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THE *TABLEAU ECONOMIQUE* OF QUESNAY
—ITS ANALYSIS, RECONSTRUCTION, AND APPLICATION—

By Izumi HISHIYAMA*

La marche de ce commerce entre les différentes classes, et ses conditions essentielles, ne sont point hypothétiques. Quiconque voudra réfléchir verra qu'elles sont fidèlement copiées d'après la nature; mais les *données* dont on s'est servi, et l'on a prévenu, ne sont applicables qu'au cas dont il s'agit ici. François Quesnay

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Introduction

The *Tableau Economique* of Quesnay was a first systematic attempt at a *dynamic* theory of development from a macroscopic view-point. Resting on the basis of special assumptions concerning price and returns, it presents the propositions that the value amount of net returns and the ways of expenditures constitute a factor of fundamental importance in determining the scale of the system, and further that through each period succeeding one after another, the ways how net returns are expended constitute a decisive factor in rendering the devised system dynamic and in deciding the course of dynamic development.

In order, first of all, to throw light on these propositions and the relations between each other, this essay will try to reach the logic essential to the conception of the *Tableau Economique,* and to reconstruct the *Tableau Economique* in comprehensive and would-be perfect terms so as it may cover all cases we can think of. The cardinal point of our discussion on these points will be found in Chapter III, and the basic idea of this author can be condensed in a sheet of diagram numbered (7.1). In the second place, the relations between the propositions of the *Tableau Economique* and the law of markets together with the reciprocity of the fundamental assumptions on which the *Tableau Economique* is based will be examined.

The reexamination of the *Tableau Economique* as attempted here is also aiming at a decisive criticism on some of the views which have been predominant as a by-product. In the last part, the author will annex his attempt at an application of the *Tableau Economique* to an economy which is far advanced than the one originally intended for.

(I) The *Tableau Economique* and an equilibrium theory for determining the proceeds of sales -Formulation of the *Equation Fondamentale* and the Fundamental Figure-

1) If we represent the *dépenses du revenu* of a certain year by a, and the ratio of the expenditures on agricultural food-stuffs to the whole expenditures of each component sector by r in the *Tableau Economique* of Quesnay (" Tableau Fondamental "), the process of all transactions postulated explicitly and implicitly in the *Tableau Economique* can be expressed in a general formula as shown in the diagram (1.1)[1]. In the diagram (1.1), a representing

1) In his article (On the *Tableau Economique* of Disequilibrium, MITA GAKKAI ZASSHI, Vol. 51, No. 8, p. 63), Mr, Tateru Watanabe arrived at a formula almost the same as mine in the diagram (1·1). This diagram is identical in essence with his "Formularized *Tableau Economique* (Fundamental Table)", except that part where I introduced explicitly the internal transactions.

General Formula of the *Tableau Economique*

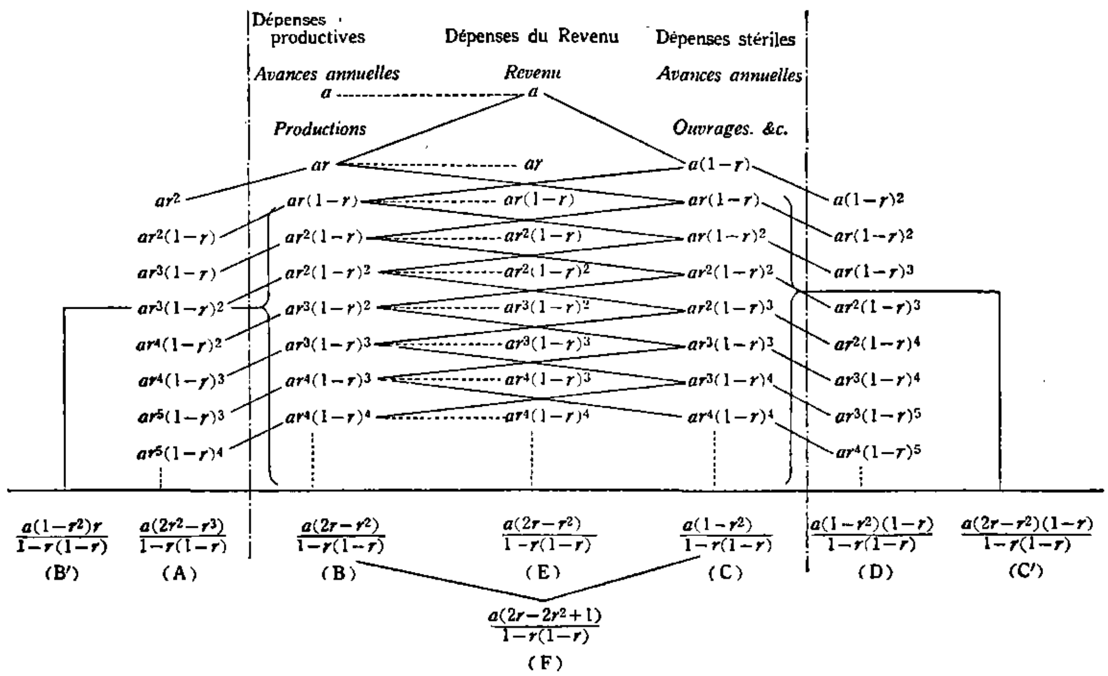


Diagram (1.1)

the *dépenses du revenu* constitutes a decisivley important factor for the system. It is a strategic factor. It is because the scale of this system, viz., the size of output, is determined by the expenditures a after all. r alike a is an important parameter in determining the production. r shows in what proportion is the revenue allotted to agricultural products and manufactured products. In other words, it represents the preference of the *dépenses du revenu* class between these two kinds of products. Thus, r is the propensity to expend in a special sense. Nevertheless, r means more than that. Assuming that each industry conforms to this propensity to expend r in its internal transactions as well as transactions with the other industry, r can be regarded as representing the propensity to expend in *any and every* transaction of this system (no matter whether it is a industrial transaction or a transaction for consumption pure and simple). Therefore, we may as well call r the propensity to expend of a society or simply an *expenditure coefficient.* Of course, r is in the most general terms restricted by the condition of $1 \geqq r \geqq 0$. Assuming r to be 1/2, all sectors—the *dépenses du revenu* class, the Industry I (agriculture), as well as the Industry II (manufacture)—spend 1/2 per unit of value to agricultural products and $(1-r=)$ 1/2 to manufactured products. In like manner, all sectors spend 2/3 (1/3) to agricultural products and 1/3 (2/3) to manufactured products when r is 2/3 (or 1/3). We can also think of the marginal cases (either $r=1$ or $r=0$), when all sectors expend the whole amount per unit of value to one of the two industry sectors alone. When *the dépenses du revenu a* is given, the sales of each sector can vary infinitely as r takes an infinite of values possible between zero and 1. To put it in another way, if the value of r is given, the sales of each sector will be determined uniquely. Thus, r is a decisively important parameter in determining the output of the system under consideration.

2) The *Tableau Economique* is composed of two industry sectors (agriculture and manufacture) and an non-industrial sector (the *dépenses du revenu* class). First of all, it is a theory to determine the sales of each industry sector by the expenditures a and the expenditure coefficient r of the non-industry sector. If a certain amount of a is thrown into the system and the preference between products r is given, the sales of each industry sector will be settled automatically. The total output of this system will also be determined eventually. Thus, the *Tableau Economique* is primarily a theory to determine a equilibrium output when the amount of expenditures and the preference between products of the non-industry sector are given. Let us study deep into this point.

The total $a\dfrac{2r-r^2}{1-r\ (1-r)}$ of the column (B) in the diagram (1.1) is the sales of the Industry I. This sum is made up of two parts; one is the sales to the non-industry sector ar, and the other is the sales to the Industry II $a\dfrac{(1-r^2)r}{1-r\ (1-r)}$[(B′)] which is the aggregate of $ar(1-r)$, $ar^2(1-r)$, $ar^2(1-r)^2$,⋯ ⋯The totol $a\dfrac{1-r^2}{1-r(1-r)}$ of the column (C) is the sales of the Industry II. This sum is made up of two parts, too. One is the sales to the non-industry sector $a(1-r)$, and the other the sales to the Industry I $a\dfrac{(2r-r^2)(1-r)}{1-r(1-r)}$ [(C′)] which is the aggregate of $ar(1-r)$, $ar(1-r)^2$, $ar^2(1-r)^2$,⋯⋯In their transactions with each other industry sector, the sales of one sector are identical with the purchases of the other, and therefore we can obtain the table (2.1) if we disregard the internal transactions within each industry sector (shown in the colums (A) and (D)). The horizontal rows of this table shows the sales of each in-

Table (2·1)

	Industry I	Industry II	Non-Industry Sector
Industry I		$a\dfrac{(1-r^2)r}{1-r(1-r)}$	ar
Industry II	$a\dfrac{(2r-r^2)(1-r)}{1-r(1-r)}$		$a(1-r)$

dustry (to the other industry and the non-industry sector), while the vertical columns the purchases of each industry and the non-industry sector (from the other industry). Now, the sales of Industry I to Industry II $a\frac{(1-r^2)r}{1-r(1-r)}$ shows the purchases of Industry II from Industry I, and it is evident that the amount of value equals the sales of Industry II multiplied by r (as long as the preference of Industry II to the products of Industry I is r). In the same way, the sales of Industry II to Industry I $a\frac{(2r-r^2)(1-r)}{1-r(1-r)}$ are identical with the purchases of Industry I from Industry II, and the amount of value equals to the sales of Industry I multiplied by $(1-r)$ (as long as the preference of Industry I to the products of Industry II is $(1-r)$). The relation may be understood better by referring to the diagram (1.1). Thus, if we take this into consideration and represent the sales of Industry I by x, and those of Industry II by y, the table (2.1) can be rewritten as the table (2.2). The total of the upper horizontal row in this table is nothing but the sales of Industry I x, and the total of the lower horizontal row the sales of Industry II y, hence we can induce a simultaneous equation (2.1) from the table (2.2) as shown below.

Table (2·2)

	Industry I	Industry II	Non-Industry Sector
Industry I		yr	ar
Industry II	$x(1-r)$		$a(1-r)$

$$\begin{aligned} x &= yr + ar \\ y &= x(1-r) + a(1-r) \end{aligned} \qquad (2\cdot1)$$

$$(1 \geqq r \geqq 0)$$

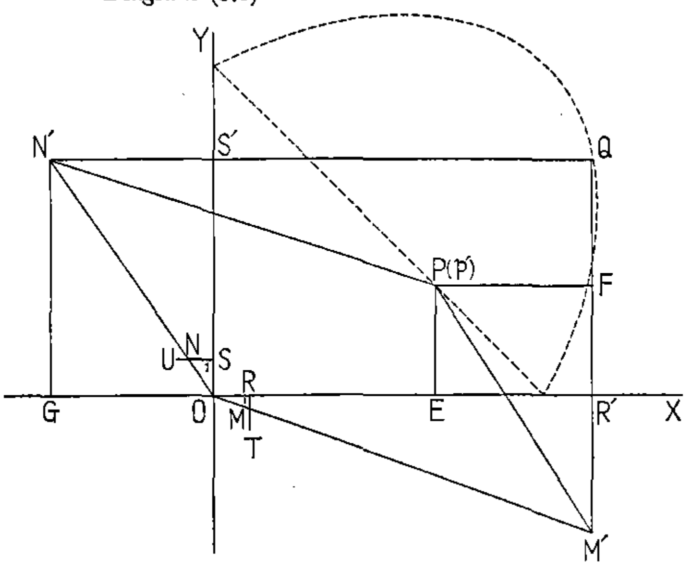
If a and r are given, x and y can be obtained right away by solving the equation (2.1). a and r represent the expenditures of the non-industry sector and the preference between products, viz., an expenditure coefficient, respectively and therefore, to solve this simultaneous eqation means to determine the equilibrium values of the sales of respective industries by giving the volume of expenditures and the expenditure coefficient of the non-industry sector. Since the equation (2.1) exactly expresses in general terms the *Tableau Economique*, it may be said that the *Tableau Economique* is a theory to determine the equilibrium sales of industries by the volume of expenditures a and the expenditure coefficient r. Following the example of the Physiocrates who called the *Tebleau Economique* the 'Tableau fondamental', we may as well call the equation (2.1) the '*équation fondamentale*' of the *Tableau Economique.* The solutions in general terms to this equation are $x=\frac{a(2r-r^2)}{1-r(1-r)}$, and $y=\frac{a(1-r^2)}{1-r(1-r)}$, each corresponding to the respective totals of the columns (B) and (C) in the diagram (1.1). In a special case when $a=600$, and $r=1/2$, both x and y have the equal value of 600. It is evident that this is the case assumed in the second edition of the *Tableau Economique*.

3) Now, let us proceed to analyse the graphic method of solution for the '*équation fondamentale*' of the *Tableau Economique*.[2)]

Let us rewrite the '*équation fondamentale*' (2.1) by transposition of the terms as follows:

$$\begin{aligned} x-ry&=ra \\ -(1-r)x+y&=(1-r)a \end{aligned} \qquad (3.1)$$
$$(1\geqq r\geqq 0)$$

Diagram (3.1)



Let the x-axis and the y-axis in the diagram (3.1) represent the sales of Industry I and those of Industry II respectively. Taking a point P within the first quadrant, and let the absciss represent ra and the ordinate $(1-r)a$. P indicates the state of the purchases of the non-industry sector from Industry I and Industry II, and at the same time it expresses the right side of the equation (3.1).

In the next place, let the point graduated 1 on the x-axis be designated R, and then draw a vertical line downwards from R, on which we take M at the point $-(1-r)$ along the ordinate, and connect O and M. The point M indicates the state of the sales of 1 and the purchases from Industry II $(1-r)$ when the sales of Industry I are 1. Likewise, let the point graduated 1 on the y-axis be designated S, and then draw a horizontal line to the left from S, on which we take N at the point $-r$ along the absciss, and connect O and N. The point N will indicates the state of the sales of 1 and the purchases from Industry I r when the sales of Industry II are 1. Now, let us take T at the point -1 along the ordinate on the production of RM,

2) For the graphical method of analysis of simultaneous equations of the first degree, see Michio Morishima's SANGYO RENKAN-RON NYUMON (Introduction to Analysis of Interindustrial relations), 1956, Sobunsha Book Publishing Co.

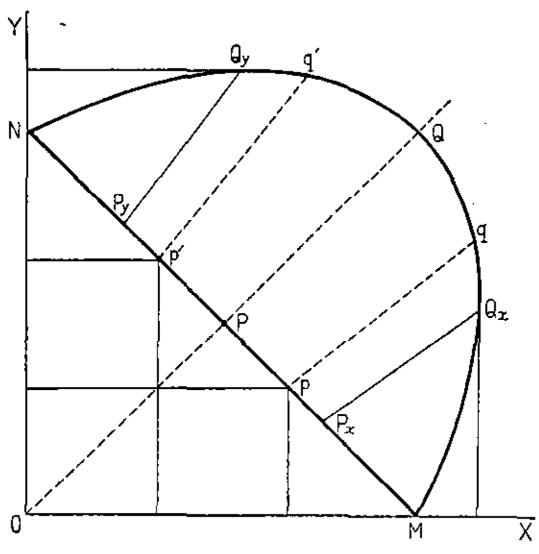
and U at the point -1 along the absciss on the production of SN. In this case, M and N move on the lines RT and SU as the value of r varies, but they can never go beyond T or U on the production of RT or that of SU since they are checked by the condition $1 \geqq r \geqq 0$.

Now, let us take the point M' on the production of the line OM so as $\frac{OM'}{OM}=x$, and the point N' on the production of the line ON so as $\frac{ON'}{ON}=y$, and describe a parallelogram $OM'P'N'$ which passes through the point P'. Now, let us draw a vertical line from M' towards the x-axis, and let the point of intersection with the x-axis be designated R'. Then, we draw a horizontal line from N', and let the point of its intersection with the y-axis be S'. Let the point of intersection of the production of the line $M'R'$ with that of the line $N'S'$ be designated Q. Also, let us draw the perpendiculars towards the x-axis and the line $M'Q$ from the point P', and call their feet E and F respectively, while we draw a perpendicular from N' towards the x-axis and call its foot G. Considering that the triangle $P'M'F$ is congruent with the triangle $ON'G$, the absciss of the point P' will be found to $(OR'-OG)$. Since OR' equals x and OG equals ry, the absciss of the point P' expresses the state of the left side of the first expression of the equation (3.1). This, of course, shows the balance between the sales of Industry I and its sales to Industry II, viz., the amount of value of production which Industry I can offer to the non-industry sector. In exactly the same manner, it can be easily demonstrated that the ordinate of the point P' expresses the state of the left side of the second expression of the equation (3.1), viz., the amount of value of production that Industry II can offer to the non-industry sector. Consequently, we see that the coordinates of the point P' show the amount of value of production that the whole industries under consideration can offer to the non-industry sector. Since the right side of the equation (3.1) should be equal to the left side under equilibrium conditions, the point P' (representing the state of the left side) should be identical with the point P (representing the state of the right side). In other words, in equilibrium the total amount of supply by all industries to the non-industry sector should equal the total amount of demand of the non-industry sector in this system.

Thus, given the amount of demand of the non-industry sector that should be assigned to each industry, we can easily determine graphically the equilibrium amount of supply (the equilibrium amount of sales) by each industry. Given the point P (representing the state of demand of the non-industry sector), we can describe a parallelogram $OM'PN'$ with P as the opposite angle of O, by extending the lines OM and ON that we obtained by the aforementioned method. In this case, X and Y or the equilibrium amount of supply (sales) of the Industry sector I and the Industry sector II are the coordinates (OR', OS') of the point Q in the diagram (3.1.). Thus, given the point P, X and Y or the equilibrium amount of x and y will be determined at the point Q in this manner. Such procedure shows us clearly how the equilibrium amount of sales of each industry will be determined uniquely by the self-adjusting force of output, once given the amount of demand (a) of the non-industry sector and the direction of the demand (r), both of which are decisively important factors in this system.

4) The next problem is to demonstrate graphically a case where a is a given amount, and r can change while satisfying the given condition $(1 \geqq r \leqq 0)$. To put it in another way, it is the analysis of such a case where the *dépenses du revenu* or the amount of expenditures of the non-industry sector is given and the expenditure coefficient of the society may change in various ways. To repeat the same thing in other expression, it is our task to erect graphically the *Tableau Economique* for a case where a is a given amount and r is variable. If we use the findings drawn from our analysis in the section 3), we can solve the problem very easily. That is, if a is a given amount, all we have to do is simply to find a locus of the point Q (x, y) which alters correspondingly as the point P $(ar, a(1-r))$ varies with the changes of r. We may easily guess the loci of the points P and Q by dint of the dotted line and curve drawn in the diagram (3.1). Thus, we shall obtain a figure shown in the diagram (4.1). In this figure, the line MN shows the locus of the point P when a is a given amount and r is variable, and the curve MQN shows the locus of the point Q which varies in correspondence with it. To put it in another way, the line MN represents every possible condition of the expenditures of the non-industry sector on the products of both industries, while the curve MQN indicates comprehensively the conditions of the amount of sales of each industry that varies correspondingly with the changes in the conditions of such expenditures. To repeat the same thing in other expression, the coordinates of every point on the line MN show the amount of purchases of the products of the industry sectors I and II by the non-industry sector,

Diagram (4.1)



while the coordinates of every point on the curve MQN indicate the equilibrium amount of the industrial sectors I and II which is determined in correspondence with the amount of purchases. Therefore, we may call the line MN the *expenditure line* (of the non-industry sector), and the curve MQN the *sales curve* (of industries). Since P taken at any point on the expenditure line MN will always give us a as the sum of the abscissa ar and the ordinate $a(1-r)$, the expenditure line should necessarily take a limited form. That is to say, it will be the hypotenuse of the right-angled triangle MON with the base OM and the perpendicular ON, both of which are a long. The expenditure line and the sales curve corresponding to the expenditure line are symmetric with respect to the 45-degree line extending north-eastwardly from O. Thus, once given any point P on the expenditure line, we shall be able to obtain a corresponding point Q (somewhere on the sales curve without fail) by the method described in the section 3), and except when the points P and Q are on the 45-degree line, the points p' and q' (their abscissas and ordinates being replaced with each other) should be located in symmetrical positions with the points p and q respectively with regard to 45-degree line. Now, let r be 2/3, then the coordinates of the point p on the expenditure line will be $\frac{2}{3}a$, and $\frac{1}{3}a$, and those of the corresponding point q will be $\frac{8}{7}a$, and $\frac{5}{7}a$. The point p' with the coordinates of $\frac{1}{3}a$ and $\frac{2}{3}a$, and the corresponding point q' with the coordinates of $\frac{5}{7}a$ and $\frac{8}{7}a$ will be located on the expenditure line and the sales curve in symmetrical positions with the points p and q on the other side of the 45-degree line or the axis of symmetry.

Now, let us draw a line perpendicular to the x-axis and let the point where it touches the sales curve be called Q_x. Let us draw another line perpendicular to the y-axis, and let the point where it touches the said curve be called Q_y. If we take the points P_x and P_y on the expenditure line in such a manner as they correspond to Q_x and Q_y respectively, we can draw the following conclusion quite easily. With the point $P\left(\frac{1}{2}a, \frac{1}{2}a\right)$ as the starting point, as the non-industry sctor chooses more of the products of the Industry I in its expenditures, that is, as it moves on the line PM towards M, the amount of sales of the Industry I will rise gradually. But once it reaches the point P_x, the amount of sales of the Industry I will continune to fall on the contrary. Thus, the effect of the expenditure coefficient of the non-industry sector upon the sales of the Industry I is asymmetric between the PP_x zone and the P_xM zone. Likewise, beginning from the point P, as the non-industry sector chooses more of the products of the Industry II in its expenditures, the amount of sales of the Industry II will rise gradually, but after the point P_y, it will tend to fall.

The nature of the expenditure line and the corresponding sales curve described in the diagram (4.1) has been made clear by the foregoing discussion, but the diagram is nothing but a graphic expression of the *équation fondamentale* (2.1) for a case where a is a given amount and r is variable (although $1 \geqq r \geqq 0$). Since our *équation fondamentale* was a mathematical expression of the *Tableau Economique* for a case where a and r were given, the diagram (4.1) shows a graphic composition of the *Tableau Economique* under the given condition for a case where r is variable. In other words, in this diagram are shown comprehensively all states of the equilibrium sales of each industry sector that correspond to all possible changes of the expenditure coefficient r, when the *dépenses du revenu* (the expenditures of the non-industry sector) is given. Therefore, we may call this fan-shaped diagram "the fundamental figure" of the *Tableau Economique*. If we relate this to the diagram (1.1), the expenditure line in "the fundamental figure" shows every possible state of ar, and $a(1-r)$ (corresponding to every possible change of r) shown at the upper ends of the columns (B) and (C), while the sales curve shows every possible state of $a\frac{2r-r^2}{1-r(1-r)}$ and $a\frac{1-r^2}{1-r(1-r)}$ or the sums of the corresponding columns (B) and (C). The originator of the *Tableau Economique* seems to have known fully the logic of our "fundamental figure". "Ces dépenses (de revenu) peuvent porter plus ou moins d'un côté ou de l'autre, selon que celui qui les fait se livre plus ou moins au luxe de subsistance, ou au luxe de décoration. On a pris ici l'état moyen où les dépenses reproductives renouvellent d'année en année le même revenu. Mais on peut juger facilement des changements qui arriveraient dans la reproduction annuelle du revenu, selon que les dépenses stériles ou les dépenses productives l'emporteraient plus ou moins l'une sur l'autre.……Car supposé que le luxe de décoration augmentât d'un sixième chez le propriétaire, d'un sixième chex l'artisan, d'un sixième chez le cultivateur, la reproduction du revenu de 600 liv. se réduirait à 500 livres. Si au contraire l'augmentation de dépense était portée à ce degré du côté de la consommation, ou de l'exportation des denrées du cru, la reproduction du revenu de 600 liv. monterait à 700 livres ainsi progressivement."[3)]

Since the *Tableau Economique* assumed, as we shall analyze later on, that the amount of reproduction of the *revenue* (that is, the income of the non-industry sector) of a certain year equalled the volume of sales of agriculture (that is, the Industry I) of that year, the foregoing context will be reduced to the problem of determining the abscissae of those points on the sales curve which correspond to the points on the expenditure line for the cases of $r=\frac{5}{12}$ (that is the case of 'luxury of decoration') and of $r=\frac{7}{12}$ (that is the case of 'luxury of means of subsistence') when $a=600$ in our figure[4)]. The *l'état moyen* (the neutral state) assumed in the second edition of the *Tableau Economique* is, needless to say, the case where $r=\frac{1}{2}$, and in our figure the points P and Q will represent the state of "the *dépenses du revenu*" and that of the sales of industries in that case.

(II) The *Tableau Economique* and the Theory of Propagation

5) So far we have analysed the *Tableau Economique* as an equilibrium theory to determine the sales or the output of industries, but as the *zigzag* lines of the *Tableau Economique* indicate point-blank, it is a theory of propagation at the same time. It is a table that manifests the process of propagation of the effect upon the sales of each industry when the expenditures of the non-industry sector are first thrown into the system.

In the first place, let us analyse the case when $1>r>0$. That means we shall consider a case where the expenditure coefficient is a positive number smaller than 1. Of course, in this case, the condition $1>(1-r)>0$ is also applicable with respect to the rate of preference of the products of the Industry II or $(1-r)$. When the income of the non-industry sector a is thrown into the system, and if the expenditure coefficient of the society r takes a certain value under the given conditions, ar will be expended on the products of the Industry I, and $a(1-r)$ on the products of the Industry

3) F. Quesnay, *Tableau oeconomique*, reprinted for the British Economic Association, London, 1894, p. i–ii.

4) When $a=600$ and $r=\frac{5}{12}$ (the case of 'luxury of decoration'), the abscissa of its corresponding point on the sales curve (the amount of sales of the Industry I) is $\frac{95}{100}a$, that is, 523. 8; on the other hand, when $r=\frac{7}{12}$ (the case of 'luxury of means of subsistence'), the abscissa of the point will be $\frac{119}{109}a$, that is, 655. Perhaps Quesnay talked loosely, and put 500 and 700 instead, but as we shall see later on, Marquis de Mirabeau did not use approximate values but made almost exact computation.

II (as we see in the diagram (1.1)). Now, the Industry I expends ar^2 out of the proceeds of sales ar on the products of its own, and $ar(1-r)$ on the products of the Industry II. Likewise, the Industry II expends $a(1-r)^2$ out of the proceeds of sales $a(1-r)$ on the products of its own, and $ar(1-r)$ on the products of the Industry I. Such process will continue to propagate itself in this manner until the increase in the amount of sales of each industry reaches zero, as is indicated by the zigzag lines in the diagram (1.1). The long and short of it is this; not that the initial expenditure thrown into this system a increases the value amount of the output of the Industry I by ar, and that of the Industry II by $a(1-r)$, but that it increases that of the Industry I by $a\frac{2r-r^2}{1-r(1-r)}$ [(B)], and that of the Industry II by $a\frac{1-r^2}{1-r(1-r)}$ [(C)], making the total sales of the two industries $a\frac{2r-2r^2+1}{1-r(1-r)}$ as is shown in the colum (F) in the diagram (1.1), eventually as a whole. If we assume that the expenditure of the non-industry sector on the products of the Industry I ar is a_1, and that of this sector on the products of the Industry II $a(1-r)$ is a_2, the sales of the Industry I $a\frac{2r-r^2}{1-r(1-r)}$ will be $a_1\frac{2-r}{1-r(1-r)}$, and those of the Industry II will be $a_2\frac{1+r}{1-r(1-r)}$. Since the multipliers of a_1 and a_2 or $\frac{2-r}{1-r(1-r)}$ and $\frac{1+r}{1-r(1-r)}$ are, in this case, the factors determining how much increase in the value amount of the sales of each industry will be brought about by the increase of the initial expenditure on the products of respective industries through propagation mechanism, we may as well call them the *propagation coefficients* of the Industry I and the Industry II. Likewise, the multiplier of the total sales of all industries $\frac{2r-2r^2+1}{1-r(1-r)}$ may be called the propagation coefficient of the expenditure a concerning all industries. A look at the diagram (4.1) will make it easy to understand that under the given condition $1>r>0$, all of these propagation coefficients are larger than 1. Therefore, it may safely be said that the propagation mechanism assumed in the *Tableau Economique* was intended to make clear the process of increase of the sales of each or all industries under circumstances meeting this condition.

The propagation mechanism under these general circumstances presupposes the mutual interdependence between the constituent industries of the system, but this can be made clear by examining the extreme or marginal cases of the condition that r should satisfy. One of such cases is when $r=$

1. In this case, $(1-r)$ will become zero, hence the whole amount of a or the income thrown into the system will be expended on the products of the Industry I, leaving nothing to be expended on the products of the Industry II. The Industry I will direct the whole proceeds of sales to be expended on the products of its own, leaving nothing to be expended on the products of the Industry II. Consequently, in this case the Industry I is completely independent from the Industry II, and each industry has no interdependence what-so-ever. In another marginal case where the condition $r=0$ applies, the reverse will happen. That is, a will be expended on the products of the Industry II alone, and the Industry II is completely independent from the Industry I. Therefore, we must say that under general circumstances satisfying the condition $1>r>0$, excepting these marginal cases, each industry is linked inseparably with each other. Hence, it may safely be said that the *Tableau Economique* is a theory of propagation dealing with the process of propagation of the effect of the expenditure of the non-industry sector a on the value amount of the output of each industry who is inseparably linked up with the other, when a is given.

(III) **The Reconstruction of the *Tableau Economique* as a Dynamic Theory of Development**

> M. Quesnay me dit qu'il avait fait un mémoire pour représenter que, dans les temps difficiles, il fallait qu'il y eût, pour le bien des affaires, un point central (c'est son mot) où tout aboutisse, Madame (de Pompadour) no voulait pas se charger du mémoire; il insista, malgré qu'elle lui dit *vous vous perdez*. Le roi jeta les yeux dessus, répéta, *point central*.
>
> *Mémoires* de Madame du Hausset.

6) So far we have called in question a determining theory of the system for the case where the expenditure coefficient of the society is constant, when we were given a or the amount of expenditure of the non-industry sector which is a strategic variable to the system. In short we have been dealing with a static theory to determine the amount of sales or output of industries. But could a or the amount of demand of the non-industry sector be an independent variable to the system? To put it in other words, does not a depend on other factors within the system? In solving this question, we cannot but introduce into the system the central column (E) of the diagram (1.1) which have hitherto been left out from our discussion, and we shall be obliged to call in question a dynamic process of the system through succeeding periods. That is to say, we shall arrive at the case of the so-called '*Tableau économique* dans ses dérangements' of Marquis de Mirabeau or the problem of dynamic construction of the *Tableau Economique*. By the way, there lies an obstacle

that we had better eliminate before we proceed to grapple with the subject. It has something to do with our doubts about the existence of a certain relation between the expenditure coefficient of the society r and the amount of expenditure of the non-industry sector a. If we can assume that there is a functional relation between a and r, we may add an additional expression (expressing the functional relation between a and r) to the fundamental equation (2.1), thereby we may obtain three simultaneous equations, with a as a known quantity, and x, y, and r as unknown quantities. Once we are given a, the system will be determined automatically all at once, and the equilibrium values of x, y, and r will be found. Thus, the whole operation of the system will be simplified in a sense. However, since we considered that the expenditure coefficient of the society r would eventually depend upon the exogenous factor of the system, that is to say, the *moeurs* of the spending class of a, and would not depend upon the value of a, we cannot assume that there is some functional relation between a and r, and therefore, we have to refrain ourselves from taking this course. Thus, it become more plausible to assume that even when a increases (or decreases) gradually in the dynamic course of the system through succeeding periods, the value of r determined in a certain period will remain constant through all periods.

Now, will the amount of expenditure of the non-industry sector a depend upon any other factor within the system? Let us assume that we are given a of a certain year i (could be any year), and let it be called a_i. Since the expenditure coefficient r should remain constant as long as the exagenous factors of the system that regulate it do not change as it is clear from what have been said above, we may as well assume that it will be constant all the time regardless of i. Let us express it by r through all years. As we can see in the diagram (1.1), a_i will be divided, and a_ir will be expended on the Industry I, and $a_i(1-r)$ on the Industry II. With a_ir it received, the Industry I will purchase the products of its own industry worth a_ir^2, and the products of the Industry II worth $a_ir(1-r)$. Hence, a_ir shows the amount of sales of the products of the Industry I, and at the same time indicates the amount of purchases of the products of the Industry I and the Industry II by the Industry I. Meanwhile, by investing the products worth a_ir that it purchased, the Industry I puts out products worth a_ir. *In addition, it turns out the net products (produit net) worth* a_ir. This latter process is expressed by the dotted lines drawn between the (B) column and the central column in the diagram (1.1). A similar process will be noticed when the Industry I receives a_ir $(1-r)$ from the Industry II. By investing only $a_ir(1-r)$, the Industry I will produce the products worth $a_ir(1-r)$ and the net products worth $a_ir(1-r)$.

Such a process applies to all items in the column (B). Since we can assume that the Industy II puts out no net products, the sum of the column (B) $a_i\frac{2r-r^2}{1-r(1-r)}$ expresses the amount of investment by the Iudustry I in the i^{-th} year, and at the same time shows the value amount of the products of the i^{-th} year turned out by the said investment. The sum of the central colum (E) $a_i\frac{2r-r^2}{1-r(1-r)}$ expresses the total value of the net products. Since this amount is equal to the investment of the Industry I in the i^{-th} year that is shown by the sum of the colum (B), it may be well assumed that the annual investment brings about 100% net products. In the *Tableau Economique,* it is assumed that the assumption of a net returns rate of 100 % is unchangeable through all years.

Assuming that *the market of the net products* of the Industry I *is guaranteed,* the value amount of net products $a_i\frac{2r-r^2}{1-r(1-r)}$ will be paid the non-industry sector, and becomes the amount of expenditure of the $(i+1)^{-th}$ year or a_{i+1}. Although it is the same thing, the amount of expenditures of the i^{-th} year a_i is equal to the net products of the $(i-1)^{-th}$ year or $a_{i-1}\frac{2r-r^2}{1-r(1-r)}$. Thus, a_i is an independent factor *to the system of the* i^{-th} *year*, but because it is equal to the net products of the $(i-1)^{-th}$ year, it depends upon the investment of the $(i-1)^{-th}$ year after all. Therefore, looking through all years, the amount of expenditure of the non-industry sector a_i of any year depends upon the investment of the preceding year, and (since the amount of investment of a certain year can be related to a of that year throuh the medium of r) also upon the amount of expenditure of the preceding year a_{i-1} eventually. The series of such expenditures interrelated one another$\cdots\cdots a_{i-1}$, a_i, $a_{i+1}, \cdots\cdots$ may be classified as either one of the three cases (1) unchangeable, (2) gradually increase, (3) gradually decrease, depending upon the value of the expenditure coefficient r which is a given amount through all years (if we assume that the net returns rate is constant) as will be analysed later on.

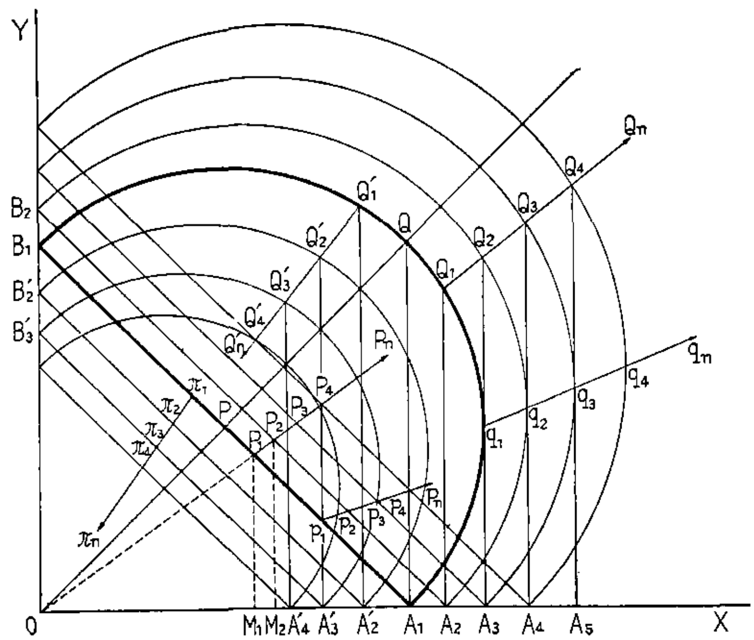
Looking back the results of our analysis in the foregoing sections from such a standpoint, it was nothing but a macroscopic analysis concerning the determination of the system in one case where r was constant and in the other where r was variable, when the amount of expenditure a_i in a given year i was given.

7) What course of development does the system under consideration take in accordance with different values of r, when the net returns rate and the expenditure coefficient of the society r are constant through all years?

Let us follow the same graphic approach as we did last time, and analyse such problem of a dynamic *Tableau Economique*. Let us adopt a hypothesis that the net returns rate is 100% (as was the case with the *Tableau Economique*), and also assume that the expenditure coefficient r which is considered as a given amount through all years will satisfy the condition $1>r>0$.

In the first place, let us analyse the case where $r=\frac{1}{2}$. The amount of expenditure a_i of the non-industry sector in the i^{-th} year is a given amount to the system of this year. Given a_i and $r\left(=\frac{1}{2}\right)$ or the state of expenditures of the non-industry sector, we can determine the equilibrium sales of the industries by the method described in the sections 2), and 3). If we construct a fundamental figure for this case, we shall obtain the diagram (7.1)[1]. Since the expenditure coefficient of the society r is $\frac{1}{2}$, P or the point that represents the state of expenditure of the non-industry sector and Q or its corresponding point that represents the state of sales of each industry will be found at those points that the 45-degree line extending from O intersects the *expenditure line* and the *sales curve* respectively. In this case, the equilibrium sales of the Industry I can be expressed by OA_1 if we call the foot of the perpendicular drawn from Q down to the x-axis A_1. Now, OA_1 is not only the amount of sales of Industry I, but also the amount of investment of the i^{-th} year as we discussed in the Section 6). And since it is assumed that investment brings about 100% net returns, OA_1 is a_{i+1} or the amount

Diagram (7.1)



1) The *sales curve* described in this diagram is shown by a semicircle for the convenience of construction. Strictly speaking, however, it should a curve just line the one in the diagram (4.1) in p. 8. The curve in the diagram (4.1) looks like a semicircle, but it isn't. Nevertheless, the diagram (7.1) is useful enough for our present purpose of clearing up the real nature of our argument.

of expenditure of the $(i+1)^{-th}$ year, after all. But as it is evident from this figure, OA_1 is equal to the expenditure of the i^{-th} year a_i. Thus, as long as $r=\frac{1}{2}$, the same process that took place in the i^{-th} year will be repeated in the $(i+1)^{-th}$ year. In this way, as long as the expenditure coeffiicient that is assumed constant is $\frac{1}{2}$, the amount of expenditure a remains constant through all years, and the series of expenditures$\cdots a_{i-1}$, a_i, $a_{i+1}\cdots$will become a series of constant flow through each year. In this case, the non-industry sector expends annually the same amount on the products of each industry, and each industry produces the same amount of products and invests the same amount by the same method, producing annually the same amount of net products. In fine, the reproduction of the same scale will be repeated from year to year.

8) In the next place, what about the case where the expenditure coefficient of the society r takes a quantity smaller than 1 but larger than $\frac{1}{2}$ $\left(1>r>\frac{1}{2}\right)$, and this quantity is assumed to remain constant through all years? Let us assume $r=\frac{7}{12}$. To simplify the case, let us suppose that the i^{-th} year is the first year, and that the amount of expenditure in the first year is a_1. Also let us assume that a_1 is equal to the amount of expenditure for the case when $r=\frac{1}{2}$ (the case that has been analysed already). Let us take the point M_1 on the x-axis in the diargam (7.1) so as $\frac{OM_1}{OA_1}=\frac{7}{12}$, and let the point where the perpendicular with its foot at M_1 intersects the expenditure line A_1B_1 be called P_1. P_1 indicates the state of expenditure of the non-industry sector for the case when $r=\frac{7}{12}$. In other words, this sector divides a_1 into two parts, and expends on OM_1 worth of the products of the Industry I, and on P_1M_1 worth of the products of the Industry II. The point Q_1 on the sales curve which corresponds to the point P_1 represents the state of the equilibrium sales of each industry in the first year. If we draw a perpendicular from Q_1 down to the x-axis, and call its foot A_2, the equilibrium sales of the Industry I will be OA_2, and the equilibrium sales of the Industry II will be Q_1A_2. Now, as we have said already, OA_2 is the value amount of net products of the first year of the Industry I, and at the same time is a_2 or the amount of expenditure of the non-industry sector of the second

year. Therefore, when $r=\frac{7}{12}$, the amount of expenditure of the second year a_2 will be larger than the amount of expenditure of the first year. If we draw a line from A_2 parallel to B_1A_1, and name the point where it intersects the y-axis B_2, B_2A_2 will become the expenditure line of the second year. By assumption, r is always $\frac{7}{12}$. Therefore, if we take the point M_2 on the x-axis so as $\frac{OM^2}{OA^2}=\frac{7}{12}$, and name the point where the perpendicular passing through M_2 intersects the B_2A_2 line P_2, P_2 represents the state of expenditure of the non-industry sector in the second year. We can see quite easily from the diagram (7.1) that the point P_2 can be found on the production of the line OP_1 connecting O and P_1. If P_2 is once determined, its corresponding point Q_2 can be obtained on the sales curve $B_2Q_2A_2$ of the second year by the method shown already. The point Q_2 represents the state of sales of each industry in the second year of course. In this case, OA_3 will become a_3 or the amount of expenditure of the non-industry sector in the third year. The same thing will be true to the successive years. We may perhaps call the line connected with points P_1, P_2, P_3,······on the expenditure line of each year *the propensity to expend line*, and the line connected with those points Q_1, Q_2, Q_3······which represent the state of equilibrium sales of industries in each period *the equilibrium sales line*. In the case considered here, the series of expenditures through each year a_1 a_2, a_3,······will continue to increase gradually at a constant rate. That is to say, it will become $\frac{a_2}{a_1}=\frac{a_3}{a_2}=\frac{a_4}{a_2}=\cdots$ $\cdots$In general terms, it will become $\frac{a_i}{a_{i-1}}=a\frac{2r-r^2}{1-r(1-r)}\Big/a=\frac{2r-r^2}{1-r(1-r)}$. The geometric rate of increase with respect to a, $\frac{a_i-a_{i-1}}{a_{i-1}}$, will become $\frac{3r-2r^2-1}{1-r(1-r)}$. In this case, the ratio $\frac{a_i}{a_{i-1}}$ should be larger than 1 for any value of r under the condition of $\frac{1}{2}<r<1$. On the other hand, the rate of increase $\frac{a_i-a_{i-1}}{a_{i-1}}$ should be a positive value under the same condition. Therefore, in the case of $\frac{1}{2}<r<1$, the series of a_{i-1}, a_i, a_{i+1},······should continue to increase gradually at a constant rate from year to year. Also in this case, the amount of sales of the Industry II continues to increase at a constant rate from year to year. The rate of its increase $\frac{(QA)_i-(QA)_{i-1}}{(QA)_{i-1}}$ will become equal to the rate of increase of expenditure, that is, the rate of increase of sales of the

Industry I, and therefore, the amount of sales of the Industry II will also increase at the rate of $\frac{3r-2r^2-1}{1-r(1-r)}$

As we have seen above, in the case of $\frac{1}{2}<r<1$, the amount of expenditure of the non-industry sector to be divided between the products of the Industry I and those of the Industry II continues to increase at the same rate from year to year. The value amount of products, the amount of investment of each industry as well as the net products continue to increase at the same rate, too. That is, we are facing their harmonious expansion or the case of balanced expansion.[2)] Although the value amount of reproduction continues to expand at a constant rate from year to year, there will be no change in the quantitative relations between the aggregates of the constituent factors of the system as to each year. In this case, the assumed geometric rate of growth of their quantities is $\frac{3r-2r^2-1}{1-r(1-r)}$. Of course, the balanced expansion of the system under consideration is preconditioned by constant returns to scale of constituent industries.

Now, let us draw perpendiculars touching the sales curves we have described down to the x-axis, and let their touching points be called q_1, q_2, q_3,…… respectively as we see in the diagram (7.1). Then, we shall obtain a line passing through these touching points. If we call their corresponding points on the expenditure lines p_1, p_2, p_3,……respectively, we shall obtain a line passing through these points in the same way. The p_1p_n line is one of what we call the propensity to expend lines, and the q_1q_n line is one of the so-called equilibrium sales curves. But these lines will have the following characteristics. The q_1q_n line is a line showing the maximum of equilibrium sales of the Industry I through all years among all equilibrium sales lines that can possibly exist, and the p_1p_n line represents the rate of preference of products that corresponds to it. Since it is assumed that only the Industry I produces net products, and its value amount is equal to the equilibrium sales of the Industry through all years, the p_1p_n line will also represent such a rate of preference of products that would bring about the maximum value amount of net products through all years. As we have analysed in the Section 4) already, in the lower portion of each expenditure line that lies below the p_1p_n line, the corresponding value amount of net products will gradually fall even if more of the products of the Industry I are preferred. Therefore,

2) The idea of steady and balanced growth is analogous in essence to the conception suggested by A. Marshall (*Principles*, V, Ch. V, § 3) and G. Cassel (*Theory of Social Economy*, Ch. 1, § 6), and contained in the growth model of Harrod-Domar.

if the acquisition of the maximum of net products through each year is desired from the view-point of the society, such rate of preference that is shown by p_1p_n should be adopted. In this case, the course of development in the system must be the one that is to be shown by q_1q_n.

9) Let us analyse the case where the expenditure coefficient of the society r is larger than zero but smaller than $\frac{1}{2}$, that is, the case where r satisfies the condition $\frac{1}{2}>r>0$. In contrast to the preceding case, this corresponds to the contracting process of the system under consideration. In this case, the assumption that r and the net returns rate are constant, and above all, the premise that only the Industry I produces net products are very important. Now, let us assume $r=\frac{5}{12}$. We also assume as we did that the amount of expenditure of the first year α_1 is equal to the expenditure for the case when $r=\frac{1}{2}$. Now, in this case, we can obtain the point π_1 representing the state of expenditure of the non-industry sector in the first year. π_1 will be located on the expenditure line B_1A_1 in symmetrical position to P_1 with respect to the 45-degree line as we have stated in the Section 4). Once π_1 is determined, the point Q'_1 representing the state of sales of industries in the first year will be obtained on the sales curve. Now let us draw a perpendicular from Q'_1 down to the x-axis, and let its foot be called A'_2. The value amount of net products in the first year is OA'_2. This is the amount of expenditure in the second year α_2 at the same time. Of course $\alpha_2<\alpha_1$. If we draw a line from A'_2 parallel to B_1A_1, and let the point where it intersects the y-axis be called B'_2, $B'_2A'_2$ will be the expenditure line of the second year. On this line, let us take the point π_2 that shows the state of expenditure of the non-industry sector in the second year so as $r=\frac{5}{12}$. Once π_2 is determined, the corresponding point Q'_2 can be obtained on the sales curve of the second year $B'_2Q'_2A'_2$. OA'_3 will be the amount of expenditure of the third year α_3. A similar process will continue thereafter. In this case, the series of expenditures in each year α_1, α_2, α_3,······will continue to fall at a constant rate. In this case, $\frac{\alpha_t}{\alpha_{t-1}}$ will be smaller than 1 for any value of r under the condition of $\frac{1}{2}>r>0$, and can be expressed in general terms as $\frac{2r-r^2}{1-r(1-r)}$. And also, the rate of increase

$\frac{\alpha_i-\alpha_{i-1}}{\alpha_{i-1}}\left(\frac{3r-2r^2-1}{1-r(1-r)}\right)$ should be a negative value under the same condition.

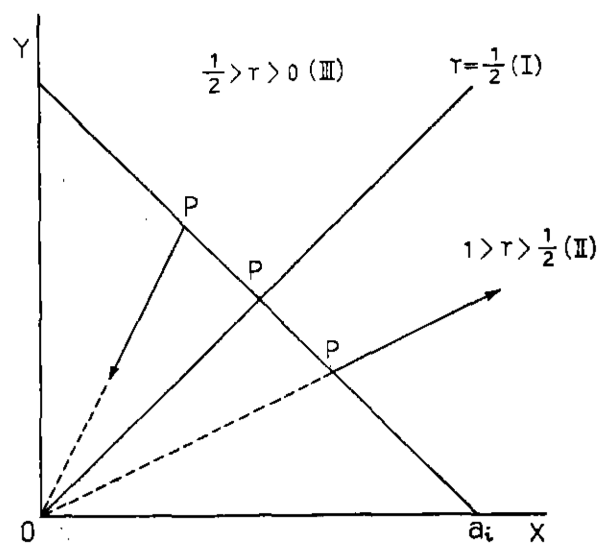
Thus, in the case where $\frac{1}{2}>r>0$, the value amount of products, the amount of investment of each industry as well as the net products will continue to decrease at the same rate from year to year. We are facing a balanced contracting process of the system which forms a marked contrast to the preceding case. This course of contraction is represented by the propensity to expend line $\pi_1\pi_n$ that runs towards O, and the equilibrium sales line $Q'_1 Q'_n$.

10) In the dynamic construction of the *Tableau Economique* that has been discussed so far, it is decisively important that more consideration should be given to the date (period) of the amount of expenditure of the non-industry sector. It is not merely a, but must be a_i. Viewed from the angle of a specific period, the amount of expenditure is an independent factor to the system under consideration. But, from the standpoint through all periods, the amount of expenditure of a certain period becomes a factor dependent upon that of the preceding period. Therefore, what have been analysed up to the Section 5) amount to nothing but a theory neglecting such date. To put it in another way, it was a theory which would be sure to work *as far as the period it was involved was concerned*, no matter whatever period. However, since the quantities in the *Tableau Economique* intrinsically have dates, the *Tableau Economique* should be grasped from the angle through all period, that is, from the viewpoint of period analysis. If it is true, the popular view that, being absorbed to one aspect of the *Tableau Economique*, that is, to the case when $r=\frac{1}{2}$ in the foregoing analysis, grasps it only as a static structure of *circular flow* should be given up altogether.[3] Because, if we are allowed to class the viewpoint of period analysis with that of dynamic analysis, the *Tableau Economique* essentially belongs the field of dynamics as it is evident from the foregoing discussion, and the case when $r=\frac{1}{2}$, that is, the case of circular flow is nothing more than a special case of dynamic structure in the *Tableau Economique.*

3) Among those who share such a popular view may well be included almost all economists who have touched upon the *Tableau Economique.* Perhaps, it won't be necessary to cite various authorities, but to mention a few of them, J.A. Schumpeter (*Theorie der Wirtschaftlichen Entwicklung*, 2. Auflage, 1926, pp. 79–80); L. Robbins (On a Certain Ambiguity in the Conception of Stationary Equilibrium, *Economic Journal*, Vol. 40, 1930, pp. 195–96). Such being the case, we may as well say that the essential logic of the *Tableau Economique* of Quesnay has been misconceived thoroughly for the past two centuries. Based on this misunderstanding, the authorities were busy with its philosophical embellishments.

The foregoing analysis may be summarized as simply as follows: a_i which is a strategic factor of a certain year under consideration is the value amount of net products of the preceding year, and can be related eventually to the amount of expenditure of the preceding year a_{i-1} after going through the chain of net products$\longrightarrow$the annual investment of the Industry I$\longrightarrow$ a_{i-1}. In a general case when the expenditure coefficient of the society r satisfies the condition of $1>r>0$, the system under consideration may expand, contract or remain unchanged according to the different values that r is allowed to take. We have classified this general case into three cases. First is the case when $r=\frac{1}{2}$, second, the case when $1>r>\frac{1}{2}$, and third, the case when $\frac{1}{2}>r>0$. These cases correspond to the respective fields divided by the 45-degree line passing O, as shown in the diagram (10.1).

Diagram (10.1)



Given the amount of expenditure a_i of the non-industry sector in a given period i, in the first case, that is to say, in case when any point P is given on the 45-degree line, the system will continue reproduction on a constant scale from year to year. In this case, the flow of the value amount of net products or the amount of expenditure a_i will be constant through all periods. In the second case, that is to say, in case when any point P is given within the field enclosed by the 45-degree line and the x-axis, the system will go on indefinitely north-eastwardly through the course shown by the production of the OP line connecting O and P, and the scale will continue to expand at a constant rate from year to year. Asymmetical with this is the third case, in which, given any point P within the field enclosed by the y-axis and the 45-degree line, the system will go on towards O through the course shown by the line connecting O and P, and the scale will continue to contract at a constant rate from year to year. As clearly shown in the diagram (10.1), in the dynamic construction of the *Tableau Economique* analysed above, the expenditure coefficient r is a decisive factor that makes the system dynamic. It is because the system may expand (or contract) or repeat the same recurring process according to the value of r, and in this case, the volume of expenditure a_i does only determine the scale that the value amount of production can take in a specific period i, but has nothing to do with the determination of the dynamic process of the system through all periods.

The originator of the *Tableau Economique*, and his faithful exponeut Marquis de Mirabeau, did understand fully and correctly the logic of dynamic structure of the *Tableau Economique* that has been discussed so far. Considering a case when the amount of expenditure a is 1050 livres, Maruquis de Mirabeau stated that all sectors of the society prefered equally one-sixth more of the products of the Industry sector II in their expenditures, the value amount of net products would decrease to 915 livres at the end of this period. Then, he said as follows: "Si au contraire l'augmentation de dépense étoit portée à ce degré du côté de la consommation ou de l'exportation des denrées du crû, la reproduction du revenu de 1050 livres monteroit à 1146 livres, & les reprises du Laboureur de 1655 livres seroient alors de 1806 livres; donc elles augmenteroient de 151 livres. Ainsi l'accroissement total seroit de 247 livres ou environ d'un dixième; ainsi progressivement, tant que la culture & le terroir pourroient *y* contribuer."[4] Expounding faithfuly the ideas of Quesnay, what Marquis de Mirabeau is setting forth here are the two cases where $a=1050$, and the expenditure coefficient $r=\frac{5}{12}\left(\frac{7}{12}\right)$ in our diagram. The former corresponds to the case of $\frac{1}{2}>r>0$ which was analysed in the Section 10), and the latter to the case of $1>r>\frac{1}{2}$ exactly, each presenting a very special case.

Thus, our Diagram (7.1) can show any and every possible case conceivable in the *Tableau Economique* and can represent inclusively the course of development of various quantities through each period as well as determine the equilibrium values of these quantities of a certain period, and therefore, this may as well be called a general economic table. Since the *Tableau Economique* was published two hundred years ago, the Physiocrats themselves,

4) Marquis de Mirabeau, *Tableau Oeconomique avec ses explications*, *L'Ami des Hommes*, Suite de La sixième partie, 1760, p. 195. In this context, 'les reprises du Laboureur' is considered to be 1655 livres which is the sum-total of the annual advance of 1050 and the interest of 605 on both the original advance (5000) and the annual advance at an annual rate of 10%. Since all items increase at a constant rate (9% is the rate assumed here) annually, 'les reprises du Laboureur' defined as above rises to 1806 livres from 1655 livres. 'Les reprises' plus net products or the total products will therefore increase from 2705 to 2952 livres with the increment of 247 livres. Presumably he said an one-tenth increment in approximation of an increment of about 9%. In our diagram, the interest on the above investment is left out of consideratin for simplification's sake. But this kind of procedure was often adopted by Quesnay and Mirabeau.

and many other people have written numerous volumes in their efforts to explain it without much success, but now we at last got a sheet of diagram[5] which could show exhaustively any and every possible case conceivable in the *Tableau Economique* in strict form and faithful to the logic as you see in the Diagram (7.1). So, if what is shown in this diagram is really the strict formulation of the *Tableau Economique*, we can commit ourselves that the *Tableau Economique* was the first formulation of a dynamic theory of development, and it will be shown manifestly the appraisal that has been set on it up to date is either wrong or can only partly be correct.

From what has been said above, the following points will also be made clear incidentally. It is universally known that Quesnay, the originator of the *Tableau Economique*, went heart and soul into the study of geometry in his closing years, and the result of his study was published in book form under the title of "*Recherches philosophiques sur l'évidence des vérités géométriques*, 1773" in the year before his death. However, the significance of this study was either ignored completely or misconceived not only by his contemporaries but also by their disciples. And today, even those who are regarded as greatest authorities on Physiocrat studies seem to have failed in comprehending the real significance of it. If our foregoing analysis of the *Tableau E-*

5) The well-known *zigzag* table by Quesnay and Mirabeau has an advantage of appealing to the visual angle for the process of propagation of expenditure that was discussed in the Section 5). But for the analysis of various cases implied in our diagram (7.1), we need as many tables as the number of the cases. In fact, Mirabeau could not help to do so. Also, since this economic table is a table of a certain year, we shall be obliged to need as many tables as the number of years under consideration or to have recourse to supplementary explanation without additional tables if we are to analyse all through successive years. There will arise such necessity when $r \neq \frac{1}{2}$. Thus, this seems to have made the analysts of the *Tableau Economique* to concentrate their attention on a very special case and to ignore the correlation between all cases, and consequently led them to misconceive the essential logic of the *Tableau Economique*. It is really surprising that the analysts of the *Tableau Economique* dared to ignore even what was suggested by the theory of propagation which was its strength. Whereas our diagram has the advantage of eliminating these defects. It embraces any and every possible case conceivable in the *Tableau Economique* in one sheet of diagram. And it will demonstrate before everything else that the *Tableau Economique* is a dynamic theory of development viewed from the standpoint of period analysis. So, for instance, it will become clear that the case when $r=\frac{1}{2}$ is only a special case of such theoretical construction. The economic table devised by Professor Woog is not also free from the same defect of the Quesnay-Mirabeau table in essence. He is one of the few scholars who recognized the importance of dynamic theory, but he failed to introduce this point into his table. Also, if my understanding is not wrong, he seems not to understand the importance of the realization of net products that is to be discussed in the Chapter (IV) of this article. It is very doubtful, therefore, if his interpretation holds good when $r \neq \frac{1}{2}$, that is, when the system expands or contracts. (Henri Woog, *The Tableau économique of François Quesnay*, 1950; ditto, Le mécanisme du "Tableau Economique" de François Quesnay, in *François Quesnay et La Physiocratie*, tome 1, 1958).

conomique is not wrong, we can say positively that the *Tableau Economique* depends upon the logical foundation of geometrical progression in a sense, and it is no wonder that the author of the *Tableau Economique* was absorbed in geometry, above all, *Polygonométrie*. Therefore, we should like to consider that the geometrical study by the originator of the *Tableau Economique* in his last years is not foreign to his study of the *Tableau Economique*, but has a great significance in his study history. So, the perfect misunderstanding Quesnay has suffered for these two hundred years in this respect should be thrown into the sea altogether.[6)]

(IV) The *Tableau Economique* and the Theory of Markets

11) In the dynamic construction of the *Tableau Economique* developed in Sections 6) through 10), it was premised as a matter of course that the amount of expenditure of a certain year a_i was equal to $a_{i-1}\frac{2r-r^2}{1-r(1-r)}$ or the value amount of net products of the preceding year. Needless to say,

6) Quesnay became enthusiastic in geometry from about 1769. His work referred to in the text is a collection of two pamphlets written previously on Polygonométrie. The subject with which he grappled was Polygonométrie, particularly the most difficult problems of geometry that were presented by the sophists. Such study of Quesnay was thoroughly misunderstood and ignored by his contemporaries. Turgot called it "*le scandale des scandales*". Fouchy who paid that famous tribute of praise to Quesnay upon his death also failed to appreciate the significance of this study. Thus, even Dupont, one of his disciples, said "*ce sont les récréations d'un vieillard bien respectable*". I wonder if this prodigy did really grasp the true logic of the *Tableau Economique*. d'Alembert, one of Quesnay's friends, reasoned with him on the mistake that the chief of a school was indulged in geometry.

A. Oncken perceived a flash of wit in Quesnay in reading the said work. But he failed to observe the relation that this study had to the study of the *Tableau Economique*. (*Oeuvres de F. Quesnay*, p. 36, note (1); *The Works of Quesnay*, translated by Shimazu & Hishiyama, Vol. 1, pp. 82-3).

J. Hecht, who contributed greatly to the compilation of the Collected Essays in Memory of the Bicentenary of the Publication of the *Tableau Economique* by her detailed and valuable biography '*La vie de François Quesnay*', said as follows: "Vers la fin de sa vie, Quesnay, déçu par les mécomptes de la physiocratie, et peut-être par l'incompréhension partielle de ses disciples, se désintéressa progressivement des travaux économiques pour se tourner vers les mathématiques." (J. Hecht, La vie de François Quesnay, in *François Quesnay et La Physiocratie*, tom 1, 1958, p. 277). A similar view, though more moderate in tone, can be seen in Oncken (A. Oncken, *Oeuvres*, p. 692, note (1)). At any rate, according to Hecht, his study of geometry in his closing years was nothing but "*les récréations d'un vieillard*", an opinion just like Dupont's. It appears that she also failed to grasp the relation between the genuine logic of the *Tableau Economique* and the geometrical truth.

As a work can hold its value apart from the words of the author, it should be proper to call the *Tableau Economique* a product of '*esprit de géométrie*', if our formulation is correct. Hence, we cannot admit that the conventional way of expounding the *Tableau Economique* by the analogy to medical science that has been maintained by the authorities (a typical example of it can be found in A. Oncken, "*Geschichte der Nationalökonomie*". *Cf. ibid.* ss. 342-44 [*b. Methode*], especially ss. 343-44) has any more significance than as a convenient means of explanation, because it does not pass the confines of analogy and is lacking in the grounds of demonstration.

this premise was taken for granted in the Quesnay-Mirabeau formula, too. However, the net products of the preceding year should be sold by the Industry I before they become the income of the non-industry sector. "La vente du produit net que le cultivateur a fait naître l'année précédente, par le moyen des *avances annuelles* de 600 livres employées à la culture par le fermier, fournit au propriétaire le paiement d'un *revenu* de 600 livres."[1] But, to what degree will it be possible under a given condition to realize the value amount of net products of the preceding year that was produced by the investment of the preceding year $a_{i-1}\frac{2r-r^2}{1-r(1-r)}$ at a net returns rate of 100%? Before we proceed to discuss this problem, we shall reconstruct the transaction structure of the *Tableau Economique* by introducing the internal transactions of each industry (the Columns (A) and (D) in the diagram (1.1)) that have been left out of our consideration, and then, resting on this ground, we shall examine closely the relation of the *Tableau Economique* to the theory of Markets.

In the foregoing analysis, it has been assumed that the respective volume of transactions of both industries and the non-industry sector is identical with the total value amount of each sector. For all that, the *Tableau Economique* was, strictly speaking, a device to present graphically the representative business relations between typical enterprises and households or between enterprises themselves. Should the number of such typical household economies (hence, the number of such typical enterprises of each industry) be known, it is assumed that the total volume of transactions of each sector can be determined automatically by multiplying this number by the individual volume of transactions of that sector. Therefore a set of business relation may look at first sight as if it were an individual relation between a household economy and an enterprise, but in essence it represents a *small-scale replica* or a *microcosm* of aggregative business relations of the economy as a whole. Thus, the word representative means a typical epitome of business relations of the economy as a whole. So, what has been called the Industry I or the Industry II will become to mean a typical enterprise of the Industry I or the Industry II, and the non-industry sector will mean a typical household economy. In the *Tableau Economique*, it means a typical household economy of the landed class, of course. Hereupon, we have to introduce into our scheme the group of other constituent enterprises than the above typical enterprises under consideration if we are to consider the internal transactions of each industry. Let these typical enterprises as to respective industries be represented by the accompanying figure 1, and the group of other enterprises be

1) F. Quesnay, *Tableau Oecnnomique*, op. cit., p. 1.

represented by the accompanying figure 2. Then, we shall be able to represent all constituent enterprises of each industry by the figures 1 and 2. If so, the internal transactions of each industry be expressed as the reciprocal business relation between 1 and 2.

In the next place, we must introduce into our scheme the transactions in net products (the Column (E) in the Diagram (1.1)). As was analysed in the Section 6), the net products of a certain year should become an income that would serve as the fund of the expenditures of the non-industry sector for the following year. For that purpose, the net products must have gotten sold in advance by the Industry I. In the foregoing analysis, it has been assumed that they would be sold without fail, and that with 100 % value amount to be always realized from the annual investment. Now, this assumption itself must be called in question. Meanwhile, it is rather logical to assume that the net products turned out in a given year by 1 or a typical enterprise of the Industry I will be sold to the group of enterprises other than the typical enterprises of respective industries (that is, 2 of I and II)—since the typical enterprises of respective industries would leave no fund to buy them as a result of the reciprocal transactions presented in the *Tableau Economique*.[2] Now then, let us assume that the value amount of net products to be sold to the group of enterprises of the Industry I itself (2 of I) is α,

		Industry I		Industry II		The Non-Industry sector
		1	2	1	2	
Industry I	1		α	$\alpha\frac{(1-r^2)r}{1-r(1-r)}$	β	αr
	2	$\alpha\frac{2r^2-r^3}{1-r(1-r)}$				
Industry II	1	$\alpha\frac{(2r-r^2)(1-r)}{1-r(1-r)}$				$\alpha(1-r)$
	2			$\alpha\frac{(1-r^2)(1-r)}{1-r(1-r)}$		

Table (11.1)

2) If my understanding is correct, the assumption that Professor Sakata adopted in his valuable annotations of the *Tableau Economique* (" *Tableau fondamental* ") is the same as this. (Taro Takata, *The Tableau Economique of Quesnay*, 1956, Shunjyusha Publishing Co., pp. 28–52, especially, pp. 46–47). However, Professor Sakata does not seem to recognize the importance of the problem of realization of net products as was examined in this chapter, and that of the conditions that bind the validity of the assumption. Therefore I don't think the interpretation of Prof. Sakata as it was presented there would apply to the case of $r \fallingdotseq \frac{1}{2}$ or the case when the system is expanding or contracting. It seems to me that the same problem was also missed by Mr. Tateru Watanabe who developed an interesting criticism on the annotations of Professor Sakata. (Tateru Watanabe, *Some Doubts about the Tableau Economique* (" *Tableau fondamental* "), Mitagakkai Zasshi, Vol. 50, No. 6, pp. 80–96.)

and the value amount to be sold to 2 of the Industry II is β. Then, $(\alpha+\beta)$ will be total value amount of net products to be sold in the said year, and is destined to become the fund of the expenditures of the non-industry sector in the following year.

Thus, the business relation in consideration of the internal transactions and the transactions of net products may be shown as the Table (11.1) in comparison with the diagram (1.1). In the same manner as before, the horizontal rows in this table represent the amount of sales (supply) of each industry, and the vertical columns the amount of purchases (demand) of each industry and the non-industry sector. Let us assume as we did before that $a\frac{2r-r^2}{1-r(1-r)}$ (the total of the Column (B) in the diagram (1.1)) or the amount of sales or the annual investment of the typical enterprise 1 of the Industry I is x, and $a\frac{1-r^2}{1-r(1-r)}$ (the total of the Column (C) in the diagram (1.1)) or the amount of sales of the typical enterprise 1 of the Industry II is y, this table can be rewritten as the table (11.2).

		Industry II		Industry I		The Non-Industry sector
		1	2	1	2	
Industry I	1		a	yr	β	ar
	2	xr				
Industry II	1	$x(1-r)$				$a(1-r)$
	2			$y(1-r)$		

Table (11.2)

The grand total of the sums of horizontal rows will be the aggregate sales (the aggregate value amount of supply). Assuming that the aggregate value amount of supply is S, we get the following expression.

$$S \equiv x+y+a+(\alpha+\beta) \cdots (11.1)$$

The grand total of the sums of vertical columns will be the aggregate purchases (the aggregate value amount of demand). Assuming that this aggregate value amount is D, we obtain the following expression.

$$D \equiv x+y+a+(\alpha+\beta) \cdots\cdots (11.2)$$

hence,

$$S \equiv D \cdots\cdots (11.3)$$

In other words, for whatever amount of expenditure of household a or the value of the expenditure coefficient r, the aggregate supply will always be identical with the aggregate demand. If we assume that the value amount of supply of net products is $(\alpha+\beta)_S$, and the value amount of demand for them is $(\alpha+\beta)_D$, the following expression can be induced from the above expressions (11.1) and (11.2),

$$S=D \cdots\cdots\cdots (11.4)$$

provided that the following condition is satisfied.

$$(\alpha+\beta)_S=(\alpha+\beta)_D \cdots\cdots\cdots (11.5)$$

That is to say, the supply of net products and the demand for net products should be equal. Hence, in order for the relation expressed in (11.3) to hold good, the condition

$$(\alpha+\beta)\equiv(\alpha+\beta)_D \cdots\cdots\cdots (11.6)$$

should always be satisfied. What is shown in (11.3) amounts to saying that the aggregate supply is always identical with the aggregate demand, and this is nothing but the theory of markets.[3] Thus, the condition of (11.6) that the supply of net products is always identical with the demand for them is the necessary and sufficient condition of the theory of markets. If the above condition can be satisfied (under the given conditions assumed in the *Tableau Economique*), we may as well say that the *Tableau Economique* rests on the theory of markets. But, is it sure enough that such a condition will always be satisfied in the *Tableau Economique*?

12) Meanwhile, $(\alpha+\beta)_S$ or the value amount of supply of net products by the typical enterprise 1 of the Industry I is an amount to be determined by the production of a given year as we analysed in the Section 6). In other words, it is equal to $a\frac{2r-r^2}{1-r(1-r)}$ or the amount which is equivalent to 100% of the investment of the said year. Will this amount of supply be sure to be realized in circulation process? According to our scheme shown in the Table (11.1), this planned amount must be supplied to the group of other enterprises 2 of the same Industry I and that of the Industry II. On the other hand, these groups of enterprises will sell the respective amounts of $a\frac{2r^2-r^3}{1-r(1-r)}$ and $a\frac{(1-r^2)(1-r)}{1-r(1-r)}$ to the typical enterprises 1 of both industries. And as a result of the reciprocal transactions assumed in the *Tableau Economique*, the amount of money equivalent to these amounts of sales combined would eventually flow into their hands.—Such a process may be easily understood from the diagram (1.1). Now, if these two groups of enterprises cannot use other funds than the proceeds of sales to purchase $(\alpha+\beta)_S$, the value amount of demand for net products by them $(\alpha+\beta)_D$ will necessarily be limited. In other words, $(\alpha+\beta)_D$ must be equal to $a\frac{2r^2-r^3}{1-r(1-r)}+a\frac{(1-r^2)(1-r)}{1-r(1-r)}$ [(A)+(D) in the diagram (1.1)], and will always be equal to

3) The definition of the theory of markets adopted here follows the same line that Mr. Lange took in his famous article. (Oscar Lange, Say's Law: A Restatement and Criticism, *Studies in Mathematical Economics and Econometrics; in Memory of Henry Schultz*, 1942, p. 52).

a for any value of r. Meanwhile, $(\alpha+\beta)_S$, that is, $\frac{a(2r-r^2)}{1-r(1-r)}$, is not equal to a, excepting the case when $r=\frac{1}{2}$, hence the following expressions can be drawn out.

$$\begin{array}{ll} \text{When } r=\frac{1}{2}, & (\alpha+\beta)_S=(\alpha+\beta)_D \\ \text{When } r\neq\frac{1}{2}, & (\alpha+\beta)_S\neq(\alpha+\beta)_D \end{array} \qquad \cdots\cdots\cdots\cdots\cdots(12.1)$$

In other words, when the expenditure coefficient of the society is $\frac{1}{2}$ (that is, a case of circular process on a constant scale as it is obvious from our analysis in the Sections 6) through 10)), the value amount of supply of net products will be equal with the value amount of demand for them, whereas when the expenditure coefficient is not $\frac{1}{2}$ (that is, the cases where the system either expands or contracts), both will not be equal. Thus, assuming constant prices and a 100% net returns rate, and as long as the available cash balance equals the amount of expenditure a, the supply of net products is not always identical with the demand for them, regardless of the value of the expenditure coefficient r. Hence, neither does the proposition that the aggregate demand and the aggregate supply are always identical for any value of r hold good. In consequence, *as long as we maintain the viewpoint of a closed system* we cannot admit under the given conditions that the *Tableau Economique* rests upon the theory of markets generally.

13) The value amount of supply of net products $(\alpha+\beta)_S$ must depend upon the value amount of demand for them $(\alpha+\beta)_D$ eventually, and as long as we assume and maintain the transaction structure of the *Tableau Economique*, the latter is limited by a or the fund returning to the groups of enterprises 2 that belong to respective industries, for whatever value the expenditure coefficient r may take. It should be so as long as it is assumed that the demand for a certain product must be taken care of by the supply of another product, and that no other fund than that to be obtained by it can be used for the purchase of that product. What kind of relation does this thing have with the supposition of a 100% net returns rate? The rate of net returns in this case means, needless to say, (the value amount of net products/the annual investment) or (E)/(B) in the diagram (1.1).

In the first place, let us see the case when $r=\frac{1}{2}$, that is, the case of circular flow. In this case, the value amount of net products that can possibly be supplied $a\frac{2r-r^2}{1-r(1-r)}$ will be a. Since it is equal to the value amount of demand a, the realization of a 100% net returns rate becomes possible.

In the second place, in the case when $1>r>\frac{1}{2}$ (that is, when the system is expanding), $a\frac{2r-r^2}{1-r(1-r)}$ or the value amount of net products that can possibly be supplied will become larger than a or the value amount of demand for them. Also, the realized value amount of supply must equal a or the value amount of demand. Since investment which is the denominator of the rate of net veturns to be realized is assumed to be equal to the value amount of net products that can possibly be supplied, and the numerator to be equal to the value amount of net products to be realized, the rate of net returns to be realized will be smaller than 100%.

Lastly, in the case when $0< r<\frac{1}{2}$ (that is, when the system is contracting), the amount of supply of net products that can possibly be supplied will be smaller than the amount of demand for them. Also, the amount of supply to be realized must equal a or the value amount of demand. Thus, the rate of net returns to be realized will become larger than 100%.

Also, as can be easily demonstrated, the assumption of constant price will be inconsistent in the case when $r\neq\frac{1}{2}$. Now, let the price be represented by p, and the net products expressed in a real unit be represented by O_n, the following relation must come into existence.

$$(\alpha+\beta)_S=pO_n \quad \cdots\cdots(13.1)$$

Since O_n or the net products (measured by a real unit) to be sold is constant, in order for p to be invariable, the left side $(\alpha+\beta)_S$ must also be invariable. However, it was demonstrated clearly by the foregoing analysis that excepting the case when $r=\frac{1}{2}$, the value amount of net products that can possibly be supplied is not equal to the value amount of net products to be realized, and therefore, when $r\neq\frac{1}{2}$, the left side of the expression (13.1) will become variable, and as long as O_n is a given amount, p cannot be constant.

Such being the case, it may safely be said that the assumption of constant price throws in its lot with that of a 100% net returns rate.

In making a summary of what has been said above, we may reach the following salient points. In cases when the system expands or contracts, excepting the case when $r=\frac{1}{2}$, the assumption of constant price adopted in the *Tableau Economique* will become illogical, and at the same time the supposition of a 100% net returns rate will not be realized. So, generally speaking, when the condition that r is a positive number smaller than 1 is satisfied, in order that the assumption of constant price will hold good in the case when $r \lesseqgtr \frac{1}{2}$, that is, when the system is expanding (contracting), and that the rate of net returns to be realized may be 100%, the ΔM amount of money that will satisfy

$$\Delta M=(\alpha+\beta)_S-(\alpha+\beta)_D \cdots\cdots (13.2)$$

must be thrown into (withdrawn from) the system. Since $(\alpha+\beta)_S$ is the amount of supply of net products, and is equal to the sum-total of the Column (E) in the Diagram (1.1), and $(\alpha+\beta)_D$ is the amount of demad for them, and is equal to the sum-total of the Columns (A) and (D), we obtain the following expression.

$$\Delta M=(E)-(A+D)=a\frac{3r-2r^2-1}{1-r(1-r)} \cdots\cdots (13.3)$$

Hence, for instance, when $r=\frac{2}{3}\left(\frac{1}{3}\right)$, the mechanism of the system should work in such a way as the $\frac{1}{7}a\left(\frac{2}{7}a\right)$ amount of money may automatically be thrown into (withdrawn from) the system. Otherwise, the progress of expansion or contraction through each period would become inconsistent with the assumption of constant price and that of a 100% net returns rate. Also the assumption that the value amount of net products (which is equivalent to 100% of the annual investment) of a given year i will become the fund of expenditure of the non-industry sector of the $(i+1)$th year, as it was assumed in our analysis in the Sections 6) through 10) (as well as in the *Tableau Economique*), would become illogical.

As we have seen above, ΔM becomes zero when $r=\frac{1}{2}$, and we have no problem in that case. But, when $r \lesseqgtr \frac{1}{2}$, the said system will suffer every year from a deficiency or an excess of money by $\Delta M=a\frac{3r-2r^2-1}{1-r(1-r)}$ as long as we try to maintain the rate of net returns of 100%. Now, could there be any such automatic adjusting mechanism to make up good this deficiency or withdraw this excessive money every year? With the assumed process of transactions shown in the diagram (1.1), with the existing cash balance being limited to a, and with the assumption of constant price, there can exist no such automatic adjusting mechanism within the said system. The Physiocrats seem to have recognized this point correctly. Now, we have to remember that the *Tableau Fconomique* was not simply a closed system, but was an open system on the contrary. Thus, in the case when $1>r>\frac{1}{2}$, that is, when the system is expanding, there must be a favorable balance of trade to the extent of $a\frac{3r-2r^2-1}{1-r(1-r)}$ every year, and a corresponding amount of money must flow into the system. Reversely, when $0<r<\frac{1}{2}$, that is, when the system is contracting, there must be an adverse balance of trade to the extent of $a\frac{3r-2r^2-1}{1-r(1-r)}$ every year, and a corresponding amount of money must flow out of the system. Thus, when the system under consideration pursues the dynamic course of expansion or contraction analysed in the Sections 6) through 10), it requires the system to be an open system as a matter of certainty. Marquis de Mirabeau was right about it when he called the process of contraction of the system to accout in his "*Philosophie rurale*". Pursuing the process of contraction that would take place when $a=2000$, and $r=\frac{2}{5}$, he stated concerning the conditions upon which such a process might rest as follows: "toutes les matières premières de la classe stérile s'achètent dans le pays; mais les matières premières d'un luxe de décoration recherchée sont pour la plupart étrangères et même séparées du commerce extérieur réciproque des productions usuelles……On ne se procure (ces matières-ci) que par *un commerce simplement passif et de pure déprédation*," (underlined by Hishiyama)[4]. In this manner, Marquis de Mirabeau stated manifestly that the process of contraction due to "Luxe de décoration", that is, our case when $\frac{1}{2}>r>0$, should rest on the assumption of the outflow of money from the system under consideration due to "commerce passif" or an adverse balance of foreign trade.

14) Thus, if we can assume that this is an open system, and that there exists such mechanism of external trade system that would necessarily eliminate ΔM in the expression (13.2) no matter whatever value r may take, it will follow that $\Delta M\equiv 0$. Under the same conditions, from the expression (13.2) will be induced $(\alpha+\beta)_S\equiv(\alpha+\beta)_D$. To put it in other words, the value amount of supply of net products will be always identical with the value amount of demand for them for any value of r. The comparison with the expression (11.6) will demonstrate that these are the conditions of the theory of markets shown in the expression (11.3). So, granting that the external

4) Cf. Marquis de Mirabeau, *La Philosophie rurale*, 1764, tome III, p. 36.

transactions work in such a manner as to satisfy the condition of $\Delta M \equiv 0$ by dint of the self-adjusting mechanism of the total cash balance of the system through the inflow or outflow of money, the assumption of constant price and a 100% net returns rate will be valid of necessity, and the total value amount of supply will always be identical with the total value amount of demand even if the system under consideration follows the dynamic course. Quesnay knew this quite well, because he stated definitely that the *Tableau Economique* should rest on the assumption of an open system, and that it was an indispensable assumption for the purpose of maintaining constant price.

Thus, we arrive at the view that the *Tableau Economique* adopts the theory of markets, after all. But, if our demonstration was not wrong, the foregoing analysis should give a decisive answer to the unsettled question "Does not the Theory of Markets immediately remind one of the *Tableau économique*?"[5] Also, we should be able to draw the derivative conclusions from it that the *Tableau Economique* of Quesnay occupies an unshaken position of its own in the formulation of the theory of markets, and that the theory of markets of Quesnay grounded on the assumption of constant price and an open system is an effective formulation that can steer clear of Mr. Lange's criticism on Say's Law with respect to indeterminate money price.[6]

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5) Cf. Paul Lambert, The Law of Markets prior to J.B. Say and The Say-Malthus Debate, in *Internationl Economic Papers*, No. 6, 1956, p. 10. Rebutting the Teilhac view (E. Teilhac, *L'oeuvre économique de J.B. Say*, Paris, 1927) in this paper, Mr. Lambert clearly stated his position that the Physiocrats did not adopt the theory of markets. The confusion that the theory of markets debate often runs into is partly due to divergences in opinions on the definition itself. But no matter which side of the two we may take part with, the approach to question whether the words "les productions ne se payant qu'avec des productions" were discovered in the physiocrat literatures or not does not have much sense, and is far from being acceptable by us. Although we admit the popular view here, we can hardly support almost any of the procedures of demonstration.

6) Cf. O. Lange, op. cit., pp. 64–66. However, in the *Tableau Economique*, prices are determinate from the beginning if we stand on the assumption of constant price at all. Now, as it is clear from the diagram (1.1), the total value amount of transactions (inclusive of the internal as well as the net products transactions) is the product of a multiplied by a certain coefficient as to the propensity to expend of the society r. Assuming that this multiplier is $\delta(r)$, the total volume of transactions measured by a real unit (corn) is O, and the unit price is p, we obtain the following expression.

$$\delta(r)a = pO \quad \cdots\cdots (1)$$

Now, it is assumed in the *Tableau Economique* that a is always equal to the existing cash balance M, and therefore, the expression (1) can be rewritten as

$$\delta(r)M = pO \quad \cdots\cdots (2)$$

Since the expression (2) is nothing but an quantity equation of money, $\delta(r)$ is the velocity of circulation of money or the reciprocal of Marshall's k.

Now, since the left side of the expression (2) is nothing but the total value amount of demand, the right side the total value amount of supply, the expression (2) must be rewritten as below if the theory of markets can apply.

$$\delta(r)M \equiv pO \quad \cdots\cdots (3)$$

That is to say,

$$\frac{1}{\delta(r)} pO \equiv M \quad \cdots\cdots (4).$$

Since the right side of the expression (4) shows the existing cash balance, and the left side.

(V) The *Tableau Economique* and Its Presuppositions —Constant Price and the Law of Constant Returns—

15) The *Tableau Economique* stands on the assumption of '*prix constant*'. Resting on the basis of this assumption, the *Tableau Economique* made it possible for us first to approach the physical process of development and circulation through the analysis of monetary side, and second to isolate the price determination mechanism and the mechanism that functions to determine the amount of output and that of net products, laying a greater emphasis on the consideration of the latter. The first point is relatively simple. Let us examine this first. All quantities of hypothetic transactions in the *Tableau Economique* are expressed in the unit of value, and not in a physical unit of any kind. But, since constant price is assumed, changes in the amount of value due to fluctuations of prices are disregarded. In other words, under the assumption of constant price, any and every change in the value amount corresponds only to some such change in the physical amount exactly. Thus, the increase or decrease in the value amount of output or net products of the Industry I, for instance, is considered to correspond precisely to the increase or decrease of output or net products expressed in a physical unit. This makes it possible for us to trace the flow of physical goods through the flow of money. Or we can presume precisely how physical goods look like through the reflected vision of money on mirror. This can be made possible by the assumption of '*prix constant*'.

In the next place, the assumption of constant price made it possible to

the total amount of demand for cash balance, the expression (4) represents the conditions of neutral money. Now, by assumption, p *is* a given amount. Given certain conditions of supply (once p becomes certain), O will also be determined. Hence, both p and O are constant. In order that the total supply may always be identical with the total demand, hence the identical equation (4) may be satisfied, for any value of r, M must adapt itself to any value of r. Thus, M cannot be constant but is uncertain.

Such being the case, the assumption of a closed system, and the limiting of the existing cash balance to a is not consistent with the theory of markets. Whereas the assumption adopted in our analysis in the text that it is an open system and there exists the self-adjusting mechanism to the changing value of r through the inflow of $M-a=\Delta M$* makes the theory of makets applicable. Therefore, the case of Quesnay's theory of markets is free from the charge of "Either Say's law is assumed and money prices are indeterminate or money prices are made determinate—but then Say's law and hence the "neutrality" of money must be abandoned." that was set forth by O. Lange (op. cit., pp. 65–66). It is (the velocity of circulation and) the existing cash balance that become uncertain only because the theory of markets is valid in Quesnay's formulation, and the money prices assumed constant should be explained by other independent factors than those implied in the quantity theory. So the neutrality of money and the theory of markets need not to be given up at all, *if it is assumed that the external transactions guarantee such automatic self-adjusting mechanism of money*. Quesnay did understand perfectly this logic of the quantity theory of money. (Cf. *Tableau Oeconomique*, op. cit., pp. ix–x, note).

* This expression has the same meaning as the (13.3) expression after all.

separate the price determination mechanism and the mechanism that functions to determine the amount of output and that of net products, the analysis being focussed on the latter. The *Tableau Economique* was primarily concerned to trace how output and net products were determined, how they were reproduced from year to year, and what course of development they would follow, and it thoroughly disregarded the effect of price fluctuations on them in determining output as well as in confirming the dynamic course developing through periods. As we have discussed in full, it is not the price but the amount of expenditure by the non-industry sector a or the expenditure coefficient of the society r that is decisively important to the said system in such an analysis. As we analysed in the Section 10), a and r are the two decisively important (strategic) factors, the former (together with the latter) for determining the scale of the system in a given year, and the latter for confirming the dynamic course to be followed through each period. But, to what extent will it be appropriate to amplify rashly the supposition of given price to the dynamic structure of the said system?

16) This assumption of constant price becomes plausible when it is founded on the assumption of constant returns to scale of industry which was adopted in dynamic construction of the system. But, since the latter assumption will be conditioned by special premises with respect to the original means of productions or land and labor power, this fact restricts considerably the validity of *Tableau Economique*. Let us examine this point closely.

In the expanding (contracting) process through each period in the *Tableau Economique*, net products/annual investment, that is, the net returns rate, is always 1 in any period, and output/annual investment is always equal to 2 (*because annual investment + net products = output of the Industry I*). In other words, the said system expands (contracts) in balansed proportion at a constant rate as it is clear from our diagram (7.1). Through changes in the scale of the system in each period, the relative relations within the system itself, above all, the proportion of input and output is always maintained constant. Such an assumption, that is, the assumption of constant returns to scale, renders it plausible to adopt '*prix constant*' in all process of development through each period.

Let us examine this point as to the case where the system tends to expand (the case which was already analysed in the Section 7) when $1 > r > \frac{1}{2}$. When the said system expands in balanced proportion at a constant rate, not only the output and the net products but also the amount of investment will also expand at a constant growth rate. The situation such as this will necessarily demand a special premise with respect to land and labor power.

To put it in other words, it should be either of the two cases: there exists boundless land of equal fertility, or the intensive capital investment in a certain tract of land produces always the same yield. In the next place, labor power should be reproduced endlessly at a constant supply price in correspondence with the expansion of the said system. The latter assumption concerning the reproduction of laboring population at a constant wages rate has something in common with that of the classical school, but the bottleneck of land problem by which the expanding system was confronted has been left unexamined (together with the analysis of the effect of technical innovation to increase returns successively)[1]. At any rate, such a special assumption with respect to original means of production will restrict considerably the validity of the assumption of constant returns to scale that has been so generally applied, and at the same time it will bring a sever damage on the effect of the assumption of '*prix constant*' that has been adopted throughout the dynamic process of the said system. But such a restricting effect of the assumption will not be defect vital to our work of constructing a fundamental theory as the first approximation, nor will it become a decisive obstacle to our attempt of applying the conception of the *Tableau Economique* to the modern economy.

(VI) The *Tableau Economique* and Its Application

17) The first difficulty we meet with in our attempt to apply the *Tableau Economique* comes from the fact that it is rather based on the French economy of the *ancien régime* at an immature stage of capitalism – a world which has a feature markedly different from that of today's economy –, hence it rests on a very special and narrow conception. In other words, it was considered that agriculture is the only branch that could bring forth net product, and net product was the income of landlords, that is to say, rent. But this will not be a difficulty that we cannot surmount in our attempt, because we may consider, instead, that each and every constituent industry of the system can turn out net product, and that net product is not rent but profit.

An insurmountable difficulty that we cannot neglect in our attempt to apply the *Tableau Economique* would rather lie in the following point.——It will be found in the assumption of the *Tableau Economique* that the expenditure coefficient of the income of the non-industry sector would represent the

1) The criticism on the assumption of constant returns in *the Tableau Economique* and the formulation of the law of diminishing returns of land were made by Turgot in the following essay: Turgot, Observation sur la mémoire de M. Saint-Péravy, *Oeuvres de Turgot* (par G. Schelle), 1914, tome 2, pp. 642–46. But, as to the formulation of Turgot, please refer to the following pioneering article; P. Sraffa, Sulle relazioni fra costo e quantità prodotta, *Annali di Economia*, 1925, pp. 282–87.

rate of preference of products in all transactions within the system under consideration. In reality, however, the expenditure of the non-industry sector and that of industry sectors depend upon different factors of their own, and it is the decision of household economy (restricted by a set income) in the former case that determines the allocation of expenditure to each product, while it is the decision of entrepreneur (restricted by the technical structure of production) in the latter case. Therefore, the expenditure coefficient of income of the non-industry sector does not necessarily coincide with the rate of preference of products in the transactions of each industry. However, such a difficulty will prove not to be fatal to our attempt of applying the conception of the *Tableau Economique*, if properly modified.

The conception suggests a number of possibilities of application, but let us see just one of them. Our system consists of two industry sectors and a non-industry sector. We assume that profit is the only source of the income of the non-industry sector. The full amount of a or a given profit of the system is expected to be expended on products of the Industry I and II in the year under consideration. Assuming the ratio λ out of a will be expended on the products of the Industry I, it naturally follows that $(1-\lambda)$ will be expended on the products of the Industry II (provided that $1\geqq\lambda\geqq0$). Since the profit a will be expended in purchasing investment goods and consumption goods in reality, it will be more practical to consider that either of the two industries is solely enaged in the production of investment goods. Nevertheless, we shall stick to the general classification of the Industry I and II in our analysis. As we consider that the receits and disbursals of wages will not be separated from the reciprocal transactions between the industries, but shall be included instead, the expenditure of wages by the workers belonging to each industry will be included in the expenditure of the industries. Such a procedure is a logical conclusion of our assuming profit to be the only source of the non-industry sector, hence excluding wages therefrom. It is a treatment very faithful to the conception of the *Tableau Economique*. As for wages, it is assumed that the whole amount will be devoted to consumption expenditure within the said year and nothing will be left for saving.

Let us assume that the measured-in-value technical structure of production of one industry is closely analogous to that of the other. Hence, each industry is expected to expend r on the products of the Industry I, and $(1-r)$ on the products of the Industry II respectively (provided that $1\geqq r\geqq0$) in their business transactions. What such an assumption implies is as follows: ——Since the measured-in-value technical structure of each industry is the same, the value amount of each product that is purchased for the purpose of turning out one unit of product in terms of the value unit must be exactly equal in either industry. And further, since the expenditure of wages is included in that of each industry, the total expenditure of each industry will necessarily become equal to the amount of sales (minus profits) or the proceeds of sales, if we disregard the transaction in net products.

18) In our system, therefore, the expenditure coefficient λ of profit a or the income of the non-industry sector, and the expenditure coefficient r of production of each industry for a given year are given. Thus, if we disregard the internal transactions within each industry and represent the proceeds of sales of the Industry I by x, and those of the Industry II by y, the fundamental equation (2.1) of the *Tableau Economique* shown in the Section 2) will be made applicable by some modification.

$$\begin{aligned} &x-yr=a\lambda \\ &-(1-r)x+y=a(1-\lambda) \qquad \cdots\cdots(18.1) \\ &\quad (1\geqq r\geqq 0,\ 1\geqq\lambda\geqq 0) \end{aligned}$$

Therefore, our system becomes a theory to determine the equilibrium proceeds of sales of each industry x and y, when we are given the total expenditure of profits a and its expenditure coefficient λ together with the expenditure coefficient r of production (a reflex of the measured-in-value production coefficient) of each industry.

Also, we can construct a 'fundamental figure' for the case where λ is variable (provided that $1\geqq\lambda\geqq 0$) by the same procedure discussed in the Section 4), when we are given the amount of profits a and the expenditure coefficient r of production of each industry. What is shown in the diagram (18.1) is a 'fundamental figure' for the case when r is $\frac{1}{2}$. Since the expenditure coefficient λ of profits and the expenditure coefficient r of production of each industry depend on different factors, λ does not equal r generally with the exception of some special cases. This is the point which makes 'the fundamental figure' of the *Tableau Economique* thoroughly different from the one

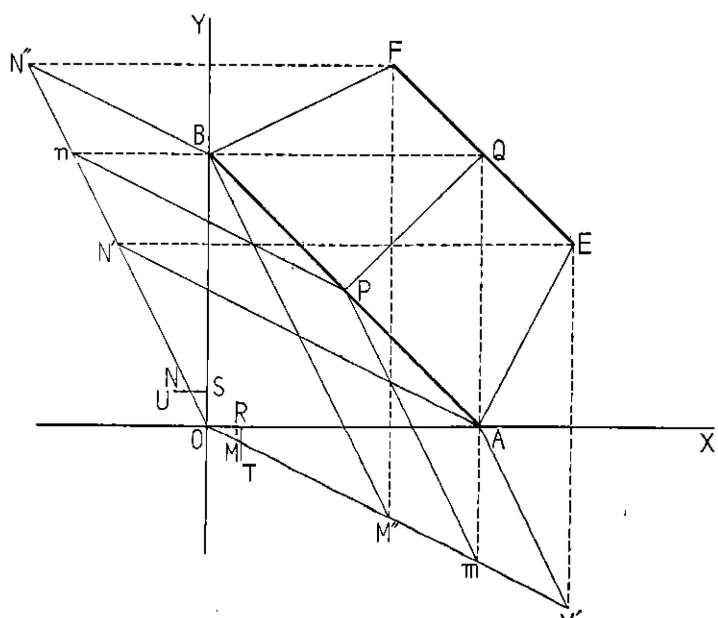

Diagram (18.1)

shown in the diagram (18.1). Thus, in this diagram, the locus of the equilibrium proceeds of sales corresponding to each point on the expenditure line (of profits) is not a curve, but becomes the line EF running in parallel with the expenditure line in this case where it is assumed that r is equal to $\frac{1}{2}$. Of course, the sales line EF represents all states of the equilibrium proceeds of sales of each industry that correspond to those of the expenditure of the profits a. The point E represents the maximum (minimum) proceeds of sales of the Industry I (the Industry II), the point F the maximum (minimum) proceeds of sales of the Industry II (the Industry I), and the point Q the equal equilibrium proceeds of sales of the Industry I and II. The points A, B, and P show the states of expenditure a corresponding to these proceeds of sales. Therefore, granting that the amount of expenditure of profits is given, this diagram clearly demonstrates the way how the proceeds of each industry varies as the apportionment ratio of profits between industries changes.

19) However, this diagram is of no great importance any more than the 'fundamental figure' of the *Tableau Economique* unless it affords some foothold for further reasoning. The 'fundamental figure' of the *Tableau Economique* was important as it served as a corner-stone of the dynamic structure of the system through all periods by making it possible for us to consider the process of annual reproduction of the value amount of net products. We have to introduce some hypotheses before we can attempt the same procedure on the diagram (18.1). First, let us assume that each industry yields a certain quantity of profit equivalent to some per cent of its equilibrium proceeds of sales (x or y) in this period so that the fund of expenditure of the coming period may be secured. In the assumed case of $r=\frac{1}{2}$ in this diagram, if the rate of profit (the quantity of profit of each industry x or y) of one industry is equal to that of the other industry, the total quantity of profits of the whole industries must always be the same for any value of λ (that is, in any state of the equilibrium proceeds of each industry corresponding to it), and if the system is to repeat the same circular process from year to year, the rate of profit must be 50%. Hence, when an equal rate of profit is larger than 50%, the system will expand, and when it is smaller than 50%, the system will contract.

In order that we make it possible to apply the procedure of dynamic construction of the *Tableau Economique* analysed in the Sections 6) through 10), we have to adopt the assumption of unequal profits rate rather than equal profits rate. And in an extreme case of this assumption, that is, when we assume that the profits rate of either industry is at zero, a situation such as this may be able to show in a most emphatic manner the process essential to the case when there is disparity of profits rate between the industries. Further it will prove to be the closest approximation of the construction of the *Tableau Economique.* In consequence, we shall assume that the Industry I maintains constantly the profits rate of 100% while the profits rate of the Industry II is at zero.

Under this assumption, λ or the expenditure coefficient of profit in a given year becomes a definitely important factor, a factor that determines the dynamic course of the system through all periods. Assuming that the technical coefficient of production of each industry is maintained constant through each period and that $r=\frac{1}{2}$, a general diagram shown in (19.1) may be constructed as being corresponding to the diagram (7.1). Then, if we consider the differences with the *Tableau Economique* that were discussed in the Section 16), the greater part of the things analysed in the Section 6) through 10) will be found applicable (simply by changing r into λ). In this diagram, the system either repeats the same circular process on a constant scale, expands or contracts in accordance as the case may be either $\lambda=\frac{1}{2}$, $\lambda>\frac{1}{2}$ or $\lambda<\frac{1}{2}$ (provided that $\lambda>0$). In other words, the diagram shows in a most emphatic manner that the decision as to what portion of profit will be apportioned to which industry cannot be irrelevant to the changing scale of the system (when there exists some disparity in the net returns rate between the industries), nay it will be an important factor definitely affecting the determination of the dynamic course of the system.

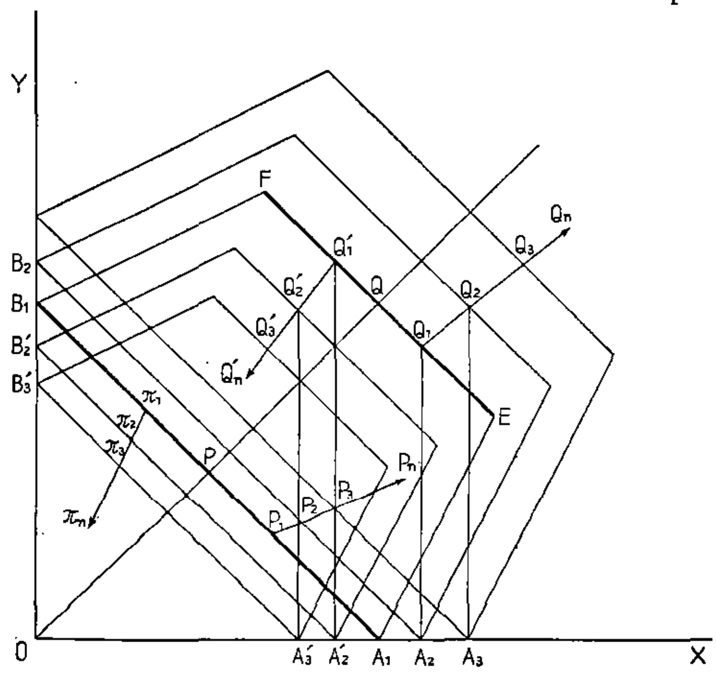

Diagram (19.1)

20) So far we have confined ourselves to the case where r is $\frac{1}{2}$. Now, let us proceed to analyse some other cases where

r is not $\frac{1}{2}$. In the first place, let us consider the case when $1 > r > \frac{1}{2}$, that is, when each industry depends more on the products of the Industry I for its production activity. Here again, of course, it is assumed that the technical structure of production of one industry is equal to that of the other industry, hence the assumption that the productive expenditure coefficient r of constituent industries is the same will become plausible. As it is clear from the diagram (20.1), the sales line C inclines more sharply than the sales line $\left(\text{for the case of } r = \frac{1}{2}\right)$. The intersection Q of the (c) line and the sales line (a) is the point where the equilibrium proceeds of sales of the Industry I equals the amount of profits a. As long as the hypothesis that only the Industry I maintains the profits rats of 100% constantly through all periods remains valid, the point Q represents the state of the equilibrium proceeds of sales corresponding to the reproduction on a constant scale of the system under consideration. With the perpendicular QA as the line of demarcation, all sales lines are divided into two parts. Needless to say, when the equilibrium sales point is found on the right side of the line of demarcation QA, the system will expand under the given conditions as we have discussed in the Section 19). On the other hand, if the equilibrium sales point is found on the left side of the line of demarcation, the system will tend to contract. Now, the point on the expenditure line AB that correspond to the critical point Q on the sales line (c) is U, and generally AU is larger than AP, hence a larger number of those which we can select out of all values of λ or the expenditure coefficient of profits when r is greater than $\frac{1}{2}$ $\left(\text{as compared with the case when } r = \frac{1}{2}\right)$ bring about the expansion of the said system. It is because when $1 > r > \frac{1}{2}$, the point U corresponding to

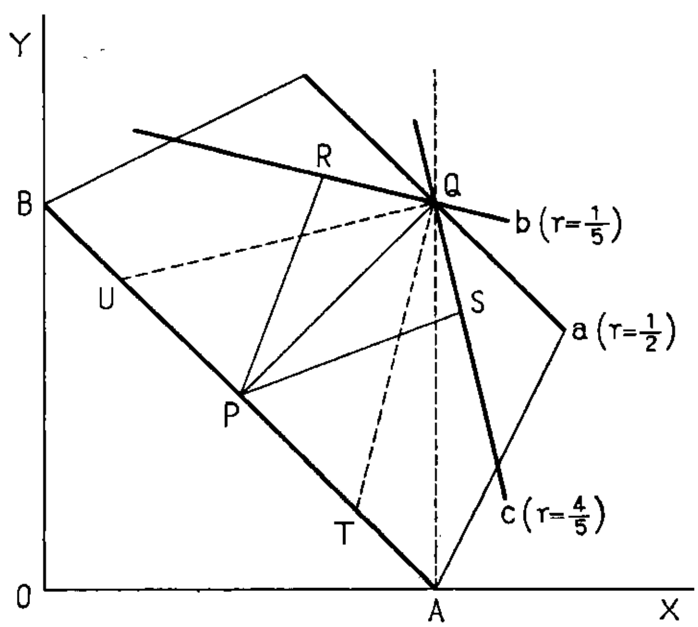

Diagram (20.1)

the critical point Q of the sales line (c) must generally satisfy the condition of $0<\lambda<\frac{1}{2}$. Of course, in this case the system expands even if $\lambda=\frac{1}{2}$. It is evident from the diagram (20.1) in which the point S on the sales line that corresponds to the point P with $\lambda=\frac{1}{2}$ is found on the right side of the critical point Q.

It the opposite case where $\frac{1}{2}>r>0$, that is, when each industry depends less upon the products of the Industry I in its production activity, the slope of the sales line (b) becomes gentle, and the point T on the expenditure line that corresponds to the critical point Q generally satisfies the condition of $1>\lambda>\frac{1}{2}$, hence a smaller number of those which we can select out of all values of λ or the expenditure coefficient of profits (as compared with the case when $r=\frac{1}{2}$) bring about the expansion of the said system. To put it in another way, the system cannot be expanded unless a considerable amount will be directed to the purchase of the products of the Industry I in the expending of profits. Needless to say, the system cannot help but contract when $\lambda=\frac{1}{2}$.

21) The following things may be suggested by the foregoing analysis. In a system where each constituent industry depends more upon the products of an industry with higher profits rate in its production activity, it can expand itself by directing a relatively small portion to the purchase of the products turned out by a high profits industry in the expending of profits. Further in this case, the system has generally a greater possibility of expansion. On the other hand, in a system where each industry depends more upon the products of an industry with lower profits rate, it does not expand itself unless a relatively large portion is directed to the purchase of the products turned out by a high profits industry in the expending of profits, hence the system has generally a small possibility of expansion, being always exposed to the danger of contraction.

Assuming that the investment goods industry is *a high profits industry*, the above may be expressed differently as follows. When the investment coefficient of each industry is relatively large, the system has some possibility to expand even at a comparatively low investment level. On the other hand, when the investment coefficient of each industry is relatively small, that is, when each industry depends more upon a consumption goods industry of low profits, the syetem has a small possibility of expansion, and cannot escape contraction unless a comparatively high level of investment is maintained. At any rate, it is suggestible that under the supposition of unequal profits rate, the way how profits are expended on the products of each industry will be a decisive factor affecting the determination of the dynamic course of the system under consideration.

So far we have assumed that the technical structure of production of each industry was equal, and have discussed an marginal case of unequal profits rate (that is to say, the profits rate of either industry is at zero). But to be more realistic, we must suppose a more general case where the production coefficient of one industry differs from that of the other industry, and the rate of profits is not equal between them. Also in the foregoing discussion, we have analysed a case of two industries or two groups of industries after the model of the *Tableau Economique.* But things such as these do not constitute vital defects to the system considered. The logic that we saw in that simple case does not differ in essence from those which we may find in a more complex case in which numerous industries are involved. Therefore, if we are successful in ascertaining the logic underlying the case of two industries at all, it is quite possible from a technical viewpoint to extend the application of the logic to a general case of multi-industries. Further it may be possible, too that some modification of the assumptions on which it is grounded, brings the system closer to the reality[1].

If our attempt at applying *Tableau Economique* in the foregoing analysis in Sections 17) through 21) has been successful in touching the essential features of the *Tableau Economique* to some degree, the characteristics of the ideas may be summarized as follows. In the first place, with a system under unequal returns rate condition in a given year, the total amount of expenditure of net returns and the direction of expenditure (how it will be apportioned to each industry) are the essential factors affecting the determination of the scale of the system in the said year. In the second place, the system can be rendered dynamic by introducing manifestly into the system the point that net returns which are the fund of the expenditure of the coming year are produced this year, and in the third place, the expenditure coefficient of net returns is again a decisive factor in determining the dynamic course of developmet of the system. Therefore, if we can ascertain by statistical

1) The result of our analysis in the chapters (IV) and (V) which concerned the problem of net products and the conditions precedent of the *Tableau Economique* is also applicable to the approach under consideration with little modification except that it requires a new consideration for the adjusting mechanism of money.

and experimental tests[2] the actual values of those important paremeters in such a system, a system such as this will certainly serve as a guiding-star for our long-range programming of economy. The *Tableau Economique* was devised as such. If we look into it carefully, the ideas of the *Tableau Economique* as we have seen bear some resemblance to the analysis of interindustrial relations or the Keynesian income analysis of today, but still we have to think that the *Tableau Economique* presents a type of its own which cannot be reduced to the same root.[3]

The *Tableau Economique* which was conceived just two hundred years ago had the makings suitable to accept that simple but bold ideas hidden within it, and the people who are ambitions to develop it in a strict manner and to apply it to today's economy can still derive a lesson from it.

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2) The experimental analysis in which Quesnay was engrossed in his early days seems to be very useful in measuring actual values of the parameters used in the *Tableau Economique* so that the *Tableau Economique* may serve as a guiding-star for his task of drawing up economic plans. Quesnay was assisted by Charles de Butré, an expert agricultural statistician with much practical knowledges in such work. (Cf. J. Hecht, *op. cit.*, p. 257)

3) The interpretation of the *Tableau Economique* by the aid of Leontief method of input-output analysis was attempted by A. Phillips (The Tableau Economique as a Simplified Leontief Model, *Quarterly Journal of Economics*, 1955, pp. 137–154). His analysis did not go much beyond the application of the input-output table to the *Tableau Economique* ("formule"). The interpretation of the *Tableau Economique* by dint of the theory of social accounting has been tried in an exhaustive manner in the following papers. J. Molinier, Le système de comptabilité nationale de F. Quesnay, *François Quesnay et la physiocratie*, tome I, 1958, pp. 75–104; Akiteru Kubota, A Development of Quesnay's *Tableau Economique*, *Keizai Kenkyu*, Vol. 9, No. 4, 1958, pp. 305–311.

Although Mr. Teruo Watanabe has taken a completely different approach from mine in grappling with the ideas proper to the *Tableau Economiqoe* ("Tableau fondamental"), it seems to me that his paper shown below is presenting the essential points most correctly. I feel the same way with him when he emphasizes repeatedly on the essential features of the *Tableau fondamental* that cannot dissolve themselves in the *formule*. (Teruo Watanabe, An Interpretation of the *Tableau Economique* ("Tableau fondamental"), *Tokyo Keizai Daigaku Kaishi*, No. 21, October 1958, pp. 1–61; The Ideas of the *Tableau Economique* ("Tableau fondamental"), *Keizai Kenkyu*, Vol. 9, No. 4, pp. 287–95, 1958). However, I cannot support one of his main issues where he rejected a logical construction of the *Tableau Economique* ("Tableau fondamental") in introducing the behind-the-scenes circulation (the internal transactions in our formulation). This paper itself will answer why. Of course I do not necessarily accept all the the views of Woog, Tateru Watanabe, and Taro Sakata as I have pointed out in some other footnotes in this paper.

Postscript

The main issues in this paper were reported as a report on the common theme "Quesnay as a Central Figure" in memory of the bicentenary of the publication of the *Tableau Economique* at the 18th convention of the Society of the History of Economics held in November 1958.

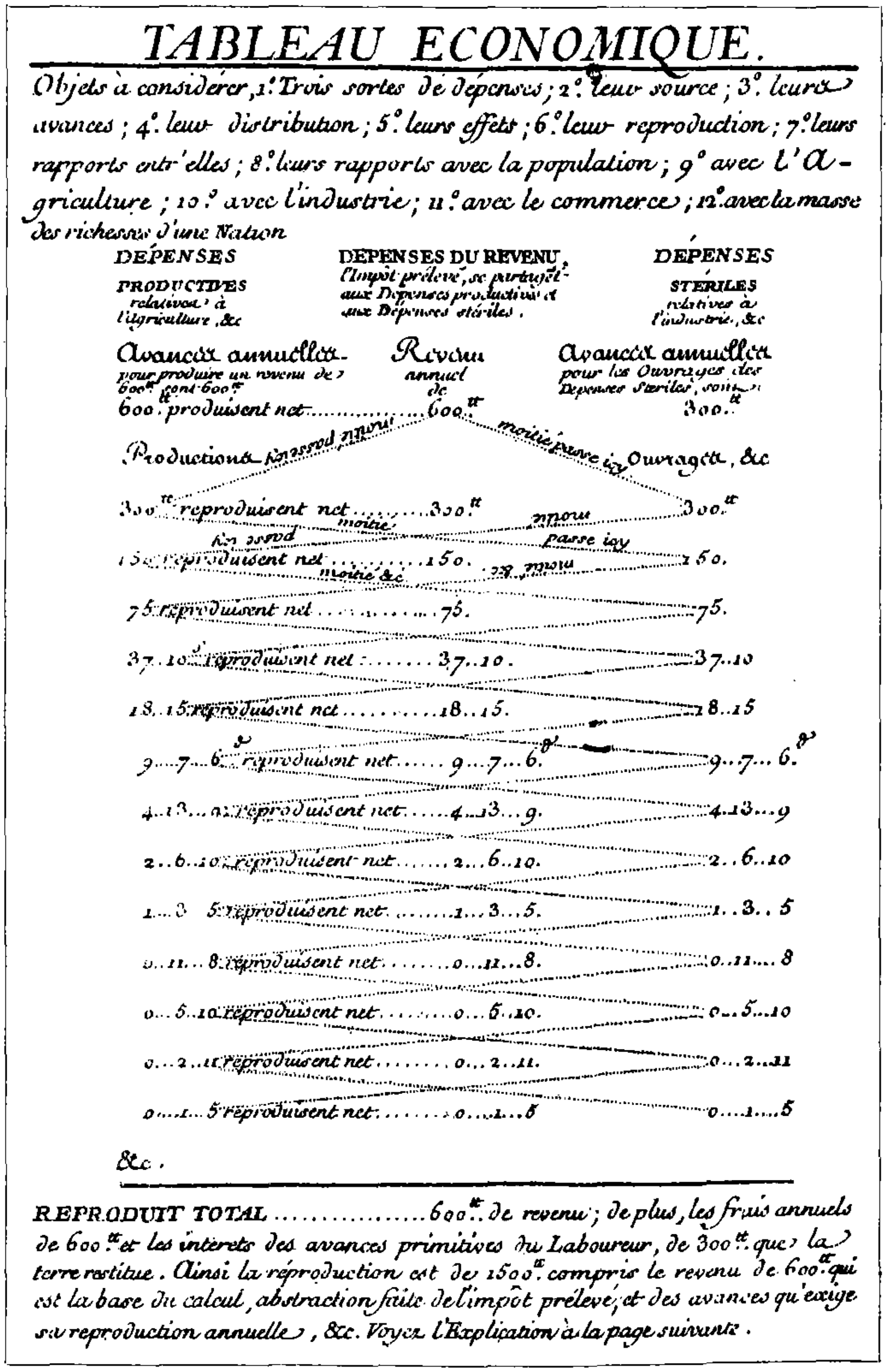

TABLEAU ECONOMIQUE.

Objets à considérer, 1.° Trois sortes de dépenses; 2.° leur source; 3.° leurs avances; 4.° leur distribution; 5.° leurs effets; 6.° leur reproduction; 7.° leurs rapports entr'elles; 8.° leurs rapports avec la population; 9.° avec l'Agriculture; 10.° avec l'industrie; 11.° avec le commerce; 12.° avec la masse des richesses d'une Nation.

DEPENSES PRODUCTIVES relatives à l'Agriculture, &c.	DEPENSES DU REVENU, l'Impôt prélevé, se partagent aux Dépenses productives et aux Dépenses stériles.	DEPENSES STERILES relatives à l'industrie, &c.
Avances annuelles pour produire un revenu de 600.tt sont 600.tt	Revenu annuel de	Avances annuelles pour les Ouvrages des Dépenses Stériles, sont
600. produisent net	600.tt	300.tt
Productions	moitié passe ici	Ouvrages, &c.
300.tt reproduisent net	300.tt	300.tt
150. reproduisent net	150.	150.
75. reproduisent net	75.	75.
37..10. reproduisent net	37..10.	37..10
18..15 reproduisent net	18..15.	18..15
9...7...6. reproduisent net	9...7...6.	9...7...6.
4..13...9. reproduisent net	4..13...9.	4..13...9
2..6..10. reproduisent net	2...6..10.	2..6..10
1...3...5. reproduisent net	1...3...5.	1..3..5
0..11...8. reproduisent net	0...11...8.	0..11...8
0...5..10. reproduisent net	0...5..10.	0...5...10
0...2..11. reproduisent net	0...2..11.	0...2..11
0...1...5 reproduisent net	0...1...5	0...1...5

&c.

REPRODUIT TOTAL .... 600.tt de revenu; de plus, les frais annuels de 600.tt et les intérêts des avances primitives du Laboureur, de 300.tt que la terre restitue. Ainsi la réproduction est de 1500.tt compris le revenu de 600.tt qui est la base du calcul, abstraction faite de l'impôt prélevé, et des avances qu'exige sa reproduction annuelle, &c. Voyez l'Explication à la page suivante.

Tableau économique (Second Edition), first printed in 1758 and reproduced in facsimile for the British Economic Association.