a commodity as a physical quantity, which is similar to mass in physics; mass is a physical attribute possessed by an object, and by the same token, the value quantity is an attribute possessed by a commodity - the commodity's basic attributes are value and use value, and value is the essential attribute of a commodity.

So is price determined solely by value? Price fluctuates up and down around value, but in addition to the quantity of price, the quantity that affects price fluctuations should be the quantity of information, because information can also be regarded as a kind of wave.

Let's take financial products such as stocks as an example; as we all know, the financial product itself is almost worthless, but it has its price, and the change of the price is closely related to the change of the information quantity (at a certain moment, the positive information quantity obtained by the buyer increases, the stock will be bullish; the negative information quantity obtained by the buyer increases, the stock will be bearish) which also side by side proves that the quantity of information is also a factor that affects the price and the price changes in the same direction as the quantity of information. The higher the information quantity of a good, the higher the price.

But in this derivation, the information quantity is equal to the physical quantity velocity, not to length or volume; so for simplicity, we equate the information quantity with length or volume; the inflation rate can be equated to the physical quantity of momentum in physics, so the rate of change of the inflation rate is the force F, and when F is constant, the rate of inflation is constant; and when the rate of inflation is zero, the price stays the same.... -So in this case the equilibrium state covers the situation where prices remain unchanged, and is more in line with Newton's first law of “stationary state or uniform linear motion”; furthermore, many economists believe that an inflation rate of basically 2-3%, and has

remained relatively stable, is more beneficial than detrimental to the economy; therefore, a situation where inflation remains constant can be considered an equilibrium.

At this point, modeled after Newton's second law, we get the first expression:

$$F = \frac{d\vec{\pi}}{dt} \quad (1)$$

$$\vec{\pi} = m\vec{v} = m\frac{d\vec{x}}{dt} \quad (2)$$

And with reference to mass and displacement, two equivalent economic quantities are induced - the value quantity and the information quantity - and with the addition of time t, we construct the three most basic economic quantities.

3. Initial Establishment of the System

3.1 Information Quantity X

The information quantity may appear to be a scalar quantity, but it is actually a vector quantity. Because similar to space, information has dimensions; but the difference is that space is three-dimensional, with one-dimensional displacements, two-dimensional areas, and three-dimensional volumes; the dimensionality of information is unknown, and may be three-dimensional or higher. So in the same way, information quantities are also higher dimensional quantities; the difference is that we can't know with certainty the exact dimensions of information quantities.

3.2 Value Quantity M

The value quantity of a good is determined by the amount of labor used to produce it, and since the natural measure of labor is labor time, the value quantity of a good is determined by the amount of labor time used to produce it; obviously, similar to quality, the value quantity is a scalar quantity.

With the two economic quantities, value quantity and information quantity, we proceed to construct the other basic economic quantities.

3.3 Price

It may not be easy to understand that prices are vectors; after all, we talk about prices being positive.

For example, for a laborer, the price expense of buying consumer goods is negative and the price income of wages is positive. And when both increase at the same rate, it means that they are equal in magnitude and opposite in direction, canceling each other out and having little effect on that laborer.

From the previous derivation:

$$\vec{p} = m\vec{x} \quad (3)$$

Rate of price change

$$\vec{\pi} = \frac{d\vec{p}}{dt} = m\frac{d\vec{x}}{dt} = m\vec{v} \quad (4)$$

The rate of price change is equivalent to the physical quantity momentum in physics

And because equation (1)$F = \frac{d\vec{\pi}}{dt}$

So the change rate of the change rate of price is the “force” in economics.

And inflation rate IR is actually a weighted average of the change rate of prices, which can be positive or negative, and likewise the rate can be positive or negative; people are uncomfortable with drastic changes in acceleration, and by the same token people are uncomfortable with drastic changes in the change rate of the inflation rate, logically.

3.3.1 Explanation of price fluctuations

The spring model suspended in physics is shown in Figure 1, the object is subjected to two forces, the upward force kΔx and the downward force mg; kΔx and mg of the comparison of the confrontation, in physics terms, is the two forces to cancel each other in order to achieve a kind of equilibrium.

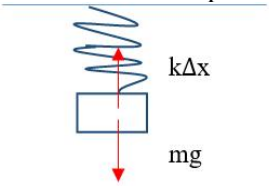

Figure 1. Spring Model for Suspension

Demand-side objective is to buy a good whose price matches the good itself; the more information obtained from producers etc., the more precise and clear the price is recognized; therefore, the bargaining power of the consumer depends on the amount of information quantity he/she knows, with a bargaining coefficient k; and the consumer's force to drive down the price is kx

The objective of the supply side is to achieve the expected profit i.e. value quantity multiplied by the rate of residual value/profit margin.

The higher the expected profit, the higher the selling price will be

The expected profit rate is b, the producer's

force to push the price up is

$$\sum c_i\, a_i(1+b) = m * \sum c_i \frac{a_i}{m}(1+b) \quad (5)$$

c_i is the weight coefficient, which indicates the importance of that raw material to the commodity, and a_i indicates the change rate of the rate of change of the price of each raw material.

If we consider $\sum c_i \frac{a_i}{m}(1+b)$as g, we find that the supply-demand equilibrium is very similar to the model of a spring suspended in physics; subjected to two opposite forces kx and mg

The position x_0 corresponding to x is the equilibrium position

$$kx_0 = m * \sum c_i \frac{a_i}{m}(1+b) \quad (6)$$

Suppose that at this point the consumer suddenly receives a positive information quantity x that deviates from the equilibrium position

$$F_R = k(\mathrm{x} + x_0) - m * \sum c_i \frac{a_i}{m}(1+b) = kx \quad (7)$$

In the direction opposite to the direction of the information quantity x (because it makes the price decrease)

That is, with the equilibrium position $x_0$as the origin of the coordinates, satisfying the definition of simple harmonic motion F = -kx

We know that the vibration equation

$$-kx = m\ddot{x} \quad (8)$$

Assuming an initial position of x_1 and an initial velocity of v, the trajectory equation is

$$x(t) = \sqrt{{x_1}^2 + \frac{m{v_1}^2}{k}} \cos\left(\sqrt{\frac{k}{m}}t + \varphi_0\right) \quad (9)$$

Amplification A= $\sqrt{{x_1}^2 + \frac{m{v_1}^2}{k}}$; Vibration period T=$2\pi\sqrt{\frac{m}{k}}$

Similarly, since the consumer-producer forces also satisfy simple harmonic oscillations, x also satisfies the sine/cosine function, and again p=mx, the price p also satisfies the sine/cosine function, which seems to explain the fact that the price is going up and down.

3.3.2 Price volatility under the influence of government taxes

Government taxes are equivalent to giving prices a force that makes them rise, assuming a tax rate of r.

Then the force of the government to make the price rise is$\frac{d^2(r*p)}{dt^2} = r * \frac{d^2p}{dt^2}$

The equilibrium equation is

$$m * \sum c_i \frac{a_i}{m}(1+b) + r * m * \frac{d^2x}{dt^2} - kx = m * \frac{d^2x}{dt^2} \quad (10)$$

$$(1-r) * m * \sum c_i \frac{a_i}{(1-r)*m}(1+b) - kx = (1-r) * m * \frac{d^2x}{dt^2} \quad (11)$$

It can be seen that the equivalent value quantity becomes (1-r) * m and g becomes $\sum c_i \frac{a_i}{(1-r)*m}(1+b)$

Applying the formula for simple harmonic vibration, it will be found that although the equilibrium position x_0 remains the same, both the amplitude A and the period T become smaller due to the reduction in the equivalent value quantity, i.e. the amplitude of the vibration decreases under the influence of the tax.

This means that taxes will filter out excessively high and low prices, but this will undoubtedly reduce consumer surplus and producer surplus.

3.3.3 Information quantity x, bargaining coefficient k and consumer utility, budget line

Careful friends may have found that this paper does not follow the previous theory of consumer utility; in fact, the amount of information is in fact closely related to utility, the full name of the amount of information should be the amount of information obtained by the consumer, in fact, it is also partially dependent on the consumer's subjective evaluation, each consumer's preference for the same commodity is different, the amount of information obtained is also different, which may result in the entire market positive total information quantity This may lead to an increase in the positive total information quantity or a decrease in the negative total information quantity, or a decrease in the positive total information quantity or an increase in the negative total information quantity.

However, unlike utility, the quantity of information can be indirectly calculated by the formula: quantity of information = price/value quantity (value quantity can be expressed in terms of socially necessary labor time), instead of the theory of ordinal utility [7], which is impossible to measure accurately.

The position and slope of the budget line are determined by income and prices in each commodity market; the bargaining coefficient k is also related to income and each commodity market - the bargaining coefficient of the poor is definitely larger than that of the rich; therefore, in this paper, the point of tangency between the non-differentiated curve and the budget line is transformed into the

bargaining coefficient * information quantity.

3.4 Time T

Understanding the period T of a simple harmonic vibration facilitates finding a correspondence with the economic cycle T.

3.5 Pressure P

The most basic definition of pressure

$$p = \frac{F}{S} \tag{12}$$

That is, the force per unit area exerted perpendicular to the surface of an object.

This suggests that with the same the change rate of the change rate of price, the greater the information quantity the consumer receives from the producer's side of the equation, the lower the pressure is

Whereas the greater the change rate of the change rate of price, the greater the pressure, given the same amount of information quantity that the consumer receives from the producer's side of the equation (and the change rate of priceusually changes dramatically when a single manufacturer has a degree of control over the price).

Generation of gas pressure: the impulse of a single molecule to collide with the wall of a vessel is short-lived, but a large number of molecules colliding frequently with the wall of the vessel produces a constant and uniform pressure on the wall of the vessel.

Similarly, the frequent collision of a large number of commodities against the "information wall" produces a continuous and uniform "force" that tries to break the "information barrier", producing the so-called pressure.

In order to better understand the physical meaning of pressure, it is known that gases always flow from a place of high pressure to a place of low pressure, because gas molecules flow from a region of high pressure to a region of low pressure.

Corresponding to the commodity market, this flow of gas molecules from a region of high pressure to a region of low pressure can be analogous to the entry of manufacturers from one market to another - i.e., market entry barriers; so that market entry barriers are in fact the external manifestation of pressure.

3.6 Thermodynamic Temperature T

The thermodynamic temperature T is a macroscopic measure representing the average amount of kinetic energy of an object's molecules, and thus individual molecules do not have a temperature; hence our construction of a similar economic quantity needs to be expanded from individual commodities to the entire market of commodities.

In the classics of economics, it has been mentioned that "the jump from commodity to money is a thrilling one. If this jump is unsuccessful, it is not the commodity that falls, but it must be the commodity possessor." This means that it is not a smooth transition from the production of a commodity to its successful sale to the consumer, and that the leap requires a great deal of "energy".

Combined with the definition of the thermodynamic temperature T, we can conclude that the success rate of each commodity from production into circulation is x. The macro-measure of the ability of the entire commodity market to move successfully from production into circulation - commodities sold/total commodities produced (commodities traded/total commodities produced, i.e., the rate of product sales) can be defined as Equivalent thermodynamic temperature;

The "energy" required to move from production to circulation is equivalent to the "average kinetic energy of the molecules of an object" in physics.

By the way, let's discuss the definition of heat: heat is defined as the thermal interaction of a system with the outside world when the change in the state of the system is caused by the disruption of the conditions of thermal equilibrium, i.e., by the difference in temperature between the system and the outside world. The result of the interaction is the transfer of energy from a high temperature object to a low temperature object, and the energy transferred is called heat.

It is clear from this that heat is not a function of the state of the system, but is related to both the system and the outside world. In economics, the system obviously represents a commodity market, and the outside world can be represented as other commodity markets.

When there is a difference in the sales rate of products between this commodity market and other commodity markets, this commodity market will interact with other commodity markets, and as a result, "heat" will be

transferred from the market with a high sales rate of products to the market with a low sales rate of products.

This result may not be easy to understand, but when there is a temperature difference between two objects or parts of the same object, heat will be transferred from the hotter object to the cooler object until they reach the same temperature. When production and sales rates differ between firms within the same commodity market, they also tend to be the same.

3.7 Entropy S

Classical thermodynamics definition of entropy

$$dS = \left(\frac{dQ}{T}\right)_r \tag{13}$$

Or

$$S = \left(\frac{\partial A}{\partial T}\right)_{N,V} \tag{14}$$

The statistical definition of entropy

$$S = kln\Omega \tag{15}$$

The information entropy is statistically given by the equation

$$I(X) = \sum_i^{\infty} -P(x_i)logP(x_i) \tag{16}$$

From the physical definition of the nature of entropy, it is deduced that entropy in economics indicates the degree to which that market is not controlled by producers and government (or the degree of freedom)

With the derivations in this paper, a definition of entropy similar to that of statistical thermodynamics can be given.

$$S = \gamma ln\Omega \tag{17}$$

The system microstate number Ω is the state of the commodity market for each commodity arrangement group k together

The higher the entropy, the higher the degree of disorder in that commodity market. Entropy reflects the diversity of states within the commodity market, or the degree of differentiation of each commodity within the commodity market

The degree of differentiation of commodities is small in a complete monopoly market because it is controlled by the government or a single enterprise; the degree of freedom is higher in a monopolistically competitive market, and the degree of differentiation of each product is also larger.

The total value of entropy in an isolated commodity market cannot be reduced. This suggests that even if a country adopts a closed trade policy, in the absence of government policy intervention, the degree of product differentiation in a commodity market will increase and commodities will become more diverse!

3.8 Quantity of Matter N and Yield Y

The quantity of matter represents a collective containing a certain number of particles and is a physical quantity that relates a certain number of microscopic particles to a weighable macroscopic substance. The quantity of matter is expressed as the ratio of the number of particles contained in a substance (N) to Avogadro's constant (N_A), i.e.

$$n = \frac{N}{N_A} \tag{18}$$

Similarly, the ratio of the total number of commodities contained in a commodity market, i.e., total production (Y), to a constant can be defined as a quantity of equivalent matter; the same way that a certain number of commodities is associated with a measurable macro-commodity market. The constant is only for the purpose of dimension harmonization, and we can represent this equivalent economic quantity in terms of total production Y by first making the constant 1.

4. Related Conclusions as well as Extensions

4.1 The Four Major Market Types and the Three States of an Object

Table 1. Segmentation of the Four Main Market Types [8]

Category	Number of firms	Degree of product differentiation	Degree of price control	Ease of entry and exit
Perfect competition	Very much	No differentiation at all	No	Very easy
Monopolistic competition	More	a few Differences	Some	Some Ease of entry and exit
Oligopoly	Several	Differentiated or undifferentiated	a fair degree	More difficult
Perfect monopoly	Only	No similar substitutes	Very much, but often regulated	Very difficult, almost impossible

After defining the first few physical quantities, we can understand the division of the four major market types (perfectly competitive market, monopolistically competitive market, oligopolistic market, and completely monopolistic market) from another perspective - perfectly competitive market is

mainly characterized by the fact that both buyers and sellers are price takers, the goods provided by each vendor are homogeneous, all resources have complete mobility, it is easier for vendors to enter, there are almost no barriers, etc.; similarly, other market types are distinguished as shown in Table 1.

It is evident that the main differences between the four main market types are expressed in the number of vendors, the degree of product differentiation, the degree of price control, the ease of entry and exit, and the completeness of information (information is complete in a perfectly competitive market, while information is extremely asymmetric in a perfect monopoly market).

The three states of matter are solid, liquid, and gas. The three states of matter can be transformed into each other by changes in temperature and pressure. A solid can change to a liquid when heated, and a liquid can change to a gas when it continues to be heated; a gas can also change to a liquid when compressed.

The gaseous state generally has a high temperature, low pressure, high entropy, and a large volume; the solid state generally has a low temperature, high pressure, low entropy, and a small volume; and the liquid state is somewhere in between.

Let's eliminate the perfectly competitive market first. The perfectly monopolized market has extremely asymmetric information quantity, i.e., consumers get less information quantity - corresponding to small volume, no similar substitutes, i.e., the degree of product differentiation is small and there is a great degree of control over the price - corresponding to low entropy value, and the hard entry for other firms - corresponds to high pressure, and since there is only one firm, firms don't have to worry about "leapfrogging", so output tends to be much larger than trading volume, and trading volume/output is small - corresponds to low temperature; monopolistically competitive markets are the exact opposite of monopolistic markets; oligopolistic markets are somewhere in between.

The reason for eliminating the perfectly competitive market first is that the other three markets can be found as prototypes in reality, while the perfectly competitive market is a virtual imaginary situation.

This imaginary situation corresponds to the ideal gas in physics, so the Clapeyron equation can be applied.

$$PV = Nk_BT \tag{19}$$

P is the barrier to entry, V is the quantity of information obtained by the consumer, and N*T is the volume of transactions.

The equation can be approximated for monopolistically competitive markets; it does not apply to the remaining two markets.

The distinction between the three is not very clear, because similar to the gas-liquid-solid in physics, the melting point and boiling point of each substance is different; will have a certain gas, liquid, solid three states of the state of the material curve is drawn in a pressure P as the vertical coordinates of the temperature T as the horizontal coordinates of the coordinate diagram can be obtained three-phase diagram, the same can be three markets in a similar form to derive the economics of the "three-phase diagram The same can be done with the three markets in a similar form to arrive at the "three-phase diagram" in economics.

4.2 Substitutes and Complements

The basic physical quantity of current in physics is the physical quantity of the category of electricity, and electricity cannot be separated from the charge, the charge has a positive charge and negative charge, so we also need to find a pair of commodity categories with opposing characteristics, substitutes and complementary products of this pair of commodity categories is the right choice.

4.2.1 Concept

Substitutes are two goods that can be substituted for each other to satisfy the same desire or need of consumers because of their similar functions. The demand for substitutes is negatively correlated

Complementary goods are goods that need to be consumed with another good. The demand for complementary goods is positively correlated

4.2.2 Connection with positive and negative charges

The concept of substitutes and complementary goods is similar to the concept of "same charges repel each other, different charges attract each other & the same magnetic poles repel each other when they are close together,

and different magnetic poles attract each other when they are close together".

So, can we follow the relevant concepts in physics to regulate substitutes and complements in a more standardized way?

We know that, for a commodity, other commodities have different degrees of substitution or complementary to it; then, we can assume that the goods with a positive charge, the alternatives are also positive charge, because they replace each other, the demand is negatively correlated, which is also in line with the laws of physics of the same kind of mutual exclusion of electric charges; Similarly, its complementary charge that is a negative charge; Therefore, we can actually provide for a certain commodity as the magnetic poles of the magnetic poles of the magnetic poles of the magnetic poles of the same name are close to each other, the same kind of similarities and differences. In fact, we can specify that a certain commodity is positively charged, and has a certain degree of substitution relationship with it is also positively charged, and has a certain degree of complementary relationship with it is negatively charged.

In physics, the charge of a rubber rod rubbed with fur is called a negative charge, and the charge of a glass rod rubbed with silk is called a positive charge. We can also pick two commodity markets to make similar normative definitions.

4.2.3 Price impact analysis

Assuming that at the beginning there are only two static goods A and B (as shown in Figure 2), these two goods are substitutes for each other, there is only a mutually exclusive "force" between the two goods, then it depends on the difference in the quantity of information available to consumers on the two, if the consumer prefer the goods A, or the more positive information available from A, then it may attract more consumers, thus increasing more positive information, forming a positive cycle. The price of A will continue to push up while good B creates a negative cycle in which the price of good B is pushed down.

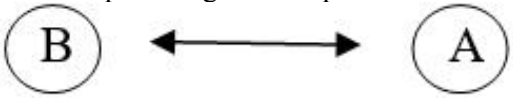

Figure 2. Price Impact Analysis of Alternatives

Of course, because each commodity market is in fact necessarily subject to producer and consumer forces, so in fact the price of commodity A will not rise indefinitely, there will be an upper limit; similarly, the price of commodity B will not fall indefinitely, there will be a minimum price lower limit.

Assuming that at the beginning of only two static goods C and D (as shown in Figure 3), these two goods are complementary to each other, and consumers have different amounts of information quantities available to the two. There is a mutual attraction "force" between the two commodities, when there is no other force, the difference in the amount of information available to the two consumers is not important. Because goods C and D will eventually meet at the midpoint, that is, the final amount of information available will be exactly the same, and even evolved into a bundle, the two prices will be a rise and a fall, but in the process the change rate of the change rate of price will gradually increase.

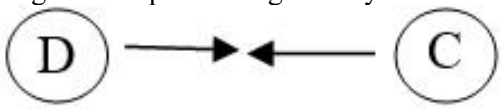

Figure 3. Price Impact Analysis of Complementary Products

After adding the forces of consumers and producers, it can be found that the price of commodity C will be lower at equilibrium as it is skewed in the negative direction compared to its original equilibrium position; and the price of commodity D will be higher compared to its original equilibrium; i.e., the price/value quantities of the two will be closer to each other.

4.3 Labor Market vs. Wave-Particle Duality of Light

Wave-particle duality is the property of a substance to be both a wave and a particle at the same time. Particle nature is manifested when the number of photons is small or the wavelength is short, and the effect produced by a large number of photons shows volatility

Similar to light as a special substance, labor, as a special commodity, may have a similar "wave-particle duality", manifesting itself as a "particle" when the number of laborers is small or the quantity of information available is small, and each laborer can freely choose to enter the market he wants to go to or leave the market he is in; on the other hand, when the number of laborers is large, it shows

"fluctuation" and it will reflect certain regularities due to the herd mentality, and it can propagate these regularities to the other laborers.

The energy of light

$$E = mc^2 \quad (20)$$

Similarly, the energy contained in labor is related to its value quantity, and labor creates value in the production of goods.

4.4 The Relationship Between the Amount of Money M and Work, Energy

Under the conditions of a developed commodity economy, money has five major functions as a measure of value, a means of circulation, a means of storage, a means of payment and a world currency, with two states of circulation and non-circulation.

In the description of the thermodynamic temperature T, said, from production into circulation, the need to spend "energy" is equivalent to the physics of the "average kinetic energy of the object molecules"; and commodities into circulation need enough money as an exchange!

Therefore, with a constant amount of money (no new money issued by the government)

The "kinetic energy" of a commodity market can be characterized by the amount of money spent to get the commodity into circulation;

This applies to the kinetic energy theorem and conservation of energy.

$$\Delta W = E_{k2} - E_{k1} \quad (21)$$

Where E_{k2} denotes the final kinetic energy of the object, E_{k1} denotes the initial kinetic energy of the object, and ΔW denotes the total amount of work done on the object by the combined external forces - i.e., the work done on the object by all of the external forces is equal to the change in the object's kinetic energy

Substituting into economics, this is expressed as the work done by all external forces on a commodity market equals the change in the amount of money spent on the circulation of goods in that commodity market.

A certain amount of money needs to be spent on advertising, promotion, marketing, etc. for a commodity to enter circulation, and this part actually represents the change in heat energy; the more money spent on advertising, promotion, and marketing, the volume of transactions/total production rises.

Economic indicators almost always have ups and downs, and in these ups and downs lies the general momentum of the economy, which can be likened to potential energy in physics - expressed in terms of the amount of money, potential energy actually represents the amount of money in the amount of non-circulating money that consumers are willing to use to consume as well as the amount of money that producers are willing to use to produce; the greater the potential energy, the more optimistic the people are about the future economic situation and the better their expectations are; according to the theory of self-fulfillment of expectations, this will push the economic indicators in the expected direction.

After the government issues a new amount of money, the above indicators can be approximated and replaced by the above amount of money/total amount of money.

5. Significance and Prospect

This paper is based on the economic theories of famous economists, with reference to the construction of the relevant system of physics, and from which several "basic quantities of economics" are abstracted, and finally part of the theories of monetary economics, microeconomics, behavioral economics and other theories are integrated with each other, to construct a set of relatively self-consistent system and to obtain a number of interesting, realistic and convincing conclusions.

In addition, the newly established system is expected to solve the problem of mismatch between the dimensions on both sides of some economic formulas - for example, the Cobb-Douglas production function,

$$Y = A(t)L^{1-\varepsilon}K^{\varepsilon} \quad (22)$$

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