PB-219 705

SHORT-TERM POLICY IN OPEN DEVELOPING ECONOMIES: THE NARROW LIMITS OF THE POSSIBLE

Lance Taylor

Harvard University

Prepared for:

Agency for International Development

January 1973

BIBLIOGRAPHIC DATA SHEET	1. Report No. 338.91-T243	2.	3. Recipient's Accession No. PB-219 704
4. Title and Subtitle "Short-Term Policy in Open Developing Economies: The Narrow Limits of the Possible".			5. Report Date January 1973 6.
7. Author(s) Lance Taylor.			8. Performing Organization Rept. No.
9. Performing Organization Name and Address Harvard ~~University~~. Center for International Affairs ~~Development Research Group~~ ~~Cambridge, Mass. 02138~~			10. Project/Task/Work Unit No. 931-17-995-476 11. Contract/Grant No. AID/csd-1543
12. Sponsoring Organization Name and Address Department of State Agency for International Development Washington, D. C. 20523			13. Type of Report & Period Covered Economic 5/21/67-1/73 14.

15. Supplementary Notes

16. Abstracts

This paper develops a model to analyze short-term policy alternatives in semi-industrialized countries. The major points raised are the following: (1) If the elasticity of substitution in the traded goods sector has an econometrically reasonable value, then shortrun improvements in both the labor share and real income may well call for revaluation of the exchange rate and an increase in the home good's price; (2) if excess supply functions have Walkasian stability, such price changes will lead to deteriation in the balance of payments; (3) if the economy is formally unstable, then balance of payments improvement in a comparative static analysis may entail reductions in both real income and the labor share; (4) if elasticities of excess supply functions for the two goods with respect to the interest rate are quite low, then in general improvement of all three targets (real income, balance of payments, and income distribution) will be unattainable.

17. Key Words and Document Analysis. 17a. Descriptors

17b. Identifiers/Open-Ended Terms

*Economic research, *Models(Economic), *Balance of payments, *Income

17c. COSATI Field/Group 338

18. Availability Statement	19. Security Class (This Report) UNCLASSIFIED	21. No. of Pages 40 41
	20. Security Class (This Page) UNCLASSIFIED	22. Price $4.25

FORM NTIS-35 (REV. 3-72) USCOMM-DC 14952-P72

SHORT-TERM POLICY IN OPEN DEVELOPING ECONOMIES: THE NARROW LIMITS OF THE POSSIBLE

by

Lance Taylor

Economic Development Report No. 228

January 1973.

DEVELOPMENT RESEARCH GROUP
Center for International Affairs
Harvard University
Cambridge, Massachusetts

Abstract

This paper develops a model to analyze short-term policy alternatives in semi-industrialized countries. The major points raised are the following:

(i) There are two sectors, producing traded and non-traded goods. The latter is characterized by a fairly low elasticity of substitution and a high relative labor share. If the elasticity of substitution in the traded goods sector has an econometrically reasonable value, then short run improvements in both the labor share and real income may well call for revaluation of the exchange rate and an increase in the home good's price (prices of both goods being measured in wage units).

(ii) If excess supply functions have Walrasian stability, such price changes will lead to deterioration in the balance of payments. On the other hand, devaluation-induced improvement in the balance of payments (with constant government expenditure) can lead to an improvement in the balance of payments (with constant government expenditure) can lead to an improvement in real income, but reduces the labor share.

(iii) If the economy is formally unstable, due to capitalists and laborers concentrating their expenditure demands respectively on the goods intensive in factor payments to themselves, then balance of payments improvement in a comparative static analysis may entail reductions in both real income and the labor share.

(iv) If the additional realistic assumption is made that elasticities of excess supply functions for the two goods with respect to the interest rate are quite low, then in general improvement of all three targets (real income, balance of payments, and income distribution) will be unattainable.

(v) Numerical sensitivity analysis based on Chilean data indicates that these (and other) rather pessimistic results hold for fairly wide ranges of "plausible" parameter values, as long as the model's short run Keynesian assumptions are maintained.

Lance Taylor
January 1973

Short-Term Policy in Open Developing Economies: The Narrow Limits of the Possible*

1. Introduction

Policy-makers in open, developing economies get little thanks for their efforts, usually because they don't succeed in what they set out to do. Often entering office compromised to improve performance with respect to at least three norms--an acceptable increase in real output, a stable balance of payments and a non-deteriorating income distribution--a new Finance Minister may face dismissal if his policies work poorly for even one of these. However, the structure of the economy may preclude improving all three. That is the main thrust of this paper, which is devoted to working out a simple, formal model illustrating the very limited range of short run policy trade-offs which confronts semi-industrialized countries. If the analysis is correct, it sheds light both on the short tenure of LDC Finance Ministers and on the vexing question as to why many developing economies fail to maintain spurts of growth into

*Portions of this research were supported by the Harvard Development Research Group through funds made available by the Agency for International Development, the Ford Foundation and the National Science Foundation. Of course, the views expressed are those of the author and not necessarily those of the sponsoring agencies. Thanks are also due numerous people for comments on an earlier draft, including Ruben Almonacid, Edmar Bacha, Jagdish Bhagwati, Anne Krueger, Alan Manne, Marcelo Selowsky, Moises Syrquin and Jeffrey Williamson.

the medium run: growth may be necessary to widen some of the bottlenecks which make the Minister's lot so difficult, but before this happens the balance of payments and distributional problems which accompany growth may make it impossible to sustain.

The algebra which illustrates this dilemma is only tedious, and not complex. However, to help signpost the way through the symbols before we set forth, the following remarks are perhaps useful:

(i) The formal manipulations are purposefully carried out in the traditional comparative static way, somewhat similar to those of Tsiang (1961) in his Keynesian balance-of-payments paper. The main extensions are incorporation of the non-traded goods sector and explicit consideration of the functional income distribution. These, and the speculations which appear below on probable elasticities of substitution in production, the relative unimportance of the money market, etc. are all grounded in the ECLA-Structuralist tradition of Latin American economics, and the model here is in some sense a formalization of what I take to be Structuralist thinking about short-term problems. Others with Latin American experience--Diaz Alejandro (1965), Harberger (1964), Sidrauski (1968)--have followed roughly similar lines, although probably only Diaz would not clearly differentiate his product from ECLA's. In any case, the current work

is based on that of all three.

(ii) Like comparative statics, good old fashioned distribution theory eases understanding, and is also adopted for that reason. Following Tsiang and the other cited authors means assuming that all firms are on their fixed capital neoclassical production functions with all that entails: returns to labor are decreasing even in the short run (i.e., labor is not a quasi-fixed factor in any sense), the real cost of labor is kept equal to its marginal product in each sector, and the money wage stays constant. Such hypotheses clearly provide the basis for one balance of payments paper and permit use of econometrically estimated elasticities of substitution, etc., to put some numerical meat on the model's algebraic skeleton. However other theories of distribution and the labor market--the Cambridge neo-Keynesian model, where equality of wage and marginal product is dropped, or the dual labor market models of Ross and Wachter (1973) and others--could fruitfully be joined with the trade gap. Perhaps this paper will stimulate such work, which might provide a better description of the semi-developed "real world."

(iii) The analysis is also kept simple by non-consideration of short-term capital movements, monetarism and all that. Financial movements may at times require policy action in the developing world (they began to do so in Brazil in 1971-72, for example) but are probably less vexing to the policy team than

the other problems considered here. Others may dissent, of course, and that could give rise to another set of extensions of the present discussion.

(iv) Finally, note that detailed calculations are presented for only one specific measure of each target: real output in base year prices, the deficit in balance of payments on current account, and the labor share of current national product. Other indicators are relevant, in particular of the income distribution. Presumably the government is "really" interested in the size distribution and the welfare of the (urban, politically relevant) poor. The real wage (which necessarily falls as output increases, on our assumptions) may be correlated with the welfare of this target group, and total labor payments more so. Since the labor share is another probably relevant distribution measure, enjoys historical precedent, and fits well with neoclassical production theory, we adopt it for the calculations here.[1/] For the other target variables, the indicators are quite standard. Real output is presumably something that almost any government would want to increase, and although a reduction (or avoidance of a marked increase) of the trade gap

---

[1/] The reader can easily extend the analysis to deal with total real labor payments with results similar to (but slightly more optimistic than) those presented.

may not be a policy goal per se, a deficit which becomes "too" big clearly constrains policy choice. Treating the deficit as a target is a simple means of expressing this fact.

2. The Model: Supply Functions and Income Distribution

There are two goods--one traded, indicated by a subscript "T," and one non-traded, indicated by "H." In general, Greek letters are used to label parameters and Latin letters without primes refer to levels of variables. A prime denotes a relative differential change of a level variable, for short a log-change (i.e., $X' = dX/X$ is the log-change of X).

We begin by describing the supply side of the economy, noting that short-run neoclassical assumptions imply that the log-change of output in either sector Q_i' (i=T, H) is equal to the log-change in that sector's employment L_i' multiplied by its labor share α_i:

$$Q_i' = \alpha_i L_i' \qquad i = T, H \quad . \tag{1}$$

Further, logarithmic differentiation of the marginal productivity condition $w/P_i = \partial Q_i/\partial L_i$ (where w is the money wage and P_i the price of good i) gives the relationship

$$Q_i' - L_i' = \sigma_i(w' - P_i') \qquad i = T, H \tag{2}$$

where σ_i is the sectoral elasticity of substitution, defined in the usual way.

These equations suffice to describe all supply responses. Since the strategy to be followed in solving the model relies

on rewriting all equations in terms of price log-changes and deriving excess supply functions, it is convenient to rearrange (1) and (2) as

$$L_i' = \sigma_i(P_i' - w')/(1 - \alpha_i) \quad i=T, H \tag{3}$$

$$Q_i' = \alpha_i\sigma_i(P_i' - w')/(1 - \alpha_i) \quad i=T, H. \tag{4}$$

The algebra can be simplified by also assuming at the beginning that the money wage is fixed,

$$w' = 0 \tag{5}$$

and treating all prices as being measured in wage units.[2/] On this assumption, we can easily write down equations for log-changes of money incomes of workers and capitalists as functions of price changes. If Y^W $(= wL_T + wL_H)$ is total workers' income in nominal terms, its log-change is just a weighted sum of the employment log-changes from equation (3),

$$(Y^W)' = [\lambda_{wT}\sigma_T/(1-\alpha_T)]P_T' + [\lambda_{wH}\sigma_H/(1-\alpha_H)]P_H' \tag{6}$$

where each weight λ_{wi} is the share of total labor income originating from sector i (e.g. $\lambda_{wT} = wL_T/Y^W$).

Similar expressions for log-changes in capitalists' income Y^π and total money income Y are

$$(Y^\pi)' = [\lambda_{\pi T}/(1-\alpha_T)]P_T' + [\lambda_{\pi H}/(1-\alpha_H)]P_H' \tag{7}$$

and

[2/] Qualitative (and in the numerical simulations below, quantitative) implications of the model are not greatly modified if a more realistic specification of the form $w=g(P_T, P_H$ total employment) is adopted, where g is homogeneous of degree less than one.

$$Y' = \theta_T \frac{1+\alpha_T(\sigma_T-1)}{1-\alpha_T} P'_T + \theta_H \frac{1+\alpha_H(\sigma_H-1)}{1-\alpha_H} P'_H \qquad (8)$$

where the $\lambda_{\pi i}$ in (7) are sectoral shares in total capital income (defined analogously to the λ_{wi} in (6)) and the θ_i in (8) are base period sectoral shares in total money income Y. These output shares also enter naturally into the definition of an aggregate price index P for the economy, the log-change of which is

$$P' = \theta_T P'_T + \theta_H P'_H \quad . \qquad (9)$$

Equations (6) - (9) will provide a means for tracing factor payments around to the demand side when we close the model. However, they can also be used to say something directly about the effects of price changes on real income and the labor share, two of model's three target variables. Beginning with the latter, note that the impact of the price log-changes on the aggregate labor share α is given by

$$\alpha' = (Y^W)' - Y' = \theta_T\left[\sigma_T \frac{\alpha_T}{1-\alpha_T}\frac{1-\alpha}{\alpha} - 1\right]P'_T + \theta_H\left[\sigma_H \frac{\alpha_H}{1-\alpha_H}\frac{1-\alpha}{\alpha} - 1\right]P'_H$$

$$= \theta_T(\sigma^*_T - 1)P'_T + \theta_H(\sigma^*_H - 1)P'_H \qquad (10)$$

where $\sigma^*_i = \sigma_i[\alpha_i/(1-\alpha_i)][(1-\alpha)/\alpha]$, is a factor-share weighted, short-run "general equilibrium" elasticity of substitution for sector i.[3/]

The final line in (10) essentially states that the overall

[3/] Derivation of (10) is straightforward when one notes that the λ's, sectoral shares in total factor payments, are related to the factor shares α and sectoral shares in output θ by identities such as

$$\lambda_{wT} = \alpha_T\theta_T/(\alpha_T\theta_T + \alpha_H\theta_H).$$

labor share will increase with an increase of a sector's market price as long as the sector's factor-share weighted elasticity of substitution σ_i exceeds one. This condition is probably not satisfied in many semi-industrialized countries. Non-traded sectors such as transportation, utilities and professional services (which provide most of value added in services, as opposed to strictly vending activities) have rather low elasticities of substitution, while higher elasticities in traded goods sectors (econometric evidence indicates that σ_T may approach or even exceed one) are offset by low relative labor shares. Although firm statements are not possible, it appears that rising prices will probably worsen the income distribution. Since price increases will be a concommitant of expansionary policy in this paper's model (as indeed they are in any Keynesian model in which labor is paid its marginal product and there are decreasing returns), one policy dilemma already begins to appear

By adding up the sectoral output log-changes from (4) with appropriate weights, or else taking the difference of equations (8) and (9), we can get an expression for the log-change in total real output Q

$$Q' = Y' - P' = [\theta_T \sigma_T \alpha_T/(1-\alpha_T)]P'_T + [\theta_H \sigma_H \alpha_H/(1-\alpha_H)]P'_H. \quad (11)$$

As just mentioned, a price increase in at least one sector is a necessary condition for a real output improvement. The magnitude of the response to an increase in P_i depends on the corresponding sector's

ply elasticity $\theta_i \sigma_i / (1-\alpha_i)$ and its share in base-period output.

From (10) and (11) it is clear that policy instruments can only move the target variables by changing the wage-unit prices of home and traded goods.[4/] It is interesting to inquire, then, what given changes in the targets will require by way of prime adjustments. The answer is given in matrix form by the following expressions:

$$\begin{bmatrix} P_T' \\ P_H' \end{bmatrix} = \frac{1}{\Delta} \begin{bmatrix} \frac{\theta_H \sigma_H \alpha_H}{1-\alpha_H} & -\theta_H(\sigma_H^*-1) \\ -\frac{\theta_T \sigma_T \alpha_T}{1-\alpha_T} & \theta_T(\sigma^*-1) \end{bmatrix} \begin{bmatrix} (Y^W/Y)' \\ (Y/P)' \end{bmatrix} \qquad (12)$$

where

$$\Delta = \theta_T \theta_H [\alpha/(1-\alpha)](\sigma_T^* - \sigma_H^*). \qquad (13)$$

On our supposition that the weighted elasticities of substitution σ_i^* are less than one, the first row of the matrix in (12) is positive and the second row negative. Hence an increase in either the labor share or real output (with the other target held constant) requires P_T and P_H to move in opposite directions, the actual changes depending on the sign of Δ. In the more perverse (but perhaps empirically more likely) case, Δ will be negative, corresponding to a traded goods sector with both a rather

---

[4/] This is not strictly true, since tax rate changes can affect both real output and factor payments. However, direct taxes on either labor or capital incomes are unimportant in most semi-industrialized countries while indirect taxes, although ubiquitous, cannot be modified in the short run for purposes of influencing aggregate demand. This lack of agility explains why indirect taxes are not carried explicitly in the formulation of the model.

low elasticity of substitution and low labor share. If these conditions obtain, an increase in either output or labor share will require a reduction in P_T (an appreciation of the currency) and an increase in P_H. To decide whether policies to achieve these price changes can be formulated, we have to look at the remaining equations in the model. A priori, currency revaluation coupled with inflation of home goods prices looks like a difficult piece of price manipulation, but I would venture to say that it is one that has been attempted from time to time in recent third world history

3. The Model: Demand Equations and Policy Instruments

The next step in the analysis is specification of the means by which the government can influence price levels. One policy instrument, frequently resorted to, is the money supply. We assume that the government can control the domestic currency stock D_H, so that total money supply D is given by

$$D = D_H + P_T D_T,$$

where the second term represents foreign currency reserves valued at domestic prices. The simplest hypothesis about money demand (that it is unit elastic with income) implies that

$$D = YD^d(i+e),$$

where the function D^d specifies the dependence of money demand on the nominal rate of interest, i.e. the real rate i plus the expected rate of inflation e. Combining the two foregoing equa-

tions, taking the logarithmic derivative and substituting for Y' from (8) gives the following lengthy expression relating log-changes of variables entering the money market,

$$\left[\theta_T \frac{1+\alpha_T(\epsilon_T-1)}{1-\alpha_T} - \frac{P_T D_T}{D}\right]P'_T + \theta_H \frac{1+\alpha_H(\epsilon_H-1)}{1-\alpha_H} P'_H - \frac{\xi}{i+c}(ii'+cc') = \frac{D_H D'_H + P_T D_T D'_T}{D} \qquad (14)$$

where ξ is the interest-elasticity of the velocity of money.

Unless foreign exchange reserves are a very large share of the total money supply (an unlikely event in exchange constrained economies) P'_T will have a positive coefficient in (14), and P'_H will have one in any case. Other things equal, an increase in the money stock requires a decrease in the interest rate i when prices stay constant (or an increase in at least one price when i is constant). If both D and i don't change, then an increase in P_H must be accompanied by a decrease in P_T, and vice-versa. These observations about directions of responses are valid for any reasonable parameter values.[5/]

Turning to the goods markets, we observe that the non-traded

[5/] In particular, they will be valid if workers and capitalists have different money demand functions, as Georgescu-Roegan (1970) seems to assume in a recent Structuralist paper. The Georgescu hypothesis would require modification of the coefficients of the price log-changes in (14) and imply different estimates of the quantitative impact of monetary policy on the income distribution and other variables, but the qualitative theory would not be altered by this complication.

commodity must satisfy a demand-supply balance of the form

$$Q_H = C_H^w + C_H^\pi + G_H$$

where C_H^w and C_H^π are total purchases of home goods by workers and capitalists, and G_H is the corresponding government purchase. In principle this equation should be rewritten to take into account separate demands for investment and consumption uses, but for present purposes it is most convenient to follow trade theory tradition (once again) and aggregate these two expenditure items.

It is straightforward to differentiate this demand-supply balance, and get an expression in log-changes of quantities supplied and demanded. These quantity variables can be expressed in terms of price log-changes after substitution from (4) for the supply response and from (6) and (7) for the dependence of factor incomes on prices. The result of all this manipulation is the equation,

$$P_H'\{\frac{\alpha_H \sigma_H}{1-\alpha_H} - \frac{C_H^w}{Q_H}[\varepsilon_{HH}^w + \varepsilon_H^w \frac{\lambda_{wH} \sigma_H}{1-\alpha_H}] - \frac{C_H^\pi}{Q_H}[\varepsilon_{HH}^\pi + \varepsilon_H^\pi \frac{\lambda_{\pi H}}{1-\alpha_H}]\}$$

$$- P_T'\{\frac{C_H^w}{Q_H}[\varepsilon_{HT}^w + \varepsilon_H^w \frac{\lambda_{wT} \sigma_T}{1-\alpha_T}] + \frac{C_H^\pi}{Q_H}[\varepsilon_{HT}^\pi + \varepsilon_H^\pi \frac{\lambda_{\pi T}}{1-\alpha_T}]\} + i'\{\frac{C_H^w}{Q_H}\eta_H^w + \frac{C_H^\pi}{Q_H}\eta_H^\pi\}$$

$$= \frac{G_H}{Q_H} G_H'$$

where the elasticity of demand of workers for good i with respect to price j is ε_{ij}^w, the income elasticity is η_i^w, the elasticity

with respect to the interest rate is η^{W}_{II}, and so on.

As written, this equation takes the form of the logarithmic derivative of the excess supply function for the home good, with the change in government purchases as the forcing variable. On Walrasian stability grounds, the expectation would be a positive coefficient for P'_{II}. However, when there is more than one consuming group in the economy, stability may be foiled by income effects.[6/] The interesting special case in which most of capitalists' expenditure is devoted to the traded good (either for consumption or investment) illustrates this possibility. The coefficient of P'_{H} then approximates

$$-c^{W}_{HH} + \frac{\sigma_{H}\alpha_{H}}{\alpha(1-\alpha_{H})}(\alpha - c^{W}_{H}\theta_{H}).$$

This can be negative when the workers' price elasticity of demand for the home good is close to zero, their income elasticity is high,

the home industry has a large share of output and its elasticity of substitution is high. Empirically, this concatenation is unlikely, so that the coefficient of P'_{II} is probably positive.[7/] Similar arguments imply that the coefficient of P'_{T}

[6/] This is well known, and has been discussed thoroughly in the offer curve analysis by Johnson (1959).

[7/] In his fascinating study of Argentina Carlos Diaz Alejandro (1965) maintains the opposite, that the workers' income elasticity of demand for the home good and that sector's elasticity of substitution are sufficiently high to make the P'_{II} coefficient negative. This has some interesting consequences, which we discuss in succeeding footnotes.

will be positive, so that the demand supply relationship for the home good finally reduces to

$$-a_{21}P'_T + a_{22}P'_H + a_{23}i' = b_2C'_H \qquad (15)$$

where all the a_{ij} are positive. (The meaning of the subscripts will become clear shortly.)

The balance equation for the traded good sector in level form is

$$Q_T = C_T^W + C_T^\pi + G_T + E,$$

where E represents net exports. The balance of payments is

$$-E = \dot{D}_T,$$

where $\dot{D}_T$ represents the rate of inflow of foreign capital, which ultimately is cumulated into the stock of foreign currency D_T. These equations can be combined and differentiated, and substitutions similar to those made to get (15) give rise to the final equation of the model,

$$a_{31}P'_T - a_{32}P'_H + a_{33}i' = -b_3\dot{D}'_T \qquad (16)$$

where it is assumed that government expenditures on either traded goods or imports are small enough to be ignored. The indicated signs of the coefficients seem to be the most probable ones,[8] and not surprisingly imply that an increase in

---

[8] Once again, Diaz Alejandro dissents. If the supply elasticity for the traded good is very low (as indeed is the case in Argentina where beef supply declines in response to an exchange rate increase in the short run while cattlemen build up their herds) and capitalists' consumption goes largely to traded goods, the coefficient on P'_T in (16) may be negative.

the traded good's price or a decrease in the home good's price would lead to an increase in net exports.

4. Comparative Static Analysis of the Effects of Policy Instruments

To recapitulate briefly, in section 2 we saw that two of the target variables--the real income level and the labor share--are determined exclusively by the prices P_T and P_H (again recall that these are measured in terms of wage units). Moreover, simultaneous improvement in both the targets may well require $P_T'<0$, $P_H'>0$, on plausible assumptions about the labor shares and short run elasticities of substitution in the two sectors.

In section 3, equations (14) through (16) show how the prices in turn interact with the domestic money supply D_H, the interest rate i, government purchases of the non-traded good G_H, and net exports E (or the sign-reversed capital inflow variable $\dot{D}_T$). With a short-hand notation for the coefficients of (14), these equations can be rewritten as

$$\begin{bmatrix} a_{11} & a_{12} & -a_{13} \\ -a_{21} & a_{22} & a_{23} \\ a_{31} & -a_{32} & a_{33} \end{bmatrix} \begin{bmatrix} P_T' \\ P_H' \\ i' \end{bmatrix} = \begin{bmatrix} b_1 D_H' \\ b_2 G_H' \\ -b_3 \dot{D}_T' \end{bmatrix} \qquad (17)$$

Several easy exercises with this system (which evidently requires three of its six included variables to be determined by the other

three) serve to demonstrate that simultaneous improvement of all target variables is impossible in the model we have constructed.

For the first of these, consider the case just mentioned, where the government desires to increase real output and shift the income distribution toward labor. The requisite price changes use up two of the three degrees of freedom in (17). We can see the implications of this by inverting the first two equations of this set to get

$$\begin{bmatrix} p_T' \\ p_N' \end{bmatrix} = (a_{11}a_{22} + a_{12}a_{21})^{-1} \begin{bmatrix} a_{22} & -a_{12} \\ a_{21} & a_{11} \end{bmatrix} \begin{bmatrix} b_1 D_H' + a_{13} i' \\ b_2 G_H' - a_{23} i' \end{bmatrix} . \quad (18)$$

Inspection of signs shows that the output/income distribution improvement will require an increase in government expenditures directed toward the labor-intensive non-traded goods sector, a probable fall in interest rates and a change of either sign (but not a large increase) in the money supply. From the last equation in (15), this particular policy combination will lead unambiguously to an increase in $\dot{D}_T$, the trade deficit. Simultaneous improvements in output, income distribution and the balance of payments are simply impossible in this economy, on our assumptions about substitution and response elasticities.

But the situation is really even worse than this rather pessimistic result implies, for it is likely that the interest rate coefficients in (15) will be quite small, reflecting the

poorly developed state of capital markets in most semi-industrialized countries.[9/] Taking the obvious step of setting the interest rate coefficients to zero gives a version of (17) in which the strict quantity theory of money rules, and excess demands for goods are unresponsive to the interest rate. In this case (18) becomes the following two equations, which determine price changes in terms of changes of the money supply and government purchases,

$$\begin{bmatrix} P'_T \\ P'_H \end{bmatrix} = \begin{bmatrix} c_{11} & -c_{12} \\ c_{21} & c_{22} \end{bmatrix} \begin{bmatrix} D'_H \\ G'_H \end{bmatrix} \qquad (19)$$

Furthermore, consolidation of equations (10), (11) and the last line of (17) shows how the target variables respond to the price changes determined in (19),

$$\begin{bmatrix} (Y^W/Y)' \\ (Y/P)' \\ -\dot{D}'_T \end{bmatrix} = \begin{bmatrix} -d_{11} & -d_{12} \\ d_{21} & d_{22} \\ d_{31} & -d_{32} \end{bmatrix} \begin{bmatrix} P'_T \\ P'_H \end{bmatrix} \qquad (20)$$

Putting (19) and (20) together would clearly give a system

[9/] This is an empirical matter, of course, but the judgment above seems to be supported by available evidence. Certainly consumption decisions in countries afflicted with persistently high rates of inflation are not affected by small variations in interest rates, and since credit for investments is not obtained through capital markets (but rather is rationed explicitly, often by the Central Bank) the interest elasticity of investment is likely to be small, also. Finally, the interest elasticity of the demand for money itself usually turns out to be statistically significant but economically rather small in the econometric estimates of this equation. These considerations suggest that the reduced equation system (19) is of some relevance for policy analysis in LDC's. Indeed, something rather close to it was the analytical basis of the most sophisticated monetary policy operation in Latin America during the 1960's. See Canas (1972) for details.

in which there are only two instruments and three target variables, so that arbitrary values for the three targets could not be attained. Another way of putting the same thing is to say that even in the short run model considered here, the exchange rate and monetary policy are not independent instruments in the absence of a smoothly functioning money market. The first equation of (19) summarizes this, showing that the exchange rate log-change P'_T is a deterministic function of D'_H and G'_H. The roles of exchange rate and money supply could be reversed in this equation--indeed this may be more realistic--but the basic point remains.[10/]

[10/] We can use these equations to underline one of Diaz Alejandro's important conclusions. If we ignore the interest rate in the last two equations of (17) and solve them for price changes in the case where government expenditures remain constant and the balance of payments improves, we get

$$\begin{bmatrix} P'_T \\ P'_H \end{bmatrix} = (a_{21}a_{32} - a_{22}a_{31})^{-1} \begin{bmatrix} -a_{32} & -a_{22} \\ -a_{31} & -a_{21} \end{bmatrix} \begin{bmatrix} 0 \\ -b_3\dot{D}'_T \end{bmatrix} .$$

If the own-price excess supply elasticities of both non-traded and traded goods have the expected signs (i.e. a_{22} and a_{31} are positive and large), the determinant $(a_{21}a_{32} - a_{22}a_{31})$ will be negative and balance of payments improvement will require an increase in both prices (to be ratified by an appropriate monetary policy, calculated from the first equation of (17)). The first two equations of (20) show that this will lead to an increase in real income and a decrease in the labor share--once again all three policy goals are unattainable. (The increases in real income and home good price accompanying non-deflationary devaluation are classical results, perhaps first obtained by Harberger (1964).)

When Diaz Alejandro's arguments about the a_{ij} coefficients are valid, the real income improvement doesn't take place. In effect, he asserts that a_{22} (especially) and a_{31} are negative and small in absolute value. Hence, balance of payments improvement requires devaluation ($P'_T > 0$) and a decrease in the home good's

(FOOTNOTE CONTINUED ON NEXT PAGE)

The internal workings of this system are shown in Figure 1, based on Chilean data which will be described in the next section. The lines in the left panel are level curves showing different P_T-P_H combinations consistent with given levels of the money supply or government spending. Shifts in these instruments lead to price changes as the intersection of the two lines changes position. In the Figure, an increase in the money supply leads to increases in both prices; a fall in government expenditures requires a rise in P_T and a fall in P_H.

The right panel shows the effects of price changes on the three target variables. The lines are again level curves based on given values of the targets. Perusal of both panels illustrates our previous conclusions:

(i) The traditional deflationary policy involving reductions of both money supply and government expenditure would be consistent with the kind of price changes necessary to improve the balance of payments in this kind of economy--a fall in P_H relative to P_T. This may even be achieved without adverse shifts in the income

---

price. Since Diaz assumes that the elasticity of substitution is high in the H-sector and low in the T-sector, these price changes can easily lead to a drop in real income, as can be seen from (11). And from (10) the elasticitiy assumptions would imply a fall in the labor share as well. Small wonder that Finance Ministers usually last for less than a year in Argentina!

distribution, but real output and future growth will be severely penalized.

(ii) Devaluation can also be accompanied by monetary expansion, a policy option discussed by Sidrauski (1968) and Cooper (1971). As described in footnote 10, the balance of payments and real income will improve, but the labor share will fall.

(iii) Price changes which lead to increases in both real output and the labor share form an extremely limited set, shown by cross-hatching in Figure 1. As we saw in discussing (18), such decreases in P_T and increases in P_H can be achieved by increases in government expenditures with accommodating monetary policy. The cost is of course an increase in capital inflows (and ultimately an increase in the money stock which will offset the gains made on the distribution side). On the other hand, an exogenous increase in capital inflows (provided by foreign aid, for example) can permit both real output and distribution improvements, without inflationary consequences if they can be sterilized. The aid would permit an overvalued exchange rate and high prices for non-traded goods, two typical phenomena in exchange-constrained economies. It would also permit fairly high incomes and labor shares, strong justifications for sticking to an overvalued local cur-

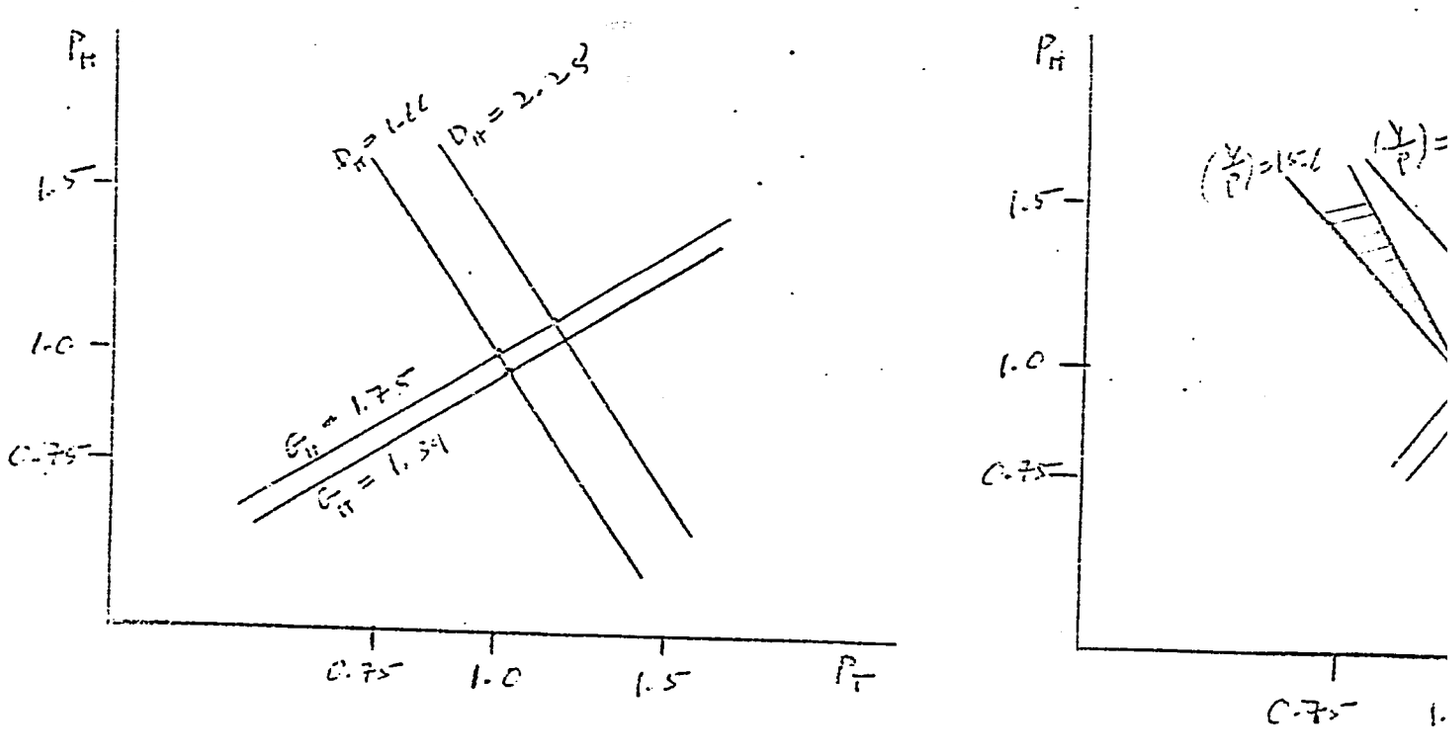

FIGURE 3: THE OPEN ECONOMY MO
APPLIED TO CHILE

rency in the first place.

5. Some Numerical Sensitivity Analysis

All in all, Figure 1 represents a fairly unappetising manu of policy choices. It is obviously important to check whether this is "representative" of semi-industrialized countries, or is only an artifact of the particular parameter values underlying the graphs. In this section, we verify that our conclusions hold for a fairly wide range of values applied at least to the Chilean economy. The model used for these exercises is similar to that of last section, but was made somewhat more complex to permit easy analysis of the economy in terms of national accounts data categories. Specifically, we recognize the existence of

(i) two traded sectors, unprotected traditional exports (copper in the Chilean case) and highly protected manufactures;

(ii) government expenditures by the three sectors, direct taxes on labor and capital incomes (net of depreciation), indirect taxes on domestic production and tariffs on volumes traded;

(iii) depreciation and its contribution to savings;

(iv) different consumption and savings functions from the two types of income; the former are based on Frisch (1959) scheme which permits a wide range of price and income elasticities.

(v) separate stocks of domestically produced capital (plant) and imported capital (equipment) in each sector, with corresponding net investment activities.

When this model is written out in log-change form, it has about fifty equations. Hand solution would be possible, but tiring; it is simpler to let the computer to invert the matrix instead (relevant parameter values are summarized in Table 1). Besides we already know pretty well from last section how the model is going to work.

Changes in Elasticities of Substitution--On the face of it, many of the conclusions we have drawn depend on "low" elasticities of substitution in production. It is natural to ask whether higher values of these elasticities would make the policy picture brighter. A partial answer is provided by Figure 2, giving changes in real output and the labor share which accompany a log-change of -0.50 in total capital inflows accommodated by devaluation and an increase in the money supply.[11/] The elasticities of substitution underlying Figure 1(the "basic" values) are two-thirds in sector two (traded goods) and one-third on sector three (non-traded goods). Figure 2 shows that

---

[11/] In terms of Figure 1 (left panel) this corresponds to holding G_{II} constant and sliding the downward-sloping D_{II} level curve to the northeast. This permits capital inflows $\dot{D}_T$ to fall, as shown in the right panel.

Table 1: Values of Parameters for Chile

Production Parameters

	Sector 1 (traditional exports)	Sector 2 (other traded goods)	Sector 3 (non-traded goods)
Output	2.6	11.7	6.15
Labor share	0.2645	0.3771	0.5917
Intermed. import share	0.1203	0.1286	0.0567
Non-traded capital stock	0.0	10.44	12.76
Traded capital stock	3.90	8.37	7.73
Elas. of Sub.	1.0	0.6667	0.3333
Employment	0.046	1.297	1.585
Indirect tax rate	0.0023	0.0666	0.1171

Balance of Payments

	Post-tariff price	World price	Tariff
Consumption imports (non-comp.)	1.3	0.585	1.2222
Intermediate imports (non-comp.)			
Sector 1	0.312	0.203	0.5385
Sector 2	1.404	0.913	0.5385
Sector 3	0.308	0.200	0.5385
Imports of traded capital goods	1.300	0.975	0.3333
Factor payments (to) abroad		0.682	
Net exports			
Sector 1	2.600	2.600	0.0
Sector 2	0.900	0.600	0.5

Money Market

Expected rate of price increase	0.30
Real rate of interest	0.075
Elas. of velocity with respect to nominal interest rate	-0.30
Domestic money supply	1.658
Foreign currency Reserves	0.500

Table 1 (Continued)

Savings and Investment

Rates of depreciation		
Non-traded capital stock	0.02	
Traded capital stock	0.04	
	Wage incomes	Rental incomes (net of dep.)
Savings shares	0.0	0.08885
Elas. of savings share w.r.t. real interest rate	0.0	0.1
Elas. of net investment (all sectors) w.r.t. rates of return	0.10	
Elas. of net investment (all sectors) w.r.t. real interest rate	-0.05	
Gross investment	3.2	
Net capital inflows	0.358	
Net investment	1.936	
Net national saving	1.578	

Consumption

	Wage incomes	Rental incomes (net of dep.)	Government
Engel elasticities (and cons. levels)			
Sector 1	0.0 (0.0)	0.0 (0.0)	(0.0)
Sector 2	1.050(7.254)	1.050(3.346)	
Sector 3	0.900(1.913)	0.750(1.287)	(0.20)
Imports	0.782(0.785)	1.300(0.515)	(1.75)
Income flexibility	-0.784	-0.784	
Total consumption	9.952	5.148	
Net direct taxes	-2.623	0.502	

Note: All monetary values are in billions of 1965 Chilean Escudos; employment figures are in millions of man-years. Government consumption of sector 3 product includes investment in residential housing. The data for this table was pieced together from several not necessarily consistent sources. For more detail, see Taylor and Black (1973).

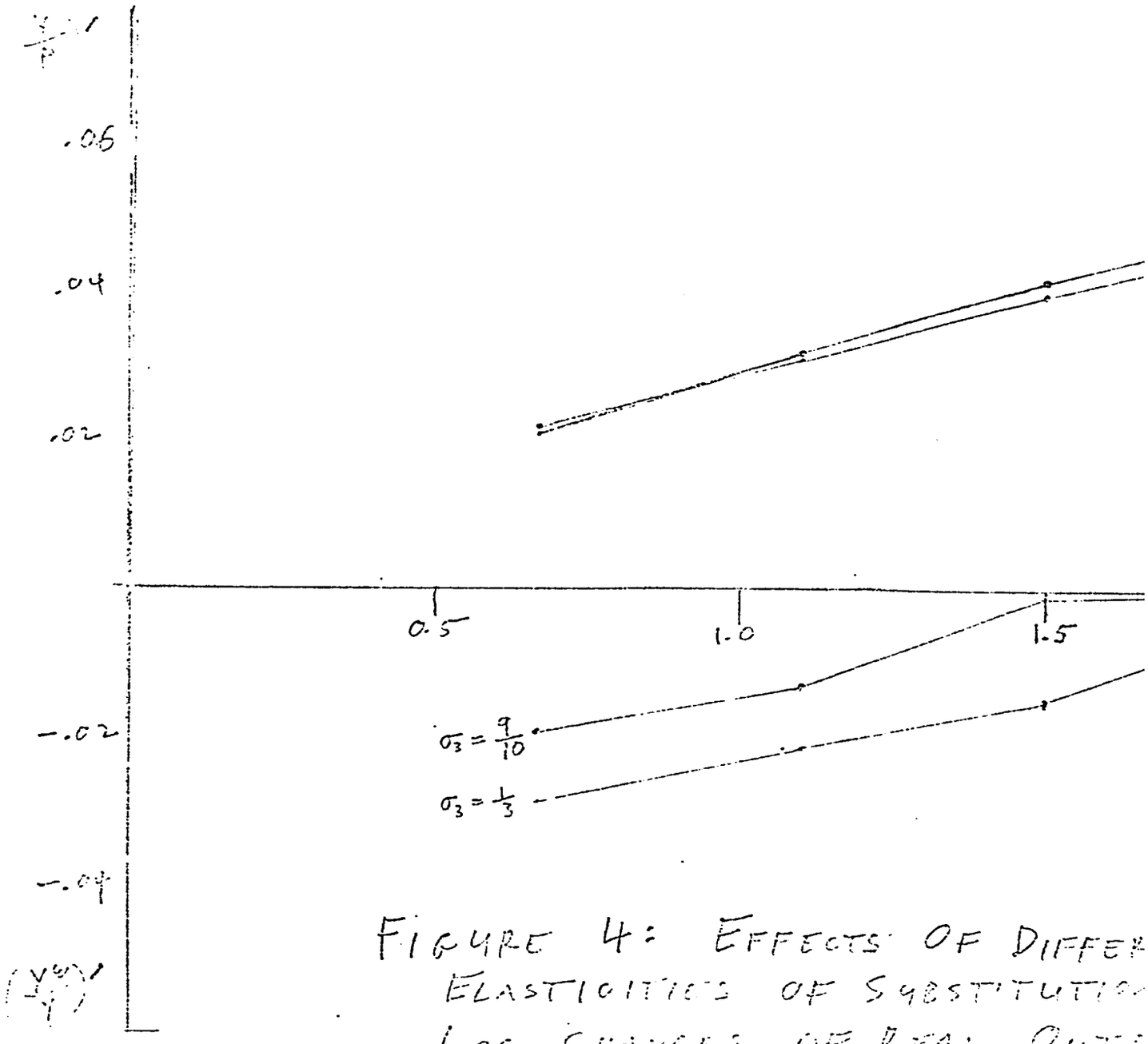

FIGURE 4: EFFECTS OF DIFFER
ELASTICITIES OF SUBSTITUTIO
LOG-CHANGES OF REAL OUTP
THE LABOR SHARE WHEN B
OF PAYROLL TAX IMPROVEMENT I
MEASURED BY MARGINAL PR

higher elasticities of substitution in the traded goods sector (number 2) would have some impact on the responses of the target variables. However, even with the non-traded elasticity of substitution σ_3=0.9 (probably an unduly high value) σ_2 must be substantially above one before the devaluation has a "small" negative effect on the labor share. Much the same conclusion applies when devaluation is accompanied by a reduction in government expenditures in the non-traded goods sector, except that the decrease in the labor share which accompanies this policy package is <u>increased</u> as σ_3 assumes higher values.[12/]

<u>Higher Interest Elasticities</u>--Like Figure 1, the foregoing analysis is based on the assumption that the interest rate does not change. Table 2 shows the effect of relaxing this rather strong assumption. The policy mix underlying that Table is an increase in capital inflows (perhaps from foreign aid) accompanied by an increase in government expenditures on the non-traded good. The first column shows what happens under a monetary policy designed to keep the interest rate constant; the second column permits a large (fifty percent) increase in the real rate. The effects are quite small, justifying our section 4 analysis ignoring the interest rate.

The third column, on the other hand, shows what happens when the model's interest rate elasticities are set to higher

---

[12/]The policy corresponds to sliding the G_H level curve to the southeast in Figure 1, while holding the D_H curve approximately constant.

Table 2:
Effects of a 50% Increase in Capital Inflows Accompanied by a 10% Increase in Government Expenditures on Non-Traded Goods

Log-Changes	No change in interest rate	Interest rate increases 50%	Interest rate increas 50%; high interest elasticities
Exchange rate	0.1136	0.0980	0.0477
Money supply	0.3082	0.2271	0.0506
Employment	0.100	0.087	0.042
Real Output	0.0415	0.0358	0.0173
Labor Share	-0.0555	-0.0479	-0.0231

Note: The "high" interest elasticities are money demand (with respect to nominal rate): -0.6 as opposed to -0.3; investment demand; -0.25 as opposed to -0.05; savings share from capital incomes: 0.3 as opposed to 0.1.

Table 3:
Effects of a 50% Reduction in Capital Inflows Accompanied by a 50% Reduction in Sector Two Tariffs

Log-Changes	No change in government expenditure	Sector 3 government expend. increases 10%	Sector 3 government exp. increases 20%
Exchange Rate	0.1041	0.1528	0.2015
Money supply	-0.1987	-0.0488	0.1011
Employment	-0.060	-0.009	0.042
Real output	-0.0657	-0.0449	-0.0240
Labor share	0.0527	0.0257	-0.0012

Note: The calculations are made with the basic parameter set.

values (details in the Table's note). Although the directions of the effects of the policy package are not changed by these elasticity changes, the magnitudes are. Clearly, the money supply does not have to expand nearly as much (presumably leading to a smaller inflationary impact in the medium run) and some of the other changes are moderated. However, the "high" interest elasticities are indeed quite high for a developing country, and the third column probably gives an elevated upper bound on the importance of interest rate changes in the short run.

Trade Liberalization--The present model permits investigation of more realistic policy alternatives than the two-sector model of last section. In particular, we can look at the effects of trade liberalization, i.e. reduction in the fifty percent tariff-cum-subsidy which is assumed to apply to Sector Two. The traditional IMF stabilization package has coupled devaluation and liberalization. Its effects in this model, shown in the first column of Table 3, are cathartic. Even if government expenditures remain constant (which the IMF wouldn't like) a fifty percent decrease in capital inflows coupled with a reduction in the tariff from fifty to twenty-five percent would require a twenty percent reduction in the money supply and a contraction of real output approaching seven percent. At the cost of greater devaluation, the effects on em-

ployment and output of the trade liberalization policy could be mitigated in the short run by increases in government expenditure on non-traded goods. As far as I know, this expenditure-switching package has not been widely applied.

At least on the basis of the present analysis, it might merit further investigation. Certainly, long run considerations would argue in favor of trade liberalization, if it could be made more palatable in the short run.

Wages Responding to Price Increases--Finally, we check the behavior of the model when the money wage[13/] increases in response to price increases. In the exercises conducted thus far, it has been assumed that the overall money wage rate has an elasticity of 0.1 with respect to the general price level. Table 4 shows what happens when this elasticity is increased, for the policy package in which the balance of payments improves by fifty percent while government expenditures stay constant. (This is the policy mix underlying Figure 2.) Although the Table shows that the qualitative characteristics of the model's responses are not changed by including this wage effect, the magnitudes are. More inflation, lower output gains and a greater reduction in the labor share all have to be accepted when this sort of wage responsiveness enters the picture. Since most of the econometric evidence seems to indicate that the rele-

---

13/ To be precise, we should refer to the money wage structure, since the model is based on the assumption that pre-existing proportions among differing sector wages are preserved under all policy changes.

Table 4:

Effects of a 50% Reducation in Capital Inflows with Constant Fiscal Policy, for Different Elasticities of the Money Wage with Respect to the Price Level

	Elasticity Values		
Log-Changes	0.10	0.45	0.80
Exchange Rate	0.0649	0.0951	0.1915
Money supply	0.1583	0.2253	0.4396
Money wage	0.0058	0.0398	0.1487
Employment	0.050	0.046	0.030
Real output	0.0206	0.0181	0.0103
Labor share	-0.0285	-0.0289	-0.0305

Note: The calculations are made with basic parameter values except the wage elasticity.

vant elasticity is one-half or more, workers' pressures for their nominal wages to keep up with the price level are yet another restriction on policy flexibility in the short run.

6. Summary and Conclusions

The salient characteristics of the type of economy considered here are the following:

(i) There are two sectors, producing traded and non-traded goods. The latter is characterized by a fairly low elasticity of substitution and a high relative labor share. If the elasticity of substitution in the traded goods sector is on the order of 0.75 or so, then short run improvements in both the labor share and real income may well call for revaluation of the exchange rate and an increase in the home good's price (prices of both goods being measured in wage units).

(ii) If excess supply functions are "normal," such price changes will lead to deterioration in the balance of payments. On the other hand, devaluation-induced improvement in the balance of payments (with constant government expenditure) can lead to an improvement in real income, but reduces the labor share.

(iii) If the economy is formally unstable, due to capitalists' and laborers' concentrating their expenditure demands respectively on the goods intensive in factor payments to themselves, then balance of payments improvement in a comparative

static analysis may entail reductions in both real income and the labor share.

(iv) If the additional realistic assumption is made that elasticities of excess supply functions for the two goods with respect to the interest rate are quite low, then in general improvement of all three targets (real income, balance of payments, and income distribution) will be unattainable.

(v) Numerical sensitivity analysis based on Chilean data indicates that these (and other) rather pessimistic results hold for fairly wide ranges of "plausible" parameter values, as long as the model's short run Keynesian assumptions are maintained.

All this may explain at least in part the peculiar stop-go policies which developing countries often follow. Policy aims at improving one target variable until other target variables fall so short of their hoped-for values that policy must be reversed. The proximate cause of policy reversal might usually be a balance of payments crisis, although a deteriorating income distribution can also lead to problems.[14/]

So what does one do about the situation? Picking out specific features of a general equilibrium system and asserting that they "cause" its conclusions can be extremely misleading.

[14/] See Nelson, Schultz and Slighton (1971), chapter 7, for an illuminating discussion of exchange rate and income distribution policy problems in Colombia.

Nonetheless, two specific characteristics of the model seem to be largely responsible for its pessimistic projections. One is the assumption of low interest elasticities of demand for both goods and money. This is supported by the econometric evidence, and presumably is due to underdevelopment of financial and credit markets of all kinds. Hence one (rather conservative) conclusion is that the absence of these markets is a significant hindrance to the operation of short-run macropolicy in developing countries. Korea and Brazil may illustrate the benefits of creating such markets on a large scale.

The second key parameter is the elasticity of substitution in the traded goods sector. Its low value and the sector's low labor share enter directly into the algebra which produces the pessimistic results; the benefits of an increased elasticity show up clearly in Figure 2. Of course, the low elasticity is shorthand for many problems of poor entrepreneurship, imperfect competition, lack of efficiency, etc., etc. Lifting trade barriers after a long period of increasing protection to import-substituting industries may be one way ot dealing with such problems; more far-reaching modifications of the country and its economy may suggest themselves as well. Finally, note that economic growth sustained for a period helps widen out the bottlenecks. The present analysis shows that the cost of growth may be continual balance of payments problems and/or deterioration

of the income distribution. Obvious remedies are respectively foreign aid and domestic political repression. The reader can no doubt recall examples of application of these medicines in some of the current "success" cases.

References

Cauas, Jorge, 1972, "Short Term Economic Theory and Policy--The Chilean Case, 1964-70," (mimeo), Development Research Center, International Bank for Reconstruction and Development, Washington, D.C.

Cooper, Richard N., 1971, "Currency Devaluation in Developing Countries," Essays in International Finance #86, Princeton, N.J.

Diaz Alejandro, Carlos F., 1965, Exchange-Rate Devaluation in a Semi-Industrialized Country: The Experience of Argentina, 1955-61, M.I.T. Press, Cambridge.

Frisch, Ragnar, 1959, "A Complete Scheme for Computing All Direct and Cross Demand Elasticities in a Model with Many Sectors," Econometrica, 27, 177-96.

Georgescu-Roegen, Nicholas, 1970, "Structural Inflation-Lock and Balanced Growth," Economies et Societes: Cahier de L'I.S.E.A., 4, 557-605.

Harberger, Arnold, 1964, "Some Notes on Inflation," in Werner Baer and Isaac Kerstenetzky (eds), Inflation and Growth in Latin America, Richard D. Irwin, Homewood, Illinois.

Johnson, Harry G., 1959, "International Trade, Income Distribution and the Offer Curve," Manchester School, 27, 241-60.

Nelson, Richard R., T. Paul Schultz and Robert L. Slighton, 1971, Structural Change in a Developing Economy: Colombia's Problems and Prospects, Princeton University Press, Princeton, New Jersey.

Ross, Stephen A. and Michael L. Wachter, 1973, "Wage Determination, Inflation and the Industrial Structure," American Economic Review, 63 (to appear).

Sidrauski, Miguel, 1968, "Devaluacion, Inflacion, y Desempleo," Economica, (Buenos Aires,) 14, 79-103.

Taylor, Lance and Stephen L. Black, 1973, "Practical General Equilibrium Estimation of Resource Pulls Under Trade Liberalization," Journal of International Economics, 3 (to appear).

Tsiang, S.C., 1961, "The Role of Money in Trade-Balance Stability: Synthesis of the Elasticity and Absorption Approaches," American Economic Review, 51, 912-36.