A N *O U T L I N E* O F L A R S O N I A N E C O N O M I C S
with Transformed Equations
Version 3 with Worked Example Calculations

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PART I: Macroeconomics

[This is a précis of D. B. Larson's work, *The Road to Permanent Prosperity*, Ref. [1].]

"The first task of the present project has therefore been to supply the practical, usable, economic theory that we cannot get from the theorists to whom Viner refers-to sift the great mass of material available in the economic literature, separate the grain from the chaff, and build from the ground up the sound theoretical structure that is essential for any real progress toward the defined goal. The results of this effort constitute the preceding 20 chapters of this work. No answers to practical problems were developed in those pages, although the solutions for many of our present difficulties are clearly foreshadowed by the theoretical relations and principles that were there formulated. The work up to this point has been confined to producing the equivalent on a limited scale of the engineer's handbooks: a compilation of pertinent rules and principles that will form the background for our approach to the problems at hand. The most important of these are the General Economic Equation, and the seventeen Basic Principles, which are here recapitulated for convenient reference."

THE GENERAL ECONOMIC EQUATION. Let V = volume of goods, B = money purchasing (buying) power, P = price; then

$$P = B/V$$

[So: dividing the total money purchasing power available (in $, say) by the total number of units (manufacturing and service), we get the average price ($) per unit. This equation could be applied to *one* particular product or to any *group* of products, including the entire economy of a country.]

PRINCIPLE I: Purchasing power is created solely by the production of *transferable utilities*, and it is not extinguished until those utilities are destroyed by *consumption* or otherwise.

PRINCIPLE II: Only goods can pay for goods. [Money is an intermediary.]

PRINCIPLE III: Purchasing power and goods are simply two aspects of the same thing, and they are produced at the same time, by the same act, and in the same quantity.

PRINCIPLE IV: Exchanges between individuals or agencies at the same economic location (the same location with respect to the economic streams) have no effect on the general economic situation. [This is because the goods have already been produced and paid for originally; transfers between consumers do not alter the economic situation.]

PRINCIPLE V: The income to the producer from goods produced is exactly equal to the expenditures for labor and the services of capital. The net result to the producer is zero. [Nothing is left over--unless one wishes to count reserves--but these actually belong to the suppliers of capital.]

PRINCIPLE VI: The circulating purchasing power arriving at any point in the stream is equal to that leaving the last previous processing point, plus or minus net reservoir transactions. [Simple algebra.]

PRINCIPLE VII: Except as modified by reservoir transactions, the purchasing power (money or real) available in the goods market is equal to the purchasing power expended in the production market. [Purchasing power *expended* in the production market = purchasing power *available* in the goods market.]

PRINCIPLE VIII: Any net change in the levels of the consumer purchasing power reservoirs results in a corresponding change in the money price level in the goods market, except insofar as it may be counterbalanced by a net change in the levels of the goods reservoirs. [Levels of consumer purchasing power reservoirs influence money price level in the goods market.]

PRINCIPLE IX: The market price levels are independent of the volume of production. [Volume of production does not influence money price levels.]

PRINCIPLE X: Any net flow of money from the consumer reservoirs to the purchasing power stream, or vice versa, causes a corresponding change either in production volume, production price, or both. [Money flow from consumer reservoirs may increase or decrease production volume, price, or both.]

PRINCIPLE XI: Arbitrary increases or decreases in wage rates have no effect on the volume of production or the ability of *consumers as a whole* to buy goods. [Attempts by labor unions to increase wage rates do not change ability of consumers as a whole to buy goods.]

PRINCIPLE XII: Voluntary market price changes by producers have no effect on the volume of production or the ability of *consumers as a whole* to buy goods.

PRINCIPLE XIII: All consumer purchasing power must be used for the purchase of goods from producers; it cannot be used for the purchase of goods already in the hands of consumers, or for raising the prices of such goods.

PRINCIPLE XIV: The quantity of money existing within an economic system has no effect on prices or on the general operation of the system, except insofar as the method by which money is introduced into or withdrawn from the system may constitute a purchasing power reservoir transaction. [*Velocity of money* is as important as *quantity* of money.]

PRINCIPLE XV: Credit can make goods available to one individual or group of individuals only by diverting them from other individuals.

PRINCIPLE XVI: The cost of the services of capital is fixed by competitive conditions independently of productivity. [Cost of capital has not varied by much over the centuries.]

PRINCIPLE XVII: Average real wages are determined by productivity, and are equal to total production per worker less the items of cost that are determined independently of productivity: taxes and capital costs. [*Productivity* is what counts.]

"Here in these seventeen basic principles and the General Economic Equation are the teachings of economic science as they apply to the subject matter under consideration. These principles rest firmly on solid facts, not on assumption, speculation, or guesswork, and they have been derived from those facts by processes which are logically and mathematically exact, even though extremely simple. Because of their factual nature they are specific.

"In addition to being specific, these principles are universal. Unlike many of the conclusions of conventional economics, they are not limited to any particular economic system or to any special set of conditions. They governed the Cave Dwellers in their strenuous efforts to earn their living at the dawn of history, and they will apply with equal force to the streamlined multi-cylinder economic machine of the far distant future. They govern economic processes, not merely the systems of which these processes are constituent parts, and they are applicable to the processes wherever and under whatever system they may appear. The familiar contention that a socialistic economy is subject to a set of principles that differ from those which rule our individual enterprise system is as absurd as if we were to contend that the laws of physics applicable to a concrete bridge are not the same as those which apply to a steel structure.

"For the benefit of those who prefer to analyze the situation mathematically, the essence of this chapter can be set forth in a few equations. This economy of time and effort in the development of thought is characteristic of mathematical treatment in general, and to take advantage of the additional clarity of presentation that is made possible by this means, the appropriate mathematical expressions will be formulated in connection with the explanatory discussion from this point on. For this purpose the following symbols will be used:"

V = volume of goods
B = money purchasing (buying) power
P = price

To indicate changes due to voluntary actions affecting the operation of the economic mechanism, a series of factors denoted by lower case letters will be employed.

a = change in the volume of production
c = consumer money reservoir transaction
d = producer money reservoir transaction.
e = goods reservoir transaction [although this can normally be neglected]
f = change in production price

“This list may seem very short for a classification which purports to represent all of the things that man can do to influence the general operation of the exchange mechanism, but it is complete. The explanation of the brevity is, of course, that the term “ reservoir transaction” covers a great diversity of actions, all of which we are able to classify under no more than three headings, since all actions in each of these categories have exactly the same effect on the general operation of the economic mechanism. This recognition of the equivalence of apparently unrelated phenomena is extremely useful, and it has been one of the major tools of this analysis.

“It will be noted that a symbol has been provided for a voluntary change in production price, but none for a similar change in market price. The reason is that the market price level cannot be changed by direct action. As explained in the preceding pages, this price level is a resultant, the quotient of the *active money purchasing power* divided by the *volume of goods* entering the market. It can therefore be altered only by an action which modifies the flow in one or another of these two ways; that is, a change in production price (symbol f) or a reservoir transaction (symbols c and e). It cannot be changed arbitrarily, nor is it affected by an increase or decrease in the volume of goods produced, since any such change is accompanied by an equivalent change in the money purchasing power stream (Principle IX).

“The impossibility of any direct manipulation of the market price level, a point which has not been generally recognized heretofore, but was brought out clearly by the cooling system analogy in Chapter 8, is very significant, as it stands squarely in the way of the success of price control and similar economic actions, and it imposes an overall limitation on the ability of individual producers to set prices for their products. These matters will have more detailed consideration at appropriate points in the subsequent chapters.

“The proportionate effect of any change in the quantities that affect the price level will depend not only on the magnitude of the change itself, but also on the magnitude of the original quantity that is being modified. In order to take this into account, these changes will be expressed as percentages of the base quantities rather than as additives. In the case of a change in the volume of production, for instance, if we denote the actual additional volume as V', the factor a will be equal to (V+V')/V.

The market equation, which we will find applies to the production market as well as to the goods market, and will therefore be designated as the GENERAL ECONOMIC EQUATION, can be expressed as

$$B/V = P$$

At the end of period 0 (say at the end of the base year), we have $B_0/V_0 = P_0$. $B_0 = GDP_0$. (1a)
At the end of period 1 (say at the end of the following year), we have $B_1/V_1 = P_1$. $B_1 = GDP_1$. (1b)

Using the notation that has just been specified, we can now state Principles VIII and IX in this manner:

Principle VIII: $cB/V = cP$ [consumer reservoir transaction, c, multiplies *both* sides and therefore changes price]

Let c_{res1} = decimal change in consumer reservoir injection to (positive), or extraction from (negative), the purchasing power stream. Then:

$$(1+c_{res1})B_0/V_0 = (1+c_{res1})P_0 \qquad (2)$$

Principle IX: $aB/aV = P$ [change in volume of production, a, multiplies numerator and denominator and doesn't change price!]]

Let a_{vol1} = decimal change in volume of production (say from change in the number of employees or employee work-hours). Then:

$$(1+a_{vol1})(1+c_{res1})B_0/((1+a_{vol1})V_0) = (1+c_{res1})P_0 \qquad (3)$$

“These relations are mathematically exact, not speculative or empirical. They hold good whether the transactions take place through the medium of money or by some credit arrangement, whether the goods are durable or transient, capital goods or consumer goods. Prices rise when purchasing power is being swelled by reservoir withdrawals; they fall when the stream of purchasing power shrinks because of diversions to replenish the reservoirs. The fact that many economic activities are still being carried on by combination producer-consumers who do not utilize all of the advanced fourth stage economic processes does not alter this situation. The flow of purchasing power follows the same economic channels as in the newer type of organization. There is merely one less point along the line where the flow can be modified.

“In order to get a more detailed picture of the operation of the markets, let us now examine the reaction of the production market to various possible economic changes, by means of the general economic equation. If money is withdrawn from a consumer reservoir, increasing the flow to the markets, the initial effect is to draw upon producer stocks (goods reservoirs), increasing market volume without any change in the market price.”

cB/cV = P [consumer reservoir transaction, c, multiplies numerator and denominator and doesn't change price!]

The *initial* effect, using the decimal change in consumer reservoir injection or extraction, is:

$$(1+a_{vol1})(1+c_{res1})B_0/((1+a_{vol1})(1+c_{res1})V_0) = P_0 \qquad (4)$$

"The increased flow of money purchasing power cB passes on to the producer. In case he uses the higher rate of income entirely to increase the volume of production, the production market equation will become the same as the new goods market equation, and equilibrium between the two markets will be reestablished at this higher rate of production without any change in the price level. Some producers, however will be either unwilling or unable to increase volume. When their inventories get low they will increase prices and take a larger profit. The goods market in this case becomes"

cB/V = cP [for *some* producers, the price will go up by c, because they have *not increased volume*]

Again, using the decimal change in consumer reservoir injection or extraction, we have

$$(1+a_{vol1})(1+c_{res1})B_0/((1+a_{vol1})V_0) = (1+c_{res1})P_0 \qquad (5)$$

"The production market follows suit, and the system reaches a new equilibrium at a higher price instead of a larger volume. As a large number of producers are involved, with many variations in policies and operating conditions, the actual result in practice will be somewhere between these two limits. If we represent the modifying factors applying to V and P by y and z respectively, the final equation for both markets is"

cB/yV = zP [overall, a mix of the above two cases]

In this case, let y_{vol1} = decimal change in volume due to consumer reservoir injection or extraction, and let z_{p1} = change in price level due to consumer reservoir injection or extraction. Then

$$(1+a_{vol1})(1+c_{res1})B_0/((1+a_{vol1})(1+ y_{vol1})V_0) = (1+z_{p1})P_0 \qquad (6)$$

"In terms of the general economic equation, the higher wages increase production price from P to fP. This pushes money purchasing power up to fB, and the new production market equation is"

fB/V = fP [higher wages increase money purchasing power]

Let f_{w1} = decimal change in wage rate. Then

$$(1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0/((1+a_{vol1})(1+ y_{vol1})V_0) = (1+ f_{w1})(1+z_{p1})P_0 \qquad (7)$$

“The increased flow of purchasing power fB received by the workers passes on the goods market and, not being counterbalanced by any increase in the volume of goods, increases market price to fP. It then continues on to the producers and restores the inflow of money into their treasuries to an equality with the larger outflow to the production market for the purchase of labor and the services of capital. The net result is therefore nothing but an equilibrium at a higher price level. [therefore the workers do not really gain anything]

“We are interested now in determining the reaction of the economy in general if the producer is induced by external pressure to modify his normal policy and reduce his prices to some lower level. While this will have a prompt effect on the profits as shown on the books of the enterprise, the disbursements to the suppliers of capital will not be altered immediately, and the flow of purchasing power from production to the markets will therefore remain unchanged for the time being. This means that the average market price level likewise remains constant, and the only effect of one producer arbitrary reduction in price will be that some other producer price goes up. In all probability the futility of the action will soon be recognized and the original price will be restored.. If not, dividends will have to be cut, and since they constitute money purchasing power in exactly the same manner as wages, the total purchasing power generated by production will drop from B to fB, where f is a fraction. Market price will necessarily conform, and the new economic equation will then be”

$fB/V = fP$ [f < 1, so money purchasing power and price fall together.]

No change in production volume has occurred. This is just transitory, so we will assume *no arbitrary changes in producer price*. Changes in the goods inventory will also be neglected, as they are very small. The equation is therefore still

$$(1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0/((1+a_{vol1})(1+ y_{vol1})V_0) = (1+ f_{w1})(1+z_{p1})P_0 \qquad (8)$$

“According to Principle IX, an increase in production volume at a constant rate of productivity does not change the price level, as the increase in volume from V to aV is accompanied by a corresponding increase in the payments to the suppliers of labor and capital services, which raise B to aB. The quotient aB/aV is still P, the original price level. However, if the larger volume is attained by means of greater productivity, the payments to the suppliers of labor and capital services do not increase, and purchasing power remains at B. The economic equation is then”

$B/aV = P/a$ [market price drops if the larger volume is attained by means of greater productivity]

Let a_{1prod} = decimal change in productivity. Then:

$$(1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0/((1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})V_0) = (1+ f_{w1})(1+z_{p1})P_0/(1+a_{1prod}) \quad (9)$$

"The market price thus drops in proportion to the increase in production volume. As indicated in the preceding discussion, there are some advantages in maintaining a constant price level, and this could be accomplished by increasing money wages by the equivalent of the increase in productivity. The result is"

aB/aV = P [increasing wages in tandem with increases in productivity results in *no change in price*]

If f_{w1} is equal a_{1prod}, then there would be no change in price.

"This equation is identical with that which results when the increase in volume is accomplished by employing more workers, but in the latter case the additional purchasing power is shared by the additional workers, and the average income of the original workers remains at B. However, if the increase in volume is attained by greater productive efficiency, the total money purchasing power aB goes to the original workers and their average income is raised from B to aB. The increase in productive efficiency thus accomplishes *the kind of a true gain in the ability of the workers to buy goods* that cannot be attained by any kind of juggling of the money labels attached to either wages or goods.

From the equation derived above,

$$(1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0/((1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})V_0) = (1+ f_{w1})(1+z_{p1})P_0/(1+a_{1prod})$$

we can see by inspection that

$$B_1 = (1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0 \quad (10)$$

$$V_1 = (1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})V_0 \quad (11)$$

$$P_1 = ((1+ f_{w1})(1+z_{p1})/(1+a_{1prod}))P_0 \quad (12)$$

"The original, or " crude" version of the Quantity Theory has been abandoned by most economists because it is very evident that the rate at which the existing supply of money is being used, the "velocity of circulation," is equally as important as the absolute quantity of money that is available. Present-day opinion among those who subscribe to this theory generally favors one version or another of the so-called " Equation of Exchange," which was expressed by Irving Fisher as"

$MV = TP$

where M is the quantity of money, V is the velocity of circulation, T is the volume of trade in units, and P is the average price per unit.

"There can hardly be any question as to the mathematical validity of this equation. If we multiply the value of the existing stock of money by the number of times this stock was used during a specified period, we arrive at the total money value of the transactions during this period. Then if we multiply the total number of trade units involved in these transactions by the average price per unit, we must necessarily arrive at the same total. But the meaning of the equation is another manner. The conclusion which the supporters of the Quantity Theory draw from it, the conclusion that the price P is a function of the quantity of money M is totally unwarranted. As long as V is free to vary-which is true now, and will continue to be true as long as the use of money continues to follow anything like the present practice-price is a function of MV, not of M alone."

To avoid confusion, let's use Vel = velocity of circulation, rather than V, which will remain as the number of transactions.

Then $P = M \times Vel/ V$.

M is the money supply, typically M1 (money in circulation). Clearly $B_0 = M1_0 \times Vel_0$, and $B_1 = M1_1 \times Vel_1$. Now let m_1 = decimal change in money supply, and v_1 = decimal change in velocity. Then

$$B_1 = (1+m_1)M1_0 \times (1+v_1)Vel_0 \quad (13)$$

But $B_1 = GDP_1$. Because $M1_0$ and m_1 and GDP_0 and GDP_1 can be measured fairly easily, Vel_0 and Vel_1 can be calculated.

"In the case of money, however, it has been found possible to create instruments which appear to be of the same character, but which rest entirely on the credit of the issuing agency rather than on actual physical assets. Government bonds are the outstanding example. These credit goods differ from token goods in that their creation is not limited by the physical realities. Since the creation of token goods does not alter the total amount of goods that can be bought and sold, the total volume of goods flowing to the markets remains just the same as if these goods did not exist. But the creation of credit goods is another form of reservoir withdrawal. It swells the stream of goods and hence has the same effect on the markets as the withdrawal of real goods from producers' storage. The volume of goods V now becomes eV, and if B is unchanged then price P drops to P/e. The new equilibrium equation is"

$B/eV = P/e$

"But B does not normally remain unchanged, as the purchasing power obtained by the sale of credit goods is generally used in the markets. The original price P is then restored."

$eB/eV = P$

What has been accomplished by this credit transaction is that a *volume e-1 of real goods has been obtained by the issuing agency* ***without*** *the need to make any monetary payment, and the individuals who would otherwise have received these goods now have the credit goods (**government bonds** or similar instruments) instead.* The issuing agency, usually the *government*, has thus *obtained something for nothing-at the expense of someone else,* as always. Credit goods, like credit money, are basically a device for accomplishing this purpose-*getting something for nothing*. Governments faced with *abnormal expenditures* or with *insufficient revenues* find it politically expedient to meet their financial problems by some means which do not involve direct levies on the citizenry. In earlier times the preferred answer was a resort to the printing press, and this solution of the problem is by no means out of fashion even yet, as a glance at the *financial picture around the world* will readily verify. But it has become quite clear that *currency inflation* plunges the nation into deeper trouble, and the more advanced governments have turned from credit money to credit goods as the best means of avoiding unpleasant realities.

“If there is an inflationary withdrawal from the consumer purchasing power reservoirs which raises B to cB, market price would normally increase from P to cP, but by selling government bonds in an amount e, where e = c, and *retiring an equivalent amount of currency*, the market price can be held constant at the original level”

$cB/eV = P(c = e)$ [counteracting inflationary purchasing power by means of issuing government bonds]

Let e_1 be the decimal change in credit goods (specifically treasury bonds from the government to the public). Then, going back to our previous detailed equation:

$$(1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0/((1+e_1)(1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})V_0) = (1+ f_{w1})(1+z_{p1})P_0/((1+a_{1prod})(1+e_1)) \quad (13)$$

If $e_1 = z_{p1}$, then there would be no change in price due to those factors. *If e1 is negative, credit goods are purchased by the Fed from the pubic with newly “printed” money (which enters the purchasing power stream). If e1 is positive, credit goods are sold to the public by the Fed and an equivalent amount of currency is retired.*

“The outstanding advantage of this method of purchasing power control is that *no individual gains or loses by the transactions*. The exchanges that take place simply *substitute an asset in one form for an asset of equal value* in another form, and the desired effect on the economic system is accomplished without disturbing other economic relations. Facilities for handling transactions of this kind have already been set up under the auspices of the *Federal Reserve System*, and the use of these *open market operations* in a more systematic and organized manner for economic control purposes will be discussed at length in Chapter 25.

“Looking at the situation mathematically, we begin with the normal relation B/V = P. If there is no change in production, then the diversion of goods to the export trade causes the volume of goods flowing to the domestic markets to drop from V to eV, where e is a fraction, while the amount of money purchasing power available for use in the domestic markets remains at B. The new market equation for the United States, the exporting country, is then”

B/eV = P/e [so price here goes up if goods are *exported*]

Let x_0 be the decimal fraction of goods exported during the base year and x_1 = decimal fraction of goods exported (*not* the decimal change from previous year). Then

$$(1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0/((1+e_1)(1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})((1-x_1)/(1-x_0))V_0) = (1+ f_{w1})(1+z_{p1})P_0/(((1-x_1)/(1-x_0))(1+a_{1prod})(1+e_1)) \quad (14)$$

“Since e is fractional, the equation shows that the price level in the domestic market rises.

“If production is increased to take care of the export business, the volume of goods entering the domestic markets remains at V, but the money purchasing power available for use in these markets rises to aB because the increased production generates a corresponding increase in money purchasing power. We then have”

aB/V = aP [if volume is increased, money purchasing power increases, so price still goes up]

Let a_{x1} = decimal change (positive) in volume to take care of export business. Then:

$$(1+a_{x1})(1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0/((1+e_1)(1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})((1-x_1)/(1-x_0))V_0) = (1+a_{x1})(1+ f_{w1})(1+z_{p1})P_0//(((1-x_1)/(1-x_0))(1+a_{1prod})(1+e_1)) \quad (15)$$

“The factor a is greater than unity, so again the result is a higher price level in the domestic markets. Thus, regardless of whether the export demand is met from existing production or from increased production, the result of an excess of exports over imports is an increase in domestic prices, an inflation of the price level.

“Conversely, we find that an excess of imports reduces the domestic price level, irrespective of whether the imports replace domestic production or are in addition thereto. If the imports replace domestic goods, the total volume of goods entering the domestic markets remains constant at V, whereas the diversion of a portion of the money purchasing power stream to pay for the imports cuts the money available for use in the domestic markets from B to cB, where c is fractional. The market equation in this case is” cB/V = cP [with purchasing power down, the price goes down]

Here a_{x1} would be negative in the equation above. Note: this factor should thus be the *net* decimal change of exports – imports.

However:

“If domestic production is maintained at the original level the money purchasing power in the domestic markets remains at B, but the total volume of goods entering these markets increases to eV because of the imports, and we have”

B/eV = P/e [price drops if volume increases because of imports]

“In either case prices drop, and the consumers get more goods for their money. This is another result of the basic principle that only goods can pay for goods. Imports and exports are incomplete transactions, and each remains incomplete until it is counterbalanced by a transaction of the opposite kind. Thus the consumers in an exporting country are temporarily subsidizing the consumers in the importing country.”

Let e_{i0} be the import fraction of the total volume in the base year, and ei1 be the import fraction of the total volume in the following year . Note that imports have an opposite effect to exports. Then:

$$(1+a_{x1})(1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0/((1+e_1)(1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})((1-x_1)/(1-x_0))((1+e_{i1})/(1+ei_0))V_0 = (1+a_{x1})(1+ f_{w1})(1+z_{p1})P_0/(((1-x_1)/(1-x_0))((1+a_{1prod})(1+e_1)((1+e_{i1})/(1+e_{i0})) \quad (16)$$

From this equation, we see that

$$B_1 = (1+a_{x1})(1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0 \quad (17)$$

$$V_1 = (1+e_1)(1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})((1-x_1)/(1-x_0))((1+e_{i1})/(1+ei_0))V_0 \quad (18)$$

$$P_1 = (1+a_{x1})(1+ f_{w1})(1+z_{p1})P_0/(((1-x_1)(1-x_0))(1+a_{1prod})(1+e_1)((1+e_{i1})/(1+ei0)) \quad (19)$$

For stable prices, $(1+a_{x1})(1+ f_{w1})(1+z_{p1})/(((1-x_1)(1-x_0))((1+a_{1prod})(1+e_1)(1+e_{i1}))$ must equal 1. The Fed simply needs to select the appropriate value of e_1 with the necessary interest rate to clear the market. By inspection, this value is

$$e_1 = (1+a_{x1})(1+ f_{w1})(1+z_{p1})/(((1-x_1)(1-x_0))(1+a_{1prod})((1+e_{i1})/(1+e_{i0})) - 1 \quad (20)$$

z_{p1} could be approximated by c_{res1}.

"If we represent the real value of the currency, the general price level, and the wage rate per unit of output by C, P, and W, respectively, we can express the fact that the real value of the currency of country A (its buying power) is the reciprocal of the general price level in that country by the equation $C_A = k/P_A$, where k is a constant that depends on the units in which C and P are expressed. By a proper choice of units we can make k equal to unity, in which case the equation becomes"

$C_A = 1/P_A$ [for country A, real value of the currency is inversely related to the price level there]

"As explained previously, the *normal market price level is equal to the production price leve*l. We have now seen that *the latter is determined by the wage level*. This is, of course, the *money wage*, but it is not necessarily the amount that the worker receives in his regular paycheck. In modern practice, a part of the wage or salary is received in the form of what are called " fringe benefits" -*pensions, paid vacations, insurance, medical benefits*, etc.-which are just as much part of the compensation for labor as the payments in cash. Business taxes reduce the amount of revenue that has to be raised by taxing individuals, and thus are also additions to the workers' compensation. In applications such as the analysis of exchange rates, where we are dealing with two or more economies that operate under different conditions, it is necessary to put all wages on the same basis by correcting for the effects of these modifications of the wage payments. With this understanding, we can substitute W for P in the foregoing equation. Again eliminating the constant of proportionality by an appropriate choice of units, we have"

$C_A = 1/W_A$ [for country A, the real value of the currency is inversely related to the wage level]

"What this equation says is that the real value of the currency varies inversely with the level of money wages per unit of output; that is, if the wage rate is reduced, or if productivity increases while the time rate of wages remains constant, the real value of the currency increases, whereas if the wages per unit of time are increased while productivity remains constant, the real value of the currency falls.

"The ratio of the real value of the currency in country A to the real value of the currency in country B, the exchange rate under conditions of free exchange, is equal to the inverse of the ratio of money wages per unit of output in the two countries.

$C_A/C_B = W_B/W_A$ [exchange rate between country A and country B is inversely related to wage levels]

"This equation shows that it is mathematically impossible to control the two ratios independently of each other. If the exchange rate, the ratio of the values of two currencies, is fixed, as it is under the gold standard, this establishes the ratio to which the wage rates must conform. On the other hand, if wage rates are to be set by government decree, or by bargaining, or by any other process that does not reflect free market conditions, then the true ratio of values of the two currencies will necessarily fluctuate. Free convertibility to gold is impossible under such conditions, and fixed exchange rates can be maintained only by strict controls over currency transactions and over the " black markets" that inevitably spring up when government attempts to force economic transactions into an arbitrary pattern.

“Furthermore, it is clear from the facts brought out in the previous discussion that any arbitrary change in the wage or tax components of production price is promptly reflected in the market price level. In order to examine this situation more closely, let us go back to the General Economic Equation:

$$B/V = P$$

“Assuming the commodity dollar plan to be in effect, what happens if the workers in several major industries secure wage increases? Production price now rises to fP, and the higher wages increase money purchasing power a corresponding amount to fB. Volume is, of course, unaffected, and the new production equation becomes

$$fB/V = fP$$

“But when the increased money purchasing power fB reaches the markets and starts to raise prices, the deflationary methods of the price stabilization scheme come into play. If they work according to theory they bring the price level back to P, the “ stable” level. The principles developed earlier show that *this could only be done by some kind of an unbalancing reservoir transaction which would withdraw money purchasing power from the stream going to the markets, reducing fB to B, but even without the benefit of this previous consideration, it is clear from the equation itself that no matter how fP is reduced to P, there must be a corresponding reduction from fB to B, as V remains constant.*

“The purchasing power flowing back to the producers from the markets is now only the amount represented by B, but the wage increase prevents restoration of the original relation B/V = P, and *producers must cut the volume of production in order to adjust expenses to income. The attempt to maintain a fixed market price level in the face of higher production costs thus has exactly the same effect as a business depression, throttling industry and creating unemployment.*

“With this understanding as to the nature of the recommendations that have been made in the foregoing pages, we may summarize these recommendations as follows:

1. Set up the necessary machinery to make a continuous measurement of the flow of money into and out of each of the *purchasing power reservoirs*.

2. Dampen the cyclical movements of reservoir input and output by

a. Basing the *maximum legal loan value of securities and real estate on the long term trend of value* rather than on the current market appraisal.
b. Utilizing the *credit control facilities of the Federal Reserve System to reduce net reservoir inputs or outputs* when these movements become, or threaten to become, abnormally large.

3. Eliminate the remaining fluctuations in the aggregate reservoir levels by putting the open market operations of the Federal Reserve System on a *definite and automatic basis*, requiring the System to purchase or sell securities to individuals or non-bank agencies at frequent intervals in amounts just sufficient to *neutralize net transactions* into or out of all other consumer money reservoirs.

4. Be prepared with a program of *flexible tax rates* for use in the event that stronger measures are necessary to meet a temporary situation.

The detailed study of the operation of the economic system in its true status as a *continuous flow process* clearly indicates that *the optimum production of values results if the mechanism is allowed to operate without interference*. This is not an argument in favor of *laissez faire economics*. The economic system is not a self-sufficient mechanism. There are *certain points* at which *decisions must be made and imposed on the system*. There are other points at which arbitrary modifications may be made if the authorities in charge of the economy so desire. And both the operation of the system and the results that are obtained from it may be modified substantially by actions that are taken *after the economic mechanism has completed its task*, chiefly those taken in connection with the distribution of the products of economic activities. [Note: Clearly laissez-faire economics provides the *maximum quantity* of goods; but it needs to be embedded in a Rule of Law—a Minimal State—to function *properly*. The government should be an objective referee with a minimal code of law to enforce. Volunteer organizations are necessary to help those who cannot help themselves; everyone else should be able to find work.]

Appendix: Further Results

In the equation

$$(1+a_{x1})(1+ f_{w1})(1+a_{vol1})(1+c_{res1})B_0/((1+e_1)(1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})((1-x_1)/(1-x_0))((1+e_{i1})/(1+e_{i0}))V_0 = (1+a_{x1})(1+ f_{w1})(1+z_{p1})P_0/(((1-x_1)/(1-x_0)) ((1+a_{1prod})(1+e_1)((1+e_{i1})/(1+e_{i0})) \qquad (A1)$$

V_0 and P_0 are difficult to determine (although one could perhaps estimate them from credit card transactions and use the Fed's payment statistics). So what can we do? We can divide the LHS by B_0/V_0, and the RHS by P_0:

$$(1+a_{x1})(1+ f_{w1})(1+a_{vol1})(1+c_{res1})/((1+e_1)(1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})((1-x_1)/(1-x_0))((1+e_{i1})/(1+e_{i0})) = (1+a_{x1})(1+ f_{w1})(1+z_{p1})/(((1-x1)/(1-x0))(1+a_{1prod})(1+e_1)((1+e_{i1})/(1+e_{i0})) \qquad (A2)$$

But now the RHS, which is P_1/P_0, can be expressed as the ratio of consumer price indexes CPI_1/CPI_0—which *can* be measured relatively easily:

$$(1+a_{x1})(1+ f_{w1})(1+a_{vol1})(1+c_{res1})/((1+e_1)(1+a_{1prod})(1+a_{vol1})(1+ y_{vol1})((1-x_1)/(1-x_0))((1+e_{i1})/(1+e_{i0})) = CPI_1/CPI_0 \quad \text{(A3)}$$

Eliminating $(1 + a_{vol1})$ from the numerator and denominator, we have

$$CPI_1 = CPI_0(1+a_{x1})(1+ f_{w1})(1+c_{res1})/((1+e_1)(1+a_{1prod})(1+ y_{vol1})((1-x_1)/(1-x_0))((1+e_{i1})/(1+e_{i0})) \quad \text{(A4)}$$

So the inflation rate (%) is

$$infl = 100\ (CPI_1 – CPI_0)/CPI_0 \quad \text{(A5)}$$

Also,

$$GDP_1 = GDP_0(1+a_{x1})(1+ f_{w1})(1+a_{vol1})(1+c_{res1}) \quad \text{(A6)}$$

The growth rate in % is then

$$gr = 100\ (GDP_1 – GDP_0)/GDP_0 \quad \text{(A7)}$$

The above equations are *exact and precise*. However, the coefficients have to be *estimated* as best we can. To determine CPI_1, infl, and gr, we need to know the following factors, mostly in terms of *changes from the base year*:

a_{vol1} = decimal change in volume, say due to decimal change in employment rate or worker-hours, n_1

a_{x1} = the *net* decimal change of exports – imports

f_{w1} = decimal change in wage rates

c_{res1} = decimal change in consumer reservoirs (positive if injected into purchasing stream, negative if extracted from purchasing stream); one way to estimate this is to calculate $-((M2_2 – M1_2) – (M2_1 – M1_1))/(M2_1 – M1_1)$. M1 is liquid, M2 – M1 is a measure of the relatively illiquid money supply. A consumer reservoir transaction goes from illiquid to liquid or vice versa.

e_1 = decimal change in government credit goods (say treasury bonds); if e_1 is positive, the average transaction price in the economy will *decrease* because purchasing power is being soaked up by the payment for the bonds and currency is retired, and vice versa: the average transaction price in the economy will *increase* because purchasing power is being put into the economy by purchase of bonds with newly "printed" money by the Fed from the public

a_{1prod} = decimal change in average productivity for year 1

y_{vol1} = decimal change in volume due to consumer reservoir transactions; this is difficult to estimate, but perhaps we could use the decimal change in capacity utilization, $c_{capu1.}$

e_{i0} = decimal fraction of volume from imports in base year

e_{i1} = decimal fraction of volume from imports in the following year

x_0 = decimal fraction of volume exported in base year

x_1 = decimal fraction of volume exported in following year

With these 11 parameters, CPI_1, i, GDP_1, and gr are determined, at least approximately. Ideally, it would be best if we had a lengthy time-series of these parameters, so we could project them into the future.

Business cycles result from the *cyclical change* in the level of consumer purchasing power reservoirs, from low to high and back. In an expanding economy, money *comes out* of the reservoirs; at the end of the boom times, the reservoirs are depleted and must be replenished, and so money goes back into the reservoirs, thus causing a recession in the production market. Properly using Eq. (20), the Fed could *counteract* this cyclical tendency and thus assure a stable economy

Worked Example

Let's work with some known historical data, such as the years 2005 and 2006. 2005 is the base year, so

GDP_0 = 12623 x 10^9 (in 2005 dollars) (Ref. [4], p. 27)

GDP_{1_obs} = 12959 x 10^9 (in 2005 dollars, but will be calculated first in 2006 dollars below)

CPI_0 = 100 (since GDP_0 is in 2005 dollars)

CPI_1 to be determined (see below)

N_0 = 141.7 x 10^6 (number of workers in 2005) (Ref. [4], p. 27)

N_1 = 144.4 x 10^6 (number of workers in 2006) (Ref. [4], p. 27)

We assume that the main change in volume is due to increase in the number of employees, so

$a_{vol1} = (N_1 – N_0)/N_0 = 0.016$ (decimal change in employment)

K_1 = 13920 x 10^9 (capital stock in 2006 for use in the comparison Cobb-Douglas production function below)

A_1 = 2869.3504 (technology factor for 2006 to use in the Cobb-Douglas production function below)

a_{1prod} = 0.006 (productivity change, Ref. [4], p. 27, same as in the change of A in the Cobb-Douglas production function below)

Now we need to estimate the change in consumer reservoir volumes. This is, in essence, the change between liquid monetary assets and illiquid non-monetary assets. As far as this author can determine, the Federal Reserve does not keep track of this information! As stated in the body of the paper above, one could use the difference between M2 and M1, per capita, and detrended (so as to take out the portion attributed to population growth), but that's rather difficult to calculate. Perhaps the best we can do, pending further research, is to use the change in capacity utilization.

$c_{res1} = (0.804 - .800)/.800 = 0.005$ (assumed consumer reservoir change, based on change in capacity utilization, Ref. [17])

$f_{w1} = (37078.27 – 35448.93)/35448.93 = 0.046$ (decimal change in wage rate, from Ref. [16])

$a_{x1} = 0.139 - .108 = 0.031$ (decimal change in exported volume – decimal change in imported volume, Ref. [18])

Therefore, for 2006:

$GDP_1 = GDP_0(1+a_{x1})(1+ f_{w1})(1+a_{vol1})(1+c_{res1})$ = 13903 x 10^9

But this has to be brought back to 2005 dollars.

$CPI_1 = CPI_0(1+a_{x1})(1+ f_{w1})(1+c_{res1})/((1+e_1)(1+a_{1prod})(1+ y_{vol1})((1-x_1)/(1-x_0))((1+e_{i1})/(1+e_{i0}))$

$e_1 = -0.002$ (change in M1 (injected into purchasing power stream), Ref. [15])

$y_{vol1} = c_{res1} = 0.005$ (estimate based on change in capacity utilization)

$x_0 = 0.0723$ (total export volume as fraction of GDP in base year, Ref. [14])

$x_1 = 0.0803$ (total export volume as fraction of GDP, based on data from Ref. [14] and Ref. [4])

$e_{i0} = 0.1343$ (decimal fraction of volume due to imports in base year, Ref. [14])

$e_{i1} = 0.1080$ (decimal fraction of volume due to imports in following year, Ref. [14])

So, $CPI_1 = CPI_0(1+a_{x1})(1+ f_{w1})(1+c_{res1})/((1+e_1)(1+a_{1prod})(1+ y_{vol1})((1-x_1)/(1-x_0))((1+e_{i1})/(1+e_{i0}))$

$CPI_1 = 107.2813$

$infl = 100\ (CPI_1 – CPI_0)/CPI_0 = 7.28\%$ (which is considerably more than the official statistic, 3.2%)

Therefore, GDP_1 in 2005 dollars is

$GDP_{1real} = GDP_1\ CPI_0\ /\ CPI_1 = 12959 \times 10^9$

This compares with the historical value given above, GDP_{1obs}: 12959 x 10^9 – an *exact* match!

The real growth rate is

$gr = 100\ (GDP_1 – GDP_0)/GDP_0$

$gr = 2.66\%$

This value for the growth rate is, of course, the same as that calculated from Ref. [4].

The only discrepancy with the official stats is with the inflation rate--perhaps the official inflation rate figures are *wrong*!
After all, the (wage rate) – (productivity change) increased by 4% in 2006, and the increase in *net* export volume was 3.1%, so the total from these two factors is about 7.1%. Perhaps the official statistics do *not* include the effect of the change in exports!

The references give all of the conventional models currently used by the economics profession; *none* of them compare well with the calculations given here

In hindsight, to keep *prices perfectly stable*, the change in money supply should have been

$$e_1 = (1+a_{x1})(1+ f_{w1})(1+z_{p1})/(((1-x_1)(1-x_0))(1+a_{1prod})((1+e_{i1})/(1+e_{i0})) - 1$$

$e_1 = 0.076$, a positive number, so 7.6% of the extant money supply should have been taken *out* of the purchasing power stream in 2006, rather than the actual amount, -0.2% (or 0.2% which was put *into* the purchasing power stream).

Now let's take a look at the Cobb-Douglas production function. (Note: The parameters for the equations derived in this paper could be applied appropriately to the base year Cobb-Douglas production function to obtain the values to use for the following year.) Many of the references discuss this relation, but only Ref. [4], p. 27 provides actual numerical values applicable to the US.

$$GDP = A\, K^{\beta}\, N^{1-\beta}$$

where K is the capital stock (in \$ / \$1 so that the number is non-dimensional), N is the number of workers (both physical and mental, to one, so that the number is non-dimensional), A is the technological productivity factor, and β is the share of income received by the owners of capital, and so $1-\beta$ is the share of income received by the workers. For 2006:

A_1 =2869.3504 x 10^9 (in 2005 dollars, and corrected from the mistake in the application of β in Ref. [4])

K_1 = 13920 x 10^9 (in 2005 dollars/1\$)

N_1 = 144.1 x 10^6 workers to 1 worker

β = .30 (share of income going to the owners of capital, and thus $1-\beta$ is the share going to the workers); this value of β is empirical, of course, but it's been constant for decades

So,

$$GDP_{1\_obs} = A_1\, K_1^{\beta}\, N_1^{1-\beta} = 12959 \times 10^9,\ \text{as given above}$$

Incidentally, this author interprets the A factor as the technological contributions of all *past human generations*.

The marginal product of capital is computed by taking the partial derivative of the Cobb-Douglas function with respect to K.

The result is

$r_1 = \beta \times GDP_{1\_obs} / K_1$

$r_1 = 0.2793$, the *effective real rental price of capital* for 2006; it must include the cost of depreciation of the capital and any associated taxes

The marginal product of labor is computed by taking the partial derivative of the Cobb-Douglas function with respect to N. The result is

$w_1 = (1 - \beta) \times GDP_{1\_obs} / N_1$

$w_1 = \$62820.77$, the *effective real wage per employee* for 2006!

But this is 1.6943 x the wage assumed in the previous calculation for f_{w1} above, and it's not clear why; perhaps this is the wage with *fringe benefits*, like insurance and pension provisions, included (but it still seems too high). However, Larson's Principle V is confirmed:

$r_1 \times K_1 + w_1 \times N_1 = GDP_{1\_obs}$

Nothing is left over for the "producer"!

PART II: Microeconomic Principles

[This is a précis of D. B. Larson's work, *The Road to Full Employment,* Ref. [2].]

Nomenclature

PV = present value of a particular business firm in a particular industry sector, $
Res = current equivalent monetary reserve of business firm, $
t = time period (subscript, superscript)
T = total number of time periods considered
r = discount rate for time period representing perceived risks of the firm and the interest cost of borrowed funds (assumed not to change for periods t = 1 to T)
TR = total revenue of *average* business firm in sector for time period t, $
TC = total cost or expense of *average* business firm in sector for time period t, $
n = number of employees of particular firm
k_R = coefficient of revenue productivity of business firm relative to that of average firm in sector (normalized to 1 for average firm) (may change for each period t)
k_C = coefficient of cost of business firm relative to that of average firm in sector (normalized to 1 for average firm) (may change for each period t)

Theory of the Firm

From Larson's work, it's easy to derive the following equation:

$$\text{Value of Firm} = \text{PV} = n\sum_{t=1}^{T}\frac{(k_R/n)TR_t - (k_C/n)TC_t}{(1+r)^t} + Res \qquad (1)$$

For long-term survival of the firm, the managers must try (each period) to

1. increase k_R/n (i.e., increase relative revenue productivity per employee)
2. decrease k_C/n (i.e., reduce relative costs per employee)
3. increase Res (i.e., increase reserves to get through tough times)

The coefficients k_R and k_C are normalized so that for the average firm in the particular industry sector the values are equal to 1. A more successful firm will have a higher value of k_R and a lower value of k_C, and vice versa for a less successful firm. Many phenomena (including the distribution of individual IQ's) follow the Bell curve or Gaussian probability distribution, so we can assume that this distribution applies to the coefficients. The ratio of k_R to k_C represents a single "figure of merit" of the firm in the sector and is itself a probability distribution.

Of interest here is this question: what is the ratio of k_R/k_C below which will put the business in jeopardy? If PV goes to 0, the firm goes out of business, and all involved become unemployed. For algebraic simplicity, let's consider just one period for eq. 1 and solve for the ratio of k_R/k_C in order for PV to be greater than 0, with no help from reserves, so that the firm survives. It's clear from inspection that $k_R TR_t > k_C TC_t$ for positive PV, so therefore

$$k_R/k_C > TC_t/TR_t \qquad (2)$$

The ratio of total cost to total revenue of the *average* firm in the sector then represents the survival limit for *all* firms in the sector: the lower this ratio, the lower the survival limit for all firms in the sector. Over many periods of time, not just the one period we just considered, a particular firm's figure of merit (k_R/k_C) will fluctuate, but clearly it must *usually* be above the average TC/TR. When it's not, the firm's reserves will decrease. When it's way above the average TC/TR, the firm may increase its reserves.

If there is unemployment in a particular sector, the survival limit must be too high in that sector. If there is general unemployment, the general survival limit must be too high. The surplus labor is "substandard" in that its ratio of relative revenue production to relative cost is too low for it to be utilized under current conditions. Of course, for a governmental agency or for a socialist firm the survival limit is nearly zero—they are subsidized, and very little of value is produced. The correct general survival limit is that which provides full employment and not a whit lower, because otherwise less will be produced.

So, what is it that causes the survival limit of firms to be so high that we have unemployment? It is government taxes and laws, such as minimum wage laws and prevailing wage laws (e.g., the Davis-Bacon Act), and over-regulation of business that cause unemployment. It is also the union scale, which mandates the same labor rates across industry, regardless of differences in productivity. Thus unemployment is not the result of "market failure." To have full employment, we must reduce the survival limit of businesses by repealing minimum wage laws and prevailing wage laws, by de-regulating business and discontinuing union scale, and by cutting taxes.

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[14] U.S. Census Bureau Economic Indicator Division

[15] www.ecpafi.com

[16] Social Security Administration

[17] Board of Governors of the Federal Reserve

[18] www.statistica.com

[19] www.economagic.com

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