TEXTO PARA DISCUSSÃO

Nº 12

A Three-Sector Model of A Semi-Industrialized Economy

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Outubro de 1979

1. Introduction

With the advent of the oil crisis, triggered by the 1973 oil embargo, most developed economies have faced a new era of economic problems. Prolonged periods of combined rampant unemployment and inflation rates against which, at least in the short-run, market forces seemed inhibited and action of the conventional mix of policy instruments inoperative, have challenged traditional economic thought. This new experience of the industrial world hold close similarities with the history of the process of modernization of developing economies of the last three decades[1]. The unbalanced economic growth that followed the option to industrialize at a fast pace by primary-exporting economies generated an unbalanced productive structure. The coexistence of a traditional sluggish primary sector and a rapidly evolving modern industrial sector has been claimed responsible for the introduction of productive and external bottlenecks that need be dealt with accordingly[2].

The recognition of bottlenecks, or structural rigidities, and of the resistance of segments of society to accept a decline in their real income as a result of market equilibrating forces suggest the necessity to analyse economic policy in terms also of the income transfers it entails. This is not to say that price effects are unimportant but rather that the frequently neglected income effects may dominate or neutralize price effects in the short run. Hence, stabi1ization plans based only on pricing mechanisms may be surprised in the short term with adverse results[3]. This alternative perspective has been at the very heart of the Latin American structuralist school[4].

This paper should be regarded as a generalization and an extension of previous results[5] on income effects and structural rigidities to open economies. To such purpose the analysis is carried in terms of a short-run three-sector macroeconomic equilibrium model of a 1abor-surplus and Keynesian unemployment open economy which better characterize the semi-industrialized world. The model considers the domestic agricultural output limited by the availability of land and by a fixed food to exports composition, while mark-up pricing and excess capacity describe the emerging industrial sector. Agricultural exports and industrial imports are the unique foreign trade activities of the economy which follows a fixed exchange rate regime. The system responds to changes in the short-run through the food price, the industrial output and the trade-deficit.

Following this introduction, section 2 describes the macroeconomic model in further detail. Macroeconomic short-run equilibrium is established in section 3. Section 4 deals with the effects of demand policy in the short-run. The macroeconomic impact of an increase in investment and of a

[1] See Furtado (1964) and Hirschman (1958).
[2] The origins and implications of bottlenecks in primary-exporting countries have been analysed by Diamand (1979).
[3] See Taylor and Lysy (1979).
[4] See Malan and Wells (1980).
[5] See Bacha (1980), Taylor (1980), Cardoso (1980) and Lara-Resende (1979).

reduction on the propensity to save are evaluated. Section 5 concentrates upon the implications of alternative agricultural policies that may expand the agricultural frontier, increase land productivity and change the tradeable/non-tradeable composition of agricultural output. Income policies for wages and profit rates are considered in section 6. As most semi-industrialized economies facing external bottlenecks are sensitive to world price movements section 7 analyses the short-run macroeconomic impact of changes in the level of intermediate imports, primary exports and devaluation. Lastly, section 8 concludes this work suggesting the relevance of these results for the definition of a new scope for stabilization policies.

2. The Three-Sector Model

For the purpose of this paper the semi-industrialized economy is modelled in terms of a sectoral trilogy comprising the A-sector, a traditional subsector of agriculture yielding as output food for domestic consumption, the N-sector, a modern industrial sector manufacturing a single product with the dual character of being a consumption good as well as the unique domestic capital good in the economy and; the F-sector a foreign sector that has both a productive and commercial role, as it shares land with the A-sector for the production of primary exports and imports both intermediate goods for the domestic industrial activity, and capital-goods to supplement new capital-formation[6].

This general view of the economy establishes our basic framework for a further detailed analysis of each individual sector and the interrelationship among them, essential to the evaluation of the short-run macroeconomic impacts of changing conditions following section three.

The A-Sector

The rigidity of the agricultural supply characterizes the A-sector in the short-run. Except for random disturbances due to weather conditions that we do not discuss here, the agricultural output is solely determined by the area of land harvested. Prices and other incentives to agriculture have no effect on the crop volume in the short-run. Domestic agricultural prices adjust instantaneously to clear the market for food while the production of agricultural exports is sold at fixed world market prices. Receipts from exports in domestic currency are determined by the exchange rate given exogenously.

For simplicity labour is the only variable factor in agriculture, with the level of employment fixed in the short-run by agricultural land via fixed productivities. The nominal wage rate is exogenously given and assumed to be the equalized among sectors. While workers are assumed to

[6] This sectoral trilogy was formally introduced into short-run macroeconomic models by Sayad (1979) and Cardoso (1979).

spend their wage income entirely on consumption of food and industrial products, landlords use their agricultural income, the rentals on land, for both savings and consumption of industrial products. Landlords' consumption of food is considered a non-marketed output.

Denoting by $\lambda(0 \leq \lambda \leq 1)$ the proportion of the agricultural land, K_A, devoted to production for domestic consumption, the supply of food and exportable, X_A^H respectively, can be determined by

$$X_A^H = \lambda a_A^H K_A \qquad (1a)$$

and,

$$X_A^E = (1-\lambda) a_A^E K_A \qquad (1b)$$

The coefficients a_A^H and a_A^E represent land productivities on both food and exports production respectively.

With fixed productivities of labour in agriculture, $\frac{1}{b_A^H}$ for domestic and $\frac{1}{b_A^E}$ for exports production, employment in the short-run can be written as

$$L_A^H = b_A^H X_A^H \qquad (2a)$$

and,

$$L_A^E = b_A^E X_A^E \qquad (2b)$$

The internal price of the traded agricultural output is given by the relationship output P_A^E is given by the relationship

$$P_A^E = e P_A^* \qquad (3)$$

in which e is the exchange rate and the world price is marked by an asterisk.

Letting w denote the nominal wage the distrifcution of agricultural income between wages and profits yields

$$P_A^H X_A^H = w L_A^H + r_A^H \lambda K_A \qquad (4a)$$

and,

$$P_A^E X_A^E = w L_A^E + r_A^E (1-\lambda) K_A \qquad (4b)$$

where r_A^H and r_A^E are the agricultural rents and P_A^H is the price of food. After substitution of (1) anf (2), for X_A^H, X_A^E, L_A^H and L_A^E in (4), the following expressions for the rentals on land obtain:

$$r_A^H = a_A^H (P_A^H - w b_A^H) \qquad (5a)$$

$$r_A^E = a_A^E (P_A^E - w b_A^E) \qquad (5b)$$

The demand for food is determined solely by consumption expenditures of agricultural and industrial workers. We assume for simplicity that a proportion α of salaries is spent on food. Denoting industrial employment by L_N, the balance of supply and demand yields

$$P_A^H X_A^H = \alpha w [L_A^H + L_A^E + L_N] \qquad (6)$$

as the equilibrium condition for the A-sector.

The N-Sector

Oligopolistic behaviour is assumed to dominate the industrial activity in the economy. Industrial prices are set via a mark-up rule that allows changes in variable costs to be passed along to consumers. The reluctance of industrial capitalists to alter the mark-up rate or profit margin in the short-run characterizes the industrial sector in the model. As opposed to agriculture, prices do not clear the market for the industrial product. Fluctuations in demand are met by output adjustments with industry operating with variable excess capacity.

Labour and intermediate imports are the variable factors in industry. Industrial employment responds directly to the changes in the level of industrial activity that accompany demand fluctuations in the short-run. Urban workers are assumed to allocate their consumption expenditures, derived from wage receipts, between food and the industrial product in the same proportions as agricultural workers. This assumption disregards the increase in the demand for luxuries that might follow urban living standards. Capitalists either spend in consumption of industrial products or save their mark-up income (the industrial quasi-rent).

If we let b_N denote the inverse of labor productivity, m_N, the imported physical component of the industrial product and, P_M^*, the world market price of imports, marking up at a rate τ gives

$$P_N = (1+\tau)[wb_N + m_N e P_M^*] \qquad (7)$$

as the expression for the industrial price. Employment in industry is related to the level of industrial activity X_N by,

$$L_N = b_N X_N \qquad (8)$$

The decomposition of the sectoral net income flows between wages and profits yields

$$(P_N - m_N e P_M^*)X_N = wL_N + r_N K_N \qquad (9)$$

where K_N denotes the capital stock in industry and r_N the quasi-rent as capital. Substitution of (7) and (8) for P_N and L_N in (9) allows us to express the quasi-rent as

$$r_N = \tau(wb_N + m_N e P_M^*)\frac{X_N}{K_N} \qquad (10)$$

The demand for the industrial product is made up of investment demand I and consumption expenditures by wages and profit recipients. Landlords and industrial capitalists are assumed to save a fraction so their income and spend the rest on consumption of N-sector goods. Balancing supply and demand for the industrial product gives:

$$P_N X_N = P_N I + w(1-\alpha)[L_A^H + L_A^E + L_N] + (1-s)[r_N K_N + r_A^H \lambda K_A + r_A^E (1-\lambda)K_A] \qquad (11)$$

as the condition for equilibrium in the N-sector.

The F-Sector

In this economy, imports of intermediate products for industry and complementary capital-goods are supported by foreign-exchange receipts from exports from agriculture and capital inflows. For simplicity we neglect autonomous capital flows. In our model, short-run adjustments to trade imbalances are accomplished through foreign lending or compensatory capital inflows exclusively.

Denoting by m_I the physical ratio of investment made up of imported capital goods at the world market price P_I^* and by F the trade deficit in foreign currency, equilibrium in the foreign sector follows from the balance-of-payments condition that:

$$m_I P_I^* + m_N P_M^* X_N = P_A^* X_A^E + F \qquad (12)$$

The Savings-Investment Identity

Besides helping close the trade gap in (12) foreign lending also supplements aggregate domestic savings in financing investment. Written in national currency the savings-investment identity becomes:

$$s[r_N K_N + r_A^H \lambda K_A + r_A^E (1-\lambda) K_A] + eF = P_N I + m_I e P_I^* I \quad (13)$$

The first term on the left-hand side of (13) represents domestic savings out of profits from industry and agriculture. The second term eF is the amount of foreign-savings generated by the trade deficit. New-capital formation, on the right-hand side, includes both investment in domestic and imported capital goods.

3. Macro Equilibrium in The Short-Run

In our model a macroeconomic equilibrium will exist when simultaneously supply equals demand in both agriculture and industry, foreign exchange receipts and payments are balanced and savings equals investment. However, these four equilibrium conditions are not independent. It can easily be shown that if any three of such conditions hold, the fourth equation is necessarily satisfied.

For analytical reasons we shall restrict attention in further developments to equilibrium in agriculture (6), the balance-of-payments (12) and the savings-investment identity (13) with the knowledge that equilibrium in industry is carried out implicitly. Equilibrium values for the three short-run macroeconomic variables, namely: the price of the agricultural domestic output P_A^H; the level of industrial activity X_N; and the amount of foreign lending F, can then be determined.

Substitution of equations (1), (2) and (8) for X_A^H, L_A^H, L_A^E and L_N in (6) yields an alternative expression for equilibrium in agriculture:

$$P_A^H = \alpha w \left[b_A^H + \frac{(1-\lambda)}{\lambda} \frac{a_A^E}{a_A^H} b_A^E \right] + \frac{\alpha w b_N}{\lambda a_A^H K_A} X_N \qquad \text{(AA)}$$

Graphically (AA) corresponds to a straight line in the space (P_A^H, X_N) as depicted in Figure 1(a). With supply fixed in the short-run, an increasing price for food follows the stronger demand pressure on the agricultural product that results from a higher level of industrial activity and employment. This explains on intuitive grounds AA's positive slope. Using expressions (5) and (10) for the rents and quasi-rents and equations (12) for the amount of foreign lending, the savings-investment identity (13) becomes:

$$P_A^H = \frac{(1+\tau)[w b_N + m_N e P_M^*] I}{s\lambda a_A^H K_A} + w b_A^H + \frac{1-\lambda}{\lambda} \frac{a_A^E}{a_A^H} \left[\frac{(1-s)}{s} e P_A^* + w b_A^E \right] - [s\tau w b_N + (1 + s\tau) m_N e P_M^*] \frac{X_N}{s\lambda a_A^H K_A} \qquad (15)$$

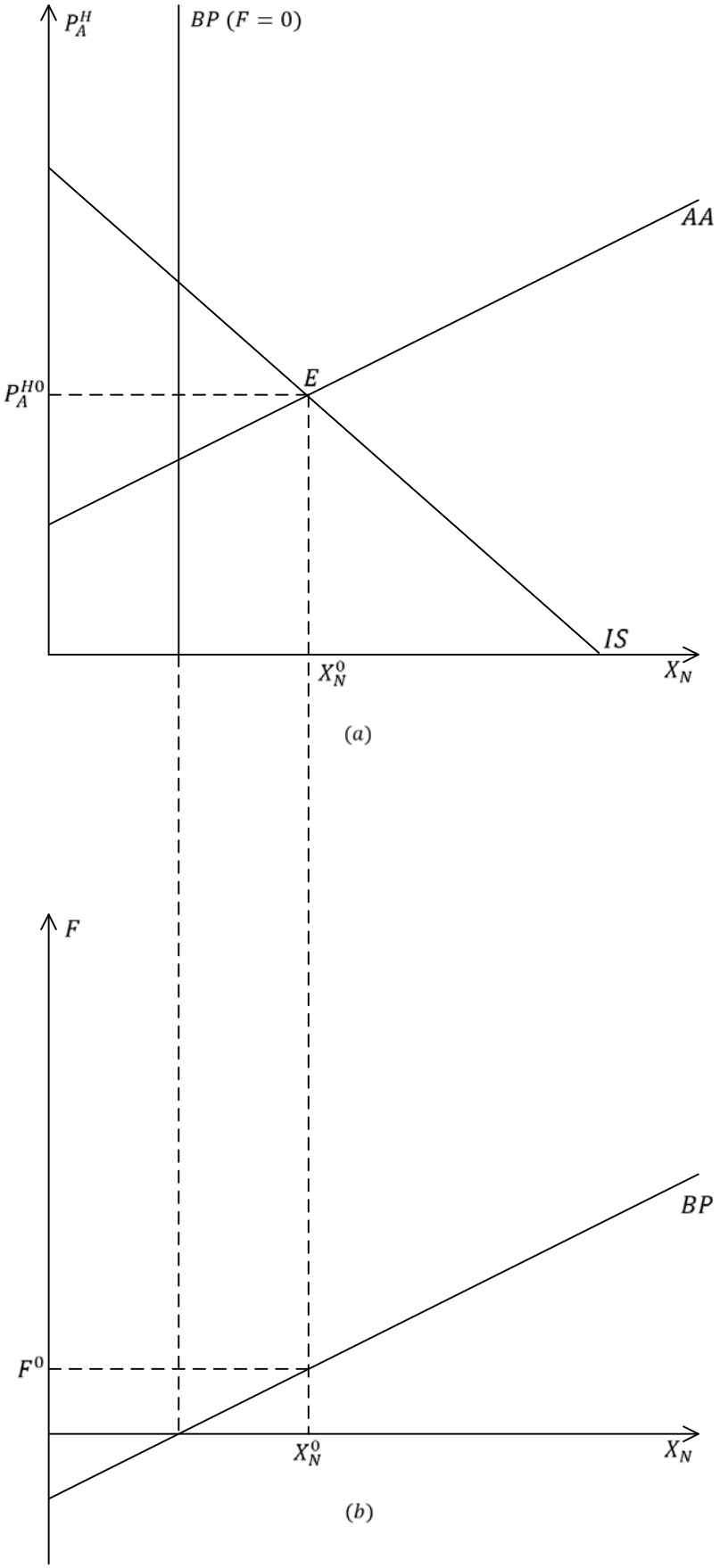
This cumbersome relation between P_A^H and X_N is also displayed in Figure 1(a). The negative sloping of the IS curve can understood as we notice that a higher level of industrial activity will provide the economy with larger savings originating from industrial capitalists and foreigners. With investment exogenously given, less savings is required from agriculture and consequently food prices need to decline.

Finally, equation (1b) allows the equilibrium condition (12) for the F-sector to be rewritten as

$$F = m_I P_I^* I - (1-\lambda) a_A^E P_A^* K_A + m_N P_M^* X_N \qquad \text{(BP)}$$

Figure l(b) displays the balance-of-payments condition (BP), vhen exports from agriculture exceed imports of foreign capital-goods. Otherwise the positively sloped line BP will intercept the vertical axis on the nonnegative range. Notice that the higher the level of industrial activity more imports of intermediate products are required and hence, the larger will be the trade deficit that must be covered through foreign lending. The equilibrium price $(P_A^H)^0$ and output $(X_N)^0$ are determined by the intersection of IS and AA in Figure l(a). Figure l(b) then determines the corresponding equilibrium capital inflow $(F)^0$. Notice that the trade deficit can be measured directly from Figure 1(a) by multiplying by $m_N P_M^*$ the horizontal distance between E and the vertical line labeled $F = 0$ which stands at the level of industrial activity for which trade is balanced.

The study of the impact on macroeconomic equilibrium of changes in the exogenous parameters is taken up in the following sections. The economy responds in the short-run to policy action and variations in the terms-of-trade through adjustments in the equilibrium values of the level of industrial activity, the price of food and the volume of foreign lending. The comparative-statics analysis is pictured more clearly when the equilibrium conditions (AA), (IS) and (BP) are expressed in terms of variations as:



Macro Equilibrium in the Short-run

Figure 1

$$-\alpha w b_N dX_N + \lambda a_A^H K_A = \Delta_{AA} \qquad (14.a)$$

$$s\tau[wb_N + m_N e P_M^*]dX_N + s\lambda a_A^H K_A dP_A^H + edF = \Delta_{IS} \qquad (14.b)$$

$$m_N P_M^* dX_N - dF = \Delta_{BP} \qquad (14.c)$$

The symbols Δ_{AA}, Δ_{IS} and Δ_{BP} denote the perturbations the equilibrium conditions AA, IS and BP, respectively, due to changes on the exogenous variables. In macroeconomic equilibrium $\Delta_{AA} = \Delta_{IS} = \Delta_{BP} = 0$. For simplicity of exposition we also define the non-negative variable

$$D = s(\tau + \alpha)wb_N + (1 + s\tau)m_N e P_M^*$$

which will appear in the denominator of most expressions of variable changes[7].

For inferences about movements of the macroeconomic aggregates and real changes in the economy we let

$$P = (P_A^H)^{\alpha}(P_N)^{1-\alpha}$$

stand for the index of the cost of living. Changes in consumers' prize are then evaluated by

$$\frac{dP}{P} = \alpha \frac{dP_A^H}{P_A^H} + (1 - \alpha)\frac{dP_N}{P_N}. \qquad (15)$$

Accordingly, nominal value-added or national income in the economy is determined by

$$Y = P_A^H X_A^H + P_A^E X_A^E + P_N X_N - m_N e P_M^* X_N = P_A^H X_A^H + P_N X_N - eF + m_I e P_I^* I \qquad (16)$$

4. Demand Policy Analysis

Given the inelasticity of the agricultural supply in our model of the economy, demand policy in the short-run can only aim at varying the level of capacity utilization and employment in industry. With rigid industrial prices, industrial expansion or contraction may be achieved through an effective positive or negative stimulus to demand respectively.

The two-consumption-goods model of section two identifies four demand categories. Industrial demand is composed of demand for investment I and demand for consumption by wage and profit recipients. The latter are assumed to spend fixed proportions $(1 - \alpha)$ and $(1 - s)$ of their income respectively on consumption of industrial goods. Food is demanded for consumption by wage earners exclusively.

Under this framework attention is restricted to demand policy options that bring about changes of the rate of new-capital formation and of the profit recipients savings pattern. While the substitution of industrial goods for food in the workers consumption basket, namely a decline in α, leads also to industrial expansion this is regarded here as a change in preferences. Demand policy instruments to affect consumers preferences are difficult to devise and hard to implement.

[7] The determinant of the 3 x 3 left-hand matrix in system (14) is $(\lambda a_A^H K_A)D$.

An increase in investment may be achieved, for example, through a program that reduces corporate income taxes, increasing the after-tax corporate rate-of-return. Favourable interest rate differentials, restrictions on dividend policy and other forms of subsidies to corporate debt can also generate incentives to invest. In an analogous fashion, a higher rate of capital accumulation in the publicly-owned enterprises will increase the global level of investment in the economy. Industrial demand will also increase as a result of policies that affect the profit recipient's inter-temporal preferences via a decline in the propensity to save. The launching of a program of capital gains taxation or general policies that lower interest rates can be expected to favour current consumption at the expense of savings for future consumption.

While the same rate of industrial expansion can result from the promotion of industrial demand through an increase in I and/or a decline in s, the short-run macroeconomic impact upon food prices and foreign lending differs between the two alternative policies. The magnitude of these effects is evaluated by the solution of (14) with

$$\Delta_{AA} = 0,$$
$$\Delta_{IS} = (P_N + m_I e P_I^*)dI - [r_N K_N + r_A^H \lambda K_A (1-\lambda) K_A]ds,$$
$$\Delta_{BP} = -m_I P_I^* dI$$

4.1. An Increase in Investment

A rise in the rate of new-capital formation in the economy expands industrial activity, raises food prices and increases capital inflow to cover the larger trade deficit. The short-run elasticities are[8]

$$\frac{d\hat{X}_N}{d\hat{I}} = \frac{P_N}{D}\frac{I}{\lambda_N} \qquad (17a)$$

$$\frac{d\hat{P}_A^H}{d\hat{I}} = \frac{wL_N}{P_A^H X_A^H}\frac{P_N}{D}\frac{I}{X_N} \qquad (17b)$$

and

$$\frac{d\hat{F}}{d\hat{I}} = \frac{m_I P_I^* I}{F} + \frac{m_N P_M^* X_n}{F}\frac{P_N}{D}\frac{I}{X_N} \qquad (17c)$$

Industrial output expands via the multiplier process as indicated by (17a). The magnitude of the investment multiplier $\frac{P_N}{D} > 1$ is inversely related to the propensity to save s and the fraction of food expenditures over total workers' consumption expenditures α. The elasticity of industrial production is proportional to the ratio of investment demand over total industrial output. Increased employment in the N-sector adds to food demand and, with supply fixed in the short-run, the domestic agricultural price level rises. Equation (17b) suggests that the smaller the fraction of agricultural land for domestic

[8] The hat denotes the logarithm of the variable, e.g., $\hat{X} = \log X$.

production, the higher will be the increase in food prices. The magnitude of the elasticity of food prices to changes in investment depends on the share of food consumption by industrial workers.

Graphically the results above follow from a parallel shift to the right of the IS curve with AA unchanged as depicted in Figure 2(a).

The trade deficit in (17c) increases for two reasons: directly, due to the increased demand for imported capital-goods and indirectly, due to the increase in the demand for intermediate imports required for industrial expansion. The latter effect can be measured in Figure 2(a) by the horizontal distance from the new equilibrium output X_N to the old trade balance line $F = 0$. Higher imports of capital-goods move the trade balance vertical line leftwards to $\Gamma' = 0$. At the new short-run equilibrium E' higher levels of industrial activity, food prices and foreign lending are attained.

4.2. A Decline in the Propensity to Save

In an analogous fashion, a reduction of the propensity to save expands industrial output and employment and raises food prices and the trade deficit according to

$$\frac{d\hat{X}_N}{d\hat{s}} = -\frac{s}{DX_N}[r_N K_N + r_A^N \lambda K_A + r_A^E (1-\lambda) K_A] \quad (18a)$$

$$\frac{d\hat{P}_A^H}{d\hat{s}} = \frac{\alpha w L_N}{P_A^H X_A^H}\frac{s}{DX_N}[r_N K_N + r_A^H \lambda K_A + r_A^E (1-\lambda) K_A] \quad (18b)$$

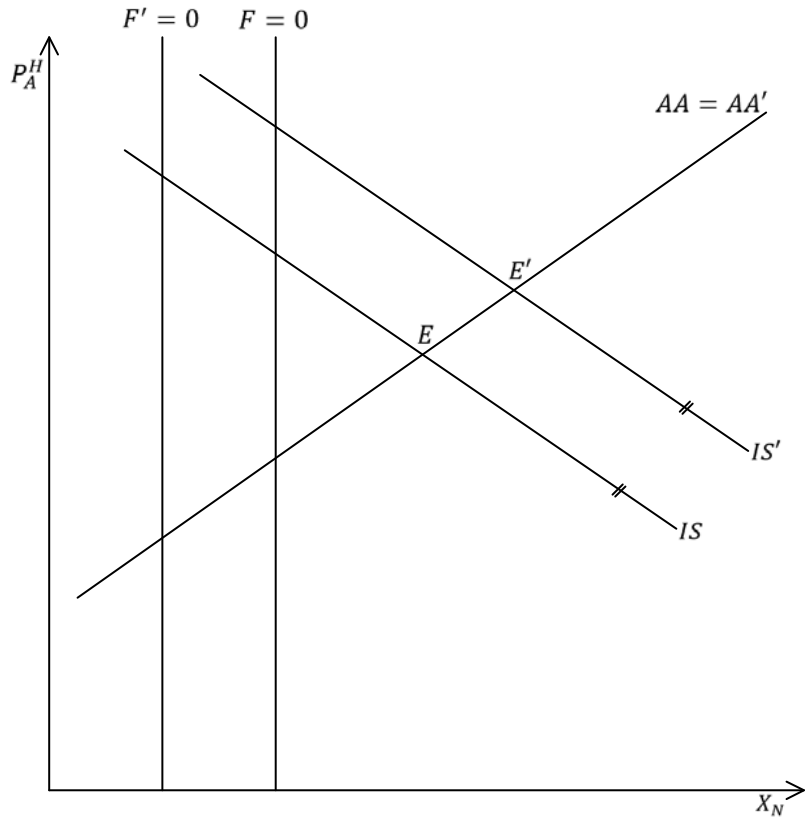
and

$$\frac{d\hat{F}}{d\hat{s}} = -\frac{m_N P_M^* X_N}{F}\frac{s}{DX_N}[r_N K_N + r_A^H \lambda K_A + r_A^E (1-\lambda) K_A] \quad (18c)$$

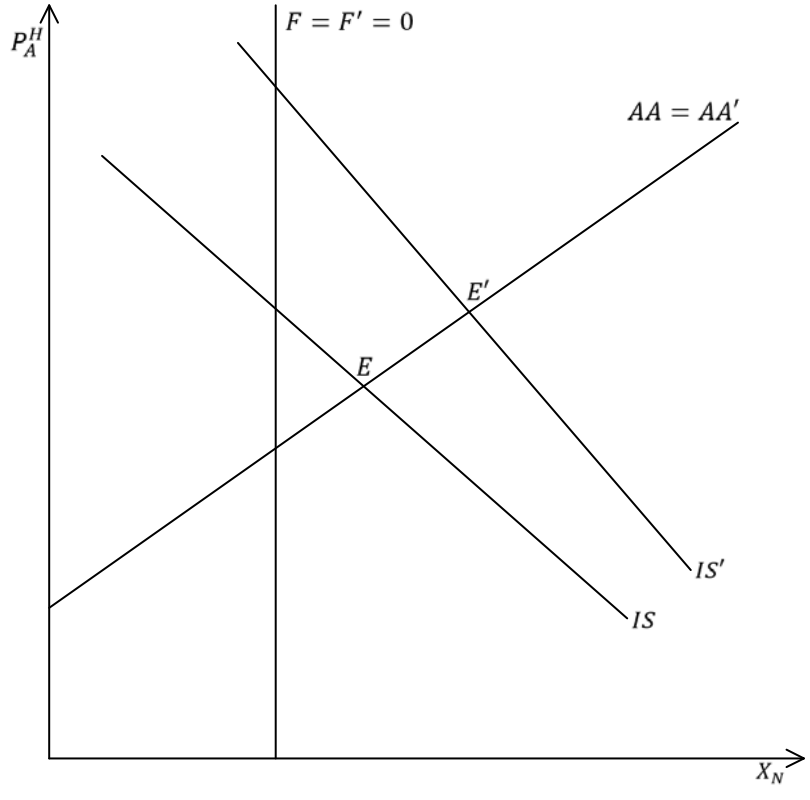
A decline in the propensity to save ($d\hat{s} < 0$) increases the demand for industrial goods by profit recipients. With rigid industrial prices-excess demand in the N-sector goods market is eliminated through an increase in industrial capacity utilization and output. The magnitude of this effect is proportional to domestic savings according to (18a). Increased urban employment raises food demand which exerts an upward pressure on food prices. Food prices rise in the short-run to restore equilibrium in the A-sector. The rise in food prices is larger the higher is the share of industrial worker's consumption of food products by (18b). The trade deficit increases, as intermediate import requirements follow industrial expansion. The short-run elasticity (l8c) is larger the higher is the ratio of intermediate imports expenditures to the trade deficit.

Savings-investment equilibrium is restored in the short-run by the increase in capital inflows that compensate for the reduced domestic capability to finance the exogenous investment level.

Figure 2(b) depicts graphically the impact upon equilibrium of a decline in the propensity to save. The IS curve moves upward and to the right into IS' with AA and BP unchanged. A new short-run equilibrium is reached at E'.



An Increase in Investment
(a)



A Decline in the Property to Save
(b)

Figure 2

Observation of Figures 2(a) and 2(b) suggests that while the same rate of industrial expansion may be achieved by a rise in investment or a decline in the propensity to save, the trade deficit further rises in the former case. This is due the greater requirements of complementary capital goods imports in (17c).

5. Agripolicies in the Short-run

In our model of the semi-industrialized economy agriculture is resource – limited in the short-run, as the extension of agricultural land is fixed. Furthermore, food and primary exports supplies are determined by a fixed crop composition and the corresponding productivities by (1), under the assumption that both respond to changes in relative prices with negligible elasticities and considerable time lags. Hence, as opposed to limitations by domestic and foreign demands both food consumption and primary exports are constrained by production[9].

Under this framework an increase in food supply, which is perceived by most semi-industrialized economies as the strongest force against rising food prices, may follow from an expansion of the agricultural frontier, productivity gains in food production and/or a more favourable tradeable to non-tradeable allocation of the agricultural land, namely $d\hat{X}_A^H = d\hat{\lambda} + d\hat{a}_A^H + d\hat{K}_A$.

Proper use of agricultural policy instruments may affect all three parameters, individually or jointly. The expansion of the agricultural frontier may result from past investment in land-clearing and irrigation stimulated by an oriented program of financing and credit for land improvement. Mechanization and, to a certain extent irrigation may sustain agricultural growth through an increase in the productivity of agricultural land. Such investment activities may require favourable credit conditions for the purchase of related equipment. Lastly, a differentiated interest-rate program for crop financing or subsidies that translate a preferential treatment to food production should be an incentive to substitution of food for exports production.

Each of the three alternatives above for food supply growth suggests a different pattern of income transfers and consequently a different impact upon industrial output and employment, food and consumer prices and the trade deficit. The effects upon the short-run equilibrium of the economy discussed in the following subsections, can be evaluated by (14) with,

$$\Delta_{AA} = [\alpha w K_A (b_A^H a_A^H - b_A^E a_A^E) - P_A^H a_A^H K_A] d\lambda + [(\alpha w b_A^H - P_A^H)\lambda K_A] da_A^H + \{\alpha w [\lambda b_A^H a_A^H + (1-\lambda) b_A^E a_A^E] - P_A^H \lambda a_A^H\} dK_A$$

$$\Delta_{IS} = -[s(r_A^H - r_A^E)K_A] d\lambda - [s(P_A^H - w b_A^H)\lambda K_A] da_A^H - \{s[r_A^H \lambda + r_A^E (1-\lambda)]\} dK_A$$

$$\Delta_{BP} = -(P_A^* a_A^E K_A) d\lambda + [P_A^* (1-\lambda) a_A^E] dK_A$$

[9] Diamand (1976) discusses these two forms of limitations.

5.1. An Increase in the Food to Exports Land Composition

The impact upon the economy in the short-run of an increase in food supply accomplished by extending the area for food production at the expense of primary exports is ambiguous[5] being highly dependent upon the economy parameters, mainly the differential of labour intensity between the two distinct agricultural crops. The percentage changes in the macroeconomic variables are given by:

$$\frac{d\hat{X}_N}{d\hat{\lambda}} = \frac{\lambda K_A}{DX_N}[s(1-\alpha)w - (1-s)P_A^E a_A^E] \tag{19a}$$

$$\frac{d\hat{P}_A^H}{d\hat{\lambda}} = \frac{\alpha w L_N}{P_A^H X_A^H}\left\{\frac{\lambda K_A}{DX_N}[s(1-\alpha)w\delta - (1-s)P_A^E a_A^E]\right\} - \frac{1}{P_A^H}(P_A^H X_A^H - \alpha w \lambda K_A) \tag{19b}$$

and

$$\frac{d\hat{F}}{d\hat{\lambda}} = \frac{m_N P_M^* X_N}{F}\left\{\frac{\lambda K_A}{DX_N}[s(1-\alpha)w\delta - (1-s)P_A^E a_A^E]\right\} + \frac{\lambda}{d\hat{\lambda}}\frac{P_A^* X_A^E}{F} \tag{19c}$$

where $\delta = a_A^H b_A^H - a_A^E b_A^E$ is the differential of labour intensity.

The results above can be better understood if we first consider the case where food and primary exports production are equally labour intensive or $\delta = 0$. With this simplication the first terms in exprqssions (19a), (19b) and (19c) vanish. At the initial level of industrial activity, an increase in food supply reduces the domestic agricultural price. Labour freed from production for exports is absorbed by domestic production not affecting agricultural workers' demand for food and for the industrial output. Foreign currency receipts from exports fall and the trade deficit rises. The increase in profits due to increased food production is matched by the declining domestic price. Rentals on tradeable agricultural land fall, reducing the landlords demand for the industrial good. Excess supply in industry is eliminated by contraction of the industrial activity X_N and employment L_N and the domestic agricultural price P_A^H further declines. The reduced demand for intermediate imports for the N-sector is not strong enough to overcome the initial trade deficit increase. The net effect in the amount of foreign lending is positive as can be demonstrate d by manipulation of (19c).

When the labour intensity of food and exports products differ, equations (19a) and (19b) suggest that the above contractionary and deflationary impacts respectively may be reversed. If food production is significantly more labour intensive than exports production ($\delta \gg 0$), increased employment in agriculture will lead to strong demand pressures by workers on both the A and N-sectors' output. Industrial production and food prices may rise. In the latter case, increased imports expand the trade gap and capital inflows in (19c) further rise.

There is still another possibility for the outcome of an increases in the food to exports land composition. Observation of equations (19a) and (19b) suggests that, depending upon $\boldsymbol{\delta}$, food prices may fall while industry and the trade deficit expand.

Figures 3(a) to 3(c) display graphically these three possibilities respectively. Equation (AA) shows that the A-sector equilibrium line intercepts the vertical axis at a lower level of the domestic agricultural price and becomes less steep as A increases, moving into AA' in Figure 3. The same observations holding for the savings-investment identity (IS), the line IS moves into IS'. Lastly, the balance-of-payments condition in expression in Figure 1(b) has a higher intercept and the same slope. The upward parallel shift of line BP in Figure l(b) results in a leftward movement in the trade balance line to $F' = 0$ also depicted in Figures 3.

The main lesson to be learned from this exercise is that an increase in food supply accomplished by substitution of non-tradeable for tradeable agricultural production may have adverse effects upon urban employment. It also shows that equilibrium in the short-run ray be restored at higher and not lower food prices. Only under special circumstances will lower food prices be accomplished with industrial expansion altogether.

5.2. Productivity Gains in Domestic Agriculture

An increase in the productivity of land for food production leads to expansion of industrial output and employment, a decline in food prices and a larger trade deficit in the short-run. The food productivity elasticities are given by

$$\frac{d\hat{X}_N}{d\hat{a}_A^H} = \frac{s}{DX_N}(1-\alpha)wL_A^H, \qquad (20a)$$

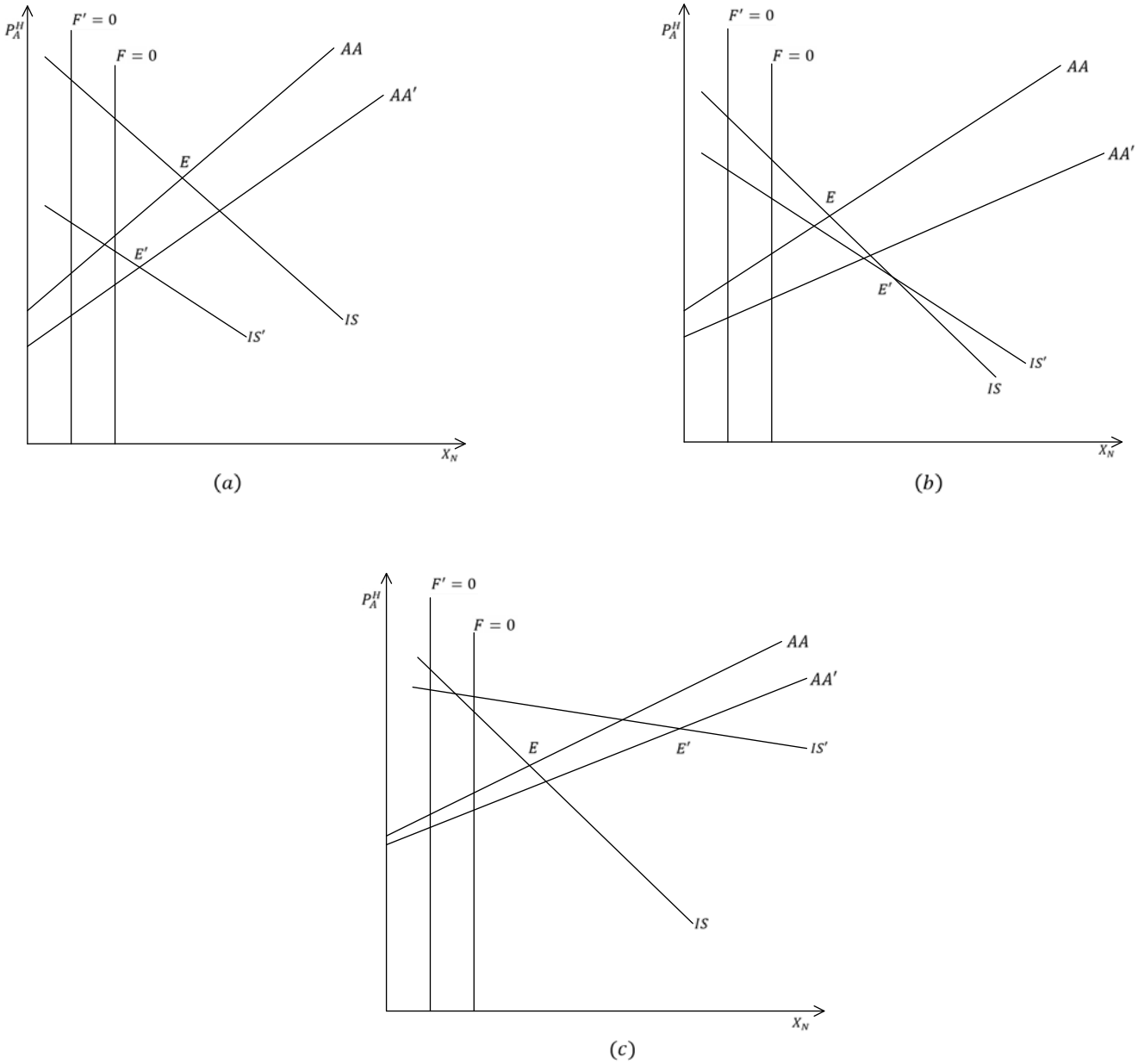
$$\frac{d\hat{P}_A^H}{d\hat{a}_A^H} = \frac{\alpha w b_A^H}{P_A^H}\left(1 - \frac{s\alpha w b_N}{D}\right) - 1 \qquad (20b)$$

and

$$\frac{d\hat{F}}{d\hat{a}_A^H} = \frac{m_N P_M^* X_N}{F}\frac{s}{DX_N}(1-\alpha)wL_A^H \qquad (20c)$$

The immediate impact of the increased productivity is to increase food supply and lower food prices in the same proportion. Increased employment in domestic agriculture adds to demand for N-sector goods. At the other end, together with lower food prices, rentals on land for food production decline, reducing the landlords demand for industrial goods. As a fraction $\boldsymbol{s}$ of the food producers rent is saved, the net effect is excess demand in the N-sector goods market. Industrial output expands to clear the market as determined by (20a). Increased employment in industry adds to food demand which exerts an upward pressure on food prices. This corresponds to the leftmost term in (20b) which can.be shown to be nonnegative and less than unit. Hence, the net impact of the two opposite forces is a decline in food prices with elasticity (20b). Lastly the trade deficit and compensatory capital inflows increase with the expansion of intermediate imports for industry. The food productivity elasticity of the trade deficit (20c) is equal to the ratio of intermediate imports to the trade deficit

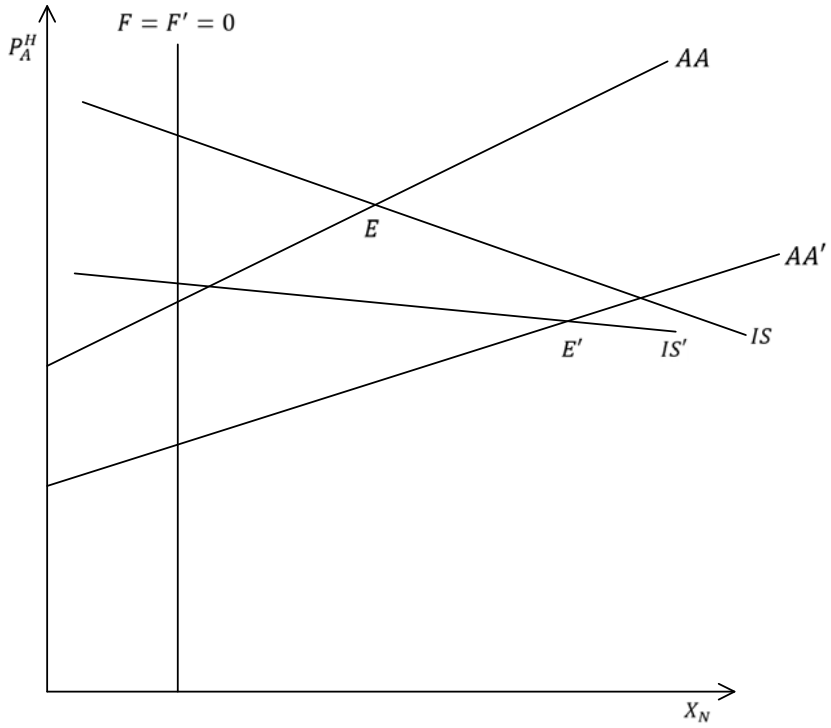
times the elasticity of industrial output.



An Increase in the Food to Exports Land Composition

Figures 3

Figure 3(d) depicts graphically the macroeconomic impact of an increase in the productivity of land for food production. The A-sector equilibrium condition line AA shows a lower vertical intercept and a smaller slope, moving into AA'. In analogous fashion, IS moves into IS'. Hence, a new short-run equilibrium E' is reached at higher levels of the industrial activity and the trade deficit and a lower level of food prices.



Productivity Gains in Domestic Agriculture

Figure 3(d)

5.3. Expansion of the Agricultural Frontier

An increase in the area for agricultural production may either expand or contract industrial output and employment, while lowering the level of food prices unambiguously. In an analogous fashion, either a larger or smaller trade deficit may follow the expansion of the agricultural frontier. The magnitude and direction of the macroeconomic adjustments are given by the short-run elasticities.

$$\frac{d\hat{X}_N}{d\hat{K}_A} = 1 - \frac{P_N}{D}\frac{I}{X_N} \qquad (21a)$$

$$\frac{d\hat{P}_A^H}{d\hat{K}_A} = -\frac{\alpha w L_N}{P_A^H X_A^H}\frac{P_N}{D}\frac{I}{X_N} \qquad (21b)$$

and,

$$\frac{d\hat{F}}{d\hat{K}_A} = \frac{m_N P_M^* X_N}{F}\left[1 - \frac{P_N}{D}\frac{I}{X_N}\right] - \frac{P_A^* X_A^E}{F} \qquad (21c)$$

An increase in K_A increases the supply of both food and primary exports. At the equilibrium level of industrial activity, the immediate impact of an expansion of the area of land harvested is felt through a decline in food prices and an improvement of the economy's trade deficit. As employment in the A-sector is limited by land, an increase in rural employment accompanies agricultural expansion. While the enlarged agricultural labour force tends create excess demand in the N-sector

goods market, the reduced rentals on land for food production may dampen demand. This would be the case when the rent decline more than offsets the expansion of agricultural land. Then, reduced profits in agriculture combined with a small propensity to save by landlords may generate an excess supply of industrial products. Industrial output and employment will either expand or contract depending upon the strength of the two forces according to (21a). This proposition can be further clarified if (21a) is rewritten as

$$\frac{d\hat{X}_N}{d\hat{K}_A} = \frac{1}{DX_N}\{wb_N[s(\tau+\alpha)X_N - (1+\tau)I] + m_N eP_M^*[(1+s\tau)X_N - (1+\tau)I]\}$$

after substitution for D. If s and α are large, $s\alpha \cong 1$, then since by (11)

$$\frac{P_N}{1+\lambda}[(1+s\tau)X_N - (1+\tau)I] = (1-\alpha)w[L_A^H + L_A^E + L_N] + (1-s)[r_A^H \lambda K_A + r_A^E(1-\lambda)K_A]$$

is non negative, industrial output expands. Conversely if α is small with respect to τ, m_N and b_A^E are negligible and s is large, substitution of (12) into (13) yields

$$\frac{P_N}{1+\lambda}[(1+\tau)I - s\tau X_N] = sr_A^H \lambda K_A$$

and industrial output contracts.

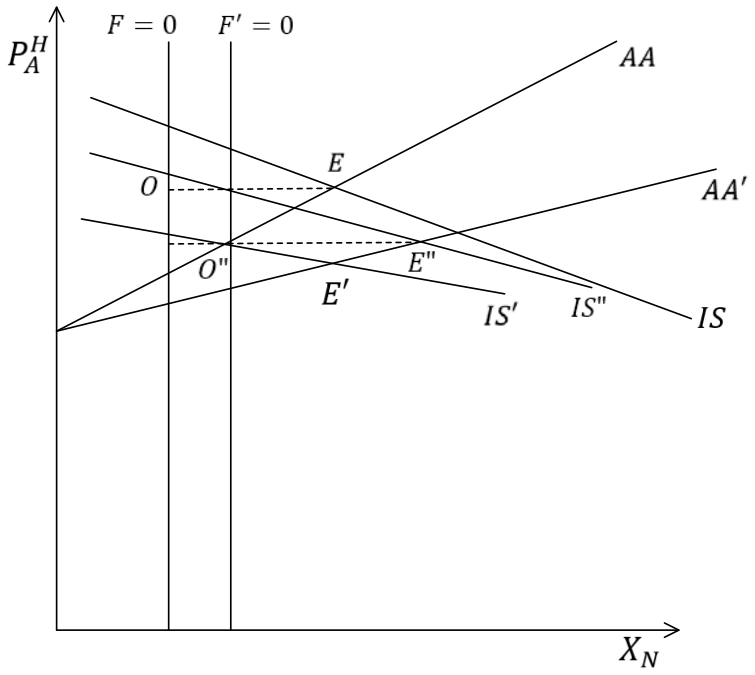
The level of food prices is by (21b) lower at the new short-run equilibrium under either industrial contraction or expansion. Lastly from (2lc) we observe that if industrial output contracts, the decline in intermediate imports further reduces the trade deficit and the volume of compensatory capital inflows. Conversely, under expansion of the N-sector a larger trade deficit may obtain in equilibrium depending upon the magnitude of the industrial output elasticity and the proportions of intermediate imports and primary exports to the trade deficit.

Figure 3(e) depicts graphically the macroeconomic impact of an expansion of the agricultural frontier. The A-sector equilibrium condition rotates downward around the vertical intercept into AA'. The trade balance line moves rightward into $F' = 0$. The savings-investment equilibrium condition has a lower vertical intercept and a smaller slope in absolute value. Two possibilities are considered: with IS', X_N, P_A^H and F decline at the new short-run equilibrium E', with $IS"$, X_N increases and F increases or decreases according to whether $O"E"$ is greater or smaller than OE.

6. Effects of Incomes Policy

Incomes policy action in the semi-industrialized economy may pursue essentially two main objectives: i) the protection of real wages, $\frac{w}{P}$ and/or; ii) the stabi1ization and progression of the income distribution between wages and profits as measured by the index

$$\Gamma = \frac{w(L_A^H + L_A^E + L_N)}{r_A^H \lambda K_A + r_A^E(1-\lambda)K_A + r_N K_N}$$



Expansion of the Agricultural Frontier

Figure 3(e)

Attention is restricted in this section upon changes in the industrial mark-up rate and the economy's nominal wage, the traditional incomes policy variables. The magnitude and direction of the impact upon the economy in the short-run of changes in τ and w can be de termined by (14) with

$$\Delta_{AA} = \left[\left(\frac{P_A^H}{w}\right)X_A^H\right] dw$$

$$\Delta_{IS} = \left\{\left[\frac{P_N}{(1+\tau)}\right](I - sX_N\right\} d\tau + \{b_N[(1+\tau)I - s\tau X_N] + s[b_A^H X_A^H + b_A^E X_A^E]\}dw$$

and,

$$\Delta_{BP} = 0.$$

Government action can affect individually the industrial mark-up rates and the nominal wages indirectly through instruments that either stimulate or retard advances in those variables. Incentives to the internal generation of funds to finance investment which is perceived by a rising mark-up rate, can be generated by artificially high interest rates, controlled access to international financial markets and restrictions upon the debt/equity ratios. Also, the government may influence the prospects for workers' claims by well-defined rules of wage policy. Direct action via wage and/or price Controls may be implemented through specific guidelines.

The results of the following subsections should help determining the path of simultaneous changes in wages and mark-ups that are compatible with alternative incomes policy goals.

6.1. An Increase in the Mark-up Rate

A rise in the industrial profit margin, the mark-up rate, may either stimulate or retard industrial production, with food prices and foreign lending moving in the same direction. A rise (fall) in X_N leads to an increase (decline) in P_A^H via industrial employment expansion (contraction) and an increase (decline) in F due to the larger (smaller) intermediate import requirements. The short-run elasticities are

$$\frac{d\hat{X}_N}{d\hat{\tau}} = \frac{\tau}{1+\tau}\frac{P_N}{D}\left[\frac{I}{X_N} - s\right] \qquad (22a)$$

$$\frac{d\hat{P}_A^H}{d\hat{\tau}} = \frac{\alpha w L_N}{P_A^H X_A^H}\frac{\tau}{1+\tau}\frac{P_N}{D}\left[\frac{I}{X_N} - s\right] \qquad (22b)$$

and,

$$\frac{d\hat{F}}{d\hat{\tau}} = \frac{m_N P_M^* X_N}{F}\frac{\tau}{1+\tau}\left[\frac{P_N}{D}\frac{I}{X_N} - s\right] \qquad (22c)$$

Concerning question as to whether an increase in the mark-up stimulates or retards industrial activity, (22) demonstrates the dependence upon the propensity to save[10]. For small values of s, namely $s < \frac{I}{X_N}$, industrial output rises. Conversely for large values of the propensity to save ($s < \frac{I}{X_N}$) industry expands.

Industrial demand by wage recipients in (11) falls with the reduced purchasing power of salaries ($\frac{w}{P_N}$) that follows the increase in the price P_N. In an analogous fashion, the demand by agricultural landlords decline with the reduced rentals on land in terms of the industrial product $\frac{r_A^H}{P_N}$ and $\frac{r_A^E}{P_N}$. Besides shifting uhe distribuition of income from wages into profits in industry, the income of profit recipients further rise by

$$\frac{d\left(\frac{wb_N X_N}{P_N X_N}\right)}{d\tau} = -\frac{1}{(1+\tau)}\frac{wb_N}{P_N}$$

and

$$\frac{d\left(\frac{r_N K_N}{P_N X_N}\right)}{d\tau} = \frac{1}{(1+\tau)}\frac{(wb_N + m_N e P_M^*)}{P_N}$$

as prime costs include intermediate imports. The importance of the propensity to save is now clearly pictured. If industrial capitalists save a large fraction of the incremental income earned through the higher mark-up, then excess supply appears in the N-sector. Output falls together with the price of food and foreign lending, according to (22b) and (22c). At the other end if the propensity to save is small, the rise in industrial capitalists' consumption expenditures may exceed the contractionary

[10] This counterintuitive result was first observed by Taylor (1980) for a closed economy model.

forces. Excess demand in the industrial good market will then lead to increases in X_N, P_A^X and F.

Referring to the savings-investment equilibrium an increase in the mark-up affects both the left-hand and the right-hand side of (13). The increase in value of domestic capital goods

$$\frac{d(P_N I)}{d\tau} = \frac{P_N I}{1+\tau}$$

may be either larger or smaller than the increase in industrial savings

$$\frac{d(sr_N K_N)}{d\tau} = \frac{P_N}{1+\tau} sX_N$$

holding industrial output fixed at its equilibrium value. In case $I > sX_N$, potential savings rise above investment and forces are set in motion to reduce industrial output and food prices. Equilibrium is restored at lower levels of X_N, P_A^H and F. Conversely for $I < sX_N$, potential savings fall below investment. The short-run adjustment proceeds with industrial expansion and higher food prices. Consequently, X_N, P_A^H and F rise.

The impact upon consumer prices (15) of a rise in the industrial mark-up rate is given by

$$\frac{d\hat{P}}{d\hat{F}} = \frac{\tau}{1+\tau}\left\{\alpha\left[\frac{\alpha w L_N}{P_A^H X_A^H}\frac{P_N}{D}\left(\frac{I}{X_N} - s\right)\right] + (1-\alpha)\right\}$$

Consumer prices inflate with industrial expansion when $s < \frac{I}{X_N}$. Conversely for $s > \frac{I}{X_N}$, industrial contraction, the corresponding reduction of urban employment and deflation food prices do not guarantee a decline in the cost-of-living. However, for large values of the income share of food consumption α, a decline in consumer prices may follow industrial recession as the decline in food prices outweighs the rise in industrial prices.

Figure 4(a) depicts graphically the effects of the rising mark-up. The agricultural equilibrium and the balance-of-payments conditions are unchanged. The equilibrium condition between savings and investment IS intercepts the vertical axis at a higher food price level. The slope of the IS line is larger in absolute value. Hence, the IS curve moves into either IS' or IS''. Macroeconomic equilibrium obtains at either E' or E'' depending upon whether the savings-investment line lies above or below the original equilibrium at E or equivalently, whether I is greater or smaller than sX_N.

6.2. A Nominal Wage Increase

An increase in the nominal wage generates an immediate increase in the industrial price level as industrial capitalists' mark-up the variation in prime costs by rule (7). However, due to the intermediate import component that enters the price setting formula in the N-sector, the purchasing power of workers $\frac{w}{P_N}$ rises by

$$\frac{d(\frac{w}{P_N})}{dw} = \frac{(1+\tau)m_n e P_M^*}{P_M^2}$$

shifting the income distribution in industry in favour of wage recipients. The wage increase also raises labour costs for agricultural production. Profits from exports fall. The macroeconomic impact of a rise in the nominal wage upon industrial output and the trade deficit is dubious while food prices rise unambiguously. The short-run effects upon the macroeconomic variables are given by

$$\frac{d\hat{X}_n}{d\hat{w}} = \frac{1}{DX_N}\{wb_N[(1+\tau)I - s\tau X_N] - sr_A^H \lambda K_A + swb_A^E X_A^E\} \quad (23a)$$

$$\frac{d\hat{P}_A^H}{d\hat{w}} = \frac{1}{DP_A^H X_A^H}\{\alpha wb_N(1+\tau)[sw(b_A^H X_A^H + b_A^E X_A^E) + wb_N I] + (1+s\tau)m_N P_M^* P_A^H X_A^H\} \quad (23b)$$

and,

$$\frac{d\hat{F}}{d\hat{w}} = \frac{m_N P_M^* X_N}{F}\frac{1}{DX_N}\{wb_N[(1+\tau)I - s\tau X_N] - sr_A^H \lambda K_A + swb_A^E K_A^E\} \quad (23c)$$

According to (23a), industrial output contracts if industrial capitalists' and landlords' demand for N-sector goods overshadows the rise in demand by wage recipient and expands otherwise. To clarify the dependence of industrial output changes upon the proportion of workers' food consumption expenditures a and the propensity to save out of profits $\boldsymbol{s}$, (23a) can be rewritten using (6) as

$$\frac{d\hat{X}_N}{d\hat{w}} = \frac{w}{DX_N}\{b_N[(1+\tau)I - s(\tau+\alpha)X_N] + s(1-\alpha)[b_A^H X_A^H + b_A^E X_A^E]\} \quad (24)$$

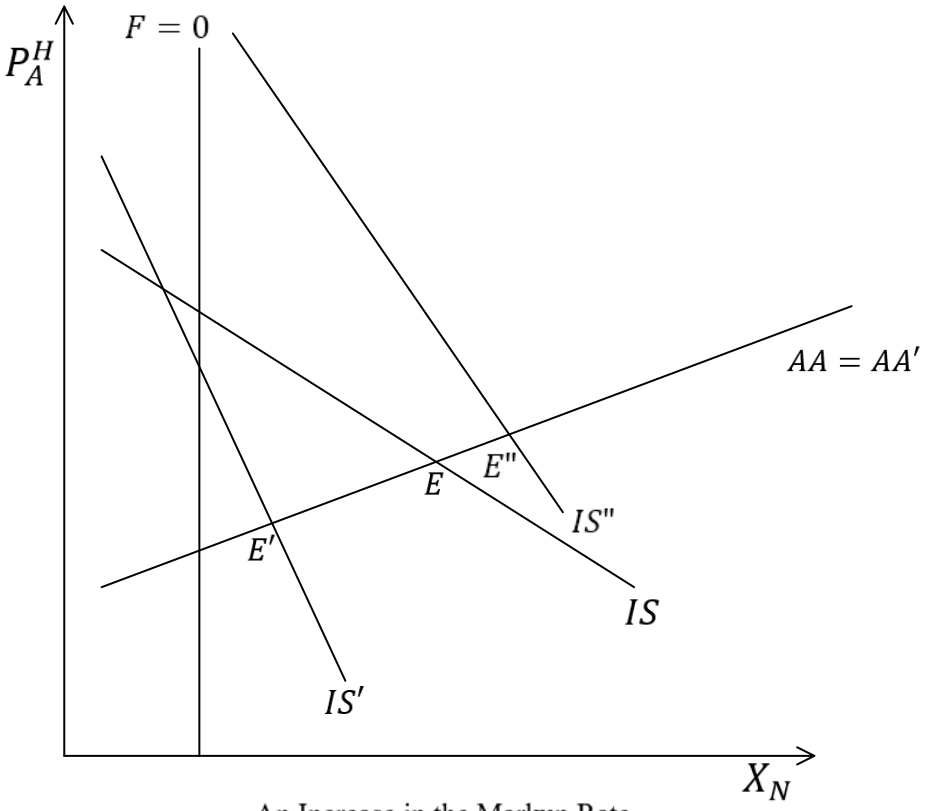
The larger is the propensity to food consumption, the smaller is the nominal wage-elasticity of industrial output. This is because for larger values of α most of the increase in wage income is channeled to the workers' agricultural demand.

Without loss of generality assume $\alpha = 1$. In the latter case the right most term in (24) vanished. At the original equilibrium output, the immediate effect of a wage increase is to raise food prices proportionately, as (23b) is equivalent to

$$\frac{d\hat{P}_A^H}{d\hat{w}} = \frac{wL_N}{P_A^H X_A^H}\frac{d\hat{X}_N}{d\hat{w}} + 1 \quad (25)$$

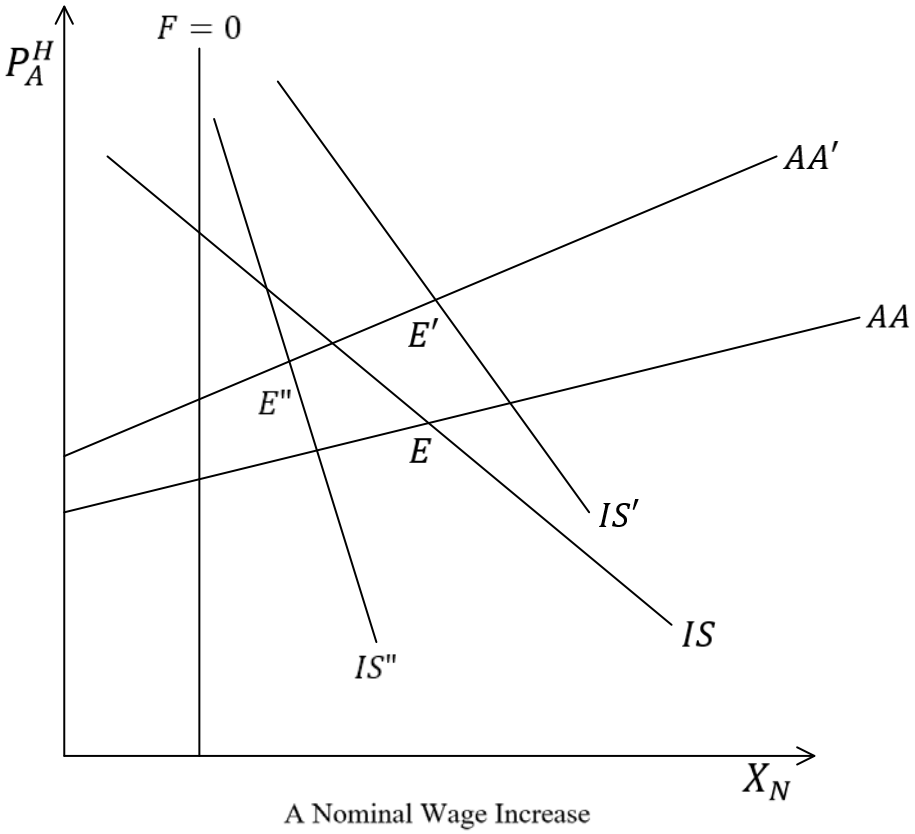
For simplicity take the case of the savings-investment equilibrium (IS), the proportionate food price rise at the equilibrium industrial output level leads to

$$d\frac{s[r_N K_N + r_A^H K_A + r_A^E(1-\alpha)K_A + eF]}{dwP_N} = \frac{(1+\alpha)wb_N}{P_N}(sX_N - I)$$



An Increase in the Markup Rate

(a)



A Nominal Wage Increase

(b)

Figure 4

Hence, according to whether I is greater or smaller than sX_N, potential savings falls below or rises above investment. In the latter case industrial output contracts while in the former case an expansionary adjustment of the industrial production level is set in motion. These are exactly the same conditions under which the proportionate food price increase generates either excess demand or excess supply in the N-sector goods market. Clearly when $\boldsymbol{\alpha}$ is smaller than 1 there is a stronger demand pressure on industry, but from (24) output contraction may still result.

Adjustments in industrial output reflect upon the domestic agricultural price through the first term in (25). Equation (23b) which results after substitution of (23a) into (25) suggests, however, that food prices always rise. Even if the rise in wages is contractionary, the reduced demand from industrial workers that follows the decline in employment is not enough to reverse the upward movement of food prices. Foreign lending in (23c) changes in the same direction as industrial output as it covers the variations in the trade deficit implied by industrial intermediate imports requirements.

To clarify the importance of the foreign sector for the above results substitution of (12) and (13) into (23a) permits the effect of rising nominal wages on industrial production to be rewritten as

$$\frac{d\hat{X}_N}{d\hat{w}} = \frac{1}{DX_N}[(1+\tau)m_N eP_M^*(sX_N - I) + (1-s)eF - (1-s)m_I eP_I^* I]$$

In a closed economy ($m_N = m_I = 0$ and $\lambda = 1$) industrial production is unaffected by nominal wages changes as $\frac{d\hat{X}_N}{d\hat{w}}$ vanishes. Food prices than rise proportionately to the wage increase as $\frac{d\hat{P}_A^H}{d\hat{w}} = 1$ leaving the real wage $\frac{w}{P}$ unchanged. For an open economy, changes in the nominal wage may induce real effects. Further observe that the direction of change of industrial output depends upon the sign of both $sX_N - I$ and $F - m_I P_I^* I$. Comparison with (22a) suggests that only when the value of primary exports balances the expenditures with intermediate imports ($F = m_I P_I^* I$) will mark-up and wage increases have opposite effects upon industrial activity.

The above results are displayed in Figure 4(b). An increase in the nominal wage increases both the intercept and the slope of the agricultural equilibrium condition AA. The AA line moves into AA'. Similarly, the investment-savings identity line IS becomes steeper with a higher vertical intercept. Figure 4(b) shows two alternatives for the relative displacement of the IS line. With IS', a new short-run equilibrium is reached at E' at higher levels of industrial production, food prices and foreign lending. Conversely industrial production and foreign lending decrease at E'' which holds as a macro equilibrium for IS''. The proportionate food price increase corresponds to the point B. Further movement from B into either E' or E'' depends on whether B lies below or above the new IS curve (IS' or IS''), or equivalently, whether potential savings falls below or rises above investment.

7. Changes in the Terms-of-Trade

In this section we analyse the impact of changes in the terms-of-trade that result either from an increase in the world price of intermediate imports and primary exports or from devaluation of the fixed exchange rate.

The semi-industrialized economy facing an external bottleneck is extremely sensitive to increases in prices of non-competitive imports as substitution possibi1ities may be limited in the short-run. Recent oil price increases provide a good example. Most of the energy-economy models[11] have relied heavily on significant price-elasticities, that better characterize a long-run adjustment process, to overcome the world-price increase neglecting the short-run effects that both the developing and developed economies have been living. Concentration upon the income transfers triggered by an increase in intermediate import prices is sufficient to explain recession, inflation and larger trade deficits in the short-run. Late events suggest that a clear understanding of the short-run income effects of an increase in import prices may help both the industrialized and semi-industrialized economies better cope with future disruptions in world markets.

At the other extreme we consider the impact of increases in primary export prices. Foreign-exchange receipts from exports are critical for most semi-industrialized economies as they help finance the acquisition of essential intermediate and capital-goods imports that secure the continuity of the development process. In an economy characterized by primary exports limited by supply and foreign lending restricted to compensatory capital inflows, foreign-exchange receipts vary in the short-run in accordance with world price movements. Expansions and contractions of foreign demand in this model are reflected upon the national economy, solely through world prices.

Devaluation increases the price in domestic currency of intermediate and capital-goods imports and primary exports in this economy. There is some antiquity in considering devaluation solely a change in the terms-of-trade in a model of a structurally rigid economy, that does not respond in the short-run to changes of the agricultural relative price $\frac{P_A^H}{P_A^E}$. As devaluation redistributes income from wage to profit recipients and foreigners it can also be perceived as an instrument of incomes policy. It has been shown that the induced income redistribution may act as a contractionary force upon economic activity[12]. The conventional stimulus to internal activity that would follow the decision to devaluate depends heavily upon the significance of price-elasticities in the short-run.

The magnitude and direction of the macroeconomic impact upon the semi-industrialized economy in the short-run, discussed in the following subsections, are determined by the solution of (14) with

[11] See Manne (1979).
[12] See Krugman and Taylor (1978).

$$\Delta_{AA} = 0$$

$$\Delta_{IS} = [(1+\tau)I - s\tau X_N]m_N e P_M^* \left(\frac{dP_M^*}{P_M^*} + \frac{de}{e}\right) - (sP_A^E X_A^E)\left(\frac{dP_A^*}{P_A^*} + \frac{de}{e}\right) + (m_I P_I^* - F)de$$

$$\Delta_{BP} = -m_N X_N dP_M^* - X_A^E dP_A^*$$

7.1. An Increase in Intermediate Import Prices

Industrial contraction, lower food prices and a larger trade deficit result from an increase in the intermediate import price. The magnitude of the impact upon the short-run macroeconomic variables is given by the elasticities

$$\frac{d\hat{X}_N}{d\hat{P}_M^*} = -\frac{m_N e P_M^*}{D}\left[(1+s\tau) - (1+\tau)\frac{I}{X_N}\right] \qquad (26a)$$

$$\frac{d\hat{P}_A^H}{d\hat{P}_M^*} = -\frac{\alpha r b_N}{P_A^H X_A^H}\frac{m_N e P_M^*}{D}\left[(1+s\tau) - (1+\tau)\frac{I}{X_N}\right] \qquad (26b)$$

and,

$$\frac{d\hat{F}}{d\hat{P}_M^*} = \frac{m_N P_M^* X_N}{F}\frac{1}{D}\left[(1+\tau)m_N e P_M^*\frac{I}{X_N} + s(\alpha+\tau)wb_N\right] \qquad (26c)$$

An increase in P_M^* is passed along to consumers by industrial capitalists via the mark-up rule (7), The higher industrial price P_N, besides shifting the industrial income distribution in favor of profit recipients, it reduces the purchasing power of workers and landlords in terms of the industrial product. Observation of (11) suggests that at the equilibrium food price level the depressed demand will lead to a contraction of the industrial output X_N. The falling level of employment in the N-sector generates excess supply in the domestic agricultural market. The price of food declines, reducing the rental on land which further contracts industrial production. The industrial output and food price elasticities (26a) and (26b) are negative as we demonstrated in section 5.3 that the term within brackets is positive.

Foreign lending increases, as indicated by (26c), to supplement the depressed domestic savings' capability to finance investment. In terms of the balance-of-payments, foreign lending rises to cover the larger trade deficit as the industrial recession is not strong enough to overcome the pressure from rising import prices.

Since the price of food declines and the industrial price rises with an increase in the intermediate import price, the impact upon the cost of living (15) depends on the fraction of workers' consumption expenditures on food α. For small values of α the industrial price increase dominates the decline in the price of food and the overall cost-of-living P rises. Conversely for large values of α, the impact of declining food prices P_A^H is stronger and the cost-of-1iving falls.

Figure (5a) displays graphically the macroeconomic adjustments to higher import prices.

Equilibrium in agriculture (AA) is unchanged as indicated by AA'. Observation of equation (IS) permits one to conclude that with rising intermediate import prices, the IS curve becomes steeper with a higher vertical, intercept moving into the IS' position. The balance-of-payments restriction (BP) depicted in Figure (1b) rotates to the left around the vertical intercept as P_M^* increases. Consequently, the trade balance line moves leftwards to $F' = 0$. A new short-run equilibrium is reached at E' at lower levels of industrial production and food prices and a larger trade deficit as the horizontal distance OE is smaller than $O'E$.

The results in (26) suggest that the contractionary income effects on industrial output are not sufficient to circumvent in the short-run the larger trade deficits incurred by most developing economies, for instance because of rising oil prices. Significant oil price-elasticities would be required for reliance upon recession as a natural adjustment process to prevent larger deficits.

7.2. An Increase in Export Prices

An increase in the world price of primary exports leads in the short-run to expansion of industrial activity, food prices inflation and a smaller trade deficit according to

$$\frac{d\hat{X}_N}{d\hat{P}_A^*} = \frac{(1-s)}{DX_N} P_A^E X_A^E \qquad (27a)$$

$$\frac{d\hat{P}_A^H}{d\hat{P}_A^*} = \frac{\alpha w L_N}{P_A^H X_A^H} \frac{(1-s)}{DX_N} P_A^E X_A^E \qquad (27b)$$

and,

$$\frac{d\hat{F}}{d\hat{P}_A^*} = -\frac{s}{D} \frac{P_A^* X_A^E}{F} [(1+\tau) m_N e P_M^* + (\alpha+\tau) w b_N] \qquad (27c)$$

An increase in the export price of the agricultural product augments the rental on land for production of exportable and hence, the landlords' consumption expenditures on N-sector goods. Industrial expansion follows as (27a) demonstrates. The expansion of the industrial output is greater for smaller values of the propensity to save s and the fraction of land devoted to food production λ. The stronger demand pressure from industrial workers leads to an increase in the food price P_A^H as indicated by (27b). While the export price increase augments foreign-exchange receipts, increased intermediate imports tend to expand the trade gap. The net effect is a reduction in the amount of foreign lending or capital inflow of magnitude given by (27c).

Concerning the savings-investment identity (IS) the increase in export prices makes potential savings fall below investment as the trade deficit or foreign savings decrease is not totally compensated by the increase in domestic savings. This occurs because a fraction 1-s of the additional agricultural income is spent on consumption of N-sector goods. The discrepancy between potential savings and planned investment leads ultimately to industry expansion and food price inflation.

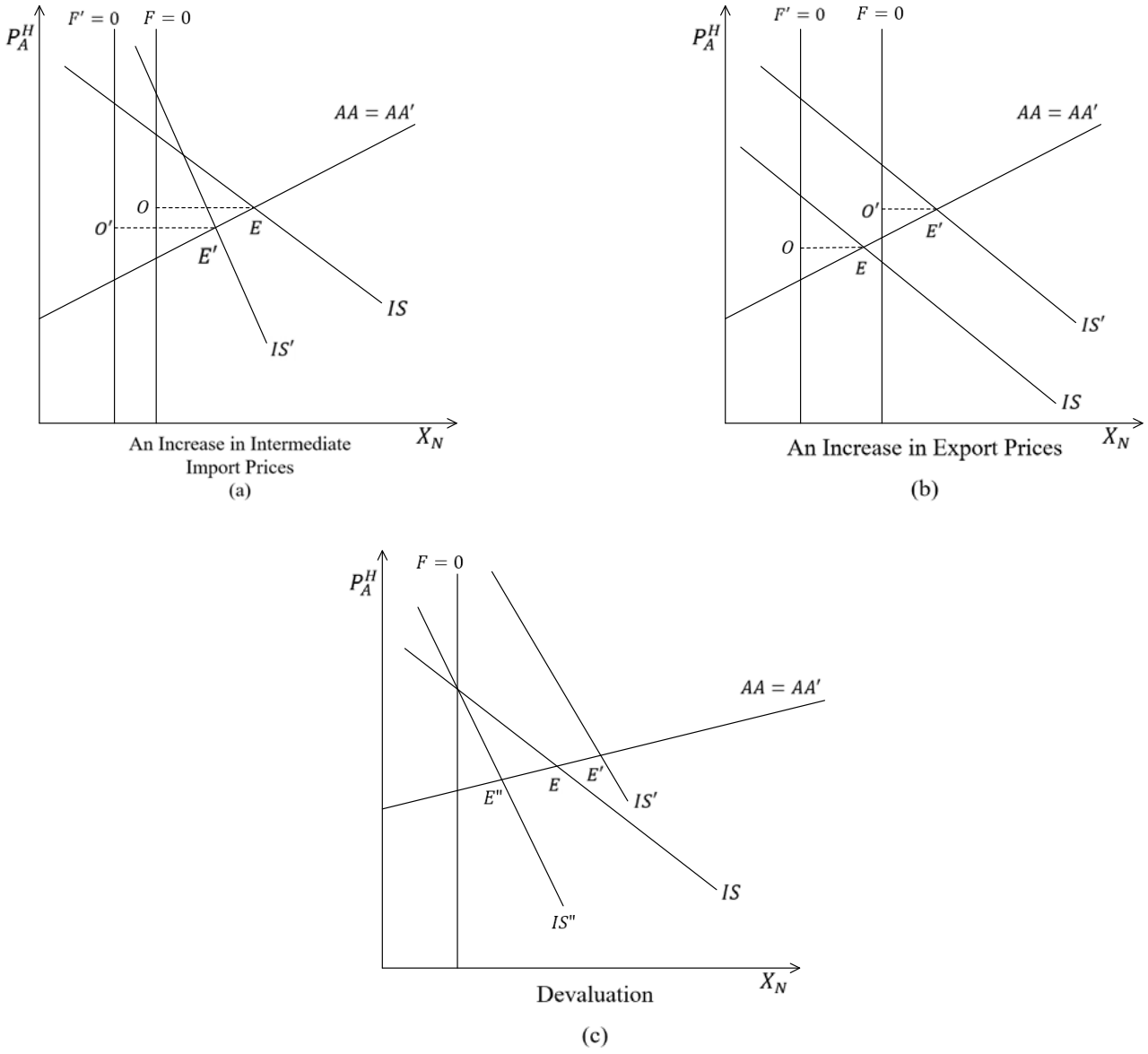


Figure 5

The attainment of a new short-run equilibrium is depicted in Figure 5(b). While the equilibrium relation in agriculture AA is unchanged, the investment savings identity IS moves upwards into IS'. This is because at the same level of industrial production larger savings from food producers are required to cover the net decline in foreign plus tradeable agricultural producers' savings. The balance-of-payments condition BP in Figure (1b) is displaced downwards into BP' moving the trade balance line rightwards into $F' = 0$. At R' a new short-run equilibrium is reached with a larger industrial output and higher food prices. Also foreign lending is reduced as the horizontal distance $O'E'$ is smaller than OE.

7.3. A Nominal Devaluation

Devaluation can either expand or contract industrial activity, with food prices and the trade deficit moving in the same direction. In the short-run the economy responds through changes in the macroeconomic variables X_N, P_A^H and F according to

$$\frac{d\hat{X}_N}{d\hat{e}} = \frac{e}{DX_N}\{m_N P_M^*[(1+\tau)I - s\tau X_N] + m_I P_I^* I - sP_A^* X_A^E - F\} \quad (28a)$$

$$\frac{d\hat{P}_A^H}{d\hat{e}} = \frac{\alpha w L_N}{P_A^H X_A^H}\frac{e}{DX_N}\{m_N P_M^*[(1+\tau)I - s\tau X_N] + m_I P_I^* I - sP_A^* X_A^E - F\} \quad (28b)$$

and,

$$\frac{d\hat{F}}{d\hat{e}} = \frac{m_N P_M^* X_N}{F}\frac{e}{DX_N}\{m_N P_M^*[(1+\tau)I - s\tau X_N] + m_I P_I^* I - sP_A^* X_A^E - F\} \quad (28c)$$

With devaluation, income is redistributed from wage to profit recipients and foreigners in industry and from foreigners to primary export producers in agriculture. Hence, whether industrial output rises or falls depends upon the strength two opposing forces. Demand for N-sector goods by workers and domestic-agriculture landlords falls with the decline in their purchasing power $\frac{w}{P_N}$ and $\frac{r_A^H}{P_N}$ respectively. Windfall profits accrue to the primary export producers raising rentals on tradeable agriculture land ($\frac{r_A^E}{P_N}$). If the latter effect dominates there will be excess demand in the N-sector goods market. The adjustment in the short-run will proceed with industrial expansion and the right-hand expression in (28a) is positive. Excess supply in industry and falling output will result if the contractionary forces are stronger. Food prices and the trade deficit move accordingly by (28b) and (28c).

To focus upon the dependence of the devaluation elasticities upon the trade deficit, expression (28a) can be rewritten, after a good deal of manipulation using the equilibrium conditions (6), (12 and (13), as

$$\frac{d\hat{X}_N}{d\hat{e}} = \frac{(1+\tau)}{P_N}\frac{e}{DX_N}\left\{(1-s)wb_N[m_I P_I^* I - F] - m_N P_M^* \frac{(1-\alpha)}{\alpha} P_A^H X_A^H\right\} \quad (29)$$

Hence, the larger the deficit F the greater is the contractionary impact of devaluation as it increases the amount of foreign savings in domestic currency eF in the economy. The larger the propensity to save the smaller is the sacrifice of consumption in favour of savings which accounts for the term $(1-s)$ in (29). In an analogous fashion for small values of the propensity to consume agricultural products α, contraction of the industrial activity is reinforced through the greater reduction in workers demand for N-sector goods. According to (29) the only expansionary force comes from capital goods imports. The larger the rate of foreign to domestic new capital formation m_I the stronger is the expansionary impact of devaluation. Notice that even for values of α near unity

trade balance ($F = 0$) is not a sufficient condition for the industrial activity to be unaffected by devaluation. Only when the value of intermediate imports equals the value of primary exports ($F = m_I P_I^* I$) the leftmost right-hand term in (29) vanishes. For an economy heavily dependent upon capital-goods imports ($m_I P_I^* I \gg F$) expansion may follow devaluation.

The effects of devaluation in the short-run are represented graphically in Figure 5(c). Neither equilibrium in agriculture nor the balance-of-payments conditions are affected.

The savings-investment identity line IS becomes steeper and intercepts the P_A^H-axis at a higher level of food prices. Two possibi1ities are depicted in Figure 5(c). If IS is replaced by IS', starting from macroeconomic equilibrium at E, potential savings falls below investment and a new equilibrium is reached at E' at higher levels of industrial activity, food prices and foreign lending. If, instead IS moves into IS" potential savings rises above investment and forces are set in motion to reduce X_N, P_A^H and F. Macroeconomic equilibrium is attained at E".

The discussion above confirms previous results that a recession of the industrial activity may be the final response of a semi-industrialized economy to devaluation in the short-run. In this case, contraction should be accompanied by a decline in the domestic agricultural price, which cannot guarantee, however, an improvement in the standard of living of wage recipients. The cost of living P defined in (15) will rise or fall depending on the value of α. If the propensity to workers to consume agricultural products is small ($\alpha \cong 0$) P will rise with P_N after devaluation. At the other extreme for values of a near unity, P will fall with P_A^H. In the case of expansion of the industrial production the real wage $\frac{w}{P}$ falls with the increase in both P_A^H and P_N that follows devaluation.

8. Summary and Conclusions

The relevant trade-offs among industrial output, food prices and the trade deficit for policy action in the semi-industrialized economy of section two are summarized in Table 1. Demand policy results have the appropriate signs while the magnitude of the changes engendered, as measured by the short-run elasticities of section four, may differ from conventional thought. Agricultural policy may be surprised in the short-run. Only productivity gains in domestic agriculture guarantee a deflation of food prices and an expansion of employment in conjunction with a rise in food output. From the results of section five, we conclude that both crop substitution in favour of food production and an expansion of agricultural land have an ambiguous impact upon the macroeconomic variables. The observation of the effects of incomes policy suggests that both a rise in wages and mark-ups have undefined impacts upon industrial output and the trade deficit. Food prices rise unambiguously with an increase in nominal wages. Furthermore, in an open economy, industrial output (and employment)

does not necessarily move in opposite directions with the rise of the two income variables, as demonstrated in section six. Changes in the world price level of intermediate imports and primary exports have exactly opposite effects upon macroeconomic equilibrium in the short-run, while the impact of devaluation is ambiguous according to the analysis of section seven.

Stabilization policies for a developing economy need consider structural rigidities that might characterize at. Different levels the behaviour of industrial mark-ups, wages, the extension of agricultural land, the food to exports land composition and the exchange rate in the short-run. The income transfers entailed either by economic policy or exogenous shocks may overcome stabilizing price effects if price-elasticities are low in the short-run. Long and medium-run plans must carefully examine the direction and magnitude of their short-run impact upon the economy which might very well risk their successful implementation. According to Table 1, short-run policies may require a different set of instruments that depend upon the economy parameters to deal effectively with employment, inflation and the external bottleneck.

Macroeconomic Impact / Exogenous Increases	Industrial Price	Food output	Industrial Output	Food Price	Trade Deficit
Investment	=	=	+	+	+
Propensity to Save	=	=	-	-	-
Food to Exports Land Composition	=	+	- / +	- / + / -	+
Food Productivity	=	+	+	-	+
Agricultural Land	=	+	- / +	-	- / - / +
Mark-up Rate	+	=	- / +	- / +	- / +
Nominal Wage	+	=	- / +	+	- / +
Intermediate Import Price	+	=	-	-	+
Export Price	=	=	+	+	-
Nominal Exchange Rate	+	=	+ / -	+ / -	+ / -

Table 1

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