

# **Welfare Effects of Demand Management Policies: Impact Multipliers Under Alternative Model Structures**

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This paper explores the sensitivity of multiplier estimates under three alternative assumptions about factor supply. For this purpose, we have used a general equilibrium model of Malaysia which allows endogenous determination of factor and output prices and which permits substitution in both production and demand in response to price. The structure of the model and three alternative factor supply assumptions under which the model can be solved are described. These alternative assumptions amount to alternative "closure rules." The results of a general increase in demand as estimated under each of the alternative closures are then presented. Finally, we examine the results of two specific types of demand increase under each of the closure rules, focusing especially upon welfare related variables such as real household consumption levels.

## **INTRODUCTION**

Policy makers are often concerned with estimating the total impact of various types of initial shock upon output and employment levels in the economy. This has produced a substantial interest in impact multipliers and their measurement.

The existing literature on impact multipliers is based on a very limited characterization of the interrelationships involved in general equilibrium. The familiar multipliers derived from the simple open Leontief model take account only of linkages arising from the domestic intermediate requirements of production, on the assumption that input-output and employment coefficients are fixed. However, second-round effects are obviously not limited only to these linkages. Increased production leads to increases in household income, which in turn lead to increases in household consumption and subsequent increases in production.

The simplest case of multipliers that take account of the linkages from initial production changes to income and consumption changes, and thence to second-round production changes, is of those derived from a closed Leontief model in which consumption demand is endogenously determined. Several studies have examined such multipliers for economies as a whole and for particular regions.<sup>1</sup> This approach is more general since it takes account of the circular flow from production to income and consumption. Furthermore, it permits quantification of impact multipliers for the incomes of different household groups, thus introducing a distributional element into the analysis. However, it remains limited by the assumption of fixed coefficients in defining the production, employment, income distribution, and consumption relationships in the economy. This assumption reflects an extremely restricted view of the economy. Under the usual profit maximizing assumptions, the fixed coefficients assumptions underlying the closed Leontief model are valid only in a world in which all primary factors are available in infinitely elastic supply at fixed prices (together with some homogeneity assumptions discussed below). Such a system is entirely demand driven, being unconstrained on the supply side.

Once we allow for supply constraints, the fixed coefficients assumption is difficult to maintain. Increases in output levels lead to increases in the demand for primary inputs, and some of these are likely to be in fixed supply. In this case, we must allow prices of these inputs to rise, which in turn alters output prices. These price changes will lead to some substitution in

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\* An earlier draft of this paper was presented at a Conference on Social Accounting Methods in Development Planning held at Cambridge, England, in April 1978. We wish to acknowledge useful comments received there. We should also like to thank Clive Bell, Suman Bery, Benjamin King, Larry Westphal, and the referees of this journal for comments on another draft. The views expressed in this paper are those of the authors and do not necessarily reflect those of the World Bank.

<sup>1</sup> See, for example, Pyatt and Round (1979). For an application of the same methodology to a regional economy, see Bell and Hazell (1980).

both production and consumption so that the assumption of fixed coefficients is obviously inappropriate.

This paper examines the sensitivity of such multipliers to alternative characterizations of general equilibrium using a recently constructed general equilibrium model of Malaysia. Although the particular focus of this paper is on static multipliers, the results are also of more general interest. They provide an example of the extent to which model behavior may depend crucially upon the "closure rules" adopted—a subject which has received considerable recent attention (Cardoso and Taylor 1979; Taylor and Lysy 1977).

## **THE STRUCTURE OF THE MODEL AND ALTERNATIVE CLOSURES**

The model used in this paper belongs to a class of computable general equilibrium model of which there are many recent examples. The model has been described in detail elsewhere, and its main features can be summarized as follows.<sup>2</sup> The model distinguishes 14 production sectors, 8 labor types, and 12 household groups, each household having its own demand system.<sup>3</sup> Production functions permit varying degrees of substitution among factors and among intermediate inputs. Household demand functions permit substitution among commodities. Furthermore, imports may be substituted for domestic supplies in both intermediate use and in household consumption according to a system similar to that of Armington (1969). World prices for imports are given (and are independent of import levels) and are converted into domestic currency at a given exchange rate. In equilibrium, the model determines domestic output and factor prices so as to clear output and factor markets.

For any given exogenous shock we can estimate impact multipliers by solving the model under each of three different factor supply assumptions. At one extreme, we assume that all primary inputs into production—capital, labor, and imports—are available in infinitely elastic supply at given prices. As shown below, on these assumptions the model behaves exactly like the closed Leontief system. Alternatively, we assume that capital stocks in each sector are fixed (reflecting short-term inflexibility of installed equipment), although the supply of labor to the economy as a whole is unconstrained, so that each sector can hire labor in any amount at fixed money wages. We have described this closure as Keynesian. Our third factor supply assumption is that capital stock in each sector is fixed and the available supply of labor to the economy as a whole is also fixed. We have described this closure as neoclassical.

### **The Structure of the Model and Its Price System**

The price system of our model follows from our characterization of producers as profit maximizers operating under perfectly competitive conditions. On these assumptions, output prices will equal the marginal costs of production and therefore will depend upon production function parameters and the prices of inputs into production.

The production function in each sector is a multilevel CES function as shown in Figure 1. This formulation is common to all the computable general equilibrium models referred to previously in footnote 2 except that we allow for some substitution among intermediate goods of different types and substantial substitution between domestic and imported supplies of each good used as an intermediate. It is clear from Figure 1 that the price of each sector's output ultimately must depend upon wages, the cost of using capital, and the prices of all domestic and imported supplies for intermediate use. In general, when an output  $Z$  is a CES function of inputs  $K$ , and  $Y_2$ , and is produced under conditions of profit maximization

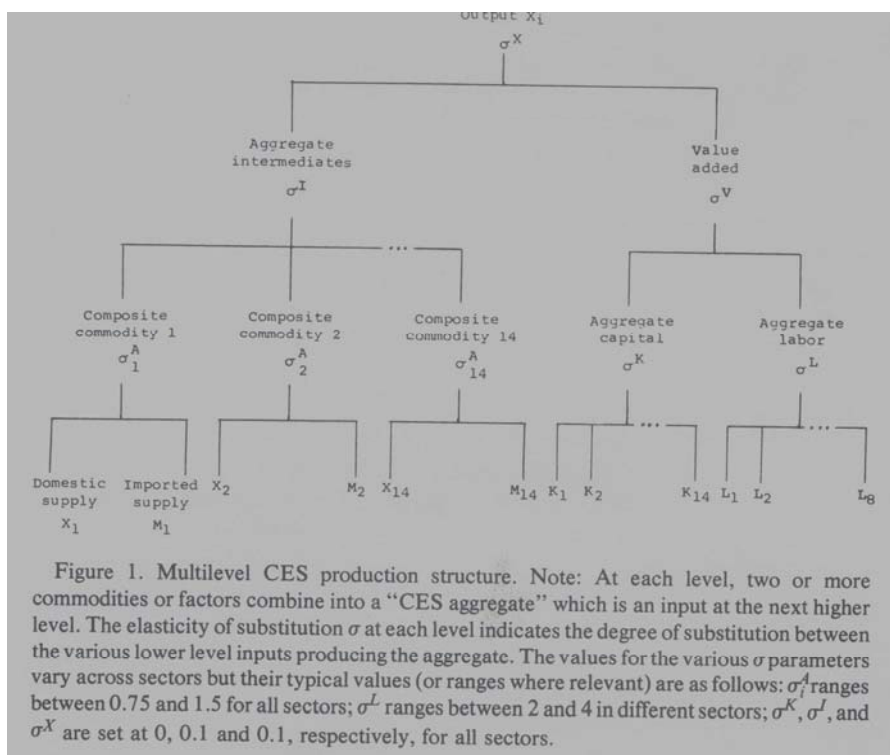
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<sup>2</sup> For a detailed statement, see Ahluwalia and Lysy (1979). Examples of recent general equilibrium models are Adelman and Robinson (1978), Taylor et al. (1979), and Robinson and Dervis (1978). See Appendix for a summary of model specification.

<sup>3</sup> The eight labor types correspond to five skill types with each of the three lower skills segmented into an agricultural labor force and a nonagricultural labor force. The two higher skills are assumed to be mobile across all sectors of the economy. Since the agricultural component of the labor force at each of the three lower skills can only be employed in (the agricultural sectors, it can be treated as a different factor from the nonagricultural component.

and perfect competition, the following relationship holds between output and input prices<sup>4</sup>:

$$P^x = [\alpha_1^\sigma P_1^{1-\sigma} + \alpha_2^\sigma P_2^{1-\sigma}]^{1/(1-\sigma)} \quad (1a)$$



Using this relationship, the price of each CES aggregate at a given level in Figure 1 can be written in terms of the price of each of the inputs at the next lower level. Since input prices at each stage can be further decomposed downwards, the price of output at the highest level can be decomposed into prices of inputs at the lowest level. This gives a set of price equations with the general form:

$$P_i^x = f(w_1, \dots, w_8, r, P_1^x, \dots, P_{14}^x, P_1^m, \dots, P_{14}^m), \quad i = 1, \dots, 14, \quad (1b)$$

where  $w_1, \dots, w_8$  are the wages of the eight labor types, and  $r$ , is the rental on aggregate capital in each sector. This system of 14 equations can be used to solve for 14 output prices  $p^x_i$ , given the wages of our different labor types, the rental for capital in each sector, and the prices of imported goods.

This price system is embedded in a larger system of equations which ensures a Walrasian general equilibrium. An equilibrium solution of the model is one in which factor prices and output prices not only conform with equation (1b) but also ensure that all factor and product markets are cleared. For this we need a set of equations determining equilibrium in factor markets and a set determining equilibrium in the product markets.

Factor market equilibrium requires the factor demands to equal factor supplies. In our model, factor demands are derived from the conditions of producer maximization. In the simple case of a CES production function, the derived demand for a factor  $X$ , is a function of the price of the factor  $P_f$ , the price of output  $P_z$ , and the level of output  $Z$ :

$$Y_i = [\alpha_i P_f / P_i]^{\sigma} Z. \quad (2a)$$

<sup>4</sup> This relationship can be derived from the first-order conditions of producer maximization or equivalently from the cost function by differentiating the cost function with respect to output. We note that equation (1a) assumes constant returns to scale.

Using this relationship at the lowest level of our production tree, we can substitute for  $Z$  using the corresponding relationship at the next higher level, and so on, until the derived demand for each factor in each production sector can be written as a function of the sector's final output  $X$ , the price of the factor, and the prices of all the inputs into production at each level. These prices can be decomposed into prices of inputs at the lowest level as described above. In the case of labor demands, the total demand for each type of labor is obtained by summing across demands from each sector and can be written as

$$L_j = l_j(w_1, \dots, w_8, r_1, \dots, r_{14}, P_1^x, \dots, P_{14}^x, P_1^m, \dots, P_{14}^m, X_1, \dots, X_{14}), \quad j = 1, \dots, 8. \quad (2b)$$

Similarly, the demand for capital in each sector can be written

$$K_i = k_i(w_1, \dots, w_8, r_1, \dots, r_{14}, P_1^x, \dots, P_{14}^x, P_1^m, \dots, P_{14}^m, X_1, \dots, X_{14}), \quad i = 1, \dots, 14. \quad (2c)$$

This block of 22 equations determines factor market equilibrium in one of two ways. If factor demands must be set equal to fixed supplies, the equations determine equilibrium factor prices, given output prices and output levels. Alternatively, if factor prices are fixed and factor supply is assumed to be infinitely elastic, these equations determine employment levels. In both cases, factor markets are cleared, although in the latter case this clearance occurs at the intersection of a demand curve with a horizontal supply curve.

The third set of equations in our model ensures equilibrium in the product markets by equating domestic output levels with demand for domestic output. There are various types of demand for the domestic output of each sector, including demands for intermediate use, household consumption, exports, investment, and for government consumption. Real demand for investment and government consumption is fixed exogenously. but the other elements of demand are endogenous and price responsive. Demand for intermediate use can be determined in a manner analogous to that described for primary factors in equation (2b). Export demand is determined by a price elastic world demand curve facing Malaysian producers. Consumption demand is a function of household income levels and prices of domestic and imported goods. Household incomes, in turn, are determined by the factor endowment of the household and factor prices received. Aggregating across all these various demands, the demand for the domestic output of a sector can be written as follows:

$$X_i = x_i(P_1^x, \dots, P_{14}^x, P_1^m, \dots, P_{14}^m, L_1, \dots, L_8, K_1, \dots, K_{14}, w_1, \dots, w_8, r_1, \dots, r_{14}), \quad i = 1, \dots, 14. \quad (3)$$

Taken together, equations (1 b, 2a,b, 3) represent a set of 14+14+8+14 equations which can be used to solve for 14 output price variables, 14 output variables, and either 8 +14 factor demands given wages and rentals, or 8+14 wages and rentals, given fixed available supplies of labor for the economy as a whole and capital for each sector.

### Alternative Closure Rules

We now turn to the alternative closure rules under which the model can be solved and examine their implications.

The Leontief closure rule amounts to specifying factor prices as given and using equations (2b) and (2c) to solve for factor demands. Under these conditions, our general equilibrium model, despite its complexity, reduces to a simple closed Leontief model with fixed coefficients. The assumption of linear homogeneity in production ensures that with fixed factor prices the price system can be solved independently of the level of output. If all prices are fixed, the ratios of all inputs to outputs are also fixed [see equation (2a)] so that, irrespective of the scope for substitution in the technology, production can be characterized in terms of a set of fixed coefficients at given prices. In other words, demands for domestic output of intermediate use in production  $D$  can be described in terms of a matrix of fixed coefficients:  $D = AX$ . Similarly, demand for imports for intermediate use, as well as the demand for labor and capital, are linear functions of output:  $M = mX$ ,  $L = lX$ ,  $K = kX$ . Value added or income

generated from each sector can also be written  $V = vX$ .

There is a similar simplification of the model on the side of household income and consumption. Since the model assumes that the mapping from factor incomes generated to household incomes is linear, the linear relationship between factors and outputs with fixed prices translates into household incomes which are linear functions of outputs  $K = BX$ , where  $B$  is a matrix.

Household demands for domestic outputs in turn are linear functions of incomes when prices are fixed:  $C = HY + \mathbf{q}$ , where  $H$  is a matrix of fixed coefficients and  $\mathbf{q}$  is a vector of constants.<sup>5</sup> This can be written as  $C = JX + \mathbf{q}$ , where  $J = HB$ . The material balance equation for the model, equating domestic supplies and equating demands for domestic outputs with domestic supplies, can be written as follows:

$$X = AX + JX + \mathbf{q} + E + I + G.$$

Exports  $E$  are functions of domestic prices given world demand conditions and are determined once domestic prices are known. Investment demands and government consumption demands are exogenous. This equation can be written

$$X = [I - A - J]^{-1} \mathbf{F}$$

where  $\mathbf{F}$  is the vector of all exogenous final demands for domestic output (including the vector of constants  $\mathbf{q}$ ) and  $I$  is the identity matrix. Thus, our general equilibrium model reduces to the closed Leontief model if factors are available in unlimited supply at fixed prices.<sup>6</sup> The impact of any exogenous demand variation on output is directly obtainable from the coefficients of the inverted matrix  $[I - A - J]^{-1}$ . The impact on employment and household incomes can also be obtained given the fixed input coefficients  $I$  and  $v$  and the level of outputs and prices.

Moving from the Leontief to the Keynesian assumption about factor supplies—capital in each sector is fixed, but labor of all types is freely available at fixed money wages—produces very different model behavior. The Keynesian assumption amounts to fixing aggregate capital stocks  $AT$ , in each sector and using the 14 equations in (2c) to solve for capital rentals in each sector. This changes the relationship between prices and outputs in the model in a fundamental way. With the fixed capital stocks, higher levels of output can only be achieved through increased employment of labor, which raises the marginal product of capital and, therefore, its rental. However, increased capital rentals will raise output prices (see equation (1b)) so that increased output is only possible with rising output prices. In other words, the supply curve of each sector is upward sloping.

Under these assumptions, an increase in exogenous demand will produce a somewhat different response from that produced in the Leontief case. As domestic prices rise relative to fixed world prices, the demand for domestic output is reduced in two ways. Since exports are price responsive, the demand for exports declines as prices rise. Secondly, the rise in domestic prices prompts a shift from domestic to imported supplies. Thus the new equilibrium is reached at a lower level of output expansion and a higher balance of payments deficit than

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<sup>5</sup> The demand function used in our model is a three-level type. First, we define "wants" such as food, shelter, clothing, etc. Households demand "wants" vary according to a linear expenditure system (LES). Each "want" in turn is satisfied by various composite commodities according to a CES transformation. At the lowest level, each composite commodity is a CES aggregation of domestic and imported supply. With fixed prices, the ratio of domestic and imported supplies of various types within each "want" remain fixed. Thus, the household consumption demand for domestic output is a linear function of income with a vector of constants  $\mathbf{q}$  corresponding to quantities of domestic output required to satisfy the LES "subsistence" quantities of each want.

<sup>6</sup> Indeed, we can go further and add (hat some such assumption is essential if we are to postulate a closed Leontief type characterization for any economy. Fixed coefficients dictated by technology are not a sufficient condition for asserting a closed Leontief view since prices may change in such a way that the linear relationships in real quantities in production may generate negative profits.

would be the case in the Leontief solution.

Our third assumption about factor supplies corresponds to the familiar neoclassical assumption in which not only are capital stocks fixed, but also there is a fixed amount of labor available to the economy. This amounts to using equations (2b,c) to solve endogenously for all factor prices. The principal difference between this closure and the Keynesian closure is that the former assumes full employment of both capital, and labor, so that exogenous shifts in demand cannot alter aggregate GDP, but only its sectoral distribution.

In the neoclassical case, the new equilibrium following an exogenous increase in demand is achieved with no aggregate increase in value added. Instead, domestic prices rise relative to world prices so that there is a reduction in export demand for export sectors and also a shift from domestically produced goods to imports in the import competing sectors. Resources released from contraction in these sectors are redeployed elsewhere to allow the nontradable sectors to expand. Thus the system responds to an increase in aggregate demand by shifting resources from the tradable to the nontradable sectors to meet increased demand for these sectors output, and there is an increased absorption of imports in the economy. The increase in imports, as well as the reduction in exports, leads to a substantial increase in the balance of payments deficit.

This brings us to an important aspect of the structure of the structure of our model: the treatment of the balance of payments. The model is not constrained to reach equilibrium with a fixed balance of payments deficit. Rather the size of the balance of payments deficit is determined endogenously and reflects the excess of domestic absorption over total domestic supply. In other words, investment is not constrained to equal domestic savings. Looked at in aggregate terms, the Leontief solution corresponds to a situation in which an increase in aggregate demand leads to an increase in both domestic supply and imports in equal proportions. However, as we move to the Keynesian and neoclassical closures with constraints on factor supply, we limit the ability to expand domestic output in the aggregate, with a consequent widening of the balance of payments deficit.

To some extent this treatment is consistent with established practice in the literature on multipliers, which treats imports as a leakage. However, it raises the question of whether we could adopt some "ultra neoclassical closure" that would ensure a fixed deficit. We note that such a closure cannot be achieved simply by allowing the exchange rate to vary. In a world of complete price flexibility, if all real demands are homogeneous of degree zero in all prices and incomes (as is the case in our model), then a change in the exchange rate (coupled with a full-employment assumption for both labor and capital) will only raise all domestic prices and incomes proportionately, leaving the real equilibrium unchanged. Exchange rate changes provide a basis for improving the balance of payments only if some prices are fixed in monetary terms (or adjusted with a lag) or some elements of demand are fixed in monetary terms. Under these assumptions a rise in domestic prices arising from an exchange rate devaluation would lead to a reduction in aggregate real demand, thus providing a mechanism for restoring equilibrium without a widening of the balance of payments deficit.

A second feature of the structure of our model that is worth noting is the absence of any explicit monetary sector. The model provides an equilibrium relative price structure in which the level of domestic prices is determined relative to the level of world prices for imports (where the latter are converted into domestic currency at a given exchange rate). This amounts to assuming that monetary policy is entirely accommodating. In other words, the monetary authorities adjust the supply of money to whatever is required to maintain neutrality as the domestic price level changes, so that there are no feedbacks into the real system via the monetary sector. Explicit modeling of the monetary sector would require specification of the demand for money, the nature of real balance effects, and interest rate effects. These could play an important equilibrating role in response to exogenous demand shifts. For example, a rise in domestic prices might lead to reduction in consumption demand if there are significant real balance effects and may also generate pressure on the interest rate, which may help to reduce investment demand. These are ignored in our model.

## IMPACT OF A GENERAL INCREASE IN SECTORAL DEMANDS

This section examines the impact of an exogenous general increase in demand as estimated under each of our alternative model closures. Starting from an equilibrium "base" solution, we assume that total exogenous final demand for each sector's output is increased by 20%.<sup>7</sup> The model is then solved with the new exogenous final demands under each of the three closure rules discussed above. The particular increase in demand is not intended to have any special relevance for policy. However, it provides a useful quantification of the very different impact upon real value-added, employment, and import shares by sector that is predicted by each of the different closure rules. The percentage changes from the base solution for each of these variables under the three alternative model closures are summarized in Table 1.

As one would expect, the Leontief solution shows the largest expansionary impact on output. The exogenous shift in demand is essentially a scalar expansion of the final demand vector which leads to an equal proportional expansion in output in each sector. Because of the linearities involved, there is a similar expansion in value added and employment of labor (as well as capital). Imports rise by 20% in each case; thus import shares remain constant.

The Keynesian solution differs from the Leontief in that, with a fixed supply of capital in each sector, expansion in output can only be achieved at rising marginal costs and therefore requires increases in output prices. The supply curves are upward sloping, whereas in the Leontief solution they were horizontal. The rise in domestic prices reduces export demand and also shifts demand towards imports in the case of household consumption demand, as well as in intermediate demands.<sup>8</sup> Thus, there is less expansion than in the Leontief case and, of course, there are intersectoral shifts because of relative price changes.

The largest increases in real value-added levels in the Keynesian solution (shown in column 2) are in those sectors that produce nontradable goods that neither face competition from imports nor have significant exports facing a price elastic world demand curve. Within the nontradable category, expansion is greatest where the demand for a sector's output does not depend upon an endogenous demand that is itself price responsive. The premier example of this case is construction, whose output is non-tradable and whose demand largely comes from exogenous investment. The other sectors in the nontradable category (utilities, trade and transport, services, and dwellings) expand somewhat less. The utilities sector is a special case since, although its product is nontradable, it has an extremely steep marginal cost curve because it is heavily dependent on capital. As a result, its price rose by 66% in the Keynesian solution, whereas the largest price increase for any other sector was only about 11%. Since this sector sells a substantial amount of its product to households and for intermediate use, these users substituted away to the extent possible.

The main sectors facing substantial competition from imports are the manufacturing sectors: basic consumption goods, advanced consumption goods, industrial intermediates, and capital goods. The import shares of the total supply of these goods in the base solution were 30%, 50%, 40%, and 67%, respectively, whereas in no other sector did it exceed 19%. As prices rise, users shift away from domestic supply towards imports; this can be seen in the rise in ratios of imported to domestic supply recorded in columns 7 and 8 of Table 1. Real value added in these sectors, therefore, rose by only modest amounts in the Keynesian case, 4.7%-9.4%, compared to the 20% expansion in the Leontief case.

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<sup>7</sup> Exogenous demands for investment, government, and exports are all raised by 20%. The increase for exports is implemented by shifting the world demand curve out by 20%, i.e., by an amount such that if prices remained constant, export demand would rise by 20%. The government demand increase includes a 20% increase in direct government employment.

<sup>8</sup> In our model the scope for substitution between domestic and imported supply is limited to these two categories. Government demands for commodities and investment demand is modeled on the assumption of fixed combinations of domestic and imported goods.

**Table 1: Sectoral Results: General Demand Increase**

	Real Value-Added Levels			Employment			Percent in Ratio of Imported to Domestic Supply			
	(1)	(2)	(3)	(4)	(5)	(6)	Keynesian		Neoclassical	
							(7)	(8)	(9)	(10)
	Le-ontief	Keynesian	Neoclassical	Le-ontief	Keynesian	Neoclassical	Consumption demand	Intermediate sales	Consumption demand	Intermediate sales
<b>Export oriented sectors</b>										
Rubber	20.0	6.6	-12.3	20.0	8.7	- 86	11.1	6.2	26.0	24.4
Forestry and logging	20.0	10.5	-18.1	20.0	16.1	-20.7	11.2	7.0	55.6	299
Mining	20.0	3.9	-21.8	20.0	7.3	-36.2	15.5	4.5	44.2	23.4
Export processing	20.0	3.8	-19.0	20.0	9.2	-35.7	18.5	6.3	59.2	18.1
<b>Import competing sectors</b>										
Agriculture and fishing	20.0	8.5	- 2.8	20.0	16.9	0.7	11.2	7.0	—	—
Basic consumer goods	20.0	5.3	- 3.6	20.0	20.2	-12.7	16.7	4.1	55.7	14.1
Advanced consumer goods	20.0	7.8	-19.0	20.0	12.7	-28.5	9.6	5.2	52.8	26.7
Industrial intermediates	20.0	4.7	- 4.8	20.0	14.0	-13.1	24.4	5.8	58.4	11.7
Capital goods	20.0	9.4	- 4.5	20.0	19.2	- 9.4	10.7	3.2	41.1	12.8
<b>NonTradable Sectors</b>										
Utilities	20.0	4.5	1.4	200	32.2	7.6	—	—	—	—
Construction	20.0	19.4	15.9	20.0	23.4	17.5	—	—	—	—
Trade and transport	20.0	11.4	3.9	20.0	17.4	4.8	11.3	5.6	148.7	63.3
Services	20.0	11.4	5.1	20.0	17.2	7.4	11.0	5.1	80.0	40.5
Dwellings	20.0	20.0	- 0.3	20.0	—	—	—	5.5	—	91.6
Government value-added	20.0	20.0	20.0	20.0	20.0	20.0	—	—	—	—
Total	20.0	104	- 1.4	20.0	16.0	0.0	11.8	5.3	56.4	19.2

<sup>a</sup> Results are expressed as percentage changes over base solution.

The smallest expansion was recorded in the export-dependent sectors: rubber, forestry and logging, mining, and export processing, which provide Malaysia's traditional exports. Exports accounted for 90% or more of final demands in each of these sectors in the base solution. Mining and export processing had particularly small increases in output.

It is interesting to note that although the increase in value added for each sector in the Keynesian case is always smaller than in the Leontief case, the Keynesian solution can show greater increases in employment than the Leontief. As shown in Table 1, basic consumer goods, utilities, and construction all display greater employment expansion in the Keynesian case than in the Leontief case. The reason can be easily seen in the isoquant diagram of Figure 2. In the Leontief case, output expands from  $X_{base}$  to  $X_{Leo}$  and producers expand both factors in proportion along the ray  $OX$ . In the Keynesian solution, capital is fixed at the initial level  $K_{base}$ , but any amount of labor can be hired. Clearly, if output were to stay at  $X_{Leo}$  total employment would have to be higher than in the Leontief solution. In fact, output will decline because prices rise and the sectors face price elastic demands. The extent to which a particular sector's output is reduced will depend upon (1) the ease with which labor can be substituted for capital, which determines the steepness of the supply curve; (2) the extent to which demand for the sector's output is price elastic; and (3) the extent to which demand is affected by cutbacks in output levels in other sectors. In some sectors the cutback of output from the Leontief level  $X_{Leo}$  to the Keynesian level  $X_{key}^1$  will be so substantial that employment will fall below the Leontief level. However, in other sectors the cutback may be more limited, e.g.,  $X_{key}^2$ , and employment may be higher.

The neoclassical closure rule produces results that are essentially an extension of the Keynesian results in the extent of their deviation from the Leontief solution. With labor supplies as well as capital supplies limited to their base solution values, aggregate real value added must stay approximately constant. However, with labor mobile across sectors, there can be quite substantial sectoral changes.

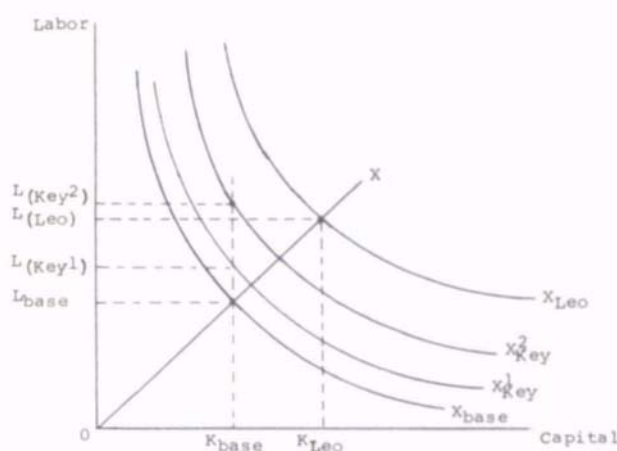


Figure 2

The relevance of our sectoral grouping is evident in the neoclassical solution. The nontradable goods sectors still expand with the increase in exogenous final demands, with construction expanding by a very substantial 16%. But this expansion can only be achieved by a shift of labor from other sectors, which must contract to release the labor. As shown in Table 1 (columns 3 and 6), the import competing and export-dependent sectors contract in terms of both employment and value added, despite the fact that there is an increase in their exogenous final demands. As we would expect, the export-oriented sectors, facing the most price-responsive demands, contract the most (12%-22%). The import competing sectors contracted by 3%-5%, generally. Advanced consumer goods had a reduction in production of 19%. The reason is that in addition to facing substantial competition from imports (imports made up 50% of the total supply of this good in the base solution), it is also an export ori-

ented sector, with exports constituting 47% of its final demands in the base solution.

We have seen that with domestic factors in fixed supply and fully employed, an increase in exogenous demands cannot increase aggregate real output. However, the increase in exogenous demands does have an effect upon the system. It raises wage rates and capital rentals, and therefore domestic prices will be higher relative to the fixed-world prices. These changes will lead to some distributional effects within the economy that may be quite different from those predicted under the simple Leontief closure. These issues are illustrated in the experiments described in the next section.

## **EFFECTS OF ALTERNATIVE DEMAND EXPERIMENTS**

In this section we shall examine the impact of two types of exogenous demand increase in the economy: an increase in government consumption and an increase in total investment. Both elements of final demand are subject to policy control and their levels are often manipulated as part of aggregate demand management. It is often relevant to ask what impact such demand management policies might have on employment, wages, and household incomes. The direct impact of these demand increases is very different. Government consumption expenditure has a very high direct employment content while investment expenditure is directed largely towards construction and capital goods with the latter showing a very high ratio of imports to domestic supply.<sup>9</sup> It is interesting to examine whether the total effects are also different and how our assessment on this score would depend upon the closure rule adopted. Unlike the discussion of the previous section, we shall focus on the impact upon total employment and wages by type of skill, as well as the impact on real consumption levels by type of household. These variables are more directly related to evaluation of welfare effects.

Starting with the base solution, our experiments consist of raising government consumption expenditure and government employment by M\$2.0 billion in base prices, and in a second experiment raising total investment by an equal amount. Thus the two demand increases are equivalent in aggregate terms but, of course, will have quite different direct and indirect effects. We note that for the purposes of this paper we are concerned only with the immediate demand generating effect of investment and not its longer-term impact on potential output.

### **Impact on Employment and Relative Wages**

The impact of our two demand experiments upon employment and wages by skill type is summarized in Table 2. As one would expect, the experiment with increased government demand shows a larger total impact on employment in the Leontief case, primarily because of the very substantial portion of government expenditure devoted to direct employment. Total employment increases by 5.1% compared to 4.1% in the investment experiment, and the composition among the skill groups is quite different. Government employment is much more intensive in the higher skilled workers, and this is reflected in the higher rate of growth of labor of the two highest skills.

Moving from the Leontief to the Keynesian solution of the model, the estimated employment impact of the two experiments changes in different directions. In the case of the investment experiment, total employment is very slightly higher in the Keynesian compared to the Leontief case, whereas in the case of the government consumption demand experiment, employment is lower. The employment increase in the government consumption demand experiment is still higher than in the investment experiment but the difference is now smaller. The factors operating to produce this differential response are precisely those discussed earlier in connection with Figure 2. The investment experiment turns out to be one in which the cutback in output in moving from the Leontief to the Keynesian solution is relatively small so that total employment is actually higher. The contractional effect of the reduction in output compared to the Leontief solution is more than offset by the additional labor needed if the

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<sup>9</sup> In our model, capital equipment consists of fixed proportions of imports and domestic output of various sectors.

output level has to be produced with capital supplies fixed at base values.

**Table 2: Impact on Employment and Monetary Wages <sup>a</sup>**

	Increased Investment Demand					Increased Government Consumption				
	(1)	(2)	(3)			(4)	(5)	(6)		
			Neoclassical (wages)					Neoclassical (wages)		
Labor Type	Leontief (employment)	Keynesian (employment)	Total	Rural	Non-rural <sup>b</sup>	Leontief (employment)	Keynesian (employment)	Total	Rural	Non-rural <sup>b</sup>
Illiterates	3.8	3.7	7.0	(3.7)	(12.7)	3.3	2.5	9.5	(3.5)	(20.2)
Some primary education	4.6	4.8	7.9	(3.7)	(13.3)	4.1	3.5	12.2	(3.5)	(20.7)
Completed primary education	4.1	4.3	7.6	(3.4)	(12.9)	4.9	4.3	13.2	(3.1)	(21.1)
Some secondary education	3.9	4.1	10.9			7.5	7.2	20.2		
Higher school certificate or more	2.8	3.0	11.9			9.4	9.2	22.2		
<b>Total</b>	<b>4.1</b>	<b>4.2</b>	<b>9.3</b>			<b>5.1</b>	<b>4.6</b>	<b>16.0</b>		

<sup>a</sup> Percentage increases from base solution.

<sup>b</sup> There are two separate wage rates for each of the three lowest skilled labor types in our model since the total supply of each of these types is partitioned into a rural sector labor force that is mobile across the three rural sectors and a non-rural labor force mobile across (the other sectors). The values shown in the columns for the total labor force are the weighted average wages received by each labor type.

There are several reasons why the cutback in output is more limited in the case of the investment experiment. In the first place, investment increases lead to increases in the domestic output of sectors such as construction, whose demand is not price elastic and is therefore not cut back as prices rise. Similarly, investment generates a large volume of additional imports and the trade and transport margins on these generate demand for trade and transport. Since the import volumes remain high, and trade and transport markups are fixed, there is very little cutback in the output of the trade and transport sector in the Keynesian solution. This turns out, quantitatively, to be an important factor. By contrast, the government consumption experiment generates large initial increases in output in certain sectors such as agriculture and fishing (because of the large direct payments to labor and the resulting rise in consumption), but these are cut back in the Keynesian solution as prices rise.

Turning to the neoclassical solution, we obviously cannot compare the results of the two demand experiments in terms of the increase in employment of different labor types since the solution assumes that total supply of each labor type is fixed. In this case, the additional demand for labor generated by the injection of additional exogenous demand into the system is reflected in higher monetary wage rates as the system moves to a new full-employment equilibrium. The percentage increase in monetary wage rates under full employment measures the increase in monetary income from wages and, to that extent, can be compared to the percentage increase in employment in the Leontief and Keynesian solutions where, with wages fixed, monetary wage incomes rise in proportion to employment. We note, however, that these monetary wage comparisons must be qualified by reference to the very different behavior of prices in the three solutions. Prices are constant under the Leontief closure but

rise in the Keynesian solution and rise even further in the neoclassical case.

The most interesting feature of the wage increases under the two experiments (see **Table 2**, columns 3 and 6) is that the increases obtained by the two highest skill types are substantially higher than those obtained by the three lower skills. This pattern is understandable in the case of the government consumption experiment since the government's demand for labor is sharply skewed towards the higher skill categories. This produces a greater increase in the demand for the higher skills than for the lower skills under the Leontief closure and this is translated into higher monetary wage increases in the neoclassical case. However, this relationship does not hold in the case of the investment demand experiment. In this experiment, the increased demand for labor under the Leontief closure shows a slightly greater increase in the demand for the lower skills than for the highest skills, but when we move to a neoclassical closure, the pattern of wage increases is very different. The increase in monetary wage rates (and, therefore, in monetary wage income) for the two highest skills is now substantially greater than those for the lower skilled workers.

This reversal of the pattern of wage increases by skill under one closure compared to the employment increases by skill under another exemplifies the importance of model closures in reaching conclusions about final impacts. It is worth examining the reasons for the reversal in some detail. The principal adjustment mechanism in response to an increase in demand in the neoclassical closure is a rise in domestic prices (of about 6%) and a consequent contraction in world demand for exports. Since the exporting sectors are more intensive in the use of the lower skilled labor force, we would expect, in line with Stolper-Samuelson effects, that the shift of production away from these sectors would produce a decline in the relative wage of the lower skills.

In our model, this adverse impact is greatly heightened by the segmentation of the total labor supply of each of the three lowest skills into an agricultural and a nonagricultural labor force. In each case, the agricultural component is available for the three agricultural sectors and the nonagricultural component is available for the other sectors. The model permits flows from one component is available for the other sectors. The model permits flows from one component to another only over time, but for short-run analysis, which is what is relevant in examining impact multipliers, we assume that labor is immobile across these components. On these assumptions, the lower skilled labor released from rubber and forestry and logging must find employment within the agricultural sector; this inevitably bids down wages. Output of the nonagricultural sectors expands (except for export manufacturing) and generates additional demand for labor, but labor market segmentation limits the availability of lower skilled categories in the urban areas.

By contrast, since the higher skilled workers are assumed to be mobile across all sectors, they are able to shift from the agricultural to the nonagricultural sectors in response to higher labor demand. As a result, the higher skilled categories in general benefit at the expense of the lower skilled labor in rural areas. Indeed, the real wage of the agricultural labor force in the lower skills actually declines. The pattern of wage changes observed in the case of the government consumption experiment is very similar, with actually greater differentials of average wages.

### **Impact on Household Real Consumption**

We now turn to evaluating the impact of the two alternative demand increases upon the level of real consumption of different household groups in the economy. We have seen that the expansion of exogenous demand raises employment with fixed monetary wages on the Leontief and Keynesian assumptions and that it increases monetary wages in the neoclassical solution. In all cases, therefore, there is an increase in total monetary wages paid out, thus raising monetary incomes of labor households. However, since prices also rise in the Keynesian and neoclassical cases, the increase in monetary income does not necessarily reflect real improvements.

This welfare impact is best measured in terms of the increase in real consumption levels of different household groups in our model under different closure rules. These results are presented in **Table 3**, which shows percentage increases in real consumption of the 12 different

household groups in the model.<sup>10</sup>

The behavior of real consumption in response to increased exogenous demand under different assumptions about factor availability displays some interesting features. In going from the Leontief to the Keynesian solutions in each demand experiment, we see that household real consumption declines, although there is still an increase relative to the base solution. This is because domestic output levels, and therefore incomes, in the Keynesian solution are lower than in the Leontief case, although they are higher than in the base solution. However, in going from the Keynesian to the neoclassical solutions, i.e., imposing both a capital constraint and a labor constraint, total household consumption increases in real terms to a level higher than the Keynesian solution and substantially above the base values.

Since aggregate domestic output in the neoclassical solution is constrained by fixed factor supplies, it is necessary to explain the forces behind the increase in real household consumption. The explanation lies in the fact that in our model the balance of payments is not constrained to a fixed deficit. Increases in domestic demand lead to a widening of the trade deficit, and this permits a higher level of absorption. In this process, both wages and domestic output prices rise relative to world prices, with wages rising by a greater amount.

As wages and rentals are bid up, the prices of domestic output will rise, but it is intuitively obvious that they will rise more slowly because domestic output includes imported intermediates whose price remains fixed. Furthermore, since import prices are fixed and imports form a substantial part of what consumers demand, the composite commodity prices facing consumers will rise by less than domestic prices and substantially less than wages or rentals. Thus real factor incomes rise as a result of increased demand in the system and this is reflected in higher real consumption. The additional resource requirement to meet this increased demand comes from a widening of the balance of payments deficit.

It is worth noting that the increase in household consumption in the neoclassical case over the Keynesian case is mainly due to the rise in consumption of the non-Malay labor households. Consumption of both Malay and non-Malay rentiers rises less than in the Keynesian solution. This is as one would expect, since these households derive their income from capital: in the neoclassical case, the same amount of capital is combined with less labor than in the Keynesian case so that the marginal product of capital is lower, leading to lower incomes and consumption for rentiers (relative to the Keynesian solution).

The Malay labor households do not display the consumption gains of the non-Malay labor households because Malay households depend heavily upon the earnings of labor in the agricultural sectors and, as we have seen, segmentation of the labor market leads to much lower wage increases for this group than for urban labor. Thus the segmentation of the labor market built into the model leads to an asymmetric pattern of distribution of benefits.

It is noteworthy that in both experiments, the neoclassical closure leads to greater differentials among the real consumption growth of different groups than either of the other two closures. Two types of differential are relevant. In the first place, higher skill households experience a greater increase in their real consumption than do lower skill households. This is in part a reflection of the Stolper-Samuelson process mentioned above and in part due to the fact that higher skilled labor is fully mobile across all sectors and therefore does not suffer from the depressant effect on wages of low skilled labor in the agricultural labor force. Second, there is much greater differential in consumption increases within Malay households compared to non-Malay households. As shown in **Table 3**, the differential increase in real consumption across the skill range for non-Malay households is about 2:1, where as for the Malay households it is about 5:1 or 6:1. This is because the unskilled Malay households are concentrated in export-dependent rural sectors, which, as we have seen, display very low wage increases. Skilled Malay households, on the other hand, do not suffer from any disad-

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<sup>10</sup> Household consumption is determined by total household income accruing to each household including wage income, capital income, and transfers. Each household is characterized according to the labor force characteristics of the household head.

vantage because skilled labor is mobile across sectors and wages rise uniformly for this category across all sectors. By contrast, non-Malay households of all skills being concentrated in the nonrural sectors benefit from the fact that in these sectors wages of all groups rise more or less comparably.

**Table 3: Household Real Consumption Levels <sup>a</sup>**

Increased Investment				Increased Government Consumption		
	Leontief	Keynesian	Neoclassical	Leontief	Keynesian	Neoclassical
<b>Malay households</b>						
Illiterates	3.4	2.0	1.2	5.1	2.2	2.0
Some primary	3.5	2.2	1.3	5.3	2.4	2.2
Completed primary	3.0	1.6	1.3	6.0	3.1	3.7
Some secondary	3.0	1.7	3.3	8.9	6.3	9.3
Higher school certificate or more	2.3	1.4	5.4	9.6	7.3	13.3
<b>Nonmalay households</b>						
Illiterates	4.2	3.0	3.9	5.2	2.5	5.0
Some primary	4.3	3.2	3.7	5.1	2.4	4.8
Completed primary	4.2	3.1	3.6	5.0	2.3	4.0
Some secondary	3.9	2.9	5.2	6.9	4.3	7.8
Higher school certificate or more	3.5	2.6	6.7	8.5	6.2	10.5
<b>Rentier households</b>						
Malays	3.8	3.7	2.6	4.6	6.2	4.9
Non-Malays	3.7	3.6	1.7	4.6	6.1	3.3
<b>Total households</b>	<b>3.7</b>	<b>2.5</b>	<b>3.1</b>	<b>6.0</b>	<b>3.3</b>	<b>5.1</b>

<sup>a</sup> Percentage increases over base solution.

## CONCLUSIONS

The specific focus of this paper was to examine differences in impact multipliers generated by changes in exogenous demand when these are estimated under different assumptions about model closure. The results obtained are also of general interest to model builders and policy makers since they illustrate the sensitivity of model behavior to alternative assumptions about model structure.

Multiplier effects estimated under the Leontief closure, which corresponds to the assumption that all primary resources are available in unlimited supply at given prices, provided little guidance to the size and pattern of multiplier effects generated under Keynesian and neoclassical closure rule. In particular, under the neoclassical closure rule, the injection of exogenous demand produces substantial changes in prices and the nature of these changes depends crucially upon the model structure. For example, the particular assumption about labor market segmentation built into the model leads to a pattern of wage and price changes that produces a highly asymmetric effect on different groups in the economy.

It is important to emphasize that we do not assert any general preference for any one of the three alternative types of model closure, whether on grounds of realism or applicability. Each of these alternatives represents a highly stylized description of the conditions under which comparative static experiments can be performed and any one might be more or less relevant for a particular country at a particular point in time. In some situations, there may well be sufficient unemployment of the various labor types, as well as available unutilized capital stocks in different sectors, for the closed Leontief model to provide a valid basis for examining the effects of marginal variations in exogenous demands. Equally, there may be situations in which it is important to recognize that capital stocks in individual sectors are fixed, or even that there is no labor surplus for the economy as a whole.

In practice, development planners are most likely to face hybrid situations in which some of these features are present in different parts of the economy. Thus, some sectors may be suffering from substantial under-utilized capacity while others are not. Similarly, there may be very substantial underutilization of the available unskilled labor force while highly skilled labor is in short supply. Constructing a realistic model for a particular country requires an appropriate combination of such relevant features. Our results show that the particular choices made in this respect will affect the conclusions quite substantially.

Needless to say, the alternative factor supply assumptions are not the only dimensions in which we find alternatives about model closure. The treatment of the balance of payments is another dimension in which alternative formulations, which ensure a fixed deficit, would produce very different types of model behaviour.

## APPENDIX

### THE BASIC EQUATIONS OF THE MODEL

Table A1 of this appendix lists the basic equations of the model used in this study. They have been simplified somewhat in that complications such as tax rates have been left out, and side equations as well as equations used only for accounting purposes have been excluded. The equations break up into three natural blocks: The first determines prices [equations (1)-(6)], the second determines input ratios [equations (7)-(11)], and the third determines output levels [equations (12)-(24)].<sup>1</sup>

The price equations follow the structure shown in Figure 1. The price of each upper level product is a CES price index of the prices of the lower level inputs [except in the case of capital (2), where no substitution is allowed<sup>2</sup>]. Equation (1) determines the price of the labor aggregate in a sector as a CES function of wage rates, (2) the price of capital, equation (3) the price of value added, (4) the price of the domestic/import aggregate used as an intermediate input, (5) the price of the aggregate intermediate input, and (6) the price of output. The price block must be solved simultaneously, since  $P^X$  enters as an input in equations (2) and (4) and emerges from (6).

Input ratios are determined in (7)-(11), and are derived by repeated application of Shephard's Lemma. As should be noted, these ratios are functions only of prices in this constant return to scale system. Equation (7) determines the ratio in which each particular labor type is demanded, relative to the artificial CES construct of a sectoral "labor aggregate"  $L^*_i$ . The ratio of this labor aggregate to value added is determined in (8), and thus is never directly used since we can always pass directly from value added to each real labor type by simply multiplying the two ratios of (7) and (8). Equation (9) determines the capital value-added ratio, (10) the value-added/output ratio, and (11) the domestic intermediate good demand. This final ratio in (11) is a compound of several ratios.

The determination of output levels, given prices and input ratios, begins with (12). The procedure is to start with a guess at the equilibrium output levels, determine what this implies for consumption and intermediate demands, combine these with other demands, and see if this corresponds to that initially guessed. If not, iterations continue. This part of the model corresponds precisely to that normally utilized in a closed Leontief system.

Equations (12) and (13) determine labor and capital demands, given a guess at output levels, and (14) and (15) define incomes. As seen in (15), capital incomes can be calculated using either their price  $P^K$ , or residually. The two are the same in a constant returns system due to Euler's Theorem. Equation (16) is a mapping to determine household incomes, which will be a function of the factor incomes generated. There is a similar mapping for the numbers of earners in the households who are currently employed. Equation (17) determines per earner household incomes, and (18) is a simple linear consumption function, with no intercept in order to maintain the homogeneity of the system.

Consumption demand is determined in (19)-(22), where we have simplified the three-level system of the model to a two-level one. Here, we have treated only the domestic/import and the intergoods choices, which are, in fact, the crucial ones. At the bottom level, a CES combination of domestic and imported goods is used, and the price of this aggregate is defined in (19). At the top level, the choice between the various goods is determined according to Stone's LES system, which implies the demand system of (20). Once the demand for the domestic/import aggregate is known, the demand for the domestic component can be found using Shephard's Lemma [equation (21)]. The constant price elasticity export demand function is (23), where  $e$  is the price elasticity,  $r^F$  the foreign exchange rate the world price, and  $E^D$  a constant scaling parameter. Equation (24) is the material balance for domestic goods, where investment and government demands are exogenous.

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<sup>1</sup> The subscripts  $j$  and  $j$  run across all sectors,  $l$  across all labor types,  $k$  across all sectors producing a capital input, and  $h$  across all households.

<sup>2</sup> This can be viewed as a CES in the limiting case where the elasticity of substitution goes to zero.

**Table A1: Basic Equations of the Model**

$$P_j^L = \left\{ \sum_i \alpha_{ij}^L \right\}^{\sigma_j^L} (W_i)^{1-\sigma_j^L} \left\{ (1-\sigma_j^L) \right\}^{-1} \quad (1)$$

$$P_j^K = r_j^K \left[ \sum_i b_{ij}^D P_i^X + \sum_i b_{ij}^M P_i^M \right] \quad (2)$$

$$P_j^Y = \left\{ (\alpha_{Lj}^Y)^{\sigma_j^Y} (P_j^L)^{1-\sigma_j^Y} + (\alpha_{Kj}^Y)^{\sigma_j^Y} (P_j^K)^{1-\sigma_j^Y} \right\} (1-\sigma_j^Y)^{-1} \quad (3)$$

$$P_{ij}^A = \left\{ (\alpha_{Xij}^A)^{\sigma_i^A} (P_i^X)^{1-\sigma_i^A} + (\alpha_{Mij}^A)^{\sigma_i^A} (P_i^M)^{1-\sigma_i^A} \right\} (1-\sigma_i^A)^{-1} \quad (4)$$

$$P_j^I = \left\{ \sum_i (\alpha_{ij}^I)^{\sigma_j^I} (P_{ij}^A)^{1-\sigma_j^I} \right\} (1-\sigma_j^I)^{-1} \quad (5)$$

$$P_j^X = \left\{ (\alpha_{Lj}^X)^{\sigma_j^X} (P_j^Y)^{1-\sigma_j^X} + (\alpha_{ij}^X)^{\sigma_j^X} (P_j^I)^{1-\sigma_j^X} \right\} (1-\sigma_j^X)^{-1} \quad (6)$$

$$c_{ij} \equiv L_{ij}/L_j^* = [P_j^L \alpha_{ij}^L / W_i]^{\sigma_j^L} \quad (7)$$

$$d_j \equiv L_j^*/V_j = [P_j^Y \alpha_{Lj}^Y / W_i]^{\sigma_j^Y} \quad (8)$$

$$k_j \equiv K_j/V_j = [P_j^Y \alpha_{Kj}^Y / P_j^K]^{\sigma_j^Y} \quad (9)$$

$$v_j \equiv V_j/X_j = [P_j^X \alpha_{Lj}^X / P_j^Y]^{\sigma_j^X} \quad (10)$$

$$a_{ij}^D = \frac{X_{ij}^D}{X_j} = \left[ \frac{P_j^X \alpha_{ij}^X}{P_j^I} \right]^{\sigma_j^X} \left[ \frac{P_j^I \alpha_{ij}^I}{P_{ij}^A} \right]^{\sigma_j^I} \left[ \frac{P_{ij}^A \alpha_{ij}^A}{P_i^X} \right]^{\sigma_i^A} \quad (11)$$

$$L_{ij} = c_{ij} d_j v_j X_j \quad (12)$$

$$K_j = k_j v_j X_j \quad (13)$$

$$Y_{ij}^L = W_i L_{ij} \quad (14)$$

$$Y^K = P_j^K K_j = P_j^Y V_j - Y_{ij}^L \quad (15)$$

$$Y_h^H = f_h(Y_{11}^L, \dots, Y_{ij}^L, \dots, Y_{LN}^L, \dots, Y_1^K, \dots, Y_j^K, \dots, Y_N^K) \quad (16)$$

$$y_h^H = Y_h^H / H_h \quad (17)$$

**(continued)**

**Table A1 (continued)**

$$Q_n = \gamma_n y_n^H \quad (18)$$

$$P_{ih}^{AC} = \left\{ (\alpha_{X_{ih}}^{AC})^{\sigma_i^{AC}} (P_i^X)^{1-\sigma_i^{AC}} + (\alpha_{M_{ih}}^{AC})^{\sigma_i^{AC}} (P_i^M)^{1-\sigma_i^{AC}} \right\} (1-\sigma_i^{AC})^{-1} \quad (19)$$

$$C_{ih} = q_{ih} + (\beta_{ih}/P_{ih}^{AC}) (Q_n - \sum_k P_{ih}^{AC} q_{ik}) \quad (20)$$

$$C_{ih}^D = (P_{ih}^{AC} \alpha_{X_{ih}}^{AC}/P_i^X) (C_{ih} H_h) \quad (21)$$

$$C_i^D = \sum_h C_{ih}^D \quad (22)$$

$$E_i^D = E_i^D [r^F \pi_i / P_i^X]^{\eta_i} \quad (23)$$

$$X_i = \sum_j a_{ij}^D X_j + C_i^D + E_i^D + I_i^D + G_i^D \quad (24)$$

In the Leontief closure, prices and input ratios are fixed, and the system can be solved from (12) onward for any given level of exogenous demands. The resulting labor and capital demands are given in (12) and (15). In the Keynesian solution, capital demands are driven back to their original levels, after the increase in exogenous final demands, by raising  $r^k_i$  (or, equivalently,  $P^k_i$ ). When the capital rental rate is raised, all prices change, and new capital demands are calculated. In the neoclassical closure, a similar procedure is applied to wage rates to force labor demands back to their base levels.

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