Vassar College Economics Working Paper # 16

the sum of consumption expenditures is equal to the rental income of landlords which, in turn, is equivalent to the value of agricultural surplus.

In constructing our Tableau, we describe the initial equilibrium as one where rent is given and is equal to the value of total surplus. This assumption specifies an analytical point of entry into the Physiocratic circular flow that runs from total rent to final consumption demands, to output levels, to agricultural surplus, and back to rent payments. If the realized agricultural surplus declines, for instance, then rent and final consumption demand also decline in tandem and the economy launches into a shrinking spiral.[6] The full account of the mishaps in this economy requires, however, examination of the financial realm.

For this purpose, we now turn to the prices. Quesnay's price conceptions are discussed at length by Vaggi (1983, 1985). Although Quesnay did not have a systematic analysis of price determination, he distinguished between the "fundamental value" and the "market value." Fundamental value of a commodity is defined as the expenditure incurred in its production, whereas market value is the actual price at which goods are sold in the market (see *Men* in Meek, 1963, p. 93). Under "normal" or "natural" conditions, argued Quesnay, the value of the industrial commodity is equal to its cost of production, or its fundamental value. This equality, however, does not hold in the case of the agricultural commodity because of the key Physiocratic assumption: the "productivity" of agriculture. In the agricultural sector, the inputs are not only transformed final product, but also a surplus is produced. Therefore, the "proper" price of the agricultural product (Quesnay's *bon prix*) must exceed unit costs of production by the unit value of surplus or the rent (see *Dialogue* in Meek, 1963, p. 228).[7]

original picture of the system of production and consumption as a circular process, and it stands in striking contrast to the view presented by modern theory, of a one-way avenue that leads from 'Factors of production' to 'Consumption goods.' "

[6] It is worth emphasizing that the ambiguity in rent determination is not pertinent to the policy analysis. Alternatively, we could have started from predetermined rent. As suggested, for instance, in the *First Economic Problem* (in Meek, 1963, p. 181), fixed rents imply crowding out of resources required for reproduction and, therefore future output, when farmers run financial deficits. The outcome does not depend on the specific assumption on rent although there are minor modifications of the mechanics.

[7] This is true in the steady state with no growth. Otherwise, the price of artichoke should also include

The price system which corresponds to the quantity system embodies the Physiocratic assumptions of productivity and sterility:

$$a_{AA}P_A + a_{IA}P_I + r = P_A \tag{5}$$

$$a_{AI}P_A + a_{II}P_I \quad = P_I. \tag{6}$$

(6)

Equation (6) is the zero profit condition: price of ink is equal to its technical unit cost of production. Equation (5), on the other hand, states that the price of artichoke is equal to the sum of its unit cost of production and the rent per unit of output (r). At the Physiocratic equilibrium, rent per unit of output is equal to the value of unit surplus created in the agricultural sector. Denoting the physical surplus per unit of output by s, this condition implies that $r = sP_A$.[8] If unit rent exceeds the unit value of surplus ($r > sP_A$), for instance, farmers suffer financial deficits which upset the delicate balance of the Tableau.[9]

We now define the *fundamental relative price* (π) as the price at which there exists no surplus gains in the industrial sector. This price ratio is derived directly from equation (6):

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the profit of the farmer/agricultural entrepreneur. See Vaggi (1985).

[8] This specification of the surplus is somewhat different from the description provided in the summary account of the *Tableau* above. In the original *Tableau*, the surplus of 3 m. livres includes 1 m. livres of raw materials sold to the artisans. Here, however, the surplus is defined net of all inputs to industry and agriculture.

[9] The linear programming interpretation of the Tableau helps clarify the duality of the quantity and price systems when consumption levels and per unit rent are given as data. The primal problem is to minimize the value of rental income rX_A subject to the constraints that sectoral output levels are at least as much as the sum of input and final consumption demands. In other words, given r, the question is to find the lowest level of agricultural output at which consumption demands are satisfied. This primal has a corresponding dual maximization problem: finding prices at which the value of landlord consumption ($P_AC_A + P_IC_I$) is maximized, subject to the constraints that the ink price does not exceed its cost of production and the artichoke price does not exceed its unit cost plus the per unit rent.

$$\pi \equiv \frac{P_I}{P_A} = \frac{a_{AI}}{1 - a_{II}}. \tag{7}$$

Table 1 is an accounting framework that keeps track of inter-class exchanges. This Tableau displays the physical and monetary holdings of each class at successive instances of the production/circulation process. Its structure is analogous to Eagly's (1974, p. 23) sequential analysis of the *Tableau* except that here both physical and monetary holdings are shown.

At step 1 of Table 1, the beginning of the production period, farmers hold artichoke and ink inputs required for the production of agricultural output as well as the money stock equivalent to rental payments. We shall refer to these as the physical and monetary annual advances, respectively. Artisans hold physical annual advances required for industrial production and no money. Next, farmers pass their money holdings to the landlords as rent payments. Production takes place in the third step where inputs are transformed into agricultural and industrial goods. Steps (4) to (7) illustrate inter-class exchanges. Landlords purchase C_A and C_I from farmers and artisans, paying $P_A C_A$ and $P_I C_I$, respectively. Farmers purchase industrial inputs $a_{IA}X_A$, paying $P_I a_{IA} X_A$, and artisans pay $P_A a_{AI} X_I$ to purchase inputs $a_{AI}X_I$. After all exchanges are completed, the economy returns to its initial state. At step (9), farmers and artisans hold physical advances required for the next round of production. In addition, farmers hold monetary annual advances of the amount equivalent to rent payments.

II. A DIAGRAMMATIC DESCRIPTION OF THE PHYSIOCRATIC EQUILIBRIUM

In this section we will construct a simple geometric interpretation of the Physiocratic model. We first set up some mathematical relationships. Since zero growth is assumed, at the steady state, rent payments (R) of each period is equal to the value of the surplus produced in the previous period:

$$R = sP_A X_A. \tag{8}$$

This condition implies that in the agricultural price equation (5), rent per unit of output (r) can be replaced with the value of the surplus per unit of output (sP_A). Physical surplus is then obtained from equations (5) and (6) as:

TABLE 1
SEQUENTIAL ANALYSIS OF REPRODUCTION AND CIRCULATION
Physical and Monetary Holdings of Each Class(*)

	Farmers	Landlords	Artisans
1. Annual	$a_{AA}X_A, a_{IA}X_A$	—	$a_{AI}X_I, a_{II}X_I$
Advances	R	—	—
2. Rent Payment	$a_{AA}X_A, a_{IA}X_A$	—	$a_{AI}X_I, a_{II}X_I$
	—	R	—
3. Production	X_A, —	—	—, X_I
	—	R	—
4. Farmer-Landlord	$X_A - C_A$, —	C_A	—, X_I
Exchange	$P_A C_A$	$R - P_A C_A$	—
5. Artisan-Landlord	$X_A - C_A$, —	C_A, C_I	—, $X_I - C_I$
Exchange	$P_A C_A$	—	$P_I C_I$
6. Landlord	$X_A - C_A$, —	—	—, $X_I - C_I$
Consumption	$P_A C_A$	—	$P_I C_I$
7. Input from Agriculture	$X_A - C_A - a_{AI}X_I$, —	—	$a_{AI}X_I, X_I - C_I$
to Industry	$P_A C_A + P_A a_{AI} X_I$	—	$P_I C_I - P_A a_{AI} X_I$
8. Input from Industry to	$X_A - C_A - a_{AI}X_I, a_{IA}X_A$	—	$a_{AI}X_I, X_I - C_I - a_{IA}X_A$
Agriculture	$P_A C_A + P_A a_{AI} X_I - P_I a_{IA} X_A$	—	$P_I C_I - P_A a_{AI} X_I + P_I a_{IA} X_A$
9. Annual	$a_{AA}X_A$ (**), $a_{IA}X_A$	—	$a_{AI}X_I, a_{II}X_I$ (**)
Advances	R(***)	—	—(***)

NOTES:
(*)The first and the second items on the first line of each step indicate physical holdings of artichoke and ink, respectively. Monetary holdings are shown on the second line of each step.

(**) $a_{ii}X_i = X_i - C_i - a_{ij}X_j$, $(i, j = A, I)$. (***) It follows from note (**) and relative price given by equation (7) that $P_I C_I - P_A a_{IA} X_A + P_I a_{IA} X_A = 0$ and $P_A C_A + P_A a_{AI} X_I - P_I a_{IA} X_A = P_A C_A + P_I C_I = R$.

$$s = \frac{(1 - a_{AA})(1 - a_{II}) - a_{AI}a_{IA}}{1 - a_{II}}. \tag{9}$$

Since the Hawkins-Simon condition is assumed to hold, $s > 0$.

Substitution of (8) into the consumption functions (3) and (4), combining the latter with (1) and (2), and solving for sectoral output levels yield the following linear system of equations:

$$AX + CX = X.$$

where

$$A = \begin{pmatrix} a_{AA} & a_{AI} \\ a_{IA} & a_{II} \end{pmatrix}, \quad C = \begin{pmatrix} \gamma s & 0 \\ (1-\gamma)s/\pi & 0 \end{pmatrix}, \quad X = \begin{pmatrix} X_A \\ X_I \end{pmatrix}.$$

A graphical description of the problem is given in Figure 1 where the horizontal and vertical axes measure quantities of artichoke and ink, and positive and negative quantities measure the outputs and "inputs," respectively. The term input is used in a very special sense here, dictated by the closed-end interpretation of the *Tableau*: it includes not only physical inputs and the subsistence of producing classes, but also the consumption of the proprietary class which is necessary for the circular flow to continue in perpetuity at the original scale. Algebraically, this implies that the input-output matrix is given not by A but by $A + C$. Net output is defined as the output in excess of physical inputs, subsistence consumption of producers, and consumption of landlords.[10] Thus, the underlying equilibrium is one where all commodities are produced and production levels are just equal to the requirements for simple reproduction of each commodity. In Figure 1 is also assumed that the gross output levels of each good is unitary. Vector OB shows the unit process of artichoke production: to produce one unit of artichoke $a_{AA} + \gamma s$ units of artichoke and $a_{IA} + \frac{(1-\gamma)s}{\pi}$ units of ink are used as inputs. Net output of this production process, in turn, is $[1 - a_{AA} - \gamma s,\ -a_{IA} - \frac{(1-\gamma)s}{\pi}]$, depicted as the net activity vector OA. For ink, input vector OG $[-a_{AI},\ -a_{II}]$ and net output vector OI $[-a_{AI},\ 1 - a_{II}]$ are derived in the same fashion. Finally, the net output frontier is the linear combination of net activity vectors, found by joining endpoints of OA and OI. Only the portion of this locus that consists of non-negative quantities of artichoke and ink represents the viable points of production. In the case of simple reproduction, by definition, the only feasible point is the origin. In Figure 1 the

[10] In order to avoid confusion it should be emphasized that this concept is different from Quesnay's *produit net* which refers to the disposable surplus over total cost in the agricultural sector.

rate of surplus is assumed to be equal to per unit real rent and that the relative price are at their equilibrium levels. Substituting for π and s from (7) and (9), it is observed that, as anticipated, lines OA and OI have the same slope, $(1-a_{II})/a_{AI}$. In other words, nothing is left over after inter-industry and final consumption demands are satisfied. At this point all stocks are replenished and simple reproduction continues. By implication, disruptions of the system can be studied in terms of their impact on the AI line.

In the next section, the Tableau of section I and the geometrical exposition developed here are utilized to examine the impact of shifting consumption patterns, taxation and relative price changes on the system.

III. PHYSIOCRATIC MAXIMS

In his *Extract from the Royal Economic Maxims of M. de Sully* Quesnay listed 24 conditions for the viability of the *Tableau* (Quesnay, 1972). The tools developed in this paper are suitable to scrutinize a number of these, which will be categorized as changes in consumption behavior, taxes levied on agricultural production, and deviations from the fundamental price. The analysis presented above indicates that simple reproduction of the economy cannot take place when either one of the following occurs: first, in the real realm, at the end of the exchange process if the productive classes do not have at hand the requisite inputs to reproduce the system, next period's output and surplus decline; secondly, even if they possess physical inputs, the farmers may fail to realize the surplus fully and suffer from a financial deficit, which leads to declining rent payments and final demand. In order to simplify the exposition in this section it is assumed that the productive classes acquire the required physical inputs for simple reproduction *as if* there exists a credit mechanism. As noted previously, this condition is necessary for reproduction but not sufficient. Unless it is complemented with balanced financial holdings at the end of circulation, simple reproduction is not feasible.

The methodology of this section consists of utilizing the accounting framework of Table 1 to determine the final holdings of each class following an alteration in one of the maxims listed above. If the final annual advances are the same as those given by line 8 of Table 1, then simple reproduction continues; otherwise, the system may disintegrate. The response of the system to each shock (with the exception of hoarding) will also be illustrated in terms of Figure 1.

III.a. Changing Consumption Behavior

Since producing classes are assumed to consume at the subsistence levels, here the focus is on the consumption pattern of the proprietary class. A change in the consumption behavior of landlords may take two forms: hoarding or modification of the consumption basket. Quesnay argued that both hoarding and reallocation of funds from agriculture to industry lead to the decline of agriculture and the whole economy.

The case against hoarding ("sterile saving" in Quesnay's terminology), which has an obvious Keynesian ring to it, is easy to demonstrate. Declining consumption creates leakages from the system and reduces aggregate demand. Positive monetary holdings of landlords imply a reduction of the annual financial advances of the farmers. The process underlying these changes is best analyzed in terms of Table 1. Suppose that landlord purchases of artichoke and ink become δC_A and δC_I, where δ is a constant between zero and unity. Total holdings of each class at steps 5 and 9 are now given in Table 2.

TABLE 2

The Effect of Landlord Hoarding

	Farmers	Landlords	Artisans
5.	$X_A - \delta C_I$	$\delta C_A, \delta C_I$	$X_I - \delta C_I$
	$\delta P_A C_A$	$(1-\delta)R$	$\delta P_I C_I$
	.		
	.		
	.		
9.	$X_A - \delta C_A - a_{AI}X_I,\ a_{IA}X_A$	—	$a_{AI}X_I,\ X_I - \delta C_I - a_{IA}X_A$
	$\delta P_A C_A + P_A a_{AI}X_I - P_I a_{IA}X_A$	$(1-\delta)R$	$\delta P_I C_I - P_A a_{AI}X_I + P_I a_{IA}X_A$

Note that the productive capacity of the economy has not declined. As observed on step 9 of Table 2, farmers and artisans hold excess artichoke and ink, respectively. Exchange of the excess quantities and their utilization as inputs can reproduce the physical output at the previous period's level. The source of the problem is that agricultural surplus is not realized fully. Inspection of the second line of step 9 reveals that financial holdings of the farmers are also below the amount required to make the rent payments. Given the financial deficit of the farmers, the next period's rent, and therefore, final demand further

decline. Monetary holding of the artisans, on the other hand, is negative at the end of circulation, instead of zero. It is also not feasible for them to purchase the required amount of annual physical advances from the farmers.

Next, consider the effect of changes in the consumption basket. Quesnay's argument against "excess of luxury in the way of ornamentation" is usually formalized in terms of variations in propensities to consume: an increase in the average (=marginal) propensity to consume of ink implies accumulation of financial surplus in the hands of artisans, at the expense of the farmers (Hishiyama, 1960; Eagly, 1974, pp. 28–9; Eltis, 1975b, pp. 330–1). The contraction of the economy is explained on the basis expenditure multipliers derived from the zigzags of earlier versions of the *Tableau* where farmers and artisans divide their income evenly between artichoke and ink. The formulation summarized in Table 1, however, does not support this proposition. At lines 4 and 5, the landlords divide the rent between artichoke and ink in an arbitrary manner and the final outcome (line 9) is independent of the consumption pattern of the landlords. Diagrammatically the only change is in the magnitude of OA. As seen in Figure 2, the artichoke input vector OB rotates counterclockwise to OB', indicating that more ink and less artichoke is required for artichoke production and OA extends to OA'. Since the slope of line OA is independent of γ, the only viable point of production is still the origin. Put differently, the outcome is unchanged artichoke output combined with a higher level of ink production.[11]

This finding is not novel. Both Barna (1975) and Samuelson (1982) pointed out that a change in tastes in favor of ink does not lead to the collapse of the Physiocratic equilibrium, but they did not discuss the source of Quesnay's and his followers' confusion on this point. We believe that at the root of this misconception lies the assumption that artisans and the farmers spend their incomes as if they are free to make an allocation decision. Since farmers and artisans do not make spending decisions *per se* the multiplier analysis of Hishiyama (1960) and Eltis (1975b) based on this assumption, is not valid. As emphasized by Eltis (1975a, pp. 178–9) consumption levels of the producing classes are determined by the "subsistence" requirements (subsumed under the a_{ij} coefficients in the present formulation), and agricultural output would change only if these requirements are altered (akin to a technical change).

[11] This argument is obviously based on the assumption that there is no shortage of labor. See Samuelson (1982, p. 54).

Marginal propensities to consume turn out to play a role in a different context, which has escaped attention of Quesnay or his commentators: taxation.

III.b. Taxation

Quesnay argued against indirect taxes on agriculture and in favor of direct taxation of rental income of landlords. Most commentators of Quesnay (Eltis, 1975b, pp. 337–41; Eagly, 1974, p. 33; Tsoulfides, 1989) agree that the prescription is consistent with the Physiocratic model. Barna (1975, p. 494), on the other had, asserted that it contradicts the implications of the linear system interpretation of the *Tableau*. Several questions seem to be pertinent to the debate. First is the assumption over who bears the burden of indirect tax. Barna's argument is based on the assumption that the tax is fully passed on to the buyers of artichoke whereas other authors claim that the tax falls, at least partially, on the farmers.[12] Second is the demand-side effects of taxation: does it create leakages from the system? Barna finds it puzzling and inconsistent that Quesnay omitted the state expenditure in his demonstration of the effects of indirect taxes. The third question is the relative price effects of taxation, explored by Tsoulfides (1989). In the Physiocratic literature there does not exist any treatment of taxation which incorporates all three of these issues, which this section attempts to do.

First let's dispose of the trivial case. A tax imposed on rental income of landlords obviously does not affect the rest of the economy. The only outcome is the reallocation of surplus, which is of no consequence for the producing classes as long as the state and the landlords share the same consumption pattern.

The question of sales tax is more complex. First, an indirect tax on artichoke does not alter the relative price because the ink price rises proportionately. It also follows directly from equation (7) that an indirect tax on ink turns the relative price in favor of the industrial sector.

Now consider an economy described by Table 1 and suppose that sales tax of t_A is imposed on artichoke. The question is whether simple reproduction is feasible, i.e. whether, at the end of the exchange process, the artisans and the farmers will have the endowments of physical and financial resources required to reproduce the economy at its original scale.

[12] Quesnay's writings seem to support the former view. See, for instance, the *Second Economic Problem*, in Meek (1963, pp. 186–202).

First assume that the burden of tax falls fully on the farmers. This implies that for each unit of artichoke sold, the farmers receive $(1-t_A)P_A$, while the landlords and the artisans pay P_A. The final demand consists of the landlord and state consumption. Following Quesnay, the state is assumed to spend all tax revenues and that it has the same marginal propensities to consume as the landlords. Nominal state expenditure on final goods (T) is given by:

$$T = t_A P_A (C_A + a_{AI} X_I).$$

The holdings of farmers and artisans after exchanges are completed are shown in Table 3. On the real side, state expenditure raises final consumption demand for goods which, in turn, implies lower physical annual advances. At the end of the process there are smaller quantities of both goods available as inputs for both farmers and artisans. In addition, the monetary holdings of artisans are now positive, which implies that farmers run a financial deficit. For these reasons it is not possible to produce the same quantities of output or to maintain the level of final demand in the next period. The value of γ determines the relative importance of the real and financial bottlenecks. At the lower limit, as γ approaches zero, the farmers have the necessary physical advances for simple reproduction but they face a financial deficit corresponding to the financial surplus of artisans. Thus, the following period's rent payments cannot be made. At the other extreme ($\gamma = 1$), farmers are at financial equilibrium but the system still breaks down because higher consumption demand for artichoke "crowds out" the physical annual advances and future production.

TABLE 3

The Effect of Agricultural Sales Tax

(Tax Burden Falls on Farmers)

	Farmers	Artisans
8.	$X_A - [1-(1-\gamma)t_A](C_A + a_{AI}X_I), a_{IA}X_A$	$a_{AI}X_I, X_I - C_I - \frac{(1-\gamma)t_A}{\pi}(C_A + a_{AI}X_I) - a_{IA}X_A$
	$[1-(1-\gamma)t_A]P_A(C_A + a_{AI}X_I) - P_I a_{IA}X_A$	$P_I(C_I + a_{IA}X_A) + (1-\gamma)t_A P_A(C_A + a_{AI}X_I) - P_A a_{AI}X_I$

Graphical demonstration of the impossibility of simple reproduction under these conditions is straightforward. The system is now written as:

$$AX + CX + EX = X$$

where E is the government expenditure matrix:

$$E = \begin{pmatrix} \gamma^2 t_A s & \gamma t_A a_{AI} \\ (1-\gamma)\gamma t_A s/\pi & (1-\gamma) t_A a_{AI}/\pi \end{pmatrix}$$

Solving the system for relative output levels, we observe that the input requirements have increased. New coordinates are $[-a_{AA} - \gamma s(1+t_A\gamma),\ -a_{IA} - \frac{(1-\gamma)s}{\pi}(1+t_A\gamma)]$ for vector OB' and $[-a_{AI}(1+t_A\gamma),\ -a_{II} - t_A(1-\gamma)a_{AI}]$ for vector OI'. As seen in Figure 3 net output vectors OA and OI accordingly rotate to OA' and OI'. The line $A'I'$ depicts the combinations of artichoke and ink that can be produced net of inputs and the landlord/state consumption. Since at least one of the quantities is always negative along this line, the economy fails to reproduce itself.

Next, we question the validity of Barna's argument by assuming that the farmers are able to pass the tax increase to the buyers of artichoke. Landlords and artisans now pay $(1+t_A)P_A$ for each unit sold of artichoke whereas farmers receive P_A. Tax revenues are now given by:

$$T = t_A P_A \left(\frac{C_A}{1+t_A} + a_{AI} X_I \right).$$

As discussed before, relative price remains unchanged, since artisans increase the price of ink proportionately to $(1+t_A)P_I$. As observed in Table 4, where for the sake of brevity only the holdings of farmers are stated, the effect on physical advances is ambiguous because landlord and state consumptions move in opposite directions. The net change depends on the composition of the consumption basket, or magnitude of γ. At the upper limit ($\gamma = 1$), expanding state demand for artichoke dominates the declining landlord demand, crowding out physical annual advances. At the other extreme ($\gamma = 0$), physical advances remain unaffected but a financial deficit is created: farmers pay more for ink although their income from sales of artichoke declines. As farmers are unable to meet rent payments, final demand also declines. In either case, Barna's (1975) argument of the neutrality of the economy with respect to taxation is not valid. Even if farmers can shift the tax burden, the economy falters.

For graphical representation of this case, first rewrite the landlord and state consumption matrices:

$$C' = \begin{pmatrix} \frac{\gamma s}{1+t_A} & 0 \\ \frac{(1-\gamma)s}{(1+t_A)\pi} & 0 \end{pmatrix}, \quad E' = \begin{pmatrix} \frac{\gamma^2 t_A}{1+t_A} & \gamma t_A a_{AI} \\ \frac{(1-\gamma)\gamma t_A s}{(1+t_A)\pi} & \frac{(1-\gamma)t_A a_{AI}}{\pi} \end{pmatrix}.$$

The coordinates of OB and OG are now as follows: $[-a_{AA} - \frac{\gamma s}{1+t_A}(1+t_A\gamma),\ -a_{AI} - \frac{(1-\gamma)s}{(1+t_A)\pi}(1+t_A\gamma)]$ and $[-a_{AI}(1+t_A\gamma),\ -a_{II} - \frac{t_A(1-\gamma)a_{AI}}{\pi}]$. Input requirements for ink unambiguously increase, depicted by the rotation of OG to OG' as in the previous case. Input requirements for artichoke decline, implying shrinking OA. The final outcome, however, is not ambiguous. Consider the impact of these shifts on the OA vector for limiting cases of $\gamma = 1$ and $\gamma = 0$. In the former case, the slope of OA does not change but its dimensions diminish. Coupled with the counter-clockwise shift of OI, this yields the result that simple reproduction is not feasible. If $\gamma = 0$ (the case depicted in Figure 3), the solution is still determinate: OA may rotate counterclockwise (OA''), but not as much as the OI vector.[13] Consequently, the new net product line, $I'A''$, does not pass through the origin or any point in quadrant I.

TABLE 4

The Effect of an Agricultural Sales Tax

(Tax Burden Falls on Artisans and Landlords)

	Farmers
8.	$X_A - \frac{1+\gamma t_A}{1+t_A} C_A - (1+\gamma t_A)a_{AI}X_I,\ a_{IA}X_A$
	$\frac{1+\gamma t_A}{1+t_A} P_A C_A + (1+\gamma t_A)P_A a_{AI}X_I - (1+t_A)P_I a_{IA}X_A$

In summary, provided that marginal propensity to consume artichoke is positive, indirect tax on agricultural production causes the final demand for artichoke to rise, crowds out annual advances and reduces productive capacity. Even in the exceptional case where landlords and the state do not buy any artichoke, simple reproduction is not viable because the farmers suffer from financial deficits and are unable to meet rent payments. These conclusions do not depend on the question of who bears the burden of taxation.

[13] The slopes of OA'' and OI' when $\gamma = 0$ are, respectively,

$$\left.\frac{dX_I}{dX_A}\right|_{OA} = -\frac{1-a_{II}}{a_{AI}}\left(\frac{1}{1+t_A} + \frac{t_A a_{AI} a_{IA}}{(1+t_A)(1-a_{AA})(1-a_{II})}\right) > -\frac{1-a_{II}}{a_{AI}}\frac{1-t_A}{1+t_A} = \left.\frac{dX_I}{dX_A}\right|_{OI}$$

The analysis of taxation changes in one important respect if indirect tax t_I is imposed on ink. By the industrial sector pricing rule, this tax is passed on to ink buyers, and the new relative price becomes:

$$\pi' = \frac{(1+t_I)a_{AI}}{1-(1+t_I)a_{II}}.$$

In addition to the changing real incomes, taxation now also affects the economy via relative price effects. In the next section, we turn to the examination of the general question of how changes in the relative price affect the Physiocratic equilibrium.

II.c. Deviations from the Fundamental Relative Price

Physiocrats have been credited as the precursors of many current economic issues and debates. One of these topics, although it has not attracted much attention, is their inquiry into the question of domestic terms of trade. Quesnay's discussion of the proper price of agriculture and industry is reminiscent of the Ricardo-Malthus and Bukharin-Preobrazhensky debates of the following two centuries. It is no surprise that, believing that agriculture is the source of surplus, Physiocrats favored higher agricultural prices to stimulate agricultural incentives and growth. The objective of the Physiocratic price policy is to prevent deviations of the market price of industrial goods from their fundamental price, and to guarantee the maintenance of the *proper* price in the agricultural sector — the price high enough to cover unit costs and rent.[14] If the *actual* price of the agricultural good in terms of the industrial exceeds the *fundamental* relative price or the *proper* domestic terms of trade (π of equation (7)), then the reproduction of the economy is not viable. The reason is that under such circumstances the surplus is not realized by the farmers and, therefore, rent payments are not met. The model developed in this paper can be used to illustrate how a deviation from the proper domestic terms of trade disrupts the system. Suppose that the relative price of the industrial commodity rises above the unit

[14] According to Quesnay, agricultural price is regulated by competition among buyers on the international scale (see *Dialogue* in Meek, 1963, pp. 227–8). Divergence of the actual and proper price created by restrictions on trade is the focal point of Quesnay's criticism of mercantilist policies. Implicit in this criticism is the presumption that the barriers to trade depressed the agricultural prices in France by cutting foreign demand for food. Quesnay's analysis, however, remains normative because he did not expound the mechanism through which the proper price is established.

costs of production (possibly due to barriers to international trade of agricultural goods, monopolistic practices in the domestic industrial sector, or imposition of indirect taxes on industrial goods): $\pi' > a_{AI}/(1-a_{II})$. This results in positive money holdings of the industrial sector at step (9) of Table 1 because the total revenue from sales to landlords and farmers will be greater than the value of artisans' purchases from farmers. That is,

$$P'_I C_I + P'_I a_{IA} X_A > P'_A a_{AI} X_I.$$

As revenues exceed the expenditures, financial surplus accrues to the sterile class. Net receipts of farmers at the termination of the circulation process fall short of the previous period's rent. The capacity of the productive class to make annual advances, and consequently, the agricultural output and net product decline with diminishing agricultural revenues. Eventually landlords and artisans are also hurt since the level of economic activity is governed by the volume of the product. The smaller surplus implies declining rent payments, contracting final demand, and reduced prosperity of the artisans.

The argument is illustrated in Figure 4. An increase in π causes the ink requirement for unit artichoke to rise. Graphically, as shown in Figure 4, vectors OB and OA rotate to OB' and OA' and line IA shifts downward to IA'.

IV. CONCLUSION

Starting from the familiar Physiocratic principles, this paper set up an analytical framework and pursued its logical implications in order to evaluate the Physiocratic maxims on their own terms. The argument was carried out in terms of two complementary tools. The Tableau constructed in section I underscores the 'dynamic' — or, more precisely, the Robertsonian 'period analysis' (Meek, 1963, p. 294) — aspect of the Physiocratic model. The contribution of the graphical apparatus of section II, on the other hand, lies in its depiction of the 'comparative statics' of the model in simplest terms. Both of these vehicles emphasize the principle of the circularity of the economy as conceived by Quesnay.

Identification of the real and financial flows provides a thorough analysis of the impact of changes in consumption behavior, tax schemes, and the relative price on the physical and financial annual advances required for the simple reproduction of the economy. This analysis indicates that the interpretations of the *Tableau* and the associated policy proposals are often incomplete, inconsistent, or incorrect.

This paper first highlights an inconsistency between the zigzag versions of the *Tableau* where circulation is described by a sequence of exchanges between farmers and artisans, and the later *Analysis* version where it is presented in summary form. According to the *Tableau*, the "consumption" of farmers and artisans consists of subsistence expenditures required for the reproduction of the system, and therefore does not reflect tastes and preferences. Given this premise, it is erroneous to refer to the spending of these classes as the outcome of discretionary decision-making and, therefore, expenditure-multiplier interpretation is not valid. As a corollary to this argument, changing marginal propensities to consume agricultural and industrial products do not cause the economy to contract. Agricultural output and surplus are independent of the consumption pattern of the proprietary class and do not respond to variations in the composition of the consumption basket. Only industrial output responds to such reallocations. Thus, this particular maxim of Quesnay, upheld by Hishiyama, Eltis and Eagly, is in conflict with the foundations of the *Tableau*.

Although Quesnay's other policy proposals considered here still stand after our inquiry, arguments advanced in their support are found to be deficient. This is most evident in the case of taxation. The available analyses remain partial, and in the case of Barna (1975) incorrect, because each ignores a certain facet of the question — tax burden, government expenditures, or relative prices. More importantly, however, none of the interpretations of Physiocracy provides a full account of the contractionary impacts of hoarding, indirect taxation of agricultural output or relative price changes. As it is demonstrated in this paper, an adequate analysis has to expose how the monetary and real circulations are influenced by these changes because it is the reproduction process which falters when the physical and/or monetary holdings of the producing classes fall short of the required annual advances.

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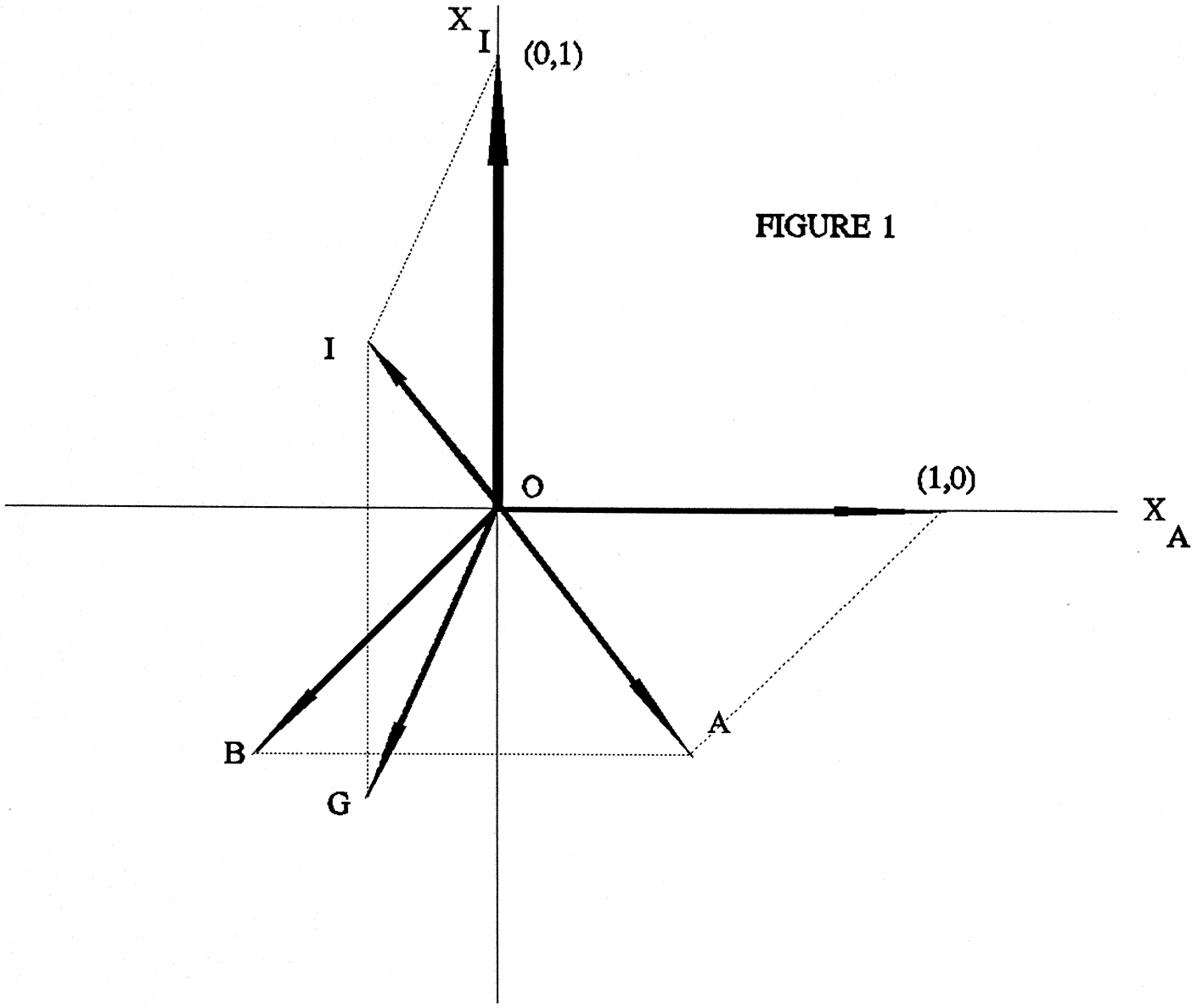

FIGURE 1

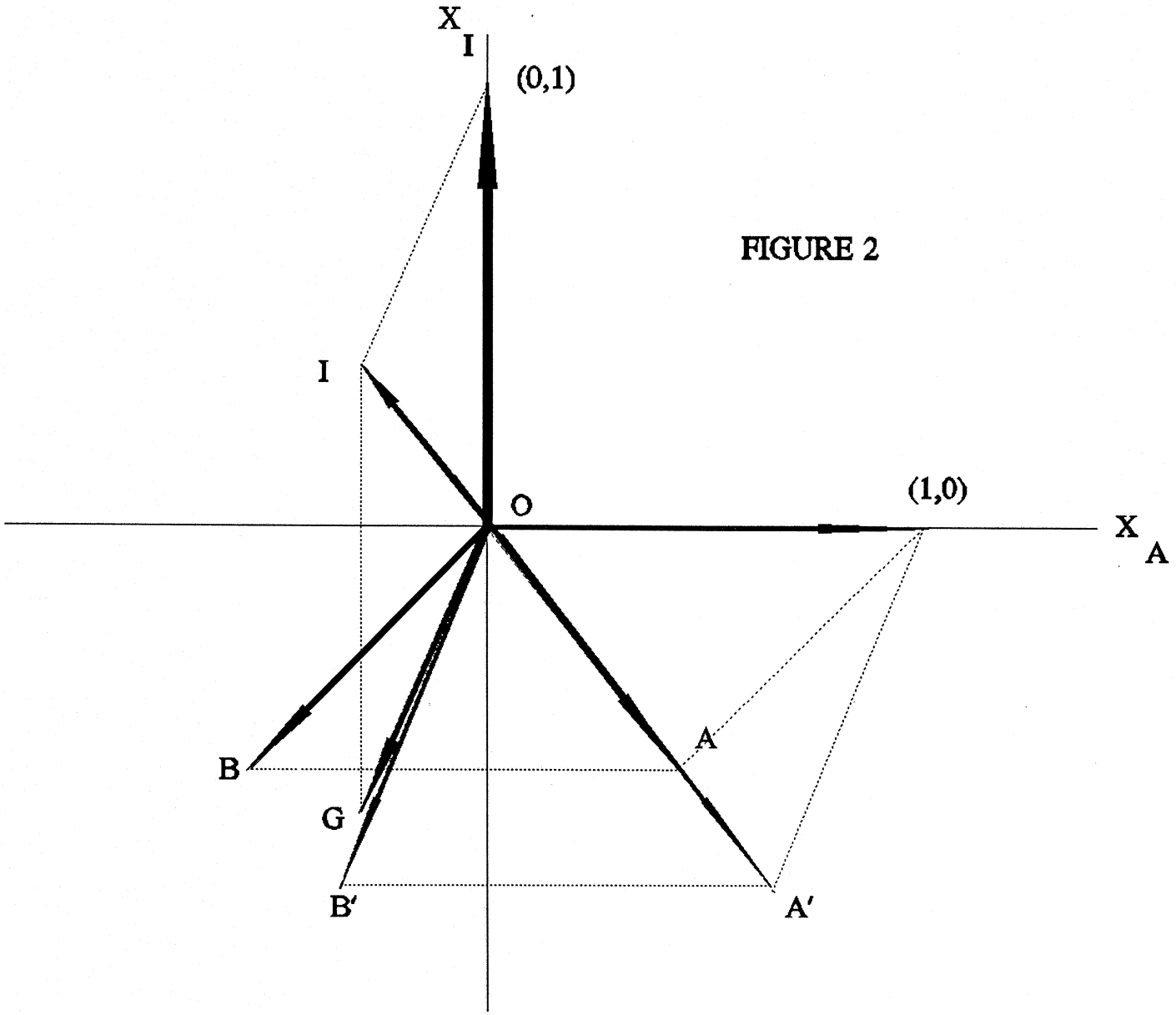

FIGURE 2

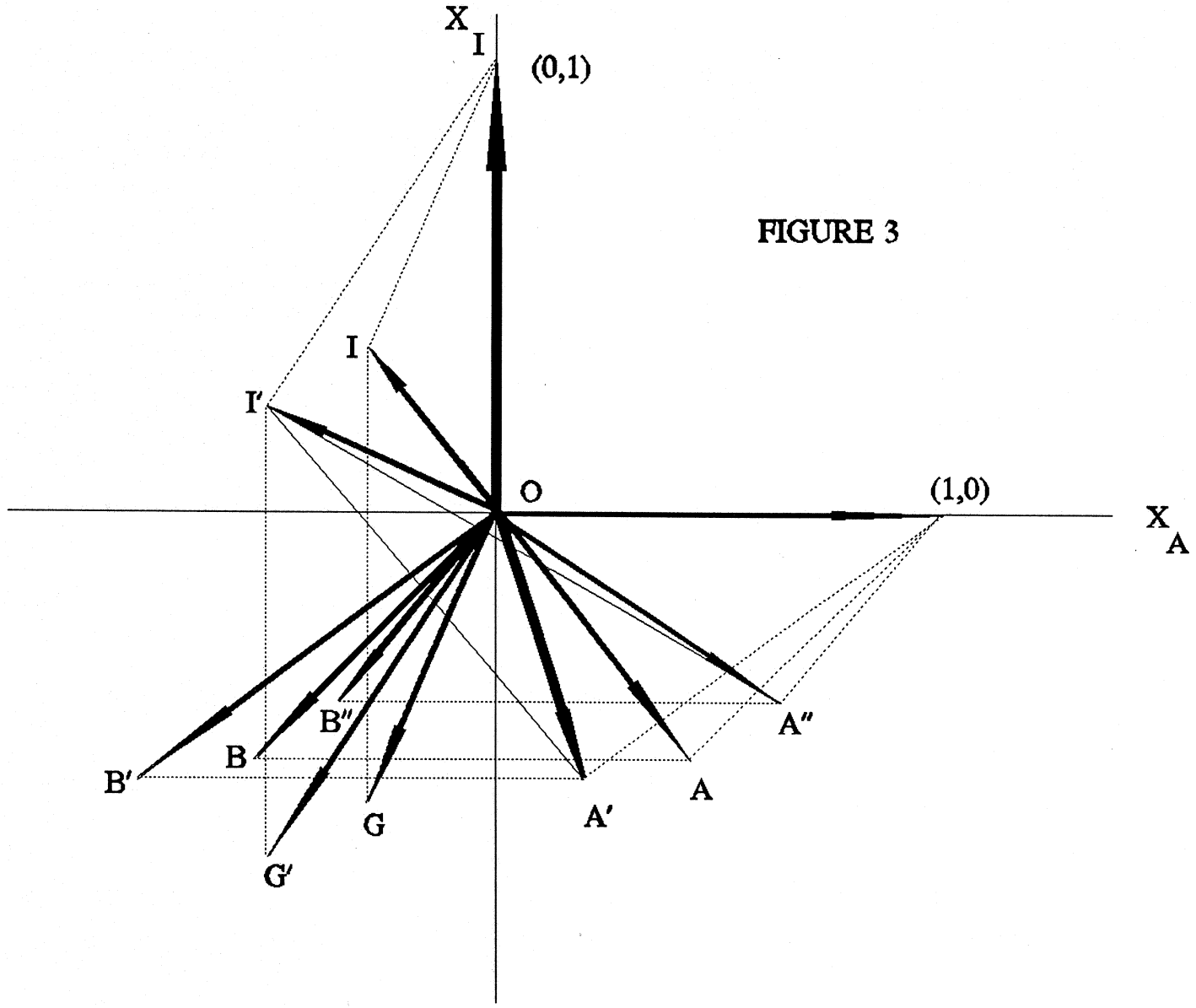

FIGURE 3

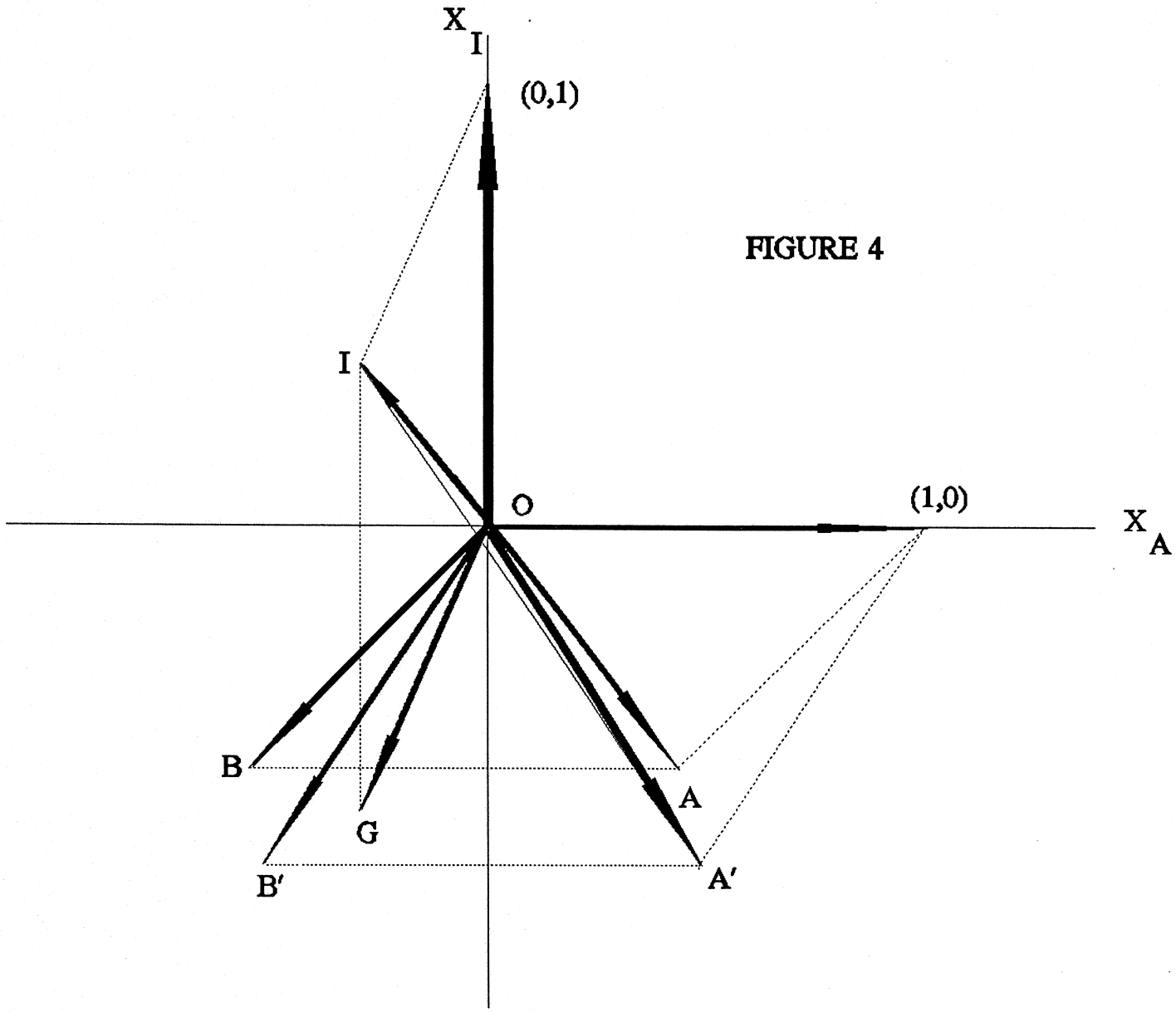

FIGURE 4