The Journal of Development Studies 23 (1), 40-59

Terms of Trade and Class Conflict in a Computable General Equilibrium Model for Mexico

*by Bill Gibson, Nora Lustig and Lance Taylor**

A computable general equilibrium model for Mexico is constructed in which class conflict over the distribution of the surplus is the principal determinant of the terms of trade. The model consists of seven social classes and eight productive sectors. Classes are distinguished as 'fundamental' or 'subsumed' according to whether their incomes are primarily determined by conscious class struggle or by the resulting system of relative prices. Flexible prices are assumed to clear markets for which non-produced means of production, such as agricultural land, limit supply while output in the remaining sectors is determined by the level of effective demand. For the latter sectors, two theories of price formation are compared and are seen to differ radically in their implicit conception of the nature of class conflict. A 'Keynes-Kalecki' closure is considered in which prices are determined by a fixed mark-up on costs. This enables capitalists to protect themselves from incursions on the rate of profit due to labour militancy or state-imposed terms-of-trade policy designed to favour peasants and/or the agrarian bourgeoisie. A second, 'Marx-Sraffian' price closure constrains the economy to a wage-profit-terms-of-trade surface; where the economy conjuncturally resides on this surface depends upon the level of effective demand, wages and terms-of-trade policy. Various policy scenarios are investigated under both closures.

I. INTRODUCTION

This article discusses a computable general equilibrium model for Mexico and its behaviour in response to a change in wages, level of investment and terms of trade policy.[1] Two variants of the model are studied. For the first, referred to a 'Keynes-Kaleckian' (K-K) closure, non-agricultural prices are determined by fixed mark-ups on prime costs.[2] Capitalists attempt to protect their real incomes from wage and commodity price increases which are fully passed along. A second Marx-Sraffa (M-S) closure employs Sraffian prices of production for non-agricultural sectors in which class conflict over the distribution of the surplus determines the system of relative prices.[3] Sub-

* University of Massachusetts, Amherst: El Colegio de México and Massachusetts Institute of Technology.

stantial differences emerge: in the M-S closure, for example, unemployment and stagnation can be combated by maintaining aggregate demand, raising wages and controlling prices, whereas in the K-K closure, increasing wages causes inflation, agricultural stagnation and a contraction in employment.

The article is organised as follows: section II discusses the basic components of the model in a simplified form. The following section describes the model in more detail and the final section presents the results of simulations in which non-agricultural wages and real investment are changed and a support price for the peasant agricultural sector is introduced. The Appendix contains the full specification of the model and the base Social Accounting Matrix (SAM).

II. STRUCTURE OF THE MODEL

A computable general equilibrium model is employed in which prices and quantities are determined simultaneously. Sectors which use non-produced means of production (NPMP), such as natural resources and agricultural land, are distinguished from those which use only reproducible capital goods as means of production.[4] The former are called 'agricultural' or 'rural' sectors while the latter are referred to as 'non-agricultural' or 'urban'. Prices of goods produced using NPMP are not necessarily equal to their costs of production due to the presence of rent. Prices in sectors which do not employ NPMP are equal to the sum of wage and intermediate costs plus profits. If profits depend upon a fixed mark-up, independent of the level of wages, the closure is K-K. If instead there is an inverse relationship between wages and the rate of profit, the closure is referred to as M-S..

In both the K-K and M-S closures, output in non-agricultural sectors is determined by the level of effective demand with real investment given exogenously. For the M-S system, output of sectors which only employ produced means of production is not limited by any endowed magnitude other than labour inasmuch as capital is conceived as the accumulated surplus product of workers. Capitalists exploit workers by virtue of private ownership of the means of production and a surplus or reserve army of unemployed workers. Capitalists, therefore, can expand output to meet demand subject only to the social constraint that the rate at which surplus product is extracted is above some minimum acceptable level. For the K-K closure, output in the non-agricultural sectors is determined by the level of effective demand only if there is excess capacity with respect to the current level of output. With a fixed stock of capital equipment and a given level of money wages and agricultural commodity prices, output may adjust to effective demand with no accompanying change in price.

In neither closure is labour a constraint; capitalists have available an arbitrarily large supply of labour at the institutionally determined money wage rate. There is no choice of technique and thus employment is determined by fixed and given labour coefficients once outputs are known. There

is no money and, needless to say, no 'capital' other than the heterogeneous vector of produced and NPMP.

Class Structure

The introduction of NPMP requires a more complex structure of classes than the typical M-S division into capitalists and workers. Owners of NPMP constitute what Resnick and Wolff call a 'subsumed' class and are distinguished from 'fundamental' classes by the following definitions:

> Marx's theory of the class process of extracting surplus labour involves the conceptual division of individuals in society into paired groupings occupying the positions of performers of such surplus labour, on the one hand, and extractors, on the other. These paired groupings we designate, with Marx, as *fundamental classes*. (emphasis added)

Subsumed classes, on the other hand, are defined as classes which:

> ... neither perform nor extract surplus labour. Rather they carry out certain specific social functions and sustain themselves by means of shares of extracted surplus labour distributed to them by one or another fundamental extracting class. [*Resnick and Wolff, 1982: 2, 3*]

The essence of the definition of subsumed class is taken here to be the distinction between 'extract' and 'distribute'. By wresting title to and control over the disposition of the surplus product produced by workers, capitalists 'extract' surplus from workers. The process is one of open and continuous conflict in which both workers and capitalists consciously pursue strategies designed to thwart their opponent's objectives. Fundamental classes exhibit what Jon Elster has termed *strategic rationality* in which agents do not regard their environment parametrically, but are aware of the objectives, strategies and tactics of other agents [*Elster, 1983: 75–7*].

In contrast to fundamental classes, subsumed classes are *parametrically rational* in that their behaviour, while rational, is not strategically or interactively determined. Subsumed class incomes primarily depend upon terms of trade resulting from the struggle between fundamental classes, terms of trade which they regard as given parameters. Thus, subsumed classes neither perform nor extract surplus labour. Subsumed classes reduce the total quantity of surplus over which the fundamental classes struggle but the transfer is systemic in nature. The process occurs 'behind the backs of the producers' in spite of rather than as a result of the intentions of agents. This is not to suggest that the income of fundamental classes is independent of the structure of relative prices. It is rather that without engaging in class struggle, fundamental class income would presumably fall to zero no matter what system of relative prices was in force. Subsumed classes, on the other hand, share in the total surplus as a matter of structural rather than strategic necessity.

The outcome of conflict between fundamental classes determines a point on the economy's wage-profit or class-conflict line.[5] Associated with every

such point is a vector of relative prices which 'distributes' or transfers extracted surplus to various subsumed classes. In the K-K closure, there is no wage-profit line. A wage increase causes a proportional increase in prices. Subsumed incomes are still determined by the resulting price vector, but the nature of the transfer depends primarily upon the pattern of fixed nominal quantities in the model.

Note that while all owners of NPMP are subsumed, not all subsumed classes need own non-produced resources. Petty-commodity producers, for example, do not have access to NPMP yet nevertheless qualify as subsumed under the definition cited above. Petty-commodity producers may be conceived of as users of alternative production processes which are not operated by capitalists since these methods fail, at prevailing prices and wages, to return an average rate of profit. Petty-commodity producers are subsumed in that their incomes depend not on their own strategic behaviour but on the existing system of relative prices. By operating alternative low- or no-profit processes, petty-commodity producers are able to capture a portion of aggregate demand that would otherwise accrue to capitalists selling the same good. Hence, competitive forces cannot eliminate petty-commodity producers from absorbing a share of aggregate demand. If capitalists attempt to increase their market share by lowering prices, petty-commodity producers must follow suit since they have no other means by which to reproduce themselves. If aggressive price competition causes petty-commodity incomes to fall below subsistence, they may shift from one branch of production to another; but the existence of a reserve army employed by non-capitalist processes always reduces the appropriable surplus for capitalists for any level of aggregate demand. Petty-commodity producers therefore take a 'cut' from the total surplus and consequently qualify as subsumed.

A Simplified Model

In this section we discuss the logical structure and functioning of the model; the details of the empirical specification for Mexico are taken up in the following section. Consider now an economy with n agricultural commodities, the production of which directly requires land or other resources as part of their means of production. For simplicity, let there be no intermediates or other capital in the agricultural sector. In addition, there are m non-agricultural goods which directly require only produced means of production. There are three classes: workers, capitalists and subsumed classes which derive their incomes from labour, capital ownership and transfers from fundamental classes, respectively. Worker income, Y^w, is defined as:

$$Y^w = wLX \tag{1}$$

where w is the wage rate and L is the (n+m)−dimentional row vector of direct labour per unit of product. X is an (n+m)−dimenstional column vector of gross outputs. Vectors are partitioned by subscripts 'n' and 'm' which refer to agricultural and non-agricultural sectors respectively.

Agricultural income accruing to the subsumed class is given by:

$$Y^s = (P_n - wL_n)X_n \tag{2}$$

and capitalist income, Y^c is:

$$Y^c = (P_m - P_nA_{nm} - P_mA_{mm} - wL_m)X_m \tag{3}$$

where A is an (m+n)xm matrix of input–output coefficients for the non-agricultural sector partitioned into A_{nm} and A_{mm}.

Consumption of ith good by the jth class is assumed to depend upon prices and distribution of income between wages, profits and subsumed income:

$$c_i^j = c(P_i, Y^j) \qquad (i = n,m;\ j = w,s,c) \tag{4}$$

Effective demand equations can now be expressed simply as:

$$X_i = A_{im} X_m + C_i + F_i \qquad (i = n,m) \tag{5}$$

with $C_i = \Sigma c_i^j$ and F as an exogenously specified level of final demand. Substituting equations (1)–(3) into (4), (5) becomes a set of (n+m) equations in the 2(n+m) unknowns X and P. If it is assumed that the level of agricultural output is known, (5) has m degrees of freedom which are eliminated by choice of the pricing rule for the model.

Marx-Sraffian Closure

Consider first a system of price-of-production equations for the non-agricultural sectors in which there is a uniform rate of profit, r, on the value of invested capital:[6]

$$P_m = P_nA_{nm} + P_mA_m + wL_m + r(P_nK_{nm} + P_mK_{mm})$$

Here K is a matrix of capital stock requirements for the non-agricultural sectors. The capital stock matrix is defined by:

$$a_{ij}\, t_{ij} = k_{ij}$$

where t_{ij} are known turnover times. Since the a_{ij} count depreciation of fixed capital, the k_{ij} matrix is total capital invested.[7]

Solving for P_m:

$$P_m = (P_nA_{nm} + wL_m + rP_nK_{nm})\ (I - A_{mm} - rK_{mm})^{-1} \tag{6}$$

Equations (6) are m equations in (n+m)+2 unknowns P, w and r. If the wage rate w is given, the model consisting of equations (5) and (6) still has one degree of freedom which is removed by choice of a numeraire. Let Q be an arbitrary normalising vector such that:

$$P_mQ = 1 \tag{7}$$

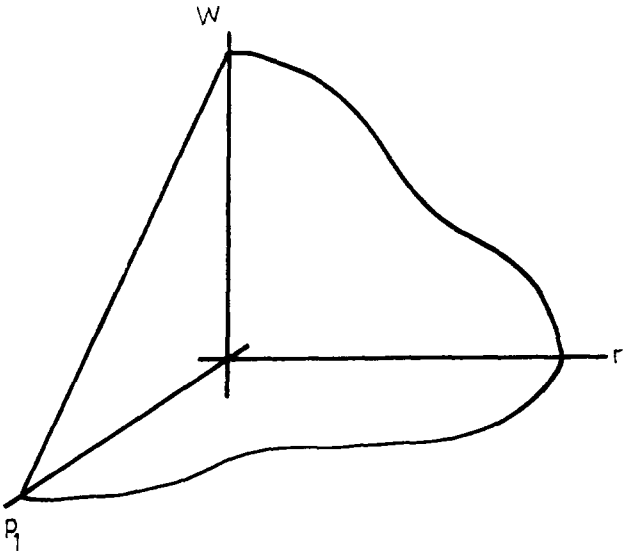
With given money wages, the model is now fully determinant in the variables, P_n, P_m, X_m and r.

Combining (6) and (7):

$$(P_nA_{nm} + wL_m + rP_nK_{nm})\ (I - A_{mm} - rK_{mm})^{-1}\ Q - 1 = 0 \tag{8}$$

Equation (8) implicitly defines a wage-profit-terms-of-trade (WRT) surface in n+2 dimensions which is the locus of possible outcomes of the struggle between fundamental classes. By the Perron-Frobenius theorems for non-negative matrices, $(I-Amm - rKmm)^{-1}$ is strictly positive for r such that the maximal eigenvalue of $A+rK_{mm}$ is less than one.[8] An increase in any element of P_n must then bring about a fall in either the wage rate or the profit rate in order to continue to satisfy (8). Thus, not only is the wage-profit line always downward sloping, but also any wage-P_n or profit-P_n line is negatively inclined as well. These relationships are depicted in Figure 1 for n = 1

FIGURE 1
THE WAGE-PROFIT-TERMS-OF-TRADE SURFACE



The WRT surface characterises the environment in which fundamental classes struggle over the distribution of income and the subsequent impact of this struggle on subsumed classes. Where the economy happens to reside on its WRT surface depends upon the nature of the effective demand equations (5) and the wage rate. Note that for constant P_n, there is the familiar inverse relationship between wages and profits characteristic of the basic Sraffian model. The existence of subsumed classes, however, significantly complicates matters. If, for example, the 'cut' of the surplus taken by subsumed classes is reduced, wages and profits can rise simultaneously.

A Keynes-Kalecki Closure

In the M-S system, competition between capitalists is assumed to bring about an equalisation of the rate of profit on the value of invested capital. If

this assumption is suspended, the model may be closed by specifying a Keynes-Kaleckian mark-up pricing rule in place of the M-S system of reproduction prices. Let $R = (r_i)$, $(i = 1, 2, \ldots, m)$ be a diagonal matrix of given mark-ups on prime costs. The non-agricultural price equation for the K-K closure can then be expressed:

$$P_m = (P_n A_{nm} + P_m A_{mm} + wL_m)(I+R) \qquad (9)$$

where I is an m-dimensional identity matrix. Given the wage rate and the mark-ups, equation (9) determines non-agricultural prices, P_m.

It is the portrait of class conflict which serves to distinguish the K-K from the M-S variant of the model under discussion. From a comparison of equations (8) and (9), it is obvious that mark-up pricing allows capitalists to try to protect profits by passing along wage or agricultural commodity price increases. Movements in the profit rate are not constrained to any particular WRT surface. The price of production formulation of equation (6), on the other hand, describes an economy in which capitalists are not in full control. Capitalists must not only struggle with workers but also pay off owners of NPMP along a WRT surface.

Mexico: Sectors

The empirical model for Mexico is a more elaborate version of the model discussed in the previous section. Table 1 lists the sectors and social classes employed. Output in sectors 1 and 2 is assumed to be limited by the existence of NPMP (for example, land) while output in the remaining sectors adjusts to the level of effective demand. 'Corn and beans' is disaggregated from 'other agricultural' in order to consider the impact of a guarantee price introduced by the Mexican government under the Lopez-Portillo administration. Petroleum and fertiliser are the two major state-owned enterprises and profits in these sectors accrue to the state in the form of general revenue. Processed foods is broken out of industry to study the impact of various scenarios on the price and consumption of food. The service sector aggregates business, personal and government services while commerce includes wholesale and retail trade. Input–output data for these sectors was aggregated from the 45-sector Mexican matrix for 1975.

Classes and Incomes and Adjustment Mechanisms

The agrarian bourgeoisie is considered here subsumed rather than fundamental although this class typically consists of an amalgam of agricultural capitalists and landlords. To the extent that they hire and exploit labour, agrarian capitalists need not be distinguished from other capitalists. Landlords, on the other hand, are clearly subsumed. As owners of NPMP, their incomes are determined by the system of relative prices resulting from fundamental class struggle. But while landlords and agricultural capitalists are theoretically distinct, their empirical identification is a data-intensive process. Hence, our classifying agricultural capitalists as subsumed is based

TABLE 1
PRODUCTIVE SECTORS AND SOCIAL CLASSES IN THE MEXICAN CGE

Sectors	Classes
Sectors Limited by NPMP	Fundamental Classes
1. Corn and Beans	1. Agricultural Workers
2. Other Agriculture	2. Urban Workers
	3. Urban Capitalists
Sectors Limited by Effective Demand	Subsumed Classes
3. Petroleum	4. Agrarian Bourgeoisie
4. Fertilizer	5. Campesinos
5. Processed Foods	6. Merchant Capitalists
6. Industry	7. Urban Marginals
7. Services	
8. Commerce	

on the simplifying assumption that the preponderance of agrarian bourgeois income derives not from extraction but from a transfer of surplus effected by their control over NPMP.[9]

Campesinos are assumed to neither hire labour, nor hire themselves out as agricultural workers and thus do not produce or extract surplus. Hence, *campesinos* satisfy the first part of the definition of subsumed class. Real income accruing to *campesinos* is governed by terms of trade over which they have no control. Like other petty-commodity producers, *campesinos* absorb a share of aggregate demand that would otherwise be satisfied by the agrarian capitalists and thus it can be said that they sustain themselves by way of transfers from fundamental classes. Accordingly, *campesinos* qualify as subsumed by the definition cited above.

In the model, *campesinos* are assigned a fixed proportion of total value added in the agricultural sectors. From the remaining value added, the income of the rural proletariat is subtracted, leaving the income of the agrarian bourgeoisie as a residual. Although *campesinos* are assumed to operate processes which do not pay the average rate of profit when wage costs and land rents are imputed at their economy-wide average rates, there are insufficient data to separate *campesino* and agrarian bourgeois processes. A change in the structure of relative prices will not redistribute the surplus between *campesinos* and the agrarian bourgeoisie as it should. The input–output matrix must be seen as representing a (fixed) weighted average of rural bourgeois and *campesino* production processes.

Urban marginals are similar to *campesinos* but without access to NPMP. They constitute a subsumed class in that, as petty-commodity producers, they absorb aggregate demand which would otherwise be satisfied by capitalists. Urban marginal incomes depend primarily upon the system of relative prices, which they regard as given, rather than upon strategic class conflict.

For the purposes of the model, urban marginals receive a fixed proportion of total value added in food processing, industry, services and commerce. As

in the case of *campesinos*, there are insufficient data to disaggregate the production processes operated by urban marginals.

Merchant capital, like the agrarian bourgeoisie, is a mixture of fundamental and subsumed elements. Merchant capitalists are owners of non-produced means of production, specifically their spatial location from which they provide their services, and thus are able to earn rent above the average rate of profit. But unlike the agricultural sectors, the existence of commercial non-produced means of production does not limit supply. There are alternative processes in both agriculture and commerce, but in commerce, output can rapidly expand over a finite range until the marginal process reaches capacity and new, more costly process mus be introduced.[10] Over a longer period of time agricultural supply could also adjust in this way. The assumption of the model, however, is that the relevant time horizon is one in which commerce can adjust, but agriculture cannot.

As in the case of the agrarian bourgeoisie, merchant rents cannot be separated from profits without data on alternative processes. Consequently, we assume in both closures that the commercial price is determined by variable costs of production with a constant mark-up. Output of the commercial sector is taken to be demand determined by fixed 'physical' commercial margins.[11]

The petroleum sector is handled in a fashion similar to commerce with output demand determined for both closures. The government is assumed to satisfy demand at a fixed price given by labour and intermediate costs marked up at the base-SAM rate.

Finally, the numeraire for the M-S closure is chosen such that the gross value of production is equal to the gross value of production in the base SAM. Base profit rate differentials (determined such that base prices under the M-S closure are equal to unity) are also maintained. The net effect of this choice of numeraire and the treatment of the profit rate is that the base SAM is the same for both K-K and M-S closures.

III. RESULTS

In this section we examine some empirical results for both the M-S and K-K closures under three different scenarios of strategic class behaviour: (1) an increase in nominal urban wages by 15 per cent; (2) an increase in real investment by ten per cent; and (3) a doubling of the guarantee price for corn and beans. For each simulation, we investigate effects upon the average rate of profit for non-agricultural sectors; the terms of trade, defined as the ratio of the agricultural to non-agricultural deflators and the rate of growth of sectors 3 to 8, that is, sectors for which output is determined endogenously.[12] We shall also be concerned with changes in the distribution of real income by social class and associated structure of private, government and foreign savings.

Wages, Profits and the Terms of Trade

The first two columns of Table 2 show how class struggle over nominal

wages affects the profit rate, output, the terms of trade, inflation and the distribution of savings according to the nature of the closure employed. For the K-K closure, a 15 per cent nominal wage increase leads to a rise in the profit rate, a contraction in output and employment, inflation and a deterioration of the terms of trade for agriculture. In the M-S closure, however, the same change in wages produces precisely opposite results: the profit rate falls, economic activity picks up, there is slight deflation and an improvement in the terms of trade for agriculture.

In the K-K closure, the rise in the mass of profits due to higher nominal wages initially causes aggregate savings to exceed investment. Equilibrium is re-established by a combination of the deterioration in the terms of trade, which reduces agricultural profits, and a contraction in non-agricultural output. In the M-S closure, on the other hand, aggregate savings initially falls short of investment due to the fall in the profit rate. Equilibrium is restored through an improvement in the terms of trade as well as an expansion in output.

The first row of Table 2 shows the rate of profit rate for sectors 4 to 7 defined as the sum of profits (including urban marginal incomes) divided by the value of capital invested in the branch of production. The base rate of profit is 9.1 per cent. The nominal wage increase raises the profit rate in the K-K closure to 9.2 per cent since higher nominal wages are converted to higher nominal profits by the fixed mark-up. With given investment and fixed savings propensities, higher profits lead to a contraction of −0.4 per cent in real output.

In the M-S closure, however, class struggle causes the profit rate to fall to 6.7 per cent. The reduction in the profit rate lowers savings which can only be recouped by an expansion in sectors 3–8 and higher terms of trade for agriculture. The wage-induced inflation in non-agricultural sectors causes the terms of trade to turn against agriculture in the K-K closure even though nominal demand for agricultural goods increases. The terms of trade turn in favour of agriculture in the M-S closure, however, since a large redistribution of income from capitalists to workers and peasants drives up the relative price of 'wage' v. 'luxury' goods. Note that the precipitous decline in the rate of profit in the M-S variant is due in part to the improvement in agricultural terms of trade as higher wages cause the economy to move in the north-west direction on the WRT surface of Figure 1.

Table 3 shows how the distribution of income responds under both closures. Nominal changes in income are deflated by consumer price indices (CPI) with weights from the base consumption matrix.[13] Note that in the K-K closure, a 15 per cent increase in nominal wages gives rise to only a 0.1 per cent increase in real wages. Here nominal wage increases simply transfer income through standard inflationary means; those with fixed incomes (agricultural workers) suffer at the hands of classes whose incomes rise with inflation (merchants and the agrarian bourgeoisie). Note, however, that the deterioration in the terms of trade squeezes *campesinos* since they receive a fixed proportion of value added. Urban marginals benefit by reverse reasoning. Consumption effects on real income in the K-K closure are limited in

TABLE 2
MACRO VARIABLES

		15% Δw		10% ΔI		GP = 2	
	base	K-K	M-S	K-K	M-S	K-K	M-S
Profit rate in sectors 4-7	9.1	9.2	6.7	9.2	7.0	9.2	7.8
Rate of growth in sectors 3-8	0	-0.4	1.2	4.3	5.7	1.8	2.8
Terms of trade	1	0.97	1.18	1.24	1.5	1.24	1.41
Inflation	0	13	-2	5	-7	4	-3
Savings (%)							
Private							
Rural	5.9	6.1	8	8.0	10.3	8.0	9.6
Urban	76.5	77.5	70.8	72.8	66.8	76.9	72.9
Government	6.1	7.7	9.3	8.6	9.7	4.1	4.7
Foreign	11.5	8.7	11.9	10.6	13.2	11.0	12.8

TABLE 3
CHANGES IN REAL INCOME
(%Δ relative to the base SAM)

	15% Δw		15% ΔI		GP = 2	
	K-K	M-S	K-K	M-S	K-K	M-S
Fundamental Classes						
Agricultural Workers	-12.7	0	-7.9	1.8	-10	-3.6
Urban Workers	0.1	16.3	-0.3	12.1	-2.3	5.9
Urban Capitalists	-0.5	-30.2	2.8	-23.0	0.1	-16.4
Subsumed Classes						
Agrarian Bourgeoisie	1.5	34.1	47.2	81.5	34.3	59.3
Campesinos	-2.6	16.5	26.3	46.4	38.1	52.7
Merchant Capitalists	1.0	9.2	-0.1	6.4	-2.0	2.3
Urban Marginals	1.2	-3.8	-2.1	-6.7	-5.7	-8.5

that the CPI rises for all classes by roughly the same amount (although urban marginals and *campesinos* do benefit slightly from the larger proportion of cheap foodstuffs in the market basket).

In the M-S closure, the numeraire prevents capitalists from transferring the burden of urban class conflict to the agricultural classes through deteriorating terms of trade. Gains in real income by workers and the agricultural bourgeoisie are not paid for by rural workers. *Campesinos* benefit from the change in the terms of trade and urban marginals lose. For the M-S regime, there is more change in the structure of relative prices and hence consumption effects are more pronounced. The CPI varies from −2 per cent for merchants and urban capital to +1 per cent for *campesinos*. Merchants again gain, but now from an increase in volume rather than price.

Note that total private savings and government savings in the K-K closure rise relative to foreign savings owing primarily to the contraction in output and lower imports. In M-S closure, agriculture finances a larger share of investment, as does government, since revenues rise with income and nominal spending is lower due to the fall in the price level. Foreign savings falls with output in the K-K closure and rises slightly in the M-S closure.

What is most obvious from the K-K closure is the marked failure of nominal wage increases as an urban working-class strategy. The net income transfer is only among segments of the working class itself. If capitalists cannot protect themselves through inflation, however, a strategy to increase urban wages is much more successful. A worker–peasant alliance organised around a demand for price controls would be effective in capturing a larger share of income for poorer classes. Nominal wage increases would then translate into real wage increases, turning the terms of trade in favour of agriculture, thereby sharing the gains with peasants and agricultural workers. Of course the incomes of the agricultural bourgeoisie would rise along with the terms of trade; but this surplus could be taxed and recycled as insurance against a 'capital strike' by urban capital. It is also true that lower non-agricultural prices reduces the real incomes of urban marginals; but as output and employment expanded in urban sectors, part of this reserve army of urban marginals could be absorbed by the working class.

Investment, Profits and the Terms of Trade

We next consider whether an increase in the level of real investment by ten per cent might bring about similar changes in the distribution of income. Augmenting the level of real investment in either closure requires that non-agricultural output must expand and the terms of trade turn move in favour of the rural branches. Table 2 confirms that this occurs under both closures. But while in the K-K case, increases in agricultural input prices are passed along in the form of higher urban prices, improved agricultural terms of trade lowers the urban profit rate in the M-S closure. In terms of Figure 1, an increase in real investment moves the economy in the $r-p_n$ plane toward the P_n axis. A lower profit rate implies that the output of non-agricultural sectors must show a higher rate of increase and the terms of trade must move more favourably for agriculture in a M-S v. K-K regime.

Table 3 reveals the familiar pattern of 'forced savings' brought about by an increase in investment demand under the K-K regime. With the

exception of the *campesinos*, the incomes of low-saving classes declines as income is shifted to classes capable of financing the rise in real investment. As the terms of trade turn in favour of agriculture, the increase in the cost of food hurts all popular classes. For urban marginals and agricultural workers the change in the CPI is approximately eight per cent, while for urban workers it rises by five per cent. The rural bourgeoisie, merchants and urban capital all benefit through the consumption effect with less than five per cent changes in their CPIs.

Observe that while urban workers' income decreases in the K-K closure, urban workers are actually better off under the M-S closure with a ten per cent increase in investment. The forced savings which does occur is through the effect of the terms of trade on rural bourgeois incomes (81.5 per cent), government and foreign savings. As a result demand does not grow as rapidly as output and the overall price level falls by seven per cent.

Should workers be content to demand of the state that higher rates of real investment be undertaken rather than struggle for wage increases? For the M-S closure, demand stimulus is more progressive than bargaining for higher wages. Both improve workers' real income by similar amounts but income is spread over more workers since output rises by 5.7 per cent with a change in investment as opposed to only 1.2 per cent former scenario. Moreover, rapid growth tends to redistribute income more equally between the rural and urban proletariat. Urban marginals suffer, but again they may find themselves converted into urban workers. Note that since higher levels of investment cause the rate of profit to fall and subsumed incomes to rise, one might then expect lower rates of accumulation when capitalists cannot defend themselves through inflation and/or when subsumed classes controlling non-produced means of production are prominent. Apparently, a working class strategy which relies on demand management as a mechanism to appropriate a larger share of the surplus will require substantial state participation. Not only must prices be controlled to deflect forced savings, but given the disincentive to invest in industry, the state must have the political power to tax the agrarian bourgoisie in order to maintain the rate of accumulation.

Terms-of-Trade Policy

Under the Lopez-Portillo regime, a comprehensive system of agricultural price supports, credit, fertiliser and other input subsidies was introduced by the *Sistema Alimentario Mexicano*. The objectives of these policies were to raise yields for corn and beans on peasant plots, reduce food imports and to improve the rural distribution of income through a system of consumer subsidies in state-run stores. In this section we investigate the effects of a direct intervention on behalf of subsumed peasant producers to force an improvement in the terms of trade. It is assumed that the state doubles the guarantee price relative to the base SAM and then subsidises the consumption of corn and beans to the point that excess demand disappears.

Again the results hinge upon the closure employed. Under the K-K closure, *campesinos* definitely benefit, as do the rural bourgeoisie, while all

other popular classes lose. The set of policies is expansionary in both closures due to the reduction in taxes the subsidy implies. Table 2 confirms that government savings falls as a percentage of total savings. Note also that in the K-K regime, the increase in the terms of trade causes the profit rate to rise slightly with a dampening effect on output. The M-S closure, on the other hand, shows rural subsumed incomes eroding the profit rate with the result that the closure is more expansionary.

Real wages fall for agricultural workers under both price closures but less so in the M-S system. The scenario shows that the cost of protecting peasant incomes can easily fall on the shoulders of rural workers if no effort is made to contain the inflationary pressures that result. Even though the price of corn and beans is subsidised in this scenario, it can be shown that agricultural workers consume less due to the income effect of the rise in other prices. Urban marginals, on the other hand, suffer more in the M-S scheme due to the greater improvement in the terms of trade. Merchants' nominal income is relatively stable: what they lose in volume under the K-K closure they gain in inflation and vice versa in the M-S closure. The consumption effect determines the sign of the change in their real income. The CPI for M-S dropped by three points while it rose four points in the K-K closure.

As in the case of a change in the level of investment, urban workers' real income falls under the K-K and rises with the M-S closure. As a class strategy, the guarantee price is successful in redistributing income toward the peasantry; but as in the first scenario, the K-K closure ensures that the preponderance of transfer will be between segments of the working class inasmuch as capitalists are able to defend their real income position through mark-up pricing.

Is a guarantee price the best way to improve terms of trade for agriculture? Observe from Table 2 that under the K-K closure, the terms of trade improve by exactly the same amount, 1.24, whether through demand stimulus or a direct state intervention. In both cases, *campesinos* benefit. But with the less expansionary terms-of-trade policy, the transfer impinges upon workers and urban marginals. In the M-S regime, terms-of-trade policy is more clearly inferior. For a slightly greater improvement in *campesino* incomes, agricultural workers must consume less and urban workers' incomes only rise by 5.9 per cent as opposed to 12.1 per cent under the increase in investment demand. It is true, however, that in both closures, the guarantee price helps *campesinos* more than demand expansion, while the latter favours the agrarian bourgeoisie.

CONCLUSIONS

The model presented in this article is non-neo-classical in the sense that class conflict rather than marginal productivities, factor endowments, or what have you, determines the distribution of income. In both closures the levels of investment and money wages are taken as historically given data rather than attempting to (falsely) attribute their determination to parameters of an essentially static model. The Keynes-Kalecki variant tends to limit

the scope of class conflict to a struggle between fundamental and subsumed classes, while the Marx-Sraffian formulation allows a more complex redistribution of income to follow parametric changes in the model. As we have seen, there are substantial differences in the qualitative properties of the model depending upon which approach is adopted.

The difference in properties of the two closures hinges on the ability of capitalists to pass along cost increases initiated by workers or an improvement in the terms of trade for agriculture. In the K-K closure, price movements cause workers to release more surplus than under the M-S system. The adjustment in output and the terms of trade needed to recoup total savings is therefore less violent under mark-up pricing than in the M-S closure.

It is worth noting that the choice of closure is not arbitrary; it must reflect the historical reality of the economy for which the model is constructed. On the other hand, there are some clear policy implications which may be drawn from the comparison of the two closures. If the ability of capitalists to protect their incomes through inflation can be restrained, the government can reduce unemployment by stimulating aggregate demand, either directly or through subsidy programmes and price supports. Increasing wages would then expand employment and improve the terms of trade for agriculture. If urban price controls are politically infeasible, however, there is much less scope for progressive government intervention and industrial wage increases will be accompanied by unemployment, inflation and (terms-of-trade induced) stagnation in agriculture. Stimulating effective demand could then reduce unemployment and improve terms of trade, but at the expense of those least able to afford it.

final version received February 1986

NOTES

1. See Taylor [*1980*], Dervis *et al.* [*1982*], Taylor *et al.* [*109;*], Adelman and Robinson [*1977*] and Taylor and Lysy [*1979*]. For analytical approaches to Marxian economic theory see Roemer [*1981; 1982*], Morishima [*1973*] and Brody [*1960*].
2. The word 'closure' may be somewhat misleading given its prevalence in recent literature. Sen [*1963*] usefully distinguishes Keynesian, Neo-Classical, Cambridge and Johansen 'closures' for a simple system of national income accounting identities. Generically, 'closure' refers to the equality of independent equations and unknowns and it is this more general usage we employ here.
3. By 'surplus', we mean a heterogeneous vector of commodities; 'surplus-value' is then the inner product of some vector of exchange ratios with the vector of surpluses while 'surplus labour' is the product of the labour coefficients with the vector of surpluses. The use of the term 'surplus-value' therefore does not imply that it is necessarily denominated in terms of embodied labour times. See Steedman [*1977*] for evidence that none of Marx's crucial insights depends upon the labour theory of value.
4. See Sraffa [*1960*], Gibson and McLeod [*1983*], Gibson and Esfahani [*1982*], Montani [*1975*] and Kurz [*1978*] for details of the theory of NPMP.
5. See Pasinett [*1977: Ch. 5*].
6. For the Marxian characterisation of this equation see Brody [*1970*]. With proper deference to the value-price controversy, we refer to this closure as 'Marx-Sraffian' although Sraffa [*1960*] does not employ a capital stock matrix as we do here.
7. We do not follow Sraffa's suggestion to treat fixed capital as a jointly produced output.

largely because Mexican data would not support the additional detail required. For more on the capital stock matrix see Brody [*1960: 34–41*].

8. See Pasinetti [*1977: 273*] for details.
9. See McLeod [*1983*], for an empirical attempt to separate rent and profit in a Sraffian model. Note that if agricultural capitalists were distinguished from landlords, yet their consumption and savings behaviour did not differ, their disaggregation would be immaterial to the model.
10. See Sraffa [*1960: 76*] for a discussion of how output may increase continuously, with 'spasmodic' changes in the methods of production.
11. See Appendix equations for details.
12. The 1975 Social Accounting Matrix is used as the base to compute all deflators. Data discussed in this section are drawn from the SAMs of the simulations and are available from the authors upon request.
13. These and other macro indicators are included in the simulation SAMs available from the authors.

REFERENCES

Adelman, I. and S. Robinson, 1977, *Income Distribution Policies in Developing Countries: A Case Study of Korea*, Stanford, CA: Stanford University Press.

Banco de Mexico, S.A., 1978, *Acervos y Formacion de Capital, 1960–75*, Serie Encuestas, Subdireccion de Investigacion Economica y Bancaria, Mexico, D.F.

Brody, A., 1960, *Proportions, Prices and Planning*, Amsterdam: North-Holland.

Chichilnisky, G. and L. Taylor, 1980, 'Agriculture and the Rest of the Economy: Macro Connections and Policy Restraints', *American Journal of Agricultural Economics*, No. 62.

Dervis, K., de Melo, J. and S. Robinson, 1982, *Planning Models and Development Policy*, Cambridge: Cambridge University Press.

Elster, J., 1983, *Explaining Technical Change*, Cambridge: Cambridge University Press.

Johansen, L., 1960, *A Multi-Sectoral Study of Economic Growth*, Amsterdam: North-Holland.

Gibson, B. and D. McLeod, 1983, 'Non-produced Means of Production in Sraffa's System: Basics, Nonbasics, and Quasibasics', *Cambridge Journal of Economics*, Vol. 7, No. 2.

Gibson, B. and H. Esfahani, 1982, 'Nonproduced Means of Production: Fundamentalists v. Sraffians', *Review of Radical Political Economics*, Vol. 15, No. 2.

Kurz, H., 1978, 'Rent Theory in a Multisectoral Model', *Oxford Economic Papers*, No. 30.

Lustig, N., 1982, 'Politicas de precios y subsidios del Sistema Alimentario Mexicano y distribucion del ingreso', Mexico, D.F.: SINE/SAM, Segundo Reporte.

McLeod, D., 1983, 'Land Rent and Inflation in the U.S. Economy', Ph.D. dissertation, Department of Agricultural and Resource Economics, University of California, Berkeley.

Morishima, M., 1973, *Marx's Economics: A Dual Theory of Value and Growth*, Cambridge: Cambridge University Press.

Montani, G., 1975, 'Scarce Natural Resources and Income Distribution', *Metroeconomica*, No. 27.

Pasinetti, L., 1977, *Lectures on the Theory of Production*, New York: Columbia University Press.

Resnick, S. and R. Wolff, 1982, 'Classes in Marxian Theory', *The Review of Radical Political Economics*, Vol. 13, No. 4.

Reyes-Heroles, J., 1980, 'Welfare Effects of Short-Run Macroeconomic Policy in a Dual Economy: The Case of Mexico', Ph.D. dissertation, Massachusetts Institute of Technology.

Roemer, J., 1981, *Analytical Foundations of Marxian Economic Theory*, Cambridge: Cambridge University Press.

Roemer, J., 1982, *A General Theory of Exploitation and Class*, Cambridge, MA: Harvard University Press.

Secretaria de Programacion y Presupuesto, 1981a, *Sistema de Cuentas Nacionales*, Vols. 1, 7. Mexico, D.F.: Coordinacion General del Sistema Nacional de Informacion.

Secretaria de Programacion y Presupuesto, 1981b, *Encuesta Nacional de Ingresos y Gastos de los Hogares: 1977*, Mexico, D.F.: Coordinacion General del Sistema Nacional de Informacion.

Sen, A., 1963, 'Neo-Classical and Neo-Keynesian Theories of Distribution', *Economic Record*, No. 39.
Sraffa, P., 1960, *Production of Commodities by Means of Commodities*, Cambridge: Cambridge University Press.
Steedman, I., 1977, *Marx After Sraffa*, London: New Left Books.
Taylor, L., 1980, *Macromodels for Developing Countries*, New York: McGraw-Hill.
Taylor, L., 1983, *Structuralist Macroeconomics*, New York: Basic Books.
Taylor, L., *et al.*, 1980, *Models of Growth and Distribution for Brazil*, Oxford: Oxford University Press.
Taylor, L. and F. Lysy, 1979, 'Vanishing Income Redistributions: Keynesian Clues about Model Surprises in the Short Run', *Journal of Development Economics*, No. 6.

APPENDIX

MODEL SPECIFICATION

Variables

p price
x output
r profit rate
ϱ retail prices
E expenditure
c consumption
y incomes

Parameters

π mark-ups
t indirect tax rate
w_1 agricultural wage
w_2 non-agricultural wage
l direct labour coefficient
I investment
G government expenditure
E exports (net competitive)
h subsistence consumption
μ marginal propensity to consume
z proportion of value added accruing to *campesinos* and urban marginals
k capital stock
d profit rate differentials
T direct tax rate
q commercial margins
w_g government wages
m^g non-competitive intermediate imports
p^o price of intermediate imports
m_c non-competitive consumption imports
σ^c consumer subsidy
s savings propensity

EQUATIONS

$$x_i = \sum_{j=1}^{8} a_{ij} x_j + \sum_{j=1}^{7} c_{ij} + I_i + G_i + E_i \qquad i = 1,2,\ldots,8$$

$$c_{ij} = h_{ij} + \mu_{ij}/p_i \left(E_j - \sum_{i=1}^{7} p_i h_{ij}\right) \qquad \begin{matrix} i = 1,2,\ldots,8 \\ j = 1,2,\ldots,7 \end{matrix}$$

$$c_{8j} = \sum_{i=1}^{7} q_i c_{ij} \qquad j = 1,2,\ldots,7$$

$$p_i = p_i + p_8 q_i - \sigma_i \qquad i = 1,2,\ldots,7$$

$$E_i = (1-s_i)(1-T_i)y_i - m_{ci} \qquad i = 1,2,\ldots,7$$

$$y_1 = w_1 (l_1 x_1 + l_2 x_2) \qquad \text{agricultural workers}$$

$$y_2 = w_2 \sum_{i=3}^{8} l_i x_i + w_9 \qquad \text{urban workers}$$

$$y_3 = \sum_{i=5}^{7} [(p_i - \sum_{j=1}^{8} p_j a_{ji} - p^o m_i)(1-z_i) - w_2 l_i] x_i \qquad \text{urban capitalists}$$

$$y_4 = \sum_{i=1}^{2} [(p_i - \sum_{j=1}^{8} p_j a_{ji} - p^o m_i)(1-z_i) - w_1 l_i] x_i \qquad \text{agrarian bourgeoisie}$$

$$y_5 = \sum_{i=1}^{2} (p_i - \sum_{j=1}^{8} p_j a_{ji} - p^o m_i) z_i x_i \qquad \textit{campesinos}$$

$$y_6 = [(p_8 - \sum_{j=1}^{8} p_j a_{j8} - p^o m_8)(1-z_8) - w_2 l_8] x_8 \qquad \text{merchant capitalists}$$

$$y_7 = \sum_{i=5}^{8} (p_i - \sum_{j=1}^{8} p_j a_{ji} - p^o m_i) z_i x_i \qquad \text{urban marginals}$$

K-K closure

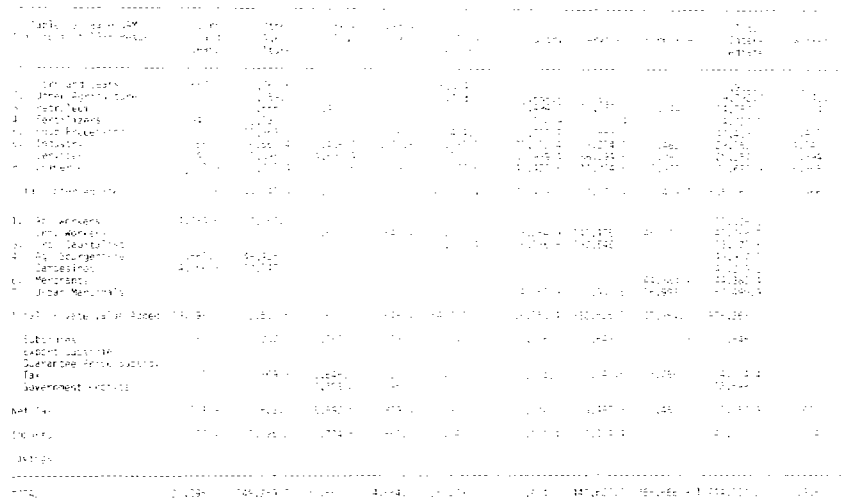
$$p_i = (1+\pi_i)(1+t_i)(\sum_{j=1}^{8} p_j a_{ji} + w_2 l_i + p_o m_i) \qquad i = 3,4,\ldots,8$$

M-S closure (replace equations above for sectors 4–7)

$$p_i = (1+t_i)(\sum_{j=1}^{8} p_j a_{ji} + w_2 l_i + p_o m_i + rd_i \sum_{j=1}^{8} p_j k_{ji}) \qquad i = 4,5,\ldots,7$$

DATA SOURCES

The input/output matrix is an aggregation of the 72-sector matrix for 1975 in Secretaria de Programcion y Presupuesto [*1981a*]. The disaggregation of agriculture into corn and beans and other agriculture is taken from the CHAC model and was compiled by Maria Bassoco of the Division of Macroeconomic Analysis of the Sistema Alimentario Mexicano. Dr Horacio Santamaria of the Coordinacion del Sistema Nacional de Informacion assisted in the disaggregation. The consumption functions were estimated using a linear expenditure system with data from a 1977 budget study conducted by Secretaria de Programcion y Presupuesto [*1981b*]. The authors had access to the original computer tapes of this study from which the class structure was determined. Direct tax rates were taken from Reyes-Heroles [*1980*] as were the proportions of value added accruing to urban marginals. Capital stock coefficients were taken from Banco de Mexico [*1978*]. A more detailed description of sources and methods can be found in Lustig [*1982*].



Urban Workers	Urban Capital	Ag. Bourg.	Campe-sinos	Mer-chants	Urban Mar-ginals	Total Consump-tion	Govern-ment	Exports	Invest-ment	Gross Value of Production
2,089.0	1,292.5	267.7	3,770.0	647.2	2,222.2	11,983.2		6.2	3,123.1	23,095.0
17,843.1	12,746.4	2,084.2	3,791.4	5,418.4	5,240.1	47,168.9	136.9	3,192.4	7,998.8	48,289.7
3,609.9	3,437.3	1,070.6	495.7	1,374.9	340.0	10,693.4	1,718.0	5,784.6	570.0	73,553.8
							13.6	398.5	225.0	4,864.9
65,627.3	36,544.0	6,788.8	11,467.2	20,389.0	17,526.6	158,464.8	176.3	7,378.9	2,825.8	226,279.5
50,440.5	29,996.9	4,775.9	6,652.5	13,163.5	7,816.7	116,989.7	5,126.7	17,368.6	182,899.4	551,534.7
121,374.4	74,767.3	12,568.6	7,355.4	32,653.9	13,257.5	247,671.2	64,376.1	2,105.8	5,012.5	447,622.7
65,061.9	43,267.9	6,705.5	8,096.1	19,843.3	11,755.4	157,038.1	977.8	2,554.5	30,674.6	268,866.9
306,245.1	202,054.3	32,251.5	41,538.4	93,164.1	57,958.5	764,209.3	72,525.4	38,779.5	233,329.3	1,744,107.2
										31,338.3
							43,264.4			381,053.1
										313,071.5
										49,987.1
										41,203.3
										144,383.4
										57,490.9
							43,264.4			1,018,527.6
19,252.6	12,435.5	2,783.9		8,040.3		47,539.5				129,296.8
-3,095.4	-2,546.4	-406.6	-335.1	-1,174.4	-467.6	-8,284.4	535.5	16,259.5	27,287.1	85,020.7
58,853.8	96,128.3	15,348.3		44,332.8		214,663.2	15,971.5	29,981.7		260,616.4
387,056.1	313,071.5	49,987.1	41,203.3	144,383.4	57,490.9	1,018,527.6	129,296.8	85,020.7	260,616.4	