The Short- and Long-Run Effects of Fiscal Policy

Edward F. Buffie

This article develops a dynamic, dual-economy general equilibrium model that can be adapted to analyze the short- and long-run effects of a variety of fiscal policies. The model provides a complete description of how the private capital stock, underemployment, and real wages evolve during the adjustment process. The main policy message conveyed by the results is that the method by which the fiscal deficit is lowered is important. There is a strong presumption that higher prices for publicly produced intermediate inputs and cutbacks in government expenditure to support social infrastructure will reduce private investment, real wages in both the formal and informal sectors, and the share of the labor force employed in the high-wage manufacturing sector. By contrast, layoffs in the final goods and services sectors can potentially improve the external balance without sacrificing output and employment growth.

A central dilemma facing policymakers in developing countries today is how to revive economic growth while maintaining debt service. After the debt crisis in 1981–82, IMF-type stabilization programs were widely adopted. Austerity measures along with high interest rates and recession in the countries of the Organisation for Economic Co-operation and Development led to sharp reductions in real output in most debtor nations. The real side repercussions of macroeconomic austerity have cut deeper and been more damaging than was anticipated by many observers (Sachs 1989).

Two striking aspects of the adjustment after 1982 in many developing countries have been the collapse of investment (both public and private) and the sharp increase in underemployment. Table 1 provides data on real per capita growth rates of gross domestic product (GDP) and investment in 15 major debtor nations and in developing countries not burdened by debt-servicing problems. The investment rate in the major debtor nations fell 32 percent between 1981 and 1984. It has increased slightly since 1984 but remains some 10 points below the average investment rate in countries not experiencing debt-servicing difficulties.

Low rates of growth and investment have been accompanied by rising underemployment. Public sector layoffs and stagnation in the industrial sector have

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Table 1. Per Capita Growth and Investment, 1980–89

<table>
<thead>
<tr>
<th>Year</th>
<th>Developing countries without debt servicing problems</th>
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<th>Developing countries without debt servicing problems</th>
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<td>24.2a</td>
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<td>-2.6</td>
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</tr>
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<td>2.7</td>
<td>21.6</td>
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</tr>
<tr>
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<td>17.1</td>
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<td>1984</td>
<td>-</td>
<td>5.4</td>
<td>16.0</td>
<td>27.0</td>
</tr>
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<td>4.3</td>
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<td>28.6</td>
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</tr>
<tr>
<td>1989b</td>
<td>-1.4</td>
<td>3.2</td>
<td>17.3</td>
<td>27.5</td>
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— Not available.
a. Average figure for 1970–82.
b. Preliminary figures.
Source: International Monetary Fund (various years).

greatly slowed or brought to a halt employment growth in the principal high-wage sectors of the economy. It is particularly noteworthy that higher unemployment has often occurred in conjunction with large decreases in real wages. Tables 2 and 3 show that in several Latin American countries industrial employment declined during the 1980s despite real wage cuts of 10–30 percent.

Although the adjustment process has proven to be quite lengthy, there is little formal analysis in the existing literature of the long-run repercussions of stabilization policy. Few development macromodels afford a perspective that stretches beyond the short run (Arida and Taylor 1989). Public finance theorists have analyzed the interdependence of public and private investment but not in a context that sheds light on the adjustment problems facing developing countries. Most of this literature seeks only to determine the implications for the social discount rate of distortionary taxes and different types of government budget constraints (Boadway 1978; Pestieau 1974, 1975; Marchand, Pestieau, and Weymark 1982; Yoshida 1986). Moreover the orientation in the literature is largely static. Arrow and Kurz (1970) and Boadway (1978) are exceptions, but their dynamic analysis is based on dubious, ad hoc specifications for private investment. None of the literature allows for labor market distortions of the type seen in developing countries or develops an explicit dynamic analysis of capital accumulation consistent with optimizing behavior in the private sector.

This article develops a dynamic, dual-economy general equilibrium model that can be adapted to analyze the short- and long-run effects of a variety of fiscal policies. The dynamics are grounded in optimizing behavior and provide a complete description of how the stock of private capital, sectoral employment, and real wages evolves during the adjustment process. The focus is on fiscal policy because fiscal adjustment has been a prominent part of many recent
stabilization programs, and there appears to be a strong, direct link between labor market developments and certain types of fiscal policies.

The main policy message conveyed by the results is that the success of the adjustment program depends in large part on the method by which the fiscal deficit is lowered. Certain fiscal measures commonly adopted in highly indebted countries produce contractionary supply-side effects. There is a strong presumption that higher prices for publicly produced intermediate inputs and cutbacks in government expenditure to support social infrastructure will reduce employment in the high-wage manufacturing sector and lower the equilibrium capital stock. Labor bears the brunt of the difficult adjustment as lower employment in manufacturing is accompanied by (possibly large) real wage cuts in both the formal and informal sectors.

Table 2. *Industrial Employment in Highly Indebted Latin American Countries, 1981–88* (1980 = 100)

<table>
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<tr>
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<td>82.8</td>
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<td>84.4</td>
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<td>81.6</td>
<td>81.3</td>
<td>83.8</td>
<td>86.1</td>
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<td>71.3</td>
<td>74.3</td>
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<td>86.6</td>
<td>93.1</td>
<td>100.3</td>
<td>111.2</td>
</tr>
<tr>
<td>Costa Rica</td>
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<td>96.2</td>
<td>99.3</td>
<td>99.8</td>
<td>100.4</td>
<td>97.7</td>
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<td>Mexicob</td>
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<td>83.4</td>
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<tr>
<td>Venezuela</td>
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<td>102.0</td>
<td>100.3</td>
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<td>99.9</td>
<td>102.6</td>
<td>110.7</td>
<td>119.3</td>
</tr>
</tbody>
</table>

a. Industrial employment in the nine major metropolitan areas.
b. Manufacturing employment in the Lima metropolitan area.


Table 3. *Average Real Wages in Highly Indebted Latin American Countries, 1981–88* (1980 = 100)

<table>
<thead>
<tr>
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<td>Brazil⁠b</td>
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<td>Mexico</td>
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<td>94.0</td>
<td>98.5</td>
<td>99.7</td>
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Note: Figures are usually for workers employed in manufacturing or industry. For more detailed descriptions of the individual wage series, see the notes to table 11 in United Nations 1988.

a. Preliminary figures.
b. Average real wage in basic industry in Rio de Janeiro.

By contrast layoffs in the final goods and services sectors can potentially improve the external balance without sacrificing output and employment growth. The layoffs stimulate investment by returning real resources to the private sector. Private capital accumulation eventually creates enough new employment in the high-wage manufacturing sector to fully compensate for the loss of public sector jobs; in the long run, real output is higher and formal sector employment and real wages are unchanged.

The article is organized into seven sections. Sections I to III develop the basic model and analyze the impact of public sector price hikes and employment cuts. Section IV investigates the repercussions of reducing infrastructure investment. Section V contrasts the adjustment processes associated with the different fiscal measures and discusses the extent to which capital decumulation and lower employment in the high-wage sectors increase the cost of adjustment. Section VI examines how the results change when endogenously varying tax revenues make the fiscal and real adjustment mechanisms interdependent. Section VII expands on the broad policy implications of the analysis.

I. A Pure Supply-Side Model

The models in this and subsequent sections highlight the supply-side effects of fiscal austerity. To abstract from demand-side complications, I assume the economy is small and completely open. Two traded goods are produced: an agricultural export good and a manufactured good. The price of each good is fixed at unity. Production in the manufacturing sector requires labor, capital, and an intermediate input (such as gas or electricity) purchased from the public sector. The agricultural good is produced by just labor and land. Introducing capital and intermediates as factors in the agricultural sector does not substantively alter the results, provided the manufacturing sector is relatively capital- and intermediates-intensive.

Numerous empirical studies conclude that sectoral wage differentials in developing countries are far too large to be explained by the payment of compensating differentials (Gregory 1975; Merrick 1976; Squire 1981, chapters 7 and 8; Mazumdar 1976, 1989a, 1989b; House 1984; Portes, Blitzer, and Curtis 1986; Gindling 1989). The labor market is highly dualistic, with wages in the modern formal sectors sometimes being more than double those paid elsewhere in the economy. In keeping with the findings of these studies, the agricultural sector in the model is equated with the low-wage informal sector; government and manufacturing comprise the high-wage formal sector. A genuine labor market distortion thus exists because there is too little employment in private manufacturing relative to agriculture.

Although the sectoral wage gap generates underemployment, there is no open unemployment. All those unable to obtain work in the government or manufacturing sectors are employed in the agricultural sector, where the wage adjusts to clear the market. The labor market is represented by equation 1:
(1) \[ L^m + L^x + L^g = L \]

where \( L^m \), \( L^x \), and \( L^g \) denote employment in manufacturing, agriculture, and the public sector, respectively, and \( L \) denotes total labor supply. Total labor demand consists of private sector labor demand plus public sector employment. The total supply of labor is constant.

The most troublesome issue in modeling the labor market concerns the appropriate way to make the manufacturing sector wage endogenous. In theory it may be set in implicit contracts to provide insurance to workers by unions, by socio-political norms embodied in minimum wage laws, or by efficiency wage considerations. Unfortunately, empirical work on the wage-setting process in developing countries is scarce and does not single out one theory as clearly superior. Furthermore, although the aforementioned theories may explain wage rigidity in manufacturing, the only restriction they place on how the wage responds to various shocks is that, other things being equal, the manufacturing sector wage should be positively related to the agricultural sector wage. As neither theory nor empirical studies offer much guidance, I choose a particularly simple specification

(2) \[ \bar{w}^m \leq b \bar{w}^x, \quad 0 < b \leq 1 \]

where \( \bar{w}^m \) and \( \bar{w}^x \) denote wages in manufacturing and agriculture, respectively, a circumflex indicates a percentage change in a variable, and \( b \) is constant (and positive to ensure the existence of a steady state). This specification is consistent with the Solow condition (when \( b = 1 \)) in efficiency wage models and with certain variants of the optimizing union model. The parameter \( b \) plays a crucial role in the adjustment process because it determines the degree of real wage rigidity in manufacturing. If \( b = 1 \), the labor market is distorted by a sectoral wage gap, but both agriculture and manufacturing are flex-wage sectors. However, when \( b \) is small the real wage in the formal sector is largely impervious to economywide employment conditions. More of the burden of adjustment to contractionary policies is then borne by wage cuts in the informal sector and increases in underemployment (that is, greater layoffs in the manufacturing sector).

Firms are perfectly competitive and operate with technologies characterized by constant returns to scale. The zero profit condition is therefore satisfied in each sector

(3) \[ 1 = C^m(w^m, r, P) \]

(4) \[ 1 = C^x(w^x, \nu) \]

where \( C^m \) and \( C^x \) denote the unit cost function in the manufacturing and agricultural sector, respectively; \( r \) and \( \nu \) are the capital and land rentals; and \( P \) is the price of the intermediate input purchased from the public sector.

For simplicity I assume technology in each sector can be represented by a
(non-nested) constant elasticity of substitution (CES) production function. Private sector demands for manufacturing and agricultural labor and for the intermediate input (denoted by Z) are then (in percentage changes)

\[ \Delta L^m = - \sigma \frac{1 - \theta Z}{\theta K} \Delta \hat{w}^m - \sigma \frac{\theta Z}{\theta K} \hat{p} + \hat{K} \]

\[ \Delta L^x = - \sigma_x \frac{\theta L}{\theta T} \Delta \hat{w}^x \]

\[ \Delta Z = - \sigma \frac{\theta L}{\theta K} \Delta \hat{w}^m - \sigma m \frac{1 - \theta L}{\theta K} \hat{p} + \hat{K} \]

where \( \sigma \) and \( \sigma_x \) are elasticity of substitution in the manufacturing and agricultural sectors, respectively; \( \theta_L, \theta_Z, \) and \( \theta_K \) are, respectively, the cost shares of labor, the intermediate input, and capital in the manufacturing sector; \( \theta_T \) is the cost share of land in the agricultural sector; and \( K \) denotes capital. The only characteristic of CES technology that is important for the results that follow is gross complementarity of factors (that is, an increase in the price of the intermediate input lowers demand for labor and capital in manufacturing). This is not a particularly strong restriction to place on technology. According to production theory, factors are normally gross complements (Rader 1968). Empirical studies also find, with rare exceptions, that complementarity holds.

Capital accumulation is governed by factor returns and the intertemporal preferences of a representative, infinitely-lived family firm. The firm is endowed with perfect foresight and chooses investment to maximize an additively separable utility function

\[ \max_{\{E, I\}} \int_0^\infty V(E)e^{-\rho t} dt \]

subject to

\[ E + I = R(K, L^m, L^g, P) + \omega_\pi L^g - T \]

\[ K = I - \delta K, \]

where \( E \) is aggregate consumption expenditure, \( I \) is investment, \( T \) is a lump-sum tax, \( \rho \) is the pure rate of time preference, \( \omega_\pi \) is the public sector wage, \( \delta \) is the depreciation rate, and an overdot signifies a time derivative. Current utility is represented by an increasing, strictly concave indirect utility function \( V(\cdot) \).

Equation 9, the budget constraint, states that consumption and investment spending must equal disposable income. (Neither the private agent nor the government has access to foreign credit.) On the right side, private sector value added is measured by the value added function \( R(\cdot) \), in which the fixed total supplies of labor and land are suppressed. The value added function has the
usual properties that an increase in the capital stock raises real output by an amount equal to the real capital rental and an increase in the real price of the intermediate input lowers output by an amount equal to the initial demand for intermediates. Also, since employment increases in other sectors of the economy come at the expense of employment in agriculture, higher public sector employment lowers private value added by an amount equal to the agricultural wage, while the marginal gain from expanding employment in manufacturing is measured by the existing sectoral wage gap \((w^m - w^x)\).

The government must respect the budget constraint

\[ wsL^g + D = PZ + T \]

where \(D\) denotes debt service. Total public sector expenditure is the sum of the wage bill and debt service (net of new capital flows). The profile of debt service is determined by negotiations with foreign creditors and is treated as strictly exogenous. The public sector wage is constant, and, of the \(L^g\) workers hired by the government, \(L_1\) are employed in producing the intermediate input \([Z = Z(L_1)]\). But although \(L_1\) is endogenous, the extent to which public sector employment varies with private sector demand for the intermediate input is a policy variable. When the demand for intermediates contracts, labor needed by the parastatal sector falls by \(dL_1 = (Z/Z')Z\), whereas the change in total public sector employment is

\[ dL^g = (Z/Z')Z, \quad 0 \leq \beta \leq 1. \]

\(\beta\) defines the government's layoff policy. When \(\beta < 1\), redundant labor is kept on the payroll or transferred to other activities where it produces "government services." In either case the short- and long-run results and the qualitative nature of the dynamics are unchanged.

Government revenue derives from two sources: a lump-sum tax \((T)\) and sales of the intermediate input \((PZ)\). The unrealistic assumption of a lump-sum tax is made at this point to simplify the analysis. The impact on the budget of variations in private sector demand for the intermediate input is offset by adjustments in the lump sum tax so that higher debt service can be dealt with by a one-time adjustment in the price of the intermediate.

Equations 1 to 12 form the complete model. Since private sector saving and investment are equal, the trade balance is \(PZ + T - wsL^g = D\); thus the overall balance of payments equals zero. In what follows, debt service increases from an initial value of zero and a fiscal instrument is adjusted to extract the required trade surplus.

II. THE SHORT- AND LONG-RUN IMPACTS OF PUBLIC SECTOR PRICE INCREASES ON OUTPUT, EMPLOYMENT, AND REAL WAGES

The manipulations involved in solving a perfect foresight general equilibrium model are straightforward but also lengthy and tedious. To keep the main ideas
clearly within view, the exposition here is mostly verbal and graphical. Solution procedures for the short- and long-run outcomes and proofs of saddle point stability may be found in a more technical version of the article that is available from the author upon request.

The Short-Run Impact

An increase in the price of the intermediate input lowers labor demand in private manufacturing and in the parastatal sector at existing wages. Aggregate high-wage employment thus contracts, forcing the agricultural wage to decrease.

Labor demand in the manufacturing sector is subject to two conflicting effects. While the decrease in the agricultural wage triggers a fall in the manufacturing sector wage, the higher price of intermediates shifts the labor demand schedule to the left. Employment rises or falls depending on whether

\[
\sigma^m > \sigma^x \frac{L^x(1 - s)\theta}{LM\theta_L b\beta}
\]

where \( s = (w^m - PZ')/w^m \) denotes the percentage gap between the marginal product of labor in private manufacturing and in the parastatal sector. If \( b\beta \) is small either because the government maintains the level of public sector employment (\( \beta = 0 \)) or because the manufacturing sector wage responds weakly to changes in the agricultural wage (\( b \) is small), the adverse productivity effect dominates, and manufacturing sector employment declines. More generally, employment in both high-wage sectors is likely to contract unless technology is far more flexible in manufacturing than in agriculture. Since the share of the labor force employed in private manufacturing is small (the ratio of agricultural to manufacturing sector employment generally lies between two and seven), the term multiplying the elasticity of substitution in the agricultural sector (\( \sigma^x \)) in expression 13 will usually be quite large.\(^1\) Even when the government takes a tough line on layoffs (\( \beta = 1 \)), real wages are equally flexible in the formal and informal sectors (\( b = 1 \)), and the productivity gap between labor in the public and private manufacturing sectors is 50 percent (\( s = 0.5 \)), the elasticity of substitution in the manufacturing sector has to be substantially larger than the elasticity of substitution in the agricultural sector in order for employment in the manufacturing sector to increase.

Dynamics and the Long-Run Impact

The adjustment process stretches beyond the short run because fiscal austerity affects the incentive to accumulate capital. As investment gradually alters the

\(^1\) In 1980 the employment share of the industrial sector (a rough proxy for the employment share of the formal sector) was 13 percent in low-income developing countries, 23 percent in middle-income developing countries, and 31 percent in upper middle-income developing countries. In our dual economy model, the corresponding values for \( L^x/L^m \) are 6.7, 3.4, and 2.3.
capital stock, the temporary equilibrium is displaced and further changes occur in real output, sectoral labor demands, and real wages.

The important qualitative features of the adjustment process are depicted in figure 1. The steady state is a saddle point with a unique convergent path to equilibrium. In the first quadrant the positively sloped \( KK \) schedule shows the set of points for which net investment is zero. Above \( KK \) net investment is positive and the capital stock is increasing; below the schedule, the capital stock is falling. The saddle path \( SS \) may be positively or negatively sloped. Regardless of the slope of \( SS \), the capital stock approaches its steady-state level monotonically.

The \( WW \) and \( LL \) schedules in the third and fourth quadrants complete the description of the equilibrium path. These schedules track the paths of the agricultural wage and high-wage sector employment as the economy traverses the saddle path \( SS \). Both schedules are positively sloped because an increase in the capital stock bids up the market clearing value of the agricultural wage by raising labor demand in the high-wage sectors.

Figure 1. *Major Qualitative Features of the Adjustment Process*
The dynamics of the adjustment process depend entirely on how the policy package affects the steady-state capital stock. Across steady states

\[ \frac{\dot{K}}{\dot{P}} = \left[ \sigma^m(s + \beta - 1) - \sigma^x \frac{L^x(1 - s)}{L^m \theta \tau b} \right] \theta_z / N \]

where \( N = \theta_L (1 - s) + \beta \theta Z \).

The impact on the equilibrium capital stock depends on whether the increase in the price of the intermediate and the induced decrease in the manufacturing sector wage combine to raise or lower the profitability of investment. Although initial conditions (that is, \( L^x / L^m \)) and the nature of technology influence the outcome, equation 14 yields several well-defined results. First, for small \( b \) the potentially positive term involving the elasticity of substitution in the manufacturing sector \( (\sigma^m) \) is dominated by the negative term on the right side of equation 14. Thus \( K \) declines when there is a high degree of real wage rigidity in the manufacturing sector because the manufacturing sector wage does not adjust enough to preserve profitability. Second, the capital stock always decreases when the parastatal sector “properly” belongs to the high-wage sector \( (s = 0) \). Third, capital decumulation occurs if the government resists making layoffs. More precisely, the smaller the productivity gap between manufacturing and parastatal labor, the tougher must be the government layoff policy. There is no hope whatsoever of stimulating capital accumulation unless \( \beta > 1 - s \).

In the most general case there is a strong presumption that the capital stock will fall. Even when the productivity gap \( (s) \) is quite large, the government adopts a tough layoff policy, and the real wage in manufacturing is highly flexible, capital decumulation is to be expected. For the example considered earlier in which the government lays off workers strictly as dictated by the decrease in demand for intermediates \( (\beta = 1) \), the productivity gap is 50 percent \( (s = 0.5) \), and labor in the formal sector accepts the same percentage wage cut as labor in the informal sector \( (b = 1) \), the capital stock still decreases if \( \sigma^m < \sigma^x \frac{L^x}{L^m} \theta \tau \). As in the condition governing the short-run impact on manufacturing labor demand, the capital stock falls if the elasticity of substitution in the manufacturing sector is not many times larger than the elasticity of substitution in the agricultural sector.

The high probability that the capital stock will decrease implies that manufacturing employment is more likely to fall in the long run than in the short run. The change in employment in manufacturing across steady states is

\[ \frac{\dot{L}^m}{\dot{b}} = \frac{\theta \tau}{\theta_L N} \left[ \sigma^m \beta (1 - \theta_k) - \sigma^x \frac{L^x(1 - s) \theta_L}{L^m \theta \tau b} \right] \]

The critical value of \( \sigma^m \) required for \( L^m \) to increase is \( (1 - \theta_k)^{-1} \) times larger than the critical value defined in expression 13. Hence the condition for manufacturing employment to increase is roughly twice as demanding in the long run (the cost share of capital in the manufacturing sector in developing countries is around 50 percent) as it is in the short run.
The preceding analysis argues that the increase in the price of the intermediate will usually provoke capital decumulation. Figure 1 describes the workings of the adjustment process in this the normal case. The initial equilibrium is \(A,B,C\). Immediately following the price increase, investment, employment in the high-wage sectors, and the wage rate in the agricultural and manufacturing sectors all decline. As the capital stock decreases over time, employment conditions continue to worsen, and real wages and investment continue to fall.\(^2\) The failure of repeated real wage cuts to forestall further reductions in investment and further decreases in nonagricultural employment reflects an inherent feature of the adjustment process. Falling real wages on the transition path are an induced response to weakened labor demand brought on by capital decumulation and consequently do not stimulate employment growth or investment spending.

When the productivity gap \(s\) is exceedingly large, it is possible that the capital stock will increase, as indicated by the dynamics resulting from the initial equilibrium \(D,E,F\) in figure 1. After the initial shock, capital accumulation bolsters labor demand in the high-wage sectors, thus driving up the agricultural and manufacturing sector wages. Real output may eventually increase,\(^3\) but the labor market never fully recovers. In the new steady state \((X,Y,Z)\), formal sector employment and real wages are lower.

### III. Public Sector Layoffs

Cuts in public sector employment release resources to the private sector. Layoffs connected with higher prices for intermediate inputs are part of a policy package that subjects the private sector to a joint supply shock. By contrast layoffs in those branches of the government that produce final goods and "services" (broadly defined) combine the release of labor resources with a cut in consumption. Layoffs of this type can be analyzed by deleting the intermediate input from the model and letting \(Q(L_g)\) represent the value of government services measured in units of tradable goods. Assuming the government cannot charge for its services, a reduction in public sector employment of \(-dD/w_g\) maintains fiscal balance when debt service increases.

Initially, the cut in public sector employment increases the supply of labor to

\(^2\) The lump-sum tax adjusts to offset the fiscal effects of variations in public sector employment and demand for the intermediate input \((Z)\). Real wages here are thus gross real wages (which differ from net real wages if some part of the tax falls on labor). Since demand for the intermediate input falls with capital stock, the tax is rising on the transition path if and only if \(b w_g / P Z' < 1\). Net real wages, therefore, fall faster than gross real wages if labor is paid its marginal product in the parastatal sector. In subsequent sections the lump-sum tax is constant, and it is not necessary to distinguish between variations in gross and net real wages.

\(^3\) Real output always increases if the government lays off workers as dictated by the drop in demand for the intermediate input and if the marginal product of public sector labor exceeds the agricultural wage.
the agricultural sector, thereby depressing agricultural and manufacturing sector wages. Real output may rise or fall in the short run depending on the productivity of public sector labor and the division of new hires between manufacturing and agriculture.

If there is an initial contractionary phase, it ultimately proves to be temporary. Lower real wages spur greater investment spending, and, as the capital stock grows, employment in manufacturing increases further and the agricultural wage starts rising. Over the long run the capital stock increases enough that all of the laid-off workers are absorbed in the high-wage manufacturing sector without lowering real wages. (In terms of figure 1, point E is horizontally to the left of point Y, and F is vertically below Z.) To establish this result, observe that in long-run equilibrium the capital rental \( r \) is tied down by the rate of time preference \( \rho + \delta \). It then follows from the zero profit conditions that real wages and the land rental are also constant across steady states. Thus employment in agriculture is unchanged at the new long-run equilibrium, and clearing of the labor market implies that the increase in employment in the manufacturing sector is equal to the decrease in the public sector \( dL_m = -dL_g \).

What is appealing in these results is that eventually higher debt service is financed partially or wholly by an expansion in economic capacity. It is, however, a long step from this to the conclusion that public sector layoffs (in the final goods and services sectors) constitute an easy remedy to the debt problem. A potentially difficult intertemporal tradeoff exists when output decreases in the short run. Furthermore, even if layoffs generate a favorable output path, the distributional repercussions may not be judged acceptable. Real wages and formal sector employment are lower everywhere on the transition path until the new steady state is reached. A prolonged bout of greater inequality is the price paid for higher output in the long run.

IV. Reductions in Public Investment

Fiscal belt tightening often takes its greatest toll on public investment. Cutbacks occur not only in planned infrastructure and industrial projects, but also in a wide variety of education, health, and training programs. I investigate below the repercussions of reducing infrastructure investment. A very similar analysis applies, however, to cuts in government expenditures that foster human capital formation (see Buffie forthcoming).

Infrastructure capital serves to enhance the productivity of private capital and labor. The simplest way to capture this complementarity of social infrastructure and private inputs is to introduce urban infrastructure capital as a third distinct factor in the manufacturing sector. The stock of social infrastructure \( K_i \) is fixed in the short run and rises or falls over time depending on whether net public investment is positive or negative. All rents generated by social infrastructure accrue to private capitalists—there is no charge for the productive services yielded by the stock of social infrastructure.

Consider now what happens in the long run when greater debt service forces a
A cut in infrastructure investment \( P \). With factors being complementary, the productivity of labor in private manufacturing declines. Consequently, real wages and employment in private manufacturing fall across steady states.

In view of the countervailing effects exerted by a smaller stock of social infrastructure and a lower manufacturing sector wage, it might appear that the impact on the incentive to accumulate capital is generally ambiguous. This is not the case. The decrease in the wage is an induced, second-round response; as such it is too weak to offset the drop in the productivity of private capital caused by the reduction in the stock of social infrastructure. Disinvestment in social infrastructure thus leads to capital decumulation on a broad front. In the new steady state the capital stock is lower by the amount

\[
\hat{K} = \frac{\theta_L (\sigma^x L^x + \sigma^m L^m b \theta_T)}{\sigma^m L^m \theta_T (1 - \theta_K) + \sigma^x L^x \theta_i}
\]

where \( \theta_i \) is the cost share of social infrastructure. \( \theta_i = r^i K^i / C^m \), where \( r^i \) is the implicit rental attached to social infrastructure, and \( C^m \) is total costs in the manufacturing sector.

With two capital stocks varying over time, the dynamics are intrinsically complex, and a variety of adjustment paths are possible. On a "normal" adjustment path, private investment jumps downward on impact but does not overshoot its steady-state level. The two capital stocks, manufacturing sector employment, and real wages all decline monotonically en route to the steady state.

In the normal case the lower equilibrium capital stock elicits an immediate reduction in private investment. There is also, however, the intriguing possibility that investment will increase initially. When the government announces a reduction in infrastructure investment, the representative family firm foresees a declining path for future income and the capital rental. The lower stream of quasi-rents earned by the capital stock implies that eventually investment will decline. But if the family firm has a strong preference for a smooth consumption path, it may increase investment temporarily to shift some consumption from the present to the future. This gives rise to the dynamics shown in figure 2. The possibility of this type of adjustment underscores the importance of bringing the medium and long run into view when evaluating stabilization policy. Over phase \( AB \), private and public investment appear to be substitutes, and, if the economy experiences a downturn, it is likely to be mild. The short-run response, however, is a faulty guide to how the policy affects the economy's growth prospects. Phase \( AB \) is only one part of a much longer adjustment process in which public and private capital ultimately prove to be strongly complementary.

V. THE ADJUSTMENT PROCESS AND THE SACRIFICE RATIO

There are many ways to raise revenue and lower expenditure to achieve a desired reduction in the fiscal deficit. The simple but important point of the analysis in sections II to IV is that the real repercussions of fiscal austerity depend sensitively on how the fiscal deficit is lowered.
Tables 4 and 5 present evidence on the adjustment costs for public sector price increases and cutbacks in infrastructure investment. These tables show the decrease in net national income (GDP minus external debt service) relative to the increase in debt service. I call this ratio the "sacrifice ratio." In a world in which lump-sum taxes could be employed to service the debt, the sacrifice ratio would equal unity.

In tables 4 and 5 the elasticity of substitution in manufacturing, the degree of labor market dualism (the ratio of the manufacturing wage to the agricultural wage), and the degree of real wage rigidity are allowed to vary. The other parameter values underlying the solution grids for both tables are the elasticity of substitution in agriculture ($\sigma^s$) at 0.50, the cost share of land in agriculture ($\theta^r$) at 0.475, the cost share of labor in manufacturing ($\theta^l$) at 0.40, the rate of time preference ($\rho$) at 0.10, the depreciation rate ($\delta$) at 0.05, and the ratio of agricultural to manufacturing sector output ($Q^s/Q^m$) at 1.7. In table 4 the cost share of the intermediate input ($\theta^i$) is 0.10, the parameter that defines the government's layoff policy ($\beta$) is 1, and the percentage gap between the marginal product of labor in private manufacturing and in the parastatal sector ($s$) is 0.3. In table 5 the cost share of social infrastructure ($\theta_s$) is 0.2.

The values for the ratio of agricultural to manufacturing sector output and the cost shares are set to yield output and employment shares for the manufacturing sector close or equal to those of the industrial sector in the highly indebted developing countries in 1980, the last year before the debt crisis. The ratio of
Table 4. The Sacrifice Ratio with Adjustment through an Increase in the Price of the Intermediate Input

<table>
<thead>
<tr>
<th>Degree of real wage rigidity (b)</th>
<th>Elasticity of substitution in manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Ratio of manufacturing wage to agricultural wage = 1.25</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>5.0</td>
</tr>
<tr>
<td>0.75</td>
<td>3.5</td>
</tr>
<tr>
<td>1.00</td>
<td>2.8</td>
</tr>
<tr>
<td>Ratio of manufacturing wage to agricultural wage = 1.50</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>6.8</td>
</tr>
<tr>
<td>0.75</td>
<td>4.8</td>
</tr>
<tr>
<td>1.00</td>
<td>3.7</td>
</tr>
<tr>
<td>Ratio of manufacturing wage to agricultural wage = 1.75</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>8.6</td>
</tr>
<tr>
<td>0.75</td>
<td>6.0</td>
</tr>
<tr>
<td>1.00</td>
<td>4.6</td>
</tr>
<tr>
<td>Ratio of manufacturing wage to agricultural wage = 2.00</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>10.4</td>
</tr>
<tr>
<td>0.75</td>
<td>7.2</td>
</tr>
<tr>
<td>1.00</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Note: The sacrifice ratio is the decrease in net national income relative to the increase in debt service. Source: Author's calculations.

Table 5. The Sacrifice Ratio with Adjustment through an Increase in Investment in Infrastructure

<table>
<thead>
<tr>
<th>Degree of real wage rigidity (b)</th>
<th>Elasticity of substitution in manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.5</td>
</tr>
<tr>
<td>Ratio of manufacturing wage to agricultural wage = 1.25</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
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<td>7.1</td>
</tr>
<tr>
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<td>6.9</td>
</tr>
<tr>
<td>Ratio of manufacturing wage to agricultural wage = 1.50</td>
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</tr>
<tr>
<td>0.50</td>
<td>8.2</td>
</tr>
<tr>
<td>0.75</td>
<td>7.9</td>
</tr>
<tr>
<td>1.00</td>
<td>7.6</td>
</tr>
<tr>
<td>Ratio of manufacturing wage to agricultural wage = 1.75</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>8.8</td>
</tr>
<tr>
<td>0.75</td>
<td>8.5</td>
</tr>
<tr>
<td>1.00</td>
<td>8.2</td>
</tr>
<tr>
<td>Ratio of manufacturing wage to agricultural wage = 2.00</td>
<td></td>
</tr>
<tr>
<td>0.50</td>
<td>9.2</td>
</tr>
<tr>
<td>0.75</td>
<td>8.9</td>
</tr>
<tr>
<td>1.00</td>
<td>8.6</td>
</tr>
</tbody>
</table>

Note: The sacrifice ratio is the decrease in net national income relative to the increase in debt service. Source: Author's calculations.
employment in manufacturing to employment in agriculture varies so as to be consistent with the values chosen for other parameters. (This implies that the distribution parameter changes in the CES production functions. Technology differs across the cells in tables 4 and 5.) The employment ratio \( L^a / L^m \) is thus higher the more distorted the labor market, rising from 2.79 when \( w^m / w^a = 1.25 \) to 4.46 when \( w^m / w^a = 2 \). At \( w^m / w^a = 1.5 \), the proportion of the private labor force employed in the manufacturing sector assumes the same value (23 percent) as the weighted average employment share of the industrial sector in the highly indebted countries in 1980. The share of the manufacturing sector in GDP (37 percent) equals the 1980 output share of the industrial sector in the highly indebted countries. (The figures for the output and employment shares of the industrial sector are from the World Bank [1988].)

In table 4 it is assumed that the productivity gap between parastatal and private manufacturing labor is fairly large (\( s = 0.3 \)) and that the government summons the political will to enforce a tough layoff policy (\( \beta = 1 \)). (Since \( \beta = 1 \), production of government services does not change, and the results measure the impact on total output, not just private sector value added.) To generate the solution grid in table 5, it was necessary to make some assumption about the return on infrastructure capital. I imposed the condition that the initial direct return (the return ignoring the impact on employment in manufacturing and the labor market distortion) equal the return on private capital.

What stands out in both tables is that the sacrifice ratio is so far above unity. The large values reflect the fact that capital decumulation and greater allocative inefficiency in the labor market substantially increase the costs of adjustment. If the capital stock and employment in manufacturing were unchanged, the sacrifice ratio would be unity in table 4 and three in table 5. The actual values for the sacrifice ratio indicate that the real loss of output attributable to adverse general equilibrium repercussions is usually several times larger than the combined loss owing to higher debt service and the direct contractionary effect produced by the policy shift. It is notable that real wage flexibility helps a good deal in table 4 but not much in table 5. Increasing the percentage wage cut in the formal sector from 50 to 100 percent of the percentage wage cut in the informal sector (that is, \( b = 1 \) versus \( b = 0.5 \)) seldom lowers the sacrifice ratio for a reduction in infrastructure investment by more than 10 percent.

Is it sensible to take seriously the quantitative predictions of a simple model? In this instance I believe the answer is yes. Sacrifice ratios on the order of 5–10 do not seem particularly unrealistic. Since the growth rate is zero across steady states in the model, a sacrifice ratio of eight should be interpreted as saying that the adjustment to an increase in debt service equal to 3 percent of gross national product would entail a cumulative output loss of 24 percent before the economy recovered its previous trend growth rate. This might take the form of the per capita growth rate being (approximately) two points lower for 10 years. In light of the deep contractions suffered by many debtor countries, it is not obvious whether the sacrifice ratios in tables 4 and 5 are too large or too small.
VI. Feedback Effects and the Government Budget Constraint

So far I have assumed that taxes are lump sum. Because of this assumption, the previous analysis, grim as it was, understates the difficulty of adjustment. Under the more realistic specification that tax revenues depend upon output, one-shot fiscal adjustments no longer suffice to meet the debt service target. Any measure that lowers real output lowers tax revenues as well, necessitating further fiscal retrenchment. It is all too easy for the economy to fall into a vicious, contractionary spiral in which capital decumulation, worsening underemployment, and fiscal difficulties become mutually reinforcing.

For illustrative purposes, return to the model of section IV and replace the lump-sum tax by a flat value added or income tax \( t \). As tax revenues are now endogenous, infrastructure investment must be adjusted to satisfy the government budget constraint. This makes public and private investment strongly interdependent. A decrease in the private capital stock leads to a reduction in tax revenues and a matching cut in public investment. The subsequent decrease in the supply of social infrastructure depresses private capital accumulation still more, which results in a further loss of tax revenues, and so forth.

The joint dependence of the two capital stocks (the private capital stock and social infrastructure) is depicted in figure 3. The upward sloping KK schedule is

Figure 3. The Joint Dependence of the Stock of Social Infrastructure and the Private Capital Stock
based on equation 16 and reflects the positive relationship between the equilibrium capital stock and the stock of social infrastructure. The $HH$ schedule shows how social infrastructure varies with the capital stock as needed to comply with the government budget constraint. A stable underlying adjustment mechanism requires that, after taking account of the induced reduction in output (for a given private capital stock), the fiscal surplus increases in the long run when social infrastructure is reduced. Given this, $HH$ is also positively sloped.

An increase in debt service shifts $HH$ vertically downward while leaving the $KK$ schedule in place. If taxes were lump sum, point $B$ would be the new long-run equilibrium. But when revenues derive from a value added tax, the lower level of output at $B$ produces a fiscal deficit. Facing a revenue shortfall, the government further reduces investment in infrastructure, which leads to another round of capital decumulation, lower tax collections, and additional expenditure cuts. If $HH$ intersects $KK$ from below, private and public capital decumulation feed back upon one another in a destabilizing fashion, and the downward spiral continues until either debt service is suspended or a greater share of the adjustment is shifted onto fiscal instruments less harmful to investment. In figure 3 a stable process operates ($HH$ intersects $KK$ from above), so the economy eventually converges to point $C$. The distance between $B$ and $C$ measures the additional capital decumulation (private and public) owing to the feedback effects. This may well exceed capital decumulation directly attributable to higher debt service. It can be shown, for example, that when $2t > b \rho$ (where $r_i$ is the implicit rental on infrastructure capital) the respective decreases in the capital stock, social infrastructure, and the agricultural wage are more than twice as large as the decreases that occur under lump-sum taxes.

The message here accords, I believe, with recent macroeconomic history in several developing country debtors. The adjustment to higher debt service is long and traumatic because, once growth decelerates, fiscal problems become nearly systemic and the government finds it is compelled, year after year, to make cuts in productive expenditures. Experience to date and the large sacrifice ratios in tables 4 and 5 suggest that this vicious cycle, if not actually unstable, requires considerable time to work itself out. Macroeconomic austerity can acquire a life of its own.

**VII. Summary and Concluding Remarks**

One of the fundamental, unresolved puzzles in development macroeconomics concerns why austerity programs have produced such deep and prolonged recessions in many debtor nations. In this article I have argued that part of the answer to the puzzle may lie in the measures directed at lowering the fiscal deficit. There are sound reasons for thinking that fiscal policy exerts a stronger influence on private investment than is commonly believed. Cuts in public infrastructure investment and higher prices for publicly produced intermediates depress private
investment by lowering usage of factors complementary to capital. Once capital
decumulation sets in, employment growth slows in the high-wage sectors of the
economy. As a result, formal sector employment declines at the same time as real
wages are subject to general downward pressure. Moreover the adjustment
process is likely to be protracted by ongoing budgetary problems. If slower
growth leads to lower tax collections, further fiscal retrenchment becomes nec-
essary as the economy contracts. It may take a long time to escape the strong,
interlocking grip of slow growth and chronic fiscal deficits. In fact, as shown in
section VI, endogenously driven fiscal austerity may account for the greater part
of the losses suffered when adjusting to higher debt service.

Public sector wage cuts and layoffs in the final goods and services sectors offer
better prospects for maintaining growth in the face of increased debt service.
Wage cuts are a pure absorption-reducing policy that need not have any lasting
adverse impact on real output. Layoffs in the final goods and services sectors are
actually conducive to adjustment through growth. But although these two poli-
cies appear to work better than other fiscal measures, neither can be recom-
manded without qualifications. For public sector layoffs, the adjustment process
that brings gains over the long run also entails lower real wages and lower
formal sector employment in the short and medium run. Given the valid concern
of policymakers to minimize the impact of adjustment policies on the poor,
layoffs will often have to be phased in slowly.

Public sector wage cuts are less objectionable on distributional grounds but
have other drawbacks. After eight years of adjustment further wage cuts may no
longer be a real policy option in some highly indebted countries. In several Latin
American and African nations real public sector wages have fallen to the point
where moonlighting, long lunch breaks, and shirking have severely undermined
the government's capacity to carry on normal operations.

There are two broad lessons for policy in this analysis. First and most ob-
vious, something must be done to revive investment. In addition to increased
spending on social infrastructure and human capital formation, substantial in-
vestment subsidies are needed to overcome the divergence between social and
private returns caused by underemployment. In short, a “big push” in productive
government expenditures is required. This points, of course, to the urgency of
tax reform. Without a wider tax base and heavier taxation of factors in inelastic
supply, there is little hope the fiscal bind will loosen enough to allow per capita
growth rates to again reach respectable levels.

The second broad lesson is that adjustment should be gradual. Large-scale
fiscal adjustments are often necessary. But if all adjustment is to take place
within just a year or two, it is inevitable that a wide range of contractionary
measures will be adopted, including many that are incompatible with policy-
makers' output and employment targets. With new capital inflows financing a
longer timetable for reform, more of the burden of adjustment can be shifted
onto the small set of fiscal instruments that do not damage the economy's long-
run prospects for development.
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