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History of Economic Theory (2)

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Chapter II Some Pioneers in Economic Theory

1. Locke's Microfoundation of Quantity Theory

John Locke (1632 - 1704) is a famous philosopher and political theorist who wrote An Essay Concerning Human Understanding (1689) and Two treatises of Government (1689). He made also, however, interesting contributions to economic theory. It is, therefore, not inappropriate to choose him as the first of individual scholars whose economic theory we reconsider in the light of the modern economic theory. Locke is to be followed by David Hume (in section 2) and Francois Quesnay (sections 3 and 4). After a brief sketch of the life and works of John Locke, in this section we shall try to construct a simple economic model which can show that John Locke's original theory of value in terms of the ratio of value and quantity of commodities does make sense, unlike its erroneous interpretation in terms of the ratio of demand and supply, so far as he used his theory of value to give a microeconomic foundation to his quantity theory of money, which is not necessarily identical to the classical quantity theory.

In 1632 John Locke was born in Somerset to a moderately well-off Puritan family of the minor gentry.¹⁾ As a result of his father's service to Cromwell's army, he was able to be educated in Westminster School, one of the best public schools in England. In 1652 John entered Christ Church, Oxford where he remained for fifteen years. He took the position of lecturer in Greek in 1660 and was elected censor of moral philosophy for Christ Church in 1663. He decided, however, to study medicine, since he was enthusiastically interested in Bacon's experimental method which was becoming more and more accepted in the study of medicine. Locke was influenced by Robert Boyle, the leader of the Oxford empiricists, and interested in the study of experimental philosophy which cumulated

later to his famous Essay Concerning Human Understanding.

In 1666, Anthony Ashley Cooper, later the first earl of Shaftesbury, visited Oxford and invited Locke to join his household in London as resident physician. Since Ashley was a politician interested in problems of trade, it is natural that Locke became also interested in economic problems with the result that he wrote a paper "Some of the Consequences that are like to follow upon lessening of Interest to 4 Percent," responding to parliamentary agitation concerning a proposal to lower the rate of interest. In 1672, Ashley became lord high chancellor of England and the first earl of Shaftesbury, and Locke became secretary of the Council of Trade and Plantations presided by Shaftesbury and a member of a charter company organized by Shaftesbury. Shaftesbury was dismissed from all offices for plotting against the king in 1674, and Locke returned to Oxford, and then went to France for three years. While Shaftesbury was involved in the abortive Monmouth Rebellion in 1679 to 1683, Locke was quietly living at Oxford, where he wrote Two Treatises of Government, justifying change of rulers who no longer protect the interests of their subjects. When Shaftesbury died in an exile to Holland in 1683, Locke felt threatened enough to go to Holland where he stayed for six years and completed his Essay Concerning Human Understanding.

Locke returned to England in 1689 after William of Orange deposed James II, and then quickly published An Essay Concerning Human Understanding and Two Treatises of Government. A bill was once again before Parliament to lower the rate of interest and Locke, revising his earlier paper on interest, published his Some Considerations of the Consequences of the Lowering of Interest and Raising the Value of Money in 1691. This was followed by his Further Considerations Concerning Raising the Value of Money in 1695. Although Locke was not so influential to Parliament in the

case of the former, he was more successful in the case of the latter. Locke retired to Oates in 1700 and died there in 1704.

John Locke's Some considerations (1691) was sub-titled as " In a Letter sent to a Member of Parliament " and was concerned with a current problem of economic policy which was being discussed in Parliament in early 1680's. He started, however, his discussions with a basic theory of value and founded his quantity theory of money on it. In his theory of value, Locke was concerned not with intrinsic but with marketable value. " The marketable value of any assigned quantities of two, or more commodities, are (pro hic et nunc) equal, when they will exchange one for another " (Locke [28], p. 43).

Such a market value or price is determined not by the ratio of, but by the equality of demand and supply. This is made clear by J. S. Mill who declared that " the idea of a ratio, as between demand and supply, is out of place, and has no concern in the matter : the proper mathematical analogy is that of an equation " (Mill [31], p. 448). This does not of course, deny the idea that the ratio or the proportion between demand and supply determines the direction of changes of the price. The extent of the required change in the price depends, however, not only on the ratio of the deficiency or excess of demand to supply, but also on elasticities of demand and supply with respect to price. After all, as Mill insisted, such a change in price is required that " the rise or the fall [of price induced by the difference in demand and supply] continues until the demand and supply are again equal to one another " (Mill [31], p. 448).

Although his statement that " the price of any commodity rises or falls, by the proportion of the number of buyers and sellers " (Locke [28], p. 30) may be interpreted that the price changes according to the

ratio of demand and supply,²⁾ it is not easy to interpret Locke's theory of the determination of the marketable value or price in terms of the traditional equilibrium theory of demand and supply, since it is given in terms of quantity and vent.

" That which regulates the price, i e., the quantity given for money (which is called buying and selling) for another commodity, (which is called bartering) is nothing else but their quantity in proportion to their vent " (Locke [28], pp. 35 - 36).

" He that will justly estimate the value of any thing, must consider its quantity in proportion to its vent, for this alone regulates the price. The value of anything, compared with itself or with a standing measure, is greater, as its quantity is less in proportion to its vent : but, in comparing it, or exchanging it with any other thing, the quantity and vent of that thing too must be allowed for, in the computation of their value " (Locke [28], p. 40).

" 4. The change of this marketable value of any commodity, in respect of another commodity, or in respect of a standing, common measure, is not the altering of any intrinsic value, or quality, in the commodity (for musty and amutty corn will sell dearer at one time than the clean and sweet at another) but the alternation of some proportion which that commodity bears to something else. 5. This proportion in all commodities, whereof money is one, is the proportion of their quantity to the vent " (Locke [28], p. 43).

While the quantity can be taken simply as the given supply, the vent is not identical to the usual concept of demand, since it is the realized sale which is defined by Locke as follows.

" The vent is nothing else but the passing of commodities from one owner to another in exchange ; and is then called quicker, when a greater

quantity of any species of commodity is taken off from the owners of it, in an equal space of time. 6. This vent is regulated, i.e., made quicker or slower, as greater or less quantities of any saleable commodity are removed out of the way and course of trade ; separated from public commerce ; and no longer lie within the reach of exchange " (Locke [28], p. 43).

As early as in 1705, however, John Law dared to interpret and reconstruct Locke s theory from the ordinary point of view of demand and supply in his Money And Trade Considered. " Mr. Locke sayes, The Value of Goods is according to their Quantity in Proportion to their Vent. The Vent of Goods cannot be greater than the Quantity, but the demand may be greater ---- So the Price of Goods are not according to the Quantity in Proportion to the Vent, but in Proportion to the Demand " (Law [26], p. 5). This interpretation was followed by many eminent scholars.³⁾ If we follow John Law to substitute demand for vent and reconstruct Locke's theory of value that price is determined by the ratio of demand and supply, however, it is clear that it does not make sense at all, as was already pointed out by Mill.

It is after more than two hundred and fifty years from John Law that Vaughn argued correctly that " Locke's price theory was not an early version of supply-and-demand analysis " and that " vent is not identical to the modern concept of demand " (Vaughn [40], pp. 25, 26). She insisted that " the term vent was particularly appropriate for the kind of price theory Locke was developing " (Vaughn[40], pp. 20 - 21), the purpose of which was to explain the determinants of the value of money. But the question which still remains is why the price is deter why the price is determined by the ratio of vent and quantity, or in modern terminology, the realized sale and the available supply. To

vindicate the original version of Locke's theory of value, in other words, we have to ask why the price of a commodity is higher when its rate of turnover is higher.

Let us construct a simple model of a stationary economy in which vent plays an essential role. Suppose two weeks are necessary for each individual supplier to sell out the stock of the newly acquired commodities, so that the vent in the current week is less than the quantity which can be offered, while demand and supply are equalized over two weeks.⁴⁾ The reason why vent is less than quantity is that the current market is imperfect in the sense that information is limited, search for buyers or sellers is necessary, and there exist buying and selling costs, with the result that the current sale cannot be increased without reducing the price.

An individual supplier having a stock S of newly acquired commodity to sell faces demand functions for the current and the next weeks, which are, respectively,

$$(1) \quad p_1 = a - b x_1$$

and

$$(2) \quad p_2 = q$$

and the storage cost function

$$(3) \quad C = c_1 + c_2 x_2 + c_3 x_2^2$$

where p_1 and p_2 are prices (in terms of numéraire or abstract unit of account⁵⁾) in the current and the next weeks, x_1 and x_2 are the quantity of demand in the current and the next weeks, and a , b , q , c_1 , c_2 and c_3 are positive constants. The supplier expects the perfect market with infinitely elastic demand curve in the next week, i.e., in the long run, where the long run normal price q prevails. Since demand and supply have to be equalized over two weeks,

$$(4) \quad x_1 + x_2 = 0$$

should be observed. In view of (1) - (2), the supplier will allocate his stock S to x_1 and x_2 so that his gain

$$(5) \quad (a - b x_1) x_1 + r [q x_2 - c_1 - c_2 x_2 - c_3 x_2^2]$$

is maximized, where r is a positive constant less than one, which signifies the time preference of the supplier.

Although Locke might know that the monopolist could drive up the price by restricting supply, he had no concept of an optimal price which would maximize the revenue (Vaughn [40], p. 59). Obviously, therefore, Locke would not have been able to state his problem in the form of the maximization of the gain. The maximization of the gain (5) is, however, an assumption which is logically consistent with the consequences he arrived by experience and intuition, i.e., the positive association of the current price of a commodity and the ratio of its vent and quantity.

The condition for the maximization of the gain (5) is, of course, the zero marginal gain with respect to x_1 , which is obtained through the elimination of x_2 in (5) by the use of (4) and the differentiation with respect to x_1 as

$$(6) \quad (a - r q + r c_2) - 2 (b + r c_3) x_1 + 2 r c_3 S = 0.$$

This can be solved for x_1 when S , q , a , b , c_2 , c_3 and r are given. According to Locke, the current price p_1 should be higher if the proportion of vent to quantity x_1/S is higher.

Let us first consider whether Locke is right, when the proportion x_1/S is changed through a change in quantity S . By differentiating (6) with respect to x_1 and S , we have

$$(7) \quad d x_1 / d S = r c_3 / (b + r c_3) > 0.$$

In words, the vent is increased if the quantity is increased. In view

of the demand function in the current week (1), this implies that the current price is reduced. On the other hand, in view of (6) and (7), we have

$$(8) \quad d(x_1/S) / dS = (rq - a - rc_2) / 2S^2(b + rc_3)$$

which is negative, if a is not much smaller than q . In this case, therefore, there can be the positive association between the price and the proportion of vent and quantity.

Suppose next that vent x_1 is increased through an increase in demand in the current week while quantity S remains unchanged. In view of (1), the current demand is increased either by increasing a or by decreasing b . By the differentiation of (6) with respect to x_1 and a , we have

$$(9) \quad dx_1 / da = 1 / (2b + 2rc_3) > 0.$$

By the differentiation of (1), on the other hand,

$$(10) \quad dp_1 / da = (b - 2rc_3) / (2b + 2rc_3) > 0.$$

Similarly, by the differentiation of (6) with respect to x_1 and b , we have

$$(11) \quad dx_1 / db = -x_1 / (b + rc_3) < 0.$$

By the differentiation of (1), furthermore,

$$(12) \quad dp_1 / db = -2rc_3 x_1 / (b + rc_3) < 0.$$

In this case, therefore, p_1 changes in the same direction as x_1 and there always exists the positive relation between the price of the commodity and the proportion between vent and quantity.

The vent of a commodity can be increased through an increase in the current demand, at least temporarily, when the quantity of money or its velocity is increased.⁶⁾ This argument can be justified by slightly generalizing the following discussion of Locke.

" The vent of any commodity comes to be increased, or decreased, as a greater part of the running cash of the nation is designed to be laid out, by several people at the same time, rather in that than another " (Locke [28], p. 31).

In any way, Locke is right, in the cases considered so far, to say that the price of commodity " compared with itself or with a standing measure " is higher if the ratio of vent to quantity is larger, since p_1 is given in terms of numéraire or abstract unit of account and q is given and unchanged. This does not imply, however, that he is always right. Suppose there is a change in parameters like q , c_2 , c_3 and r which have no relation to the current demand function (1). In view of (1), p_1 changes in the opposite direction to the change in x_1 induced by changes in such parameters. Since S is unchanged, there is a negative relation between the price and the ratio of vent and quantity.

We may vindicate Locke that his theory of value is constructed not as the general theory of value which is always right but as a theory particularly designed to give micro economic foundation to the quantity theory of money which explained the general price level. This is actually a view emphasized by Vaughn ([40], pp 31 - 32). If it is so, we have to be satisfied if Locke explained successfully the relation between the quantity of money and the general price level by applying his theory of the relation between the price and the ratio of vent to quantity. As we already noted, an increase in the quantity of money or its velocity induces increases of vent of other commodities, which raises the general price level through the increased turnover of commodities, since we can take money as numéraire.⁷⁾ To consider the relation between the general price level and the quantity of money more directly, we have also to examine the relation between vent of money,

since in the computation of the price of anything " in comparing it, or exchanging it with any other thing [money], the quantity and vent of that thing too must be allowed for."

" Hence it is that other commodities have sometimes a quicker, sometimes a slower vent : for nobody lays out his money in them, but according to the use he has of them, and that has bounds. But every body being ready to receive money without bounds, and keep it by him, because it answers all things : therefore the vent of money is always sufficient, or more than enough. This being so, its quantity alone is enough to regulate and determine its value, without considering any proportion between its quantity and vent, as in other commodities "

(Locke [28], p. 45).

Vaughn ([40], p. 37) regards this passage difficult to interpret, and actually many different scholars have interpreted it differently (Leigh [27]). From the point of view of our model given in the above however, the implication of this passage is clear and simple. Since the money commodity has an almost perfect market even in the current week, its vent is equalized with quantity.

Suppose in the above model that the commodity in question is money as a medium of exchange, S denotes the quantity of money to be spent, and p_1 is the marketable value or price of money commodity in terms of numéraire or abstract unit of account. Since the current market is almost perfect in the sense that \underline{b} is very small in (1), the marginal gain obtained from (5), i.e.,

$$(13) \quad (a - r q + r c_2) \quad 2 b x_1 + (2 r c_3 S - 2 r c_3 x_1)$$

is still positive when x_1 is equal to S . This is because the last term in (13) vanishes if $x_1 = S$, and the first term in (13) can be considered positive, as before. The maximization of the gain (5) is done at the

corner, since by definition $x_1 \leq S$. In words, the rate of turnover is highest in the case of money commodity. Provided that the marginal gain (13) remains positive, therefore, any increase in S induces the same increase in x_1 , and p_1 is reduced in view of (1).

Since its vent is always equal to its quantity, the value of money commodity in terms of numéraire or abstract unit of account is determined by its quantity alone. From the point of view of the general equilibrium theory, of course, the current demand for money (1) is not independent of the value (in terms of money) of vent of all the other commodities which are sold i.e., exchanged for money. Although this point is not explicitly taken care of in our partial equilibrium model, the demand for money (1) is not inconsistent with it, since x_1 is increased when S is increased and p_1 is reduced, i.e., the general price level is made higher, so that the value (in terms of money) of vent of all the other commodities are increased.⁸⁾ Furthermore, we might say that Locke recognized it when he said that " the natural value of money, ---, depends on the whole quantity of the then passing money of the kingdom, in proportion to the whole trade of the kingdom, i.e., the general vent of all the commodities " (Locke [28], p. 46). For the relative value of a commodity and money, on the other hand, we have to consider the ratio of vent to quantity of the commodity and quantity of money. " The natural value of money, in exchanging for any one commodity, is the quantity of the trading money of the kingdom designed for that commodity, in proportion to that single commodity and its vent " (Locke [28], p.46). This is right, so far as the price of the commodity in terms of numéraire or abstract unit of account changes in the same direction as the ratio of its vent and its quantity, since the price of money commodity in terms of numéraire or abstract unit of account is determined by its quantity.

Our interpretation that " the vent for money is always sufficient, or more than enough " so that it is always equalized to the quantity is, therefore, consistent with what Locke insisted in his Some Considerations, i.e., that it is not the rate of interest but the quantity of money which determines the value of money.

" For example half an ounce of silver in England will exchange sometimes for a whole bushel of wheat, sometimes for half, sometimes but a quarter, and this it does equally, whether by use it be apt to bring in to the owner six in the hundred of its own weight per annum, or nothing at all : it being only the change of the quantity of wheat to its vent, supposing we have still the same sum of money in the kingdom ; or else the change of the quantity of our money in the kingdom, supposing the quantity of wheat, in respect to its vent, be the same too, that makes the change in the price of wheat " (Locke[28], p. 40).

To make the argument in the passage just quoted, however, Locke based it on a seemingly different idea on the vent of money form that it is equal to quantity. i.e., that it is constant.

" Because the desire of money is constantly almost every where the same, its vent varies very little, but as its greater scarcity enhances its price, and increases the scramble : there being nothing else that does easily supply the want of it : the lessening its quantity, therefore, always increases its price, and makes an equal portion of it exchange for a greater of any other thing " (Locke [28], p. 40).

Vaughn ([40], pp. 37, 142 - 143) insisted to interpret Locke's argument that the demand for money is constant and rightly pointed out that then it is much the same way as Locke explained the price of the necessaries.

" There is nothing more confirmed, by daily experience, than that

men give any portion of money, for whatsoever is absolutely necessary, rather than go without it. And in such things, the scarcity of them alone makes their prices " (Locke [28], p. 31).

When the current demand x_1 is constant, the condition for the maximum gain is

$$(14) \quad P_1 - r q + r c_2 + 2 r c_3 (S - x_1) = 0,$$

since marginal gains in weeks have to be equalized. From (14), it is easily seen that the current price is higher when quantity is smaller.

Both Locke and Vaughn were right, therefore, to say that then vent or current demand is constant, quantity alone can determine the price. In the case of money commodity however, the assumption of the constant vent has an insurmountable difficulty, since from the point of view of the general equilibrium theory vent of money is related to the sum of value (in terms of money) of vent of all the other commodities so that a change in its price, i.e., the general price level, induced by a change in its quantity implies a change in its vent. The assumption of constant vent for money is, therefore, much less attractive than our interpretation that vent and quantity are equalized in the case of money. ⁹⁾

2. Hume and Specie-Flow Mechanism

David Hume (1711 - 1776) is a philosopher who succeeded John Locke in British tradition of empiricism. Intending his philosophy to serve as the center of all the moral sciences or of a general science of human experience, he wrote extensively on philosophy, political theory, economic problems, literature and history. After a brief description of the life and works of David Hume, this section is devoted to consider some recent interpretations of classical price-specie-flow mechanism which was first discussed by Hume.

Hume was born in Edinburgh in 1711, to a family of well-established country gentry. His father died when he was an infant. He entered the Greek class at the University of Edinburgh in 1723 but did not graduate. Hume tried to be a lawyer and a merchant, without any success. In 1735, he went to France where he wrote his Treatise of Human Nature, of which book I, Of the Understanding and Book II, Of the Passions appeared in 1739, and Book III, Of Morals, in 1740. To his great disappointment, however, the work was neither a financial nor a critical success. He fared better with his two volumes of Essays Moral and Political, which he published anonymously in 1741 and 1742. Back in Scotland, he made an unsuccessful bid for the chair of Ethics and Pneumatic Philosophy at the University of Edinburgh, which were followed by two appointments, tutor to the Marquess of Annandale and secretary to General St. Clair on missions abroad.

He returned to London in 1749, and was engaged in writing The Dialogues on Natural Religion (published after his death), Inquiry concerning the Principles of Morals (published in 1751) and the Political Discourses (published in 1752). Hume's economic writings consist of nine of twelve essays in the last work. In 1752, the Faculty

of Advocates in Edinburgh elected him their librarian, which gave him both the time and materials to write the History of England, a standard text which retained its authority until well into the nineteenth century. In 1763, Hume went to France as secretary to the ambassador, Lord Herford, and returned to London in 1766 with Rousseau, with whom Hume had later one of the most famous quarrels and reconciliations ever known between men of letters. In 1767, Hume undertook the duties of an Under-Secretary of State, but retired in 1769 to Edinburgh and resumed his friendship with other leading Scottish thinkers, including Adam Smith. In 1775, learning that his disease was mortal, Hume wrote My Own Life and died in 1776, just after the publication of Smith's Wealth of Nations.

The classical economists did not doubt that the arguments of their predecessors, the mercantilists, in favor of a chronic export surplus were based on an intellectual confusion. Even Thomas Mun, who realized that an inflow of bullion through export surplus raises domestic prices and turns the balance of trade against the country did not hesitate to advocate the indefinite accumulation of hard money (McCulloch[29], pp. 115 - 209). This is the so-called mercantilist dilemma. The classical refutation of the mercantilist principle is derived from the so-called Cantillon-Hume price-specie-flow mechanism.¹⁰⁾ By this mechanism an inflow of bullion raises domestic prices and selling dear and buying cheap tends to turn the balance of trade against the country. Purely automatic forces tend, therefore, to establish a natural distribution of specie between the trading countries of the world and such level of domestic prices that each country's value of exports equals that of imports.

The crux of the classical price-specie-flow mechanism is thus the change in prices caused by redistribution of specie due to the trade imbalance. The famous and concise statement in Hume's essay " Of the

Balance of Trade " runs as follows.

" Suppose four-fifths of all the money in Great Britain to be annihilated in one night and the nation reduced to the same conclusion, with regard to specie, as in the reigns of the Harrys and Edwards, what would be the consequence ? Must not the price of all labour and commodities sink in proportion, and everything be sold as cheap as they were in those ages ? What nation could then dispute with us in any foreign market, or pretend to navigate or to sell manufactures at the same price, which to us would afford sufficient profit ? In how little time, therefore, must this bring back the money which we had lost, and raise us to the level of all the neighbouring nations ? ----- Again, suppose that all the money of Great Britain were multiplied fivefold in a night, must not the contrary effect follow ? Must not all labour and commodities rise to such an exorbitant height, that no neighbouring nations could afford to buy from us, while their commodities, on the other hand, became comparatively so cheap, that, inspite of all the laws which could be formed, they would be run in upon us, and our money flow out, till we fall to a level with foreigners, and lose that great superiority of riches, which had laid us under such disadvantages ? " (Hume[22] pp. 62 - 63).

One might wonder why " the price of all the labour and commodities " rise in a country which gained money and sink in a country which lost money, since the same good has always the same gold price in different countries, if it is internationally traded in the absence of obstacles. Staley[39] rightly argued that what Hume had in mind is a model in which international trade takes place not continuously but discretely so that the same good can have different prices in different countries unless the international distribution of gold has already settled in equilibrium.

He based his interpretation on a letter of Hume to James Oswald.

" You allow, that if all the money in England were increased fourfold in one night, there would be a sudden rise of prices ; but then, say you, the importation of foreign commodities would soon lower the prices. Here, then, is the flowing out of the money already begun. But, say you, a small part of this stock of money would suffice to buy foreign commodities, and lower the prices. I grant it would for one year, till the imported commodities be consumed. But must not the same thing be renewed next year ? (Hume [22], p. 197).

In Hume's day, certainly arbitrage took much time to establish the law of indifference internationally. If international trade does not take place quickly and continuously, it is certain that price rises temporarily not only for the exportables and domestic goods but also for the importables in the gold-gaining country. There is no reason to assume that the adjustment process in international trade to establish uniform prices is much quicker than the process of specie-flow mechanism to achieve the balance of trade equilibrium. The traditional interpretation which follows Viner ([41], pp. 313 - 317) considers, however, that uniform gold prices always prevail for identical commodities in different countries. Since it is insisted as the interpretation of the classical specie-flow-mechanism in general, to consider it is worthwhile, as Staley [39] admitted, independently of one's view about the nature of the price changes envisioned by Hume. As the same price change is now assumed to occur in all countries at the same time, the price variations responsible for adjustment in the balance of trade are changes in terms of trade, i.e., the relative price of the exportables and the importables for countries. The price of the exportables must rise relative to that of the importables in the gold-gaining country, and vice versa, if the classical price-specie-flow mechanism works

successfully.

The modern literature on international transfer has made it clear, however, that the resultant changes in price can be in either direction, depending on international difference in demand patterns, and are not necessarily in the direction suggested by the classical price-specie-flow theory ; that is, the terms of trade rise in the surplus country and fall in the deficit country (Kemp [23] pp. 79 - 81). If, for example, two countries are identical in tastes which can be expressed by a homothetic social indifference map,¹¹⁾ the equilibrium prices are independent of the distribution of income between the two countries, including the distribution of specie. In this case, as is pointed out by Dornbusch, Fischer and Samuelson [11], there is no price effect associated with a redistribution of the world money supply and therefore no effects on real variables in the adjustment process for monetary disequilibrium, contrary to the classical price-specie-flow mechanism.

Let us construct a simplified version of the model used by Dornbusch, Fischer and Samuelson. For the sake of simplicity, we consider the case of two-good, two country model, in which each country completely specializes in the production of the exportables.¹²⁾ The production is of constant returns to scale with respect to the sole factor of production, called labor.¹³⁾ As for the demand side, let us assume that the level of aggregate expenditure of each country is proportional to the supply of money in the country¹⁴⁾ and that the ratio of expenditure on each good to the aggregate expenditure is a given constant.¹⁵⁾ The sum of supplies of money in two countries is assumed to be constant.

The condition for the equilibrium of demand and supply of labor in the home country is then

$$(1) \quad w L = a V (M/G) G + a^* V^* (1 - (M/G)) G$$

where L is the given supply of labor, w is the money rate of wage, a

is the given ratio of expenditure on the exportables of the home country
 V is the constant velocity of the circulation, M is the domestic money
supply, G is the given world money supply, variables and parameters
with(out) asterisk are those of foreign(home) country, and rate of
foreign exchange is assumed to be 1. Similarly, for the labor in the
foreign country, we have

$$(2) \quad w^* L^* = (1 - a) V (M/G) G + (1 - a^*) V^* (1 - (M/G)) G.$$

If the distribution of specie, M , is given, we can solve (1) and (2) for
 w and w^* . If two countries have identical taste, such that $a = a^*$ and
 $V = V^*$, furthermore, it is easily seen that equilibrium w and w^* are
independent of the distribution of specie.

The specie-flow mechanism is given as

$$(3) \quad \frac{dM}{dt} = wL - VM$$

where t denotes time ; the supply of money is increased as a result of a
trade surplus that is equal to the difference of income and absorption.
Since w remains unchanged when M changes, if two countries are identical
in tastes, it can be easily seen that the solution of (3) is stable and a
trade balance is eventually established. Since the price of each good
is completely determined by wage cost in our model, there is no price
effect of specie flow in this special case. Something must be done to
explain the changes in prices in the direction suggested by the classical
price-specie-flow theory.

Dornbusch, Fischer and Samuelson showed that even in this special
case the introduction of nontraded domestic goods revitalizes the classical
conclusion that in the adjustment process prices decline along with the
money stock in the deficit country while both rise in the surplus country.
Let us therefore introduce the nontraded goods in our model and assume
that the ratio of expenditure on nontraded goods in each country is

constant ; that is, $(1 - k)$. Nontraded goods and the exportables are produced in each country but there is still no import competing production. In view of identical taste, then, (1) and (2) are, respectively, modified into

$$(4) \quad wL = aVG + (1 - k)(M/G)VG$$

and

$$(5) \quad w^*L^* = (k - a)VG + (1 - (M/G))(1 - k)VG$$

from which equilibrium w and w^* are obtained if M is given.¹⁶⁾ Now

equilibrium wages are no longer independent of the distribution of specie. An increase in M increases w and reduces w^* . The prices of goods produced in a country change in the same direction as the supply of money in the country. Since we have from (4)

$$(6) \quad \frac{dw}{dM} = (1 - k)V/L$$

the right-hand side of (3) is decreasing with respect to M and therefore the price specie-flow mechanism is stable.

In view of the importance of nontraded goods, if not in the classical theory of international trade, but in the actual world of international trade, there is no doubt that the result of Dornbusch, Fischer and Samuelson is interesting as a vindication of the classical price-specie-flow theory. In one respect, however, their model of international trade is different from that of the classical economics. This is the role of the exporters and importers in international trade, which is an important role in the classical theory but one completely neglected in neoclassical theory on which the model of Dornbusch, Fischer and Samuelson is based. As will be shown, price changes in the direction suggested by the classical price-specie-flow theory even in the case of identical and homothetic tastes and no nontraded goods, if the role of exporters and importers is properly taken into consideration.

Classical economic theory's emphasis on the role of exporters and importers can be seen in Ricardo's chapter on foreign trade ([34], pp. 128 - 149) as well as in the following arguments of Adam Smith on the different employment of capitals.

" The capital of the wholesale merchant replaces, together with their profits, the capital of the farmers and manufactures of whom he purchases the rude and manufactured produces which he deals in, and thereby enables them to continue their respective trades. It is by this service chiefly that he contributes indirectly to support the productive labour of the society, and to increase the value of its annual produce. His capital employs too the sailors and carriers who transport his goods from one place to another, and it arguments the price of those goods by the vlue, not only of his profits, but of their wages " (Smith [37], pp. 362 - 363).

" The capital employed in purchasing foreign goods for home-consumption, when this purchase is made with the produce of domestic industry, replaces too, by every such operation, two distinct capital ; but one of them only is employed in supporting domestic industry. The capital which sends British goods to Portugal, and brings back Potuguese goods to Great Britain, replaces by every such operation only one British capital. The other is a Portugese one. Though the returns, therefore, of the foreign trade of consumption should be as quick as those of the home-trade, the capital employed in it will give but one-half the encouragement to the industry or productive labour of the country " (Smith [37], p. 368).

Let us first note that a role exists for exporters and importers even if the cost of transport is ignored. This role is to replace the capital of the producers. The role is clearly related to the time

structure of the classical theory of production ; that is, production requires time and the wage cost must be advanced by capitalists until the product is sold to the final consumers. There is, therefore, no room for this role of exporters and importers in the neoclassical theory of international trade, which is based on either a theory of timeless or instantaneous production or the assumption that there is no need to advance wage cost (Eagly [14], pp. 3 - 9).

In the neoclassical theory of international trade, it is assumed that domestic consumers can buy directly from foreign producers in the foreign market. This assumption may not be so unrealistic in international trade among countries, like European ones, located close to one another and socially and culturally very similar. In international trade between countries far away and dissimilar, say the United States and Japan, however, the role of consumers is very limited and international trade is carried out almost exclusively in the hands of specialists called exporters and importers. Domestic consumers buy the importables in domestic markets from foreign exporters or domestic importers, because consumers have neither enough information nor suitable credit to buy directly from foreign producers, cannot finance transportation cost individually, and are not well accustomed to do foreign exchange business.

Our model, which is supposed to be that of classical economics, therefore, remains that of neoclassical economics unless the role of exporters and importers is explicitly incorporated. In view of the fact that the role of exporters and importers in the classical economics is derived from the time structure of the classical theory of production, to replace the capital of producers advanced, we have to consider that conditions (1) and (2) or (4) and (5) are, in classical economics, not so much the conditions for equilibrium of demand and supply of labor

service in the neoclassical sense as the conditions for equilibrium of demand and supply of advanced funds to support labor in the period of production. In other words, w and w^* represent the average prices of the final products resulted, after the period of production, from the input of a unit of labor, which include wages as well as profits.

Let us assume away the nontraded goods, and instead take the role of exporters and importers into consideration. Suppose that domestic importers share $100(1 - s)$ percent of the cost to be advanced by foreign producers by replacing the latter's capital earlier than the products are sold to the final consumers, and similarly foreign importers share $100(1 - r)$ percent of the cost to be advanced by domestic producers. In other words, producers sell their products to importers $100(1 - s)$ percent or $100(1 - r)$ percent cheaper than they do directly to final consumers, since their capital is replaced earlier. Conditions

(1) and (2) are now modified, in the case of identical taste, into

$$(7) \quad wL = aMV + aM^*Vr + (1 - a)MV(1 - s)$$

and

$$(8) \quad w^*L^* = (L - a)M^*V + (1 - a)MV s + aM^*V(1 - r)$$

where $M + M^* = G$ and r and s are positive constants less than 1. The last term of the right-hand side may be considered as the demand for the service of importers, while w and w^* represent the average prices of the products or services resulted from the input of a unit of labor.

Alternatively, the last term of the right-hand side may be considered as a part of demand for the importables i.e., the demand for the service of capital of importers, while w and w^* represent the average prices of the products of capital advanced to support a unit of labor.

The equilibrium values of w and w^* are obtained from (7) and (8) if M and M^* are given. An increase in M coupled with a decrease in M^*

so as to keep G unchanged clearly increases w and decreases w^* . Since w and w^* are prices paid by consumers, the specie-flow changes prices in the direction suggested by classical theory even in the case of identical taste, if the role of exporters and importers is properly taken into consideration. The stability of (3) is also easy to show.

Now our interpretation of classical price-specie-flow mechanism is located in a sense between that of Statey's disequilibrium interpretation of Mume's theory and that of Viner's equilibrium interpretation. As in the Hume-Statey model, the consumers' price of the same commodity may be different in different countries. Consumers in a money gaining country have to pay higher price for their importables than consumers of the country from which they are imported, and consumers in a money losing country pay lower price for their importables than domestic consumers of the uniform gold price of the same commodity prevails in different countries, in the sense that producers sell their products at the same price to foreign importers and domestic merchants at the same time. The terms of trade in terms of prices importers pay to producers of exporting country will change favorably for money losing country and unfavorably for money gaining country.

3. Quesnay's Tableau Économique

1. Francois Quesnay (1694 - 1774) is the founder of the physiocratic school, who influenced greatly Adam Smith and Karl Marx. The purpose of the present and the following sections is to consider his Tableau Économique from the point of view of modern economic theory. Before to give a sketch of Quesnay's life and works in this subsection, however, we describe briefly those of Richard Cantillon (1697 - 1734), since Quesnay was much influenced by Cantillon (Cantillon [8], pp. 353 - 355, Meek [30], pp. 266 - 269). The rest of this section is devoted to discuss the nature of the economy described by Tableau Économique by the use of linear economic models. In subsection 3.2, the state of economy described by the so-called Formula of Tableau is derived as an optimal solution of a linear programming model which is based on Marx's interpretation. The subsection 3.3 is devoted to review Barba [3]'s mathematical model of economic development which ends up at the economy described by Tableau. Section 4 is a critical study of Eltis ([16], [17]'s analysis of Tableau Économique, not only the Formule but also the original table, which follows Meek's interpretation.

Richard Cantillon was born in Ireland in 1697, was active as a banker in Paris until 1720, and murdered in London in 1734. Based on his rich business experience, Cantillon wrote much, but the only remaining is the famous Essai sur la nature du commerce en général (1755). Essai was written first in English and translated into French. It was circulated in manuscript form before it was finally published in 1775. Essai is famous not only for Cantillon's theory along with that of David Hume, or price-specie-flow mechanism, but also for its undeniable influence on Physiocrats, particularly Quesnay.

In the beginning paragraph, it insists that The Land is the Source

or Matter from whence all Wealth is produced. The Labour of man is the Form which produces it " and its Chapter 12, Part one is entitled as " All Classes and Individuals in a State subsist or are enriched at the Expense of the Proprietors of Land." What is more important than these statements of physiocratic flavor is, however, the land theory of value, by which Cantillon reduced the pluralism of Petty (" Labour is the father of wealth, as lands are the mother ") to the monism of land.

" The labour of an adult Slave of the lowest class is worth at least as much as the quantity of Land which the Proprietor is obliged to allot for his food and necessaries and also to double the Land which serves to breed a Child up till he is of age fit for labour, seeing half the children that are born die before the age of 17, according to the calculations and observations of the celebrated Dr. Halley " (Cantillon [8], p. 33).

While wealth is produced from land and labor, labor is merely an intermediate product which is reproduced from the consumption of products of land and labor. Land is the only one primary factor of production. The value of products can be expressed, therefore, by the quantities of land which are necessary, directly or indirectly (through labor) in their production. The significance of this land theory of value was emphasized by Schumpeter and was used by Samuelson in his criticism of Ricardo who, unlike Cantillon, eliminates land in his labor theory of value.¹⁷⁾

The significance of Cantillon's Essai is not limited to its theory of specie-flow, influence on Physiocrats, and land theory of value. For example, we can find an embryo form of modern theory of rate of interest and risk premium. In view of the fact that James Steuart's Principles of Political Oeconomy was published in 1767, Cantillon's Essai is actually

the first systematic treatise on economic science in our history.

Francois Quesnay was born in 1694 at Méré in the suburb of Paris. After receiving his surgical training at Paris, he began practicing in 1718 at Mantes. At that time a method of treatment called phlebotomy, or blood-letting, had come into vogue as a result of Harvey's discovery of the circulation of the blood. In 1730 Quesnay exploded by experiment using a hydro apparatus the blood circulation theory of Jean Baptiste Silvia, one of the most famous physicians of the day, and was elected by surgeons to lead their struggle for equality with the physicians. Because of failing eyesight and rheumatism in the hands, however, Quesnay was forced to become a physician. It was far from disappointing to him, for he was appointed as physician to Madame Pompadour and also to Louis XV. He died at Versailles in 1774.

Although his concern with social problems can be seen already in the second edition (1747) of Essai physique sur l'economie animale, Quesnay wrote nothing on economics until the age of sixty. In 1756 he contributed Fermiers to Grande Encyclopédie of Diderot and d'Alembert, in which he compared large-scale agriculture in England and traditional agriculture in France and insisted to introduce the former into France. Another contribution to Encyclopédie was Granis (1757) in which the term produit net first appeared. He also prepared, but never published, Hommes which discussed population problems and impôt which insisted that only the net revenue from land should be taxed. In 1758, the first edition of Tableau Économique appeared and Mirabeau called it one of the three greatest inventions in the human history, along with those of letters and money. Since the original Tableau is too complicated to be understood easily, however, Quesnay simplified it into Formule du Tableau Économique in 1766.¹⁸⁾

Although the controversy between Silvia and Quesnay was a detour from the point of view of the development process from Harvey to the modern medicine, and Quesnay had a false conception of the circulation of blood, it is interesting to see the relation between his concept of blood circulation and Tableau Économique.¹⁹⁾ Tableau portrays the circulation of money and goods during the course of a year. As the year begins, the money of the society is collected in the hands of landowners as the land rents in the previous year and they divide their funds into two portions, one being spent to buy manufactured goods in the city, and the other going to their tenants to finance the year's crops. These two recipient classes are represented by columns as the right- and left-hand sides of Tableau, and subdivide the funds received from landowners, spending half within its own class and sending half to the class represented by the opposite column. Similarity between Tableau and Quesnay's concept of blood circulation lies in the fact that they both begin with an initial division of the circulating medium into two separate and equal flows. The blood leaves the heart and goes equally to the upper and lower parts of the body (ignoring the pulmonary loop), and thence into the subdivisions and sub-subdivisions of the lesser arteries, just as currency goes from landowners in equal amounts to the agriculture and manufacture, and is redivided in the same repeating pattern as each recipient of funds splits his income evenly between his own and opposite classes in Tableau.

Like many other medical men of his time, furthermore, Quesnay believed that the arteries possessed the power of contraction and hence played an active role in forcing the blood through the system, while the veins carry the blood in a merely passive fashion. We can see, therefore, another similarity between Quesnay's concept of blood circulation and

Tableau. Quesnay considered that the rural agriculture class is productive while the urban manufacture class is sterile. The sterile class does not add any value to the flows which pass through their hands and they serve merely as a passive conduit for money and goods, just as the veins make no changes in the impetus of the blood flows which traverse their interiors. Only in the agriculture, owing to Nature's bounty, produit net can be added to the economy just as only in the arterial columns of the vascular system does the contractive power of the tube walls actively argument the force and flow of the blood. Finally, just as the heart is the indispensable center o indispensable center of the entire network, far outweighing the arteries as a source of motion, so the landowners are the heart of the economy, because their division of funds between the sterile and productive classes determines the health of the economy.

2. Quesnay's Tableau Économique is the first complete description of economic circulation, in which he considered a country where the agriculture is developed mostly, commercial competition prevails and the ownership of private capital in agriculture is guranteed The essence of Tableau Éconcmique can best be seen in its simplified or final version, i.e., Formule du Tableau Economique, reproduced here somewhat modified as table 1.²⁰⁾ This is a sort of resumé of Quesnay's various studies of economic problems, which is, however, so simplified that it is very difficult to interprete it and that there have been many different interpretations of it. It is well known that Karl Marx evaluated the significance of Formule very high. Actually, his reproduction scheme is a developed version of his own Tableau Économique. Marx's interpretation of Quesnay's Tableau Économique can be seen in Engels's Herrn Eugen Dührings Umwälzung der Wissenschaft (1878).

Agriculture's
annual advances

Landowners'
revenue

Manufacture's
annual advances

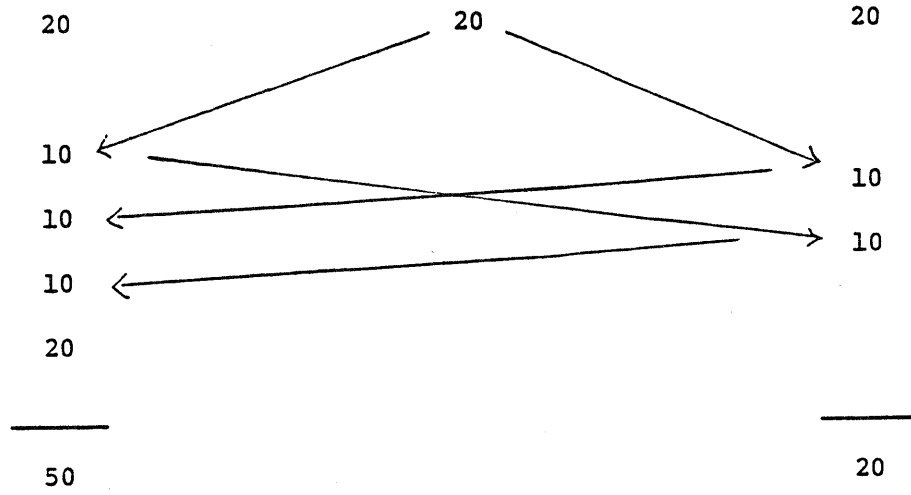


Table 1

According to Marx (Engels [18], p. 234), as is seen in table 1, agricultural sector produces annually 50 units of output from the input of 20 agricultural products as annual advances (working capital) and 100 manufactured products as original advances (fixed capital) of which 10 units depreciated annually, and pays 20 to landowners as rent.²¹⁾

Out of this 20 rent, landowners spend 10 for agricultural products and 10 for manufactured products. Manufacturing sector produces 20 output from the input of 20 agricultural products as annual advances.²²⁾ In the table, it is assumed that the agricultural sector has initially 20 units of money which are paid to landowners as rent. Landowners spend them to buy 10 agricultural products and 10 manufactured products. With 10 units of money received from landowners, the manufacturing sector buys 10 agricultural products so as to replace the first half of annual advances while the agricultural sector buys 10 manufactured products by the money received from landowners so as to replace the depreciated part of the original advances. Finally, the manufacturing sector buys 10 agricultural products so as to replace the second half of the annual advances by the money received from the agricultural sector. Unsold 20 agricultural products replace the annual advances of the agricultural sector. Since the agricultural sector regains 20 money and all the advances are properly replaced, the same process can be repeated in the next period.²³⁾

Tableau Économique describes the stationary state of an economy where rent is explicitly introduced while wage is implicitly considered as a part of annual advances. There is, however, no place for profit. Some Marxian economists seem to explain this absence of profit by the fact that in the days of Quesnay, i.e., those of ancien regime, the capitalism was not well developed so as to allow the existence of profit.²⁴⁾

This might be true in view of the French social structure in the days of Quesnay, where fundamentalistic production relation and landownership prevails, with small manufactures based on primitive hired labor. It should be noted, however, that Tableau Economique is not a positive model of French economy as it was in the days of Quesnay, since Quesnay's intention was to describe an ideal state of the economy. Some non-Marxian economists seem, on the other hand, to explain zero profit by the condition of a long-run competitive equilibrium in which price is just equal to average total cost of production.²⁵⁾

Tableau Économique can be converted into a closed Leontief table, as was done by Blaug and reproduced here as table 2.²⁶⁾ Landowners are considered as sector 2 to produce productive service of land by consuming agricultural products of sector 1 and manufactured products of sector 3. Although we can mechanically compute input-output coefficients a_{ij} , i.e., the i -th sector's product used as input to produce a unit of the j -th sector's output, we have to be careful since different a_{ij} has different stability. Coefficients a_{11} , a_{12} , a_{32} and a_{13} may be stable as technological and consumption coefficients (or products of them). The coefficient a_{21} will, however, change as the rate of rent, i.e., the scarcity of land is changed. The coefficient a_{31} is, furthermore, meaningless, unless the fixed capital is properly accumulated. The mechanical application of Leontief analysis is, therefore of questionable significance.²⁷⁾

As an application of linear economic analysis on Quesnay's Tableau Économique, what is more interesting is to consider the following linear programming problem, which will explain why there is no profit. Still considering three sectors as in table 2, let us consider the maximization of the level of surplus of the economy, defined as $t = \min (c_1, c_2)$,

Producing Sector	Purshasing Sector			Annual Output
	1	2	3	
1 Agriculture	20	10	20	50
2 Landowners	20	0	0	20
3 Manufacture	10	10	0	20
Total Purchases	50	20	20	90

Table 2

where c_i denotes the net output (produit net) of the economy in terms of the product of the sector i . Consider the maximization of t , being subject to following conditions.

- (1) $X_1 \leq L$
- (2) $2 X_1 \leq F$
- (3) $0.4 X_1 \leq K_1$
- (4) $c_1 + K_1 + K_3 \leq X_1$
- (5) $X_3 \leq K_3$
- (6) $c_3 + 0.1 F \leq X_3$

where L denotes the total available amount of land, F denotes the fixed capital of the sector 1, i.e., the agriculture, X_i denotes the output of the sector i , and K_i denotes the working capital of the sector i available initially and to be reproduced. It is assumed in (1) that the input coefficient of land in the sector 1 is unity, while other coefficients are as shown in table 1. Conditions (1) to (4) are concerned with agriculture, restrictions of land, fixed capital, and working capital, and the equilibrium condition of demand and supply of agricultural products. Similarly, conditions (5) and (6) are concerned with manufacturing sector, the restriction of working capital and the equilibrium of demand and supply of manufactured products.

Let us denote the Lagrangean multipliers corresponding to conditions (1) to (6), respectively, by r , p , w_1 , p_1 , w_3 and p_3 . In view of (4) and (6), we can safely consider that $t = c_1 = c_3$ in the maximizing problem. If t is maximized with respect to X_i , K_i , F and t , then, we have

$$(7) \quad -r - 2p - 0.4w_1 + p_1 = 0$$

$$(8) \quad p_1 = p_3 = w_1 = w_3$$

$$(9) \quad p - 0.1 p_3 = 0$$

and

$$(10) \quad 1 - p_1 - p_3 = 0,$$

from the conditions for the maximization, assuming non-zero values for the maximizing variables. It can be easily seen that Tableau Économique describes this maximized situation. From (7) to (10) and the dual theorem of linear programming, we have

$$(11) \quad t = r L = 0.4 p_1 X_1$$

which implies that the surplus or the rent to be paid to landowners is 2/5 of the value of output of the sector 1, i.e., the agriculture, since Lagrangean multipliers can be interpreted as the competitive prices which indicate the scarcity of the corresponding goods or factors of production.

Suppose F is fixed at the level lower than the optimal one. From (9) we have $p > 0.1 p_3$, which implies that positive profit (net of depreciation) is to be imputed to fixed capital in competitive situation, since p denotes the gross value imputed to a unit of fixed capital and $0.1 p_3$ denotes the value of the depreciation of a unit of such capital. Similar considerations can also be made with respect to annual advances.²⁸⁾ In other words, there is no profit in Tableau Économique because the capital is fully accumulated to the optimal level so that there is no scarcity or net productivity of capital.²⁹⁾ In this case, of course, it is to be understood that normal profit necessary to keep the supply unchanged is included in the cost of production.

3. Quesnay's Tableau Économique is not a positive model of French economy as it was in the 1750 s, but a normative model of utopia which describes French economy as it could have been if proper economic policies had been adopted. The situation described by it is optimal, however, not only with respect to the level of capital accumulation as was considered

in the above, but also with respect to the modernisation of agricultural sector as was emphasized by Barna [3].³⁰⁾ In the 1750's France was an underdeveloped country which lacked the advance in agriculture seen in large-scale agriculture in England except in the north-west except in the north-west, the region nearest to England. Quesnay believed that the solution of the French economic problem was to replace her traditional agriculture by agriculture à l'Anglais, which requires capital accumulation. To create profit so as to accumulate capital, he suggested to the promotion of free trade and tax reform.

Barna [3] considered a mathematical model of economic development which ends up at the optimal situation described by Tableau Économique when enough capital is accumulated and traditional agriculture is totally replaced by modern agriculture. Unlike Marx, Barna insisted that a significant feature of all Quesnaian models is that agriculture does not use manufactured products as original as well as annual advances.³¹⁾ The outstanding feature of Barna's model is that there are two distinct agricultural productive activities which are called the traditional and the modern. These two linear activities produces same output from different inputs. Let a_1 and a_2 be input coefficients (amount of input necessary to produce a unit of output) of land in traditional and modern agricultures and similarly k_1 and k_2 be input coefficients of capital in two agricultures. Capital consists of the stock of agricultural products and embraces both fixed and working capitals. It is assumed that $a_2 < a_1$, $k_2/a_2 > k_1/a_1$ and $s_2/a_2 > s_1/a_1$ where s_1 and s_2 are surplus coefficients (in terms of agricultural products) of traditional and modern agricultures.

Let A^* be the maximum area of land available for agriculture. Since $k_2/a_2 > k_1/a_1$, the maximum amount of the capital stock that the

economic system can use is $K^* = A^* k_2/a_2$ which corresponds to the situation where all available land is in the modern sector. Since $a_2 < a_1$ and $s_2/a_2 > s_1/a_1$, the maximum agricultural output X^* and the maximum surplus S^* are reached in the same situation, which is to be described by Tableau Économique.

Let, on the other hand, K_0 be the capital stock used when all land A^* is in the traditional sector, i.e., $K_0 = A^* k_1/a_1$. The corresponding agricultural output and surplus are, respectively, denoted by X_0 and S_0 . If the available amount of capital stock K is between K_0 and K^* , i.e., $K_0 \leq K \leq K^*$, then Barna argues that K determines the proportion of land in the modern sector m as $(K - K_0)/(K^* - K_0)$. The corresponding agricultural output X and surplus S are then $m(X - X_0) + X_0$ and $m(S^* - S_0) + S_0$, respectively. As capital accumulates from K_0 to K^* , traditional agriculture is gradually replaced by modern agriculture and X and S increase from X_0 and S_0 to X^* and S^* .

Suppose $K = K_0$ initially and that favourable policies like free trade and/or tax reform are introduced. Being based on a part of Mirabeau's Philosophie Rurale, which is due to Quesnay,³²⁾ Barna considered that land is leased to capitalist farmers at the rents fixed for the period of the lease. During that period, therefore, farmers can make profits which they reinvest, though at the end of the period competition among farmers pushes up rents until the whole surplus is again absorbed in rent. Since $s_2/a_2 > s_1/a_1$ farmers can make a temporal profit which they reinvest, so that capital is further increased.

Let us note, firstly, that in this Quesnay-Barna process of development there is no profit except temporality even if capital is scarce, i.e., its net productivity is positive. This implies that the land market is not competitive even though capitalists are competitive and that landowners

are differentiating monopolists who absorb all the surplus as rent. In other words, a farmer cannot sublease land and he cannot change the quantity of land to be leased, let alone the rate of rent. Since there is no surplus in manufacturing sector even if capital is scarce, he has no incentive to shift his capital out of agriculture. We might say that these points are reflecting some aspects of the feudalistic economy with very primitive manufactures.

Secondly, Barna's assumption that traditional agriculture always exists and all the land A^* is used for K smaller than K^* may imply the inefficiency not only from the point of view of total surplus but also from the point of view of individual farmers. Since $s_2/a_2 > s_1/a_1$, the surplus is maximized for any given K if all the land is transferred from the traditional sector to modern sector and is used in modern sector as far as capital permits, i.e., $K a_2/k_2$ land is used in modern sector and the rest of the land is left unused when $s_2/k_2 > s_1/k_1$.³³⁾ In figure 1, the output of traditional sector is measured horizontally, while that of modern sector, vertically. The line AB is the land constraint and the line CE is the capital constraint. If equi-surplus lines are as dotted lines, i.e., $s_2/k_2 > s_1/k_1$, it is clear that not the point D but the point C is optimal. In terms of mathematical programming, the disposal process of land rather than traditional agriculture process should be used with modern agriculture process.

From individual farmers' point of view, furthermore, it is always profitable to transfer land and capital from traditional sector to modern sector, since a temporal profit is accrued to farmers. Even if the fixed capital is not transferred, depreciation allowance obtained in traditional sector with corresponding working capital should not be reinvested in the same sector but should be transferred to modern sector.

Modern Agriculture

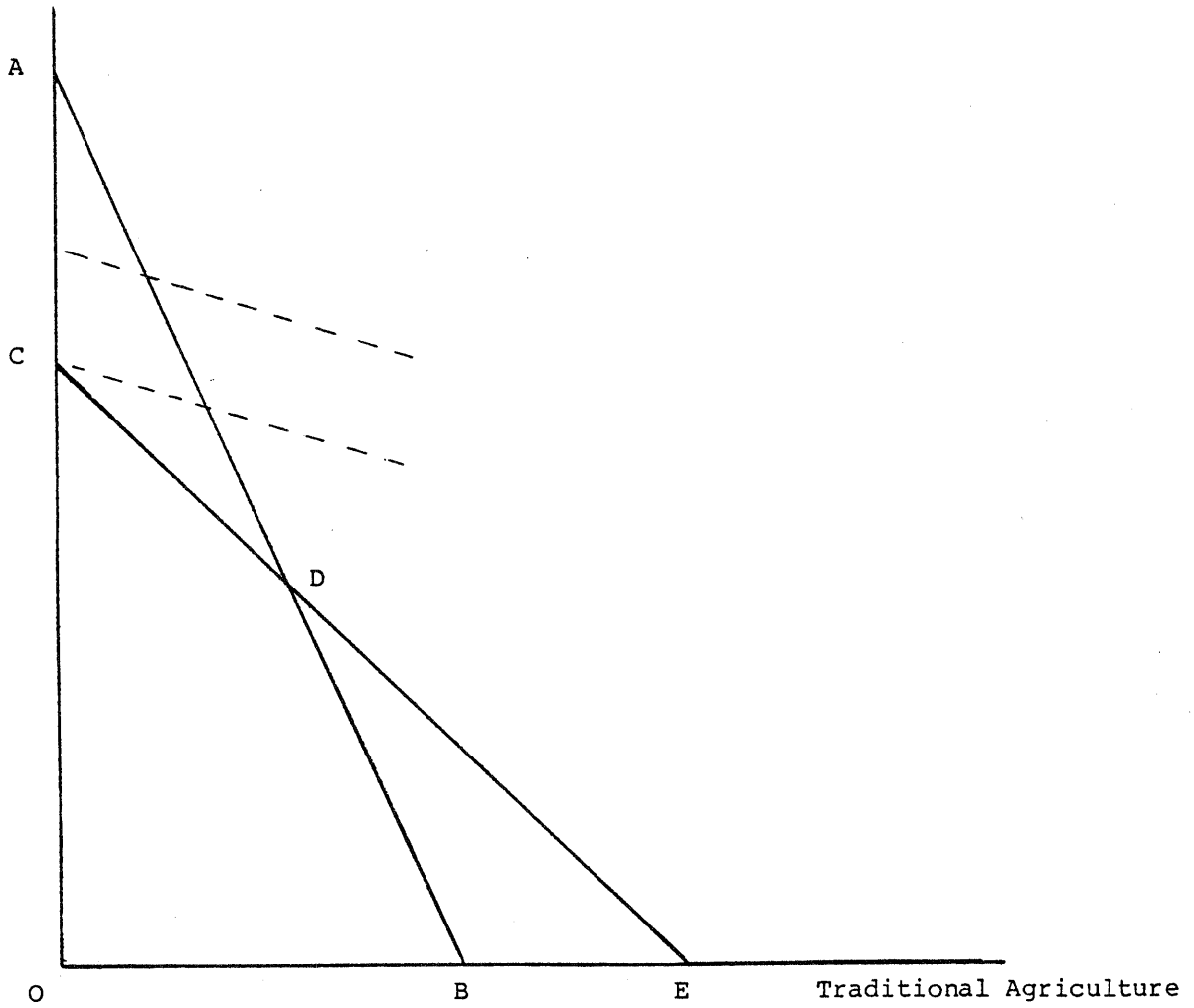


Figure 1

2

1

Then, traditional sector eventually disappears, possibly before the accumulation of capital to K^* , even if there is no initial profit created by favourable policies. We have, therefore, to consider, as Barna seems to do that it takes time for traditional farmers to know and to apply the modern techniques, with the result that traditional sector does not disappear in Barna's model.³⁴⁾

There is another possible explanation of this point, if we follow Marx as in the previous subsection and assume that fixed capital in agriculture is the stock of manufactured products which is used only in modern sector but is not used in traditional sector, while working capital is the stock of agricultural products. In figure 1, the line CE now represents working capital constraint and there is an additional constraint of fixed capital which is a horizontal line passing point D. The economy remains at point D unless profit is created by policies. Even if there exists such profit to be invested, furthermore, the rate of expansion of modern sector is limited by capacity of manufacturing sector, the expansion of which is limited in turn by the existing amount of fixed capital stock of manufactured products invested in the manufacturing sector. The traditional sector does not disappear suddenly or before the capital is fully accumulated, though there appear some unused lands, the existence of which, as emphasized by Eltis [16], Quesnay was well aware of. When the agriculture is completely modernized, we arrive at the situation which corresponds to the one described by Tableau Économique, as interpreted by Marx. with agriculture using fixed capital stock of manufactured products.

Barna [2] is right to argue that there is not a very large amount of input of manufactured products into agriculture, if they are considered as implements originating outside agriculture. Apart from the problem

of what Quesnay really meant, however, Marx's interpretation that the fixed capital of agriculture consists entirely of the manufactured products may be defended purely logically, since in Tableau Économique agriculture is to be defined not as agriculture in general but as a sector, only which can yield surplus in the form of rent, i.e., the most productive sector, represented by grain farming with most efficient horse-drawn-plough technique, and all other unproductive activities which may include cattle breeding are to be called manufactures.

4. Expenditure Patterns in Tableau Économique

Marx's interpretation of the simplified form or the final version of Quesnay's Tableau Économique was, as we saw in the previous section, based on suppositions that landowners spend half their rent income on agricultural and half on manufactured products while laborers both in agriculture and manufacture spend their whole wage income on food, i.e., agricultural products, and that the fixed capital, i.e., the original advances, of agriculture, i.e., the productive sector, consists entirely of the products of manufacture, i.e., the unproductive sector. This interpretation suffers from a weakness that the supposition of different expenditure patterns between landowners and laborers is not consistent with Quesnay's assumption of the identical expenditure pattern of all the classes in his original Tableau with zigzags, i.e., Tableau Fondamental.

The modern interpretation, which was developed by Meek [30] and followed with Barna [2], [3], and Eltis [16], [17] insists, on the other hand, that all the problems and apparent inconsistencies in the interpretations of Quesnay's Tableau Économique are solved when Quesnay's published works including some parts of Mirabeau L'Ami des homes and Philosophie rurale are read as a whole. According to this new interpretation, the fixed capital of agriculture is consist entirely of the agricultural products, mainly horses and other animals, and international trade, i.e., export of food and import of manufactured products is emphasized so as to make the identical expenditure pattern between landowners and laborers possible.

Table 3 is essentially identical to table 1, though the numerical scale is changed so that it is convenient for the purpose of discussions in this section. Each year agriculture advances 1000 million livres, i.e., 500 of agricultural products and 500 of manufactured products for

laborers and produces 2500 million livres of agricultural products while manufacture advances 1000 million livres, i.e., 500 of agricultural products for raw materials, 250 of agricultural products and 250 of manufactured products for laborers and produces 1000 million livres of manufactured products. In addition to the annual advances, agriculture advances also original advances consist entirely of agricultural products the annual depreciation of which is 500 million livres. The surplus of agriculture, 1000 million livres are paid to landowners as rent. Note that expenditure pattern of laborers both in agriculture and manufacture is assumed to be identical to that of landowners who spend half their income on agricultural and half on manufactured products.

Since landowners spend their rent income 1000 million livres half on agricultural products and half on manufactured products, the first 500 of agricultural products and the first 500 of manufactured products are sold out to them. Manufacture buys the second 500 of agricultural products by 500 million livres received from landowners and agriculture buys the second 500 of manufactured products in return. Finally, manufacture buys the third 500 of agricultural products by 500 million livres received from agriculture for the second 500 of manufactured products.

Now 1000 million livres of money, 500 of manufactured products, and 1000 of agricultural products are in the hands of agriculture. Agriculture pays 1000 million livres rent to landowners, replaces annual advances of 500 agricultural products and 500 manufactured products, and covers the depreciation of the fixed capital, the so-called ' interest ' cost of agriculture, i e., to replace horses, etc., by the remaining 500 of agricultural products. Manufacture, having 1000 of agricultural products, exports 250 of agricultural products and imports 250 of manufactured products so that annual advances of 750 agricultural products and 250 of

manufactured products are replaced. The economy can continue, therefore, to produce 2500 agricultural products and 1000 manufactured products.

Thus, the introduction of international trade certainly makes it possible to interpret Quesnay's Tableau Économique consistently, under the assumption of identical pattern of expenditures for all the classes of a nation. Quesnay insisted, however, not only to assume the identical expenditure pattern for all the classes but also to change it properly so as to make the economy grow rather than decay. The introduction of international trade, unfortunately, makes the following argument of Quesnay entirely untenable, in spite of Eltis [17]'s argument to the contrary.

" It can be seen from the distribution delineated in the Tableau that if nation's expenditure went more to the sterile expenditure side than to the productive expenditure side, the revenue would fall proportionally, and that this fall would increase in the same progression from year to year successively. It follows that a high level of expenditure on luxury in the way of ornamentation and conspicuous consumption is ruinous. If on the other hand the nation's expenditure goes to productive expenditure side the revenue will rise, and this rise will in the same way increase successively from year to year. Thus it is not true that the type of expenditure is a matter of indifference." 35)

As was emphasized by Eltis [17], this argument, if it is correct, is really remarkable for those who are familiar with modern growth theory, since it insists that the rate of growth of an economy is a function of what is consumed rather than the ratio of investment to consumption. From the point of view of the philosophy of physiocracy, this statement may follow quite naturally, since it is assumed that only the land is productive and any increase in expenditure on agricultural products gives

rise to an increase in rent, while no other form of expenditure has similar favourable effects. It is, however, one thing to insist this physiocratic policy on the basis of its philosophy, and it is quite another to demonstrate it by the use of Tableau Économique. The type of expenditure in Tableau Économique is a matter of indifference, if any change in it can always be adjusted by a corresponding change in international trade so that there is no changes in the production and the revenue (rent) of the nation.³⁶⁾ We shall demonstrate this first by using the final version of Tableau (Formula), i.e., comparing tables 3, 4 and 5.

Suppose the propensity to consume agricultural products changes from 0.5 to 0.6 not only for landowners but also for laborers in agriculture and manufacture. Tableau shifts from table 3 to table 4, though identical outputs, i.e., 2500 agricultural products and 1000 manufactured products are already produced from the annual advances made before the propensity to consume has changed. Now landowners spend 600 million livres on agricultural products and 400 million livres on manufactured products, so that the first 600 of agricultural products and the first 400 of manufactured products are sold out to landowners. Manufacture then buys 400 of the agricultural products by 400 million livres received from landowners, and agriculture in return buys the second 400 of manufactured products. Finally, manufacture buys further 400 of agricultural products by 400 million livres received from agriculture.

Now, 1000 million livres of money, 400 of manufactured products and 1100 of agricultural products are in the hands of agriculture, so that it can pay 1000 million livres to landowners as rent, advanced 600 of agricultural products and 4000 of manufactured products to laborers,

and cover the interest cost by the remaining 500 of the agricultural products. Having now 800 of agricultural products and 200 of unsold manufactured products, manufacture can replace advance for raw materials, i.e., 500 of agricultural products, and advance 300 of agricultural products and 200 of manufactured products for laborers. Changes in propensity to consume are entirely absorbed in changes in international trade and the economy can continue to produce the unchanged outputs, i.e., 2500 of agricultural products and 1000 of manufactured products, under the changed patterns of expenditure.

Similarly, table 5 shows the case where the propensity to consume agricultural products changes from 0.5 to 0.4. Landowners spend 400 million livres on agricultural products and 600 million livres on manufactured products, so that the first 400 of agricultural products and the first 600 of manufactured products are sold out to landowners. Manufacture then buys 600 agricultural products by 600 million livres received from landowners and agriculture buys 400 manufactured products by 400 million livres received from landowners. Next step for manufacture is to export 500 of agricultural products so as to import 500 of manufactured products, which implies that manufacture can supply 1500 manufactured products in all, i.e., 1000 produced and already sold and 500 imported and circled in table 5. Agriculture then buys 200 of imported manufactured products from manufacture by 200 million livres, i.e., a part of money already received from manufacture when 600 of agricultural products are sold. Finally, manufacture uses this 200 million livres and 400 million livres already received when 400 of manufactured products are sold to agriculture, to buy further 600 of agricultural products.

Since 400 million livres are left unused out of 600 million livres received from manufacture when the first 600 of agricultural products

are sold, agriculture has now 1000 million livres to pay rent. Also 600 of manufactured products and 900 of agricultural products are in the hands of agriculture, so as to advance 400 of agricultural products and 600 of manufactured products for laborers, and to cover interest by the remaining 500 of agricultural products. Having bought 1200 of agricultural products and exported 500, manufacture has 700 of agricultural products and 300 of unsold manufactured products, just enough to replace the advanced raw materials, i.e., 500 of agricultural products and to advance 200 of agricultural products and 300 of manufactured products for laborers. The economy can continue, therefore, to produce 2500 agricultural products and 1000 manufactured products under new patterns of expenditure.

Thus, changing expenditure patterns makes neither growth nor decline in output possible, if the possibility of international trade is introduced in *Tableau Économeque*. There is, of course, an implicit assumption of a small country with the given terms of trade. Otherwise, a country exporting agricultural products and importing manufactured products can certainly grow by changing its domestic expenditure pattern so that it is favourable to agriculture, which makes the terms of trade favourable. The reason for this possibility, however, of an economic growth through changing expenditure patterns is not that agriculture alone is productive as Quesnay and Physiocrats supposed, but that the country happens to be an exporter of agricultural products. For a country which export manufactured products, it is necessary to change domestic expenditure pattern so that it favours manufacture, to make an economic growth possible through a favourable change in terms of trade. This possibility is, therefore, cannot be a vindication of Quesnay's Physiocratic view of economic growth.³⁷⁾

Eltis [17] insisted that the effect of the propensity to consume agricultural products on the rate of growth can best be analyzed by using, not the final version of Tableau as we did, but the original Tableau with zigzags and by focusing attention on the financial receipts of agricultural producers. The original Tableau Économique with zigzags is given in a generalized form as table 6 when the propensity to consume agricultural products is q and rent or revenue is R .³⁸⁾ Landowners spend qR on agricultural products and $(1-q)qR$ on manufactured products. Agriculture then spends $(1-q)qR$ on manufactured products out of qR received from landowners while manufacture spends $q(1-q)R$ on agricultural products out of $(1-q)R$ received from landowners. Agriculture further spends $(1-q)q(1-q)R$ on manufactured products out of $q(1-q)R$ just received from manufacture while manufacture spends $q(1-q)qR$ on agricultural products out of $(1-q)qR$ just received just received from agriculture. In this way, agriculture ends up with the total receipt of money $R(2q-q^2)/(1-q+q^2)$ while manufacture ends up with the total receipt of $R(1-q^2)/(1-q+q^2)$.

As is well known, it is not easy to interpret rationally how the reproduction of an economy is carried out in this Tableau. Eltis [16]'s interpretation is as follows. Suppose agriculture advances annually 1000 million livres and pays rent 1000 million livres and the propensity to consume agricultural products is 0.5. In the Tableau's zigzags, both agriculture and manufacture receive 1000 million livres and spend 500 million livres on the products of the other sector, while manufacture is assumed to use the other 500 million livres as advances for raw materials which are bought from agriculture at the end of the year, i.e., after the process of zigzags is over. Thus, the economy's whole stock of money, 1000 million livres, will reach agriculture by the end of the year. Since agriculture is assumed to produce 2000 million livres of products

from 1000 million livres of annual advance, it is left with 1000 million livres of money, 500 million livres of manufactured products and 500 million livres of agricultural products, so that it can pay again 1000 million livres of rent and advance again 1000 million livres of agricultural and manufactured products for laborers. Manufacture is left with 500 million livres of raw materials and 500 million livres of other agricultural products, the half of which is assumed to be exported to import manufactured products. It can, then, advance 250 million livres of agricultural products and 250 million livres manufactured products to laborers. The economy can continue, therefore, to produce 2000 million livres of agricultural products and 1000 million livres of manufactured products.³⁹⁾

Although we agree with Eltis [16] that the original Tableau with zigzags can be interpreted rationally when q is 0.5, it does not imply that there is no difficulty to interpret similarly accounts of the effect of changes in q on the rate of growth, which are found in Philosophy rurale and L'Ami des hommes, written actually by Quesnay and Mirabeau. Suppose that q is 0.4. The Tableau's zigzags bring 842 million livres (obtained by substituting $q = 0.4$ into $1000(2q - q^2)/(1 - q + q^2)$) instead of 1000 million livres to agriculture and 1105 million livres (obtained from $1000(1 - q^2)/(1 - q + q^2)$) instead of 1000 million livres to manufacture. Eltis [17] considers that agriculture receives a further 552.5 million livres from manufacture for sales of raw materials at the end of year, since half of 1105 million livres manufacture receives is assumed to be put aside by manufacture for its advance. However, agriculture spends six-tenths of 842 million livres it receives from the zigzags or 505 million livres on manufactured products and has to pay 1000 million livres of rent. Agriculture therefore has a financial deficit of 110.5

million livres (i.e., 842+552 5-505-1000). Following Quesnay and Mirabeau, Eltis assumes that half the deficiency is met by landowners who accept lower rents than those previously agreed. Then half of 110.5 million livres has to be met by a fall in annual advance of agriculture from 1000 to 945 million livres, since Eltis considers that agriculture must sell its advance for the next year to get enough money to pay rent. The economy has to start next year with 945 million livres of agricultural advance and the same amount of rent which implies that agricultural products are only 1890 million livres. It can be shown that in this way the economy declines eventually at a rate of 5.5 percent per annum.

Naturally questions may arise to the above arguments of Eltis to explain Quesnay's theory of economic growth and decline. When $q=0.4$, the Tableau's zigzags bring 1105 million livres to manufacture and manufacture spends four-tenths of it or 442 million livres on agricultural products in zigzags, so that at the end of the year manufacture is with 663 million livres of money. Why does manufacture not spend whole 663 million livres instead of only 552.5 million livres on agricultural products at the end of the year? Since manufacture need not pay rent to landowners, it is no use for it to keep money unutilized. Eltis insisted that a part of annual advance of agriculture has to be sold, i.e., capital must be decumulated in agriculture, when agriculture has a financial deficit. Since financial deficit means that agriculture is with unsold products which are originally intended to be sold, however, it implies the accumulation of unintended stock of products and not necessarily the decumulation of capital to be advanced. To get enough money to pay rent, therefore, it is enough to sell these products originally intended to be sold and it is not necessary to sell products which are intended to be advanced.

If manufacture spends all the money it does not spend in zigzags, i.e., 663 million livres, at the end of the year on agricultural products, agriculture can pay 1000 million livres rent after it spends in zigzags 505 million livres on manufactured products, since $842+663-505=1000$. Propensity to consume agricultural products lower than 0.5 does not cause any financial deficit for agriculture and the economy can continue to produce unchanged amount of agricultural and manufactured products. Incidentally, manufacture has to sell 1105 million livres of manufactured products in zigzags while it produces only 1000 million livres of manufactured products, if $R=1000$ million livres and $q=0.4$. In the course of zigzags, therefore, manufacture has to export some of agricultural products it bought so as to import additional manufactured products necessary to carry on zigzags. This point was already pointed out in our consideration of table 5.

Similarly, we cannot accept Eltis [17]'s argument that agriculture has a financial surplus and the economy grows eventually at 4.2 percent when $q=0.6$. Eltis considered that agriculture receives 1105 million livres in Tableau's zigzags, spends there 442 million livres on manufactured products and receives 421 million livres from manufacture at the end of the year. Since manufacture receives in zigzags merely 842 million livres and spends there 505 million livres, however, how can manufacture spend 421 million livres at the end of the year? If manufacture spends all the money it has, i.e., 337 million livres (obtained by 842×0.4) on agricultural products at the end of the year, agriculture has neither surplus nor deficit, since $1105+337-442=1000$. Manufacture need not buy more than 337 million livres from agriculture at the end of the year, since it has already bought enough agricultural products in the course of zigzags, so as to advance raw materials (500) and feed laborers

(300), since $500+300 < 505+337$.⁴⁰⁾

In spite of Eltis's efforts, therefore, we have to conclude that Quesnay's doctrine of economic growth and expenditure patterns cannot be rationally explained by the use of the original Tableau with zigzags.⁴¹⁾ As Elits pointed out, many developing countries today face precisely the same conditions in which Quesnay analyzed the problems involved in achieving economic growth. We cannot blame, however, these countries for adopting policies of favouring manufactures at the expense of agriculture, at least, from the point of view of Quesnay's Physiocratic doctrine of economic growth.

Landowners

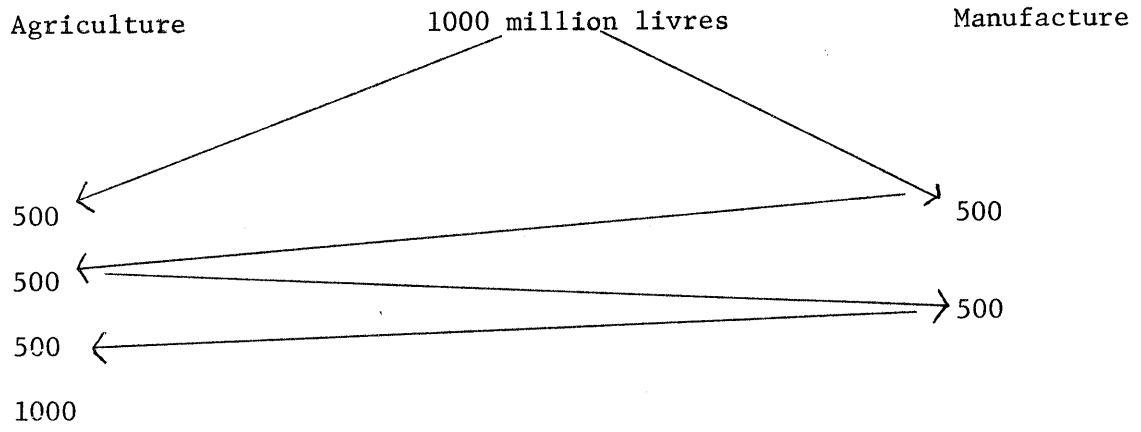


Table 3

Landowners

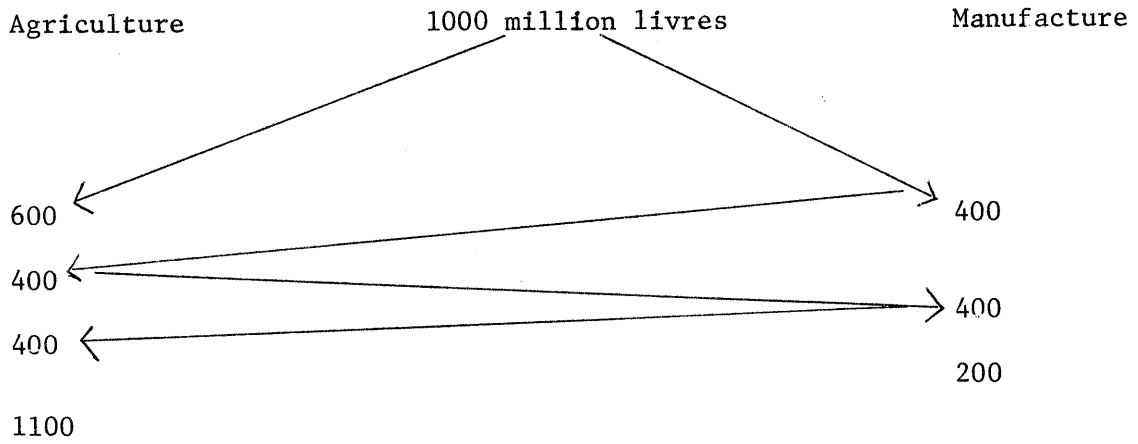


Table 4

Landowners

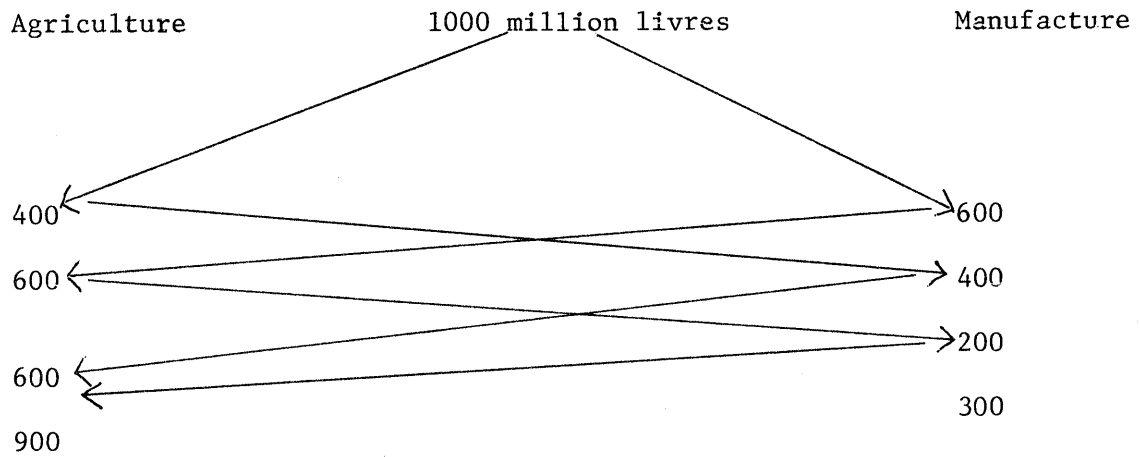


Table 5

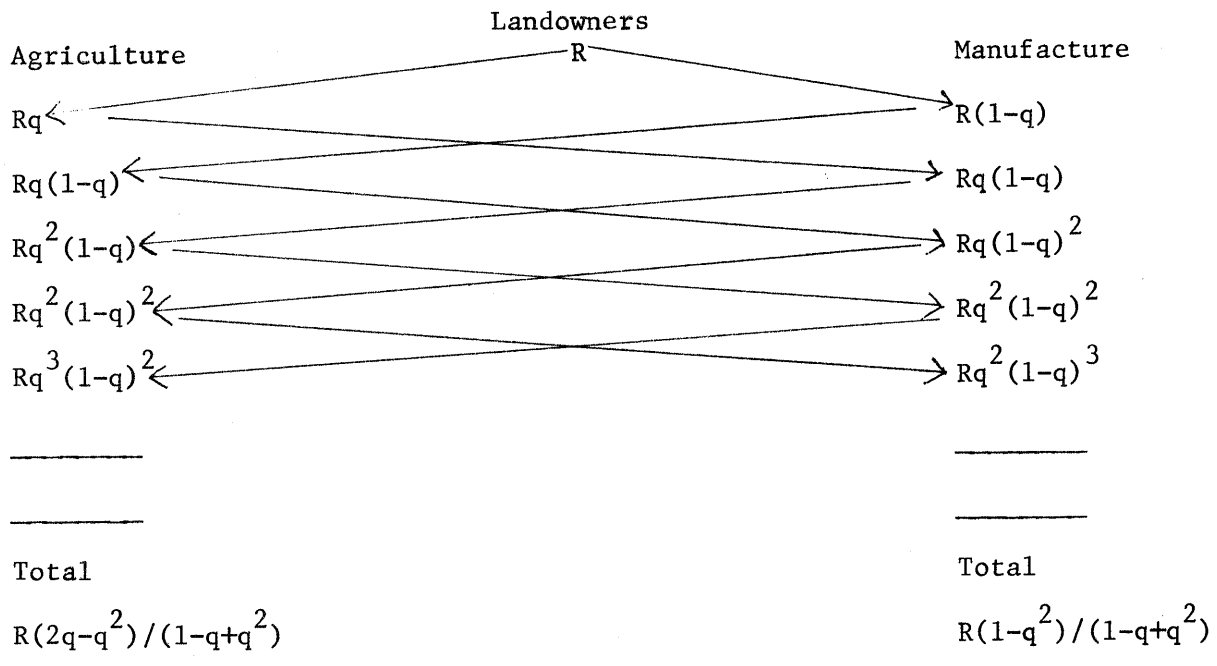


Table 6

Footnotes

- 1) The following is largely dependent on Vaughn [40], pp. 1 - 16.
- 2) See Bowley [6], [7], p. 76, Kobayashi [24], p. 390 and Spiegel [38], p. 162.
- 3) See Bowley [6], [7], p.77, Spiegel [38], p.162, Colie [10], Leigh [27] and Hatori [20].
- 4) The second week represents all future periods in the time horizon of the supplier and may be much longer than the current week.
- 5) For the abstract unit of account, see Patinkin [32], p. 18.
- 6) In the long run other parameters than a and b may be changed. The effect on vent of a change in q is, however, smaller than that of the proportionally same change in a.
- 7) To the extent that the quantity of money has effect on the rate of turnover of other commodities, Locke's quantity theory is different from the classical quantity theory. As was rightly pointed out by Hatori [20], money is not neutral if a change in its quantity has different effects on the ratio of vent and quantity of different commodities.
- 8) So far as S (quantity of money) has effects on the vent of other commodities, the elasticity of the total demand for money is larger than 1. In other words, at least temporarily T is an increasing function of M and V in $PT = MV$, though V is assumed to be constant in the model. The elasticity of demand for individual supplier of money commodity is, of course, larger than that of the total demand for money.
- 9) What is constant is, not the vent, but the ratio of vent and quantity, i.e., the velocity in the case of money. See Vaughn [40], pp. 40 - 42.
- 10) For Cantillon's version of price-specie-flow mechanism, see

Cantillon [8], pp. 167-169. The life and work of Cantillon is sketched in the section 3.1 of this chapter.

11) In other words, Engel curves are always straight lines through the origin.

12) Dornbusch, Fischer and Samuelson [11] considered the case with infinitely many goods.

13) For the more general meoclassical case, see Anderson and Takayama [1].

14) See Dornbusch and Mussa [12], where such a behavior of expenditure is explained by intertemporal optimization.

15) See Chipman [9], which explains this assumption as the generalization of numerical example considered by J.S.Mill.

16) Numerical values of \underline{a} in (4) and (5) are different from those in (1) and (2).

17) For a mathematical model of land theory of value, see Chapter 4, section 2.1.

18) For the original Tableau (Tablear Fondamental), see table 6 in section 4 and Kuczynski and Meek [25]. It describes, like Kahn's multiplier process in Keynesian economics, the dynamic process of the circulation of money and goods among three classes, i.e., landowners, agriculture and manufacture. As for the Formule, see table 1 in section 3.2 and Meek [30], p. 158. Like a static multiplier in Keynesian economics, it shows the aggregate transactions among three classes in the equilibrium.

19) The following exposition depends largely on Foley [19].

20) See Meek [30], p. 158. Table 1 is changed from the original Formule, in view of the suggestion given by Bauer [4].

21) All the units are given in terms of money and money prices are considered as constant.

- 22) Following the suggestion of Eagly [13], we assume, unlike in the original Formule, that the length of period of production is equal for agricultural and manufacturing sectors. Eagly also suggests that we may either assume that there is no original advance in manufacturing sector or that the output of that sector is net of depreciation.
- 23) See also Blaug [5], p. 27, and Eagly [14], p. 23.
- 24) For an example of Marxian interpretation, see Yokoyama [43], pp. 151 - 152.
- 25) For an example of such an explanation, see Ekelund and Hebert [15], p. 75.
- 26) See Blaug [5], p. 28, which is based on Phillips [33].
- 27) Hishiyama [21] developed a unique Leontief-like analysis and dynamization of Tableau Économique on the basis not of the simplified table 1 but of the original version of Tableau Économique, i.e., Tableau Fondamental.
- 28) The supply of labor may be assumed to be perfectly elastic at the given real wage in terms of the agricultural products.
- 29) Eagly [13] dynamized Tableau Économique correctly by introducing profit as the source of capital accumulation. He did not, however, consider how profit is generated and merely assumed that it is proportional to the level of output.
- 30) See also Meek [30], pp. 297 - 312, especially 306 - 307.
- 31) Barna [2], [3] distinguished production accounts for agriculture from household accounts of agricultural families and assumed that households consume manufactured products but there is no input of manufactured products into agricultural production.
- 32) See Meek [30], pp. 138 - 149.
- 33) Barna [3] admitted that Quesnay assumed this.

- 34) We are grateful to Professor T. Barna who kindly replied to our questions and give us useful comments, but he is not responsible for our possible misinterpretations.
- 35) See Kuczynski and Meek [25], p. 12 and Eltis [17].
- 36) Samuelson [35] is also against Quesnay in this respect, but argued that expenditure patterns have effects on the level of output of different sectors, without paying attention to international trade.
- 37) We are grateful to Professor W.A.Eltis for highly useful discussions, though he is not responsible for our possible misunderstanding.
- 38) Table 6 is originally due to Hishiyama [21] and reproduced in Eltis [16].
- 39) The existence of original advances is assumed away.
- 40) Actually, we have to understand that manufacture sold back 42 million livre agricultural products to buy back 42 million livre manufactured products in the course of Tableau's zigzags. Similarly, agriculture has to sell 42 million livre manufactured products to buy back 42 million livre agricultural products in zigzags, since otherwise it sold 1442 (i.e., 1105+337) million livre agricultural products and remaining 558 (i.e., 2000-1442) million livre agricultural products are not enough to advance 600 million livres of agricultural products to laborers. We have to say that the original Tableau with zigzags is very clumsy and inconvenient in this respect.
- 41) See Shibata [36] and Watanabe [42], pp. 341 - 398.

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