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Fiscal adjustment and labor market dynamics in an open economy

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Abstract

This paper studies the labor market effects of fiscal adjustment in a two-sector, three-good intertemporal framework. Key features of the model are an informal sector, minimum wages, unionized labor in the formal economy, imperfect labor mobility, and public production of intermediate inputs. "Luxury" and wait unemployment prevail in equilibrium. It is shown that if unions care sufficiently about employment, and if the degree of openness is high, an increase in the price of government services may reduce unemployment in the steady state. A similar result would hold in an efficiency-wage setting if the "disciplinary effect" of unemployment is sufficiently strong.

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1. Introduction

Fiscal adjustment typically represents a key component of stabilization programs. A common scenario in middle-income countries is one of excessive budget deficits fueling a rapid expansion in domestic public debt and sharp increases in real interest rates. In turn, high interest rates lead to unsustainable debt dynamics, because the government is unable to

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generate a sufficiently large primary budget surplus. An economic and financial crisis, entailing large social costs in terms of employment and poverty, often ensues, followed by a macroeconomic and structural reform program aimed at increasing the primary surplus and reducing the public debt to manageable proportions. Argentina, Brazil, and Turkey are all recent examples of countries where unsustainable debt dynamics led to crises and subsequent attempts to being fiscal imbalances under control. In Turkey, for instance, the adjustment program introduced in May 2001, shortly after the February currency crisis, called for maintaining a primary surplus on the order of 6.5% of GNP over the medium term, in order to achieve the goal of single digit inflation by 2005 (see Yilmaz and Boratav (2003)).

In practice, budget austerity has taken various forms, including cuts in expenditure on goods and services, increases in direct and indirect taxes, absolute and relative reductions in wage compensation for civil servants, increases in the relative price of public services, changes in the government's wage-setting policies, and the imposition of constraints on the growth in (or reductions in the level of) public sector employment. How the budget deficit is reduced is, of course, just as important as the magnitude of the adjustment. A reduction in the fiscal deficit achieved through cutting investment on productive infrastructure or trimming expenditure on operations and maintenance, for instance, may not be sustainable over time. Moreover, because the public sector is often a major employer in developing countries, fiscal consolidation tends to have significant effects on wages and employment in the private sector. Identifying the channels through which fiscal policies are transmitted to the labor market is thus an essential step in understanding the real effects of adjustment programs in developing countries.[1]

Of particular interest in the present study is the macroeconomic effects associated with attempts to improve the financial situation of public enterprises. These enterprises are, in some countries, major contributors to the budget through direct transfers, in addition to the tax revenue that they provide. In others, however, they represent a drain on public finances because of the large subsidies that they receive. Attempts at improving their financial situation have taken a variety of forms, including measures aimed at increasing efficiency and lowering costs (most notably by reducing "excessive" employment), and market-based pricing policies. In oil-exporting countries, for instance, adjustment has often entailed raising domestic prices of fuel and gasoline—which governments often try to keep at low levels for political reasons—to world market prices. A case in point is Nigeria where, on September 30, 2003, the government lifted its long-standing ceilings on domestic fuel prices, in an attempt to alleviate the adverse effects of subsidies (about US$1 billion a year) on the budget deficit. Because this type of public goods is used as intermediate inputs in the production process in the private sector, opponents often argue that they tend to have contractionary effects on output in both the short and the long run, and to raise unemployment. At the same time, however, advocates of these policies often claim that although there may be short-term costs, the longer-run benefits associated with a reduction in fiscal imbalances (lower interest rates, reduction in inflation expectations, and so on) may be expansionary and may well dominate. For instance, if increases in public sector prices lead to

[1] See Agénor (1996, 2000) and the World Bank (1995) for comprehensive accounts of the literature on the role of the labor market in economic adjustment.

cuts in government subsidies to state-owned enterprises, and thus to reductions in public expenditure and fiscal deficits that are sufficient to lower the debt-to-GDP ratio to sustainable levels, the risk premium incorporated in domestic interest rates may fall, thereby stimulating investment, production and employment. Alternatively, if deficits are money-financed, the reduction in subsidies can attenuate pressures to monetize fiscal imbalances, which may in turn lower inflation expectations, increase the expected real rate of return on physical investment, and once again stimulate capital accumulation, output and job creation.

The analytical literature aimed at understanding the macroeconomic effects of changes in public sector prices in developing economies in a dynamic setting remains scant.[2] The present paper contributes to this literature by emphasizing general equilibrium effects that do not operate through interest rates or inflation expectations, but rather through wage-setting behavior in the labor market. Specifically, it develops an open-economy macro framework that incorporates public sector production and employment as well as several important features of developing countries. The first is the explicit consideration of an informal sector, in which wages and prices are flexible. In many developing economies, this sector has grown considerably in importance during the 1980s and 1990s. In countries like India and Bangladesh, for instance, the proportion of employment in the formal sector barely exceeds 10% of the labor force. In many sub-Saharan African countries, the share of informal employment in total employment exceeds 60% (see Dabalen, (2000)). Similar figures can be found in the non-oil exporting countries of the Middle East and North Africa (World Bank, (2003)).[3] Other important features of the model include a heterogeneous and imperfectly mobile labor force, and labor market segmentation induced by government regulations and the behavior of trade unions. In many developing countries, trade unions play indeed an important role in determining wages for at least some categories of workers in the formal sector (see Nelson, (1994)). In Ghana, for instance, labor unions have a powerful presence in the formal economy, in both the public and private sectors. Although in some countries, unionization rates are quite low, wage settlements negotiated by unions in some "strategic" sector or sectors often play a critical "signaling role" for the rest of the economy.

The combination of these features gives a fairly "realistic" flavor to the model, despite its stylized nature. As discussed later, however, the main result of the paper regarding the macroeconomic effects of an increase in public sector prices—lower unemployment in the steady state—would carry through in more general settings. Although some of the features emphasized here do affect the shape and nature of the transitional dynamics, most of them are made to enhance tractability. The assumption about the behavior of the trade union is important but even that is not essential; it could be replaced by various types of efficiency-wage considerations, and the main result would still carry through—as long as some conditions (identified explicitly later) on the behavior of workers are satisfied.

[2] A pair of papers by Buffie (1992, 1998) is the only one, to my knowledge, to provide an analysis of these effects in an intertemporal setting, as is done here. However, the focus of those papers is on the interactions between inflation, credibility, and multiple equilibria, whereas my analysis focuses on the dynamics of the labor market.

[3] Moreover, in many countries, growth in formal sector employment has been dominated by hirings in the public sector, with correspondingly limited gains in private sector employment.

The remainder of the paper proceeds as follows. The analytical framework is presented in Section 2. Its dynamic structure is described in Section 3, with all mathematical details relegated to the Appendix A. Section 4 examines the impact and steady-state effects of an increase in the real price of government services. Section 5 elaborates on the main results of the paper, and discusses how changes in the specification of the model would affect them. Testable implications of the model are also identified. The last section discusses some possible extensions of the analysis.

2. The model

Consider a small open economy in which there are four types of agents: producers, a representative household (whose members consist of all workers in the economy), a trade union, and the government. The nominal exchange rate is kept fixed at E. There are two categories of labor in the economy, skilled and unskilled, and two segments, a formal sector and an informal sector.[4] Both segments are described in turn, followed by household behavior, the labor market, the market for nontraded goods, and the behavior of the government.

2.1. The formal economy

In the formal economy, two goods are produced: an exportable good, whose output is entirely sold abroad, and a nontraded government service.[5] Production of government services requires only unskilled labor, whereas production of exportables requires both categories of labor, as well as government services as intermediate inputs. The world price of exportables is exogenous and normalized to unity for simplicity. The domestic price of exportables is thus equal to the nominal exchange rate, E.

Production in the exportable sector is characterized by fixed proportions between government services and gross output, Y_E, and between a composite bundle of skilled and unskilled labor and Y_E. No substitution can therefore take place between government services, on the one hand, and the composite bundle of labor services, on the other, neither in the short run nor in the long run. Let G denote the flow of government services, and n_S and n_U employment levels of skilled and unskilled labor (measured in natural units). We thus have

$$Y_E = \min[sV(n_S, n_U), \alpha G], \qquad s, \alpha > 0, \tag{1}$$

where V is linearly homogeneous in n_S and n_U with partial derivatives V_{n_S}, $V_{n_U} > 0$, $V_{n_S n_S}$, $V_{n_U n_U} < 0$. The assumption of linear homogeneity (or constant returns to scale)

[4] The size of the formal and informal sectors is taken as given here. See, for instance, Fortin et al. (1997) for a model in which the relative size of the informal economy is endogenously related to the level of taxes in the formal sector and the cost of tax evasion.

[5] As suggested by Agénor and Aizenman (1996), the absence of an import-competing sector in the formal economy can be rationalized by assuming that the efficiency losses induced by government-imposed barriers to foreign trade (which are not explicitly modeled here) are initially so high that goods that were once importables have effectively become nontraded goods.

implies that $V_{n_S n_U}>0$, so that skilled and unskilled labors are Edgeworth complements in the production of value added.[6] Efficient combination of factors therefore yields

$$Y_E = sV(n_S, n_U), \quad G^d = Y_E/\alpha, \tag{2}$$

where G^d denotes the demand for government services.

The real wage earned by skilled workers, measured in terms of the consumption basket is determined by a utility-maximizing trade union (as discussed later), whereas unskilled workers are paid a fixed minimum wage set by the government. For a given level of wages, firms in that sector determine employment levels of both categories of labor so as to maximize profits. Let w_S be the nominal wage paid to skilled workers employed in the exportable sector, ω_m the real minimum wage earned by unskilled workers (measured in terms of the price of exportables) and P_G the nominal price of government services. Suppose, for simplicity, that there is only one firm producing exportables. The firm's profits are therefore given by $(E-P_G/\alpha)Y_E-w_S n_S-E\omega_m n_U$. Using Eq. (2), maximization with respect to n_S and n_U yields the following conditions, which equate the real net marginal product of each category of labor to the relevant product wage:

$$s(1-p_G/\alpha)V_{n_S}(n_S, n_U) = \omega_S, \quad s(1-p_G/\alpha)V_{n_U}(n_S, n_U) = \omega_m,$$

where ω_S is the real wage paid to skilled workers and p_G the real price of government services, both measured in terms of the price of exportables. p_G is assumed exogenous in what follows.[7] From the above equations, and given the second-order profit maximization condition $V_{SS}V_{UU}-V_{n_S n_U}^2>0$, the demand functions for labor can be derived as

$$n_S^d = n_S^d(\bar{\omega}_S; \bar{\omega}_m, \bar{p}_G), \quad n_U^d = n_U^d(\bar{\omega}_S; \bar{\omega}_m, \bar{p}_G). \tag{3}$$

Eq. (3) indicates that an increase in the product wage for either category of workers, or a rise in the real price of government services, reduces the demand for both categories of labor.

Substituting these results in Eq. (2) yields

$$Y_E^s = Y_E^s(\bar{\omega}_S; \bar{\omega}_m, \bar{p}_G). \tag{4}$$

Net supply of exportables, Q_E^s, is equal to gross supply minus the cost of intermediate inputs. Thus, Eqs. (2) and (4) yield

$$Q_E^s = \left(EY_E^s - P_G G^d\right)/E = \left(1-p_G/\alpha\right)Y_E^s(\omega_S; \omega_m, p_G). \tag{5}$$

Production of government services requires only unskilled labor. The public sector workforce is assumed fixed at n_G. For a given real price p_G, output of public sector services is demand determined from Eqs. (2) and (4). Assuming a linear production function and a labor–output ratio in the public sector equal to α_G, actual employment is

[6] See Agénor (2001) for a more detailed discussion of this assumption. Or course, the assumption that labor inputs are gross complements does not prevent them from being Hicks–Allen substitutes.

[7] The choice of units is assumed to be such that $1>p_G/\alpha$, to ensure that value added (defined later) is positive.

assumed to be such that $\alpha_G G^d < n_G$. Thus, in general, disguised unemployment prevails in the public sector.[8]

2.2. The informal sector

Firms in the informal economy produce a nontraded good, which is used only for final consumption. The price of this good is flexible and adjusts to eliminate excess demand. Production requires only unskilled labor. Technology for the production of the nontraded good in the informal sector is characterized by decreasing returns to labor:

$$Y_N = y_N(n_N), \quad y'_N > 0, y''_N < 0, \tag{6}$$

where Y_N denotes output of home goods, and n_N the quantity of labor employed. Suppose, again for simplicity, that there is only one firm operating in the informal economy. The firm's real profits are given by $z^{-1}Y_N - \omega_N n_N$, where ω_N denotes the real wage (measured in terms of the price of exportables) prevailing in the informal sector, and $z \equiv E/P_N$ the real exchange rate, defined as the ratio of the domestic price of exportables to the price of home goods, P_N. Profit maximization yields the familiar equality between marginal revenue and marginal cost, $\omega_N = y'_N/z$, from which labor demand can be derived as

$$n_N^d = y_N'^{-1}(\omega_N z) = n_N^d(\omega_N z), \quad n'_N < 0, \tag{7}$$

where $\omega_N z$ measures the product wage in the informal sector. Substituting Eqs. (7) in (6) yields the firm's supply function:

$$Y_N^s = Y_N^s(\omega_N z), \quad Y_N^{s'} < 0. \tag{8}$$

2.3. Household

As indicated earlier, skilled and unskilled workers (all belonging to the same household) supply labor inelastically, and consume, in addition to the nontraded good produced in the informal sector, an imperfectly substitutable imported good whose price is fixed on world markets. Consumption decisions are assumed to follow a two-step process. First, the household determines the optimal level of total consumption, subject to an intertemporal budget constraint. Second, it allocates that amount between spending on home and imported goods, based on relative prices.

The household's discounted lifetime utility is given by

$$\int_0^\infty \frac{c^{1-\eta}}{1-\eta} e^{-\rho t} dt, \qquad \eta > 0, \eta \neq 1 \tag{9}$$

[8] As discussed by Agénor (1996, 2004), this feature of the labor market has been observed in many developing countries. Endogenizing the factors affecting the determination of public sector employment is beyond the scope of this paper. See Rodrik (1998) for a discussion of two alternative views, the rent-seeking hypothesis (which argues that governments tend to use public sector employment as an instrument for creating and allocating rents) and the risk-insurance hypothesis (which views public sector employment as an insurance device against undiversifiable risk).

where c denotes total consumption (measured in terms of exportables), ρ the rate of time preference (assumed constant), and $\sigma=1/\eta$ the intertemporal elasticity of substitution.

The household can borrow (with loans of infinite maturity) on world capital markets, at the rate i^*. Let D_H^* denote the foreign-currency value of the household's stock of debt. With the exchange rate constant over time, the flow budget constraint of the household can be written as

$$\dot{D}_H^* = i^* D_H^* + c + \tau - q, \tag{10}$$

where q is net factor income (defined below), i^* the cost of borrowing on the world capital market, and τ lump-sum taxes. Both q and τ are measured in terms of exportables.

The world capital market is imperfect, in the sense that the interest rate facing domestic borrowers is the sum of a risk-free rate, i_f^*, and a country-risk premium, which varies positively with the economy's total foreign debt, D^*:

$$i^* = i_f^* + \kappa(D^*), \tag{11}$$

where $\kappa' > 0$, and $\kappa'' > 0$.

In the first stage of the consumption decision process, the household treats q, i^* and τ as given, and maximizes Eq. (9) subject to Eq. (10), by choosing a sequence $\{c_t\}_{t=0}^{\infty}$. The optimality condition is the familiar Euler equation, relating the rate of change in consumption to the difference between the marginal cost of borrowing (given by Eq. (11)) and the discount rate:

$$\dot{c}/c = \sigma[i_f^* + \kappa(D^*) - \rho]. \tag{12}$$

Ruling out Ponzi games also requires imposing the transversality condition $\lim_{t\to\infty} (e^{-\rho t} D_H^*) = 0$.

In the second stage of the consumption decision process, the household follows the allocation rule[9]

$$c_N = \delta z c, \quad c_M = (1-\delta)c, \tag{13}$$

where c_N denotes purchases of the informal sector good, c_M expenditure on the imported good, and $0<\delta<1$. The appropriate cost-of-living index, P, can thus be defined as

$$P = P_N^{\delta} E^{1-\delta} = E z^{-\delta}. \tag{14}$$

Using Eqs. (5) and (8), net factor income q can be defined as

$$q = Q_E^s + z^{-1} Y_N^s + \omega_G n_G, \tag{15}$$

where ω_G is the real wage earned by government workers (measured in terms of the price of exportables). $\omega_G n_G$ is thus the public sector wage bill. In what follows ω_G is also assumed exogenous.

[9] As is well known, the allocation rule described in Eq. (13) is optimal if the sub-utility function in both goods is homogeneous of degree one. The constancy of expenditure shares results from the assumption that the sub-utility function is Cobb–Douglas.

2.4. The labor market

As indicated earlier, both the minimum wage paid to unskilled workers in the exportable sector and the wage earned by public sector employees are assumed fixed by the government. To see how the wage earned by skilled workers in the exportable sector is determined, let ω_S^c denote the *consumption* wage, that is, the skilled nominal wage deflated by the cost-of-living index. ω_S^c is assumed determined along the lines of the "monopoly union" approach (see, for instance, Booth, 1995). Specifically, ω_S^c is assumed set by a centralized labor union whose objective is to minimize a quadratic loss function that depends on deviations of employment and the consumption wage from their target levels, subject to the firm's labor demand schedule in the exportable sector. Thus, the union solves the following decision problem:

$$\min_{\omega_S^c} (\omega_S^c - \omega_S^{cT})^2 + v(n_S - n_S^T)^2, \qquad v>0, \tag{16}$$

subject to the condition $n_S=n_S^d$, where n_S^d is given by Eq. (3).[10] The quantities ω_S^{cT} and n_S^T measure the union's wage and employment targets, respectively, and are both assumed constant.[11] The parameter v reflects the relative importance that the union attaches to employment deviations, as opposed to wage deviations. As long as $n_S^d<n_S^T$, a trade-off will arise between the real wage and the level of employment, because the union's optimal outcome ($n_S=n_S^T$ and $\omega_S^c=\omega_S^{cT}$) would then be inconsistent with the labor demand schedule, which defines the profit-maximizing level of employment.

Given the definition of the price level given above (Eq. (14)), the product wage and the consumption wage are linked by the relation $\omega_S^c=z^\delta\omega_S$. Substituting this relation in Eq. (3), and maximizing with respect to ω_S^c the union's objective function (16) subject to Eq. (3)—with z taken as given—yields the first-order condition[12]

$$(\omega_S^c - \omega_S^{cT}) + v(n_S^d - n_S^T)\left(\frac{\partial n_S^d}{\partial \omega_S}\right) = 0,$$

which can be solved for the union's desired (and actual) consumption wage:

$$\omega_S^c = \frac{\omega_S^{cT}}{1 + v(\partial n_S^d/\partial \omega_S)^2} - \frac{v(\partial n_S^d/\partial p_G)(\partial n_S^d/\partial \omega_S)}{1 + v\left(\partial n_S^d/\partial \omega_S\right)^2} p_G. \tag{17}$$

where $n_S^T=0$ for simplicity.

[10] The assumption that deviations of employment and wages from their target values have symmetric effects on union preferences may not be warranted in practice but is adopted for simplicity.

[11] It could be assumed that the union's target wage is a weighted average of an exogenous wage level as well as the expected income of workers who are unable to find employment in the exportable sector. In the present framework, there is no job turnover in the public sector, unemployment benefits do not exist, and there are no barriers to entry in the informal sector. Consequently, the expected "outside" income is simply the going wage in the informal sector. However, here skilled workers always opt to remain unemployed if they cannot find work in the formal sector. Thus, there is no strong reason to assume that the union's target level should depend on the informal sector wage, although fairness considerations might be relevant (see Moene et al., 1993, p. 433).

[12] Partial derivatives are evaluated throughout at levels of the real exchange rate, z, and real wages, normalized to unity. A tilde over a variable is used to denote a steady-state value.

Eq. (17) indicates that the consumption wage set by the union is increasing in the target wage, and decreasing in the price of government services. An increase in p_G, for instance, lowers the demand for skilled labor and leads the union to reduce its desired wage. If the union cared only about real wages (v=0), the wage set for skilled workers would be maintained continuously in line with the target level, ω_S^{cT}. By contrast, the more the union cares about employment, the higher will be the effect of negative shocks to labor demand on wages. In particular, the higher v is, the larger will be the downward effect of an increase in p_G on the desired consumption wage. If $v \rightarrow \infty$, ω_S^c would be set so as to offset entirely the impact of the shock on skilled employment:

$$\left(\frac{\partial n_S^d}{\partial \omega_S}\right)\omega_S^c + \left(\frac{\partial n_S^d}{\partial p_G}\right)p_G = 0. \tag{18}$$

Because $\omega_S^c = z^{\delta}\omega_S$, the *product* wage is given by, with ω_S^{cT}=0 for simplicity:

$$\omega_S = z^{-\delta}\phi(p_G), \tag{19}$$

This equation implies that ω_S is negatively related to both the real exchange rate and the price of government services ($\phi' < 0$). It is also important to note that the elasticity of the product wage to changes in the real exchange rate does not depend on the relative weight attached by the union to wage deviations in its utility function. It depends only on δ, the share of private consumption expenditure allocated to informal sector goods, or equivalently here, one minus the degree of openness. As argued earlier, $|d\phi'/dv| > 0$, so that the greater the union's concern with employment, the larger will be the downward movement in the product wage induced by a hike in public sector prices.

Consider now the informal labor market. It absorbs all unskilled workers who do not queue up for employment in the formal sector. Wages adjust continuously to equilibrate supply and demand. Labor demand is derived from profit maximization and is given by Eq. (7). The supply of unskilled workers in the formal sector, n_U^s, is predetermined at any moment in time—and so is the supply of unskilled labor in the informal sector, because the total number of unskilled workers in the economy, n_U^p, is assumed constant. In line with the "luxury unemployment" hypothesis (see Horton et al., 1994), skilled workers who are unable to find a job in the formal sector opt to remain unemployed rather than seek employment in the informal economy.[13]

The equilibrium condition of the labor market in the informal economy is thus given by

$$n_U^p - n_U^s = n_N^d(\omega_N z). \tag{20}$$

Solving this equation yields:

$$\omega_N = \upsilon\left(\bar{z}, \overset{+s}{n_U}\right), \qquad \upsilon_z = -1, \tag{21}$$

[13] Evidence supporting this hypothesis is provided also by Hirata and Humphrey (1991) for Brazil and Banerjee and Bucci (1995) for India. Agénor (1996) provides a review of the evidence on skilled unemployment in developing countries. In general, whether skilled workers who are not successful in applying for a job in the formal sector decide to seek employment (as unskilled workers) in the informal economy depends on factors such as the efficiency of on-the-job search activities, demotivation effects, and the degree of support from relatives.

which indicates that a depreciation of the real exchange rate has a negative effect on the market-clearing wage (which is such that the product wage remains constant), whereas an increase in the number of workers seeking employment in the formal economy has a positive effect. Thus, for n_U^s given, a real exchange rate depreciation has no effect on labor demand and output in the informal sector. This result is important to understand the short-run dynamics of policy shocks, as discussed later. With n_U^s constant on impact, any movement in z induced by a given shock generates an offsetting movement in ω_N.[14]

As a result of relocation and congestion costs, mobility of the unskilled labor force between the formal and the informal sectors is imperfect. Migration flows are determined by expected income opportunities, along the lines of Harris and Todaro (1970).[15] Specifically, the supply of unskilled workers in the formal sector is assumed to change gradually over time as a function of the expected wage differential across sectors. Wage and employment prospects are formed on the basis of prevailing conditions in the labor market. Because there is no job turnover in the public sector, the expected wage in the formal economy is equal to the minimum wage weighted by the probability of being hired in the exportable sector. Assuming that hiring in that sector is random, this probability can be approximated by the ratio of currently employed workers to those seeking employment, $n_U^d/(n_U^s - n_G)$. The expected wage in the informal economy is simply the going wage, because there are no barriers to entry in that sector. Thus, the supply of unskilled workers in the formal sector evolves over time according to

$$\dot{n}_U^s = \beta\left\{\frac{\omega_m n_U^d}{n_U^s - n_G} - \omega_N\right\}, \qquad \beta>0, \tag{22}$$

where β denotes the speed of adjustment. The absence of on-the-job search in the informal sector in the present setup can be justified in a variety of ways. An important consideration is the existence of informational inefficiencies, which may result from the absence of institutions capable of processing and providing in a timely manner relevant information on job opportunities to potential applicants. As a result, search activities for unskilled workers in the formal sector may require, literally speaking, waiting for job offers at factory gates.[16]

2.5. The market for home goods

The equilibrium condition of the market for informal sector goods can be written as

$$Y_N^s = c_N,$$

[14] To ensure that all workers are willing to look for employment in the formal sector first (and thus avoid corner solutions), both the minimum wage and the skilled wage set by the trade union are assumed to be strictly greater than the informal sector wage.

[15] See Bhattacharya (1993) for a review of the Harris–Todaro model and Stark (1991) for a more critical view. Note that in the present setup, the Harris–Todaro framework is used to explain migration flows between the (urban) informal sector and the (urban) formal sector, rather than migration between the rural and the urban sectors.

[16] Evidence of queuing by informal sector workers for formal sector jobs as hypothesized by the Harris–Todaro mechanism is provided for instance by Maloney (1997), in a study of labor market transitions in Mexico during the period 1987–1993.

or, equivalently, using Eqs. (8) and (13):

$$Y_{\mathrm{N}}^{\mathrm{s}}(\omega_{\mathrm{N}} z) = \delta z c. \tag{23}$$

Solving condition (23) for the equilibrium real exchange rate yields

$$z = z(\bar{c}, \bar{\omega}_{\mathrm{N}}), \quad |z_{\omega_{\mathrm{N}}}|<1, \tag{24}$$

where $z_c=\delta/(Y_{\mathrm{N}}^{\mathrm{s}'}-\delta\tilde{c})$ and $z_{\omega_{\mathrm{N}}}=-Y_{\mathrm{N}}^{\mathrm{s}'}/(Y_{\mathrm{N}}^{\mathrm{s}'}-\delta\tilde{c})$. This equation shows that an increase in ω_{N} (for c given), by raising the product wage and lowering the supply of goods in the informal sector, leads to a less-than-proportional appreciation (due to the demand side effect) of the real exchange rate. An increase in private expenditure also leads to a real appreciation.

Substituting Eq. (21) for ω_{N} in the above equation yields

$$z = \theta\left(\bar{c}, \bar{n}_{\mathrm{U}}^{\mathrm{s}}\right), \tag{25}$$

where $\theta_c=z_c/(1-z_{\omega_{\mathrm{N}}}\upsilon_z)$, and $\theta_{n_{\mathrm{U}}^{\mathrm{s}}}=z_{\omega_{\mathrm{N}}}\upsilon n_{\mathrm{U}}^{\mathrm{s}}/(1-z_{\omega_{\mathrm{N}}}\upsilon_z)$.[17]

Eq. (25) shows that an increase in the size of the unskilled labor force seeking employment in the formal economy, by lowering labor supply in the informal sector and raising wages there, lowers output and creates excess demand for informal sector goods—thereby requiring an appreciation of the real exchange rate to maintain market equilibrium.

2.6. Government

In addition to producing services that are used as intermediate inputs in the production of exportable goods, the government fixes the real price (measured in terms of the domestic price of exportable goods) of its output, pays salaries to public sector workers, and services its foreign debt, D_{G}^*. It derives revenue from the sale of public sector services and by levying lump-sum taxes on the household, τ. It finances its deficit by borrowing on world capital markets, also at the rate i^*:

$$\dot{D}_{\mathrm{G}}^* = i^* D_{\mathrm{G}}^* + \omega_{\mathrm{G}} n_{\mathrm{G}} - \alpha^{-1} p_{\mathrm{G}} Y_{\mathrm{E}}^{\mathrm{s}} - \tau. \tag{26}$$

3. Dynamic form

To derive the dynamic form of the model, the first step is to note that by adding the household and government budget constraints (Eqs. (10) and (26)), and substituting in the resulting expression the value of q, given by Eq. (15), yields

$$\dot{D}^* = i^* D^* + c - z^{-1} Y_{\mathrm{N}}^{\mathrm{s}} - Y_{\mathrm{E}}^{\mathrm{s}},$$

where $D^*=D_{\mathrm{H}}^*+D_{\mathrm{G}}^*$ is the economy's total stock of debt. By definition, $c=c_{\mathrm{M}}+z^{-1}c_{\mathrm{N}}$. Substituting this result in the previous equation yields

$$\dot{D}^* = i^* D^* + c_{\mathrm{M}} + z^{-1}\left(c_{\mathrm{N}} - Y_{\mathrm{N}}^{\mathrm{s}}\right) - Y_{\mathrm{E}}^{\mathrm{s}}.$$

[17] Note that, because $\upsilon_z=-1$ and $|z_{\omega_{\mathrm{N}}}|<1$ from Eq. (24), $1-z_{\omega_{\mathrm{N}}}\upsilon_z>0$.

Using Eqs. (4), (13) and (23), this expression becomes

$$\dot{D}^* = i^* D^* + (1-\delta)c - Y_{\mathrm{E}}^{\mathrm{s}}(\omega_{\mathrm{S}}; p_{\mathrm{G}}). \tag{27}$$

The next step is to eliminate ω_{S} from the system. Substituting Eqs. (25) in (19) yields

$$\omega_{\mathrm{S}} = \Lambda\left(\overset{+}{c}, \overset{+}{n_{\mathrm{U}}^{\mathrm{s}}}; \bar{p}_{\mathrm{G}}\right), \tag{28}$$

with $\Lambda_x = -\delta\theta_x\tilde{\omega}_{\mathrm{S}}$, for $x=c$, $n_{\mathrm{U}}^{\mathrm{s}}$, and $\Lambda_{p_{\mathrm{G}}}=\phi'$. In turn, this result can be substituted in the previous equation to give

$$\dot{D}^* = \Psi\left(\overset{+}{c}, \overset{+}{n_{\mathrm{U}}^{\mathrm{s}}}, \overset{+}{D^*}; \overset{?}{p_{\mathrm{G}}}\right), \tag{29}$$

where[18]

$$\Psi_c = (1-\delta) - \Lambda_c(\partial Y_{\mathrm{E}}^{\mathrm{s}}/\partial\omega_{\mathrm{S}}), \quad \Psi_{n_{\mathrm{U}}^{\mathrm{s}}} = -\Lambda_{n_{\mathrm{U}}^{\mathrm{s}}}(\partial Y_{\mathrm{E}}^{\mathrm{s}}/\partial\omega_{\mathrm{S}}),$$
$$\Psi_{D^*} = i_{\mathrm{f}}^* + \kappa + \kappa'\tilde{D}^*, \quad \Psi_{p_{\mathrm{G}}} = -\left[\phi'\left(\partial Y_{\mathrm{E}}^{\mathrm{s}}/\partial\omega_{\mathrm{S}}\right) + \left(\partial Y_{\mathrm{E}}^{\mathrm{s}}/\partial p_{\mathrm{G}}\right)\right].$$

An increase in the price of government services has an ambiguous effect on the demand for skilled and unskilled workers, the supply of exportables, and thus the current account. On the one hand, it has a direct negative effect on labor demand and output in the exportable sector; on the other, it lowers the wage demanded by the union, which operates in the opposite direction. In the "standard" case in which the partial equilibrium effect dominates the general equilibrium effect, $\Psi_{p_{\mathrm{G}}}>0$. However, if the union cares sufficiently about employment levels (so that v is sufficiently large), the reduction in the desired wage will be large, and the net, overall effect of p_{G} on output of exportables may be positive, the current account may improve, and foreign debt may fall ($\Psi_{p_{\mathrm{G}}}<0$). This condition is given by

$$\phi'\left(\frac{\partial Y_{\mathrm{E}}^{\mathrm{s}}}{\partial\omega_{\mathrm{S}}}\right) + \frac{\partial Y_{\mathrm{E}}^{\mathrm{s}}}{\partial p_{\mathrm{G}}} > 0. \tag{30}$$

This result can be summarized in the following proposition:

Proposition 1. *Given that $|d\phi'/dv|>0$, if the union in the formal sector cares sufficiently about skilled employment, that is, if condition (30) is satisfied, the net effect of a rise in the price of government services is an increase in output of exportables and a reduction in foreign borrowing.*

Note that even in the limit case in which the union cares only about employment ($v\rightarrow\infty$), and lowers the wage sufficiently to stabilize *skilled* employment completely (as implied by Eq. (18)), output of exportables may still increase; the reason is that because of gross complementarity between labor inputs, the drop in the skilled wage stimulates the demand for *unskilled* labor—so much so, again, that it may offset the contractionary effect of the rise in p_{G}. Note also that, following an increase in p_{G}, the effect on *skilled* employment cannot be positive; it is at best zero (when $v\rightarrow\infty$), as implied by Eq. (18).

[18] Note that $\Psi_{n_{\mathrm{U}}^{\mathrm{s}}}\rightarrow 0$ when $\delta\rightarrow 0$, that is, when the degree of openness is very high, because then $\Lambda_{n_{\mathrm{U}}^{\mathrm{s}}}\rightarrow 0$.

However, as discussed below, given that ω_S is also a function of the real exchange rate (as shown in Eq. (19)), the general equilibrium effect of a rise in p_G on skilled employment may indeed be positive, if the exchange rate depreciates to lower ω_S sufficiently.

Eq. (12) can be written as

$$\dot{c}/c = \sigma\left[i_f^* + \kappa(D^*) - \rho\right] = G(D^*), \tag{31}$$

where $G' = \sigma\kappa' > 0$.

Consider now the Harris–Todaro migration Eq. (22), which can be rewritten as, using Eqs. (3) and (21):

$$\dot{n}_U^s = \beta\left[\frac{\omega_m n_U^d(\omega_S; p_G)}{n_U^s - n_G} - \upsilon(z, n_U^s)\right].$$

Using Eqs. (24) and (28) to eliminate z and ω_S yields

$$\dot{n}_U^s = \beta H\left(\bar{c}, \bar{n}_U^s; \overset{?}{p_G}\right), \tag{32}$$

where[19]

$$H_c = \frac{\omega_m(\partial n_U^d/\partial\omega_S)\Lambda_c}{\tilde{n}_U^s - n_G} - \upsilon_z\theta_c, H_{p_G} = \frac{\omega_m[\phi'(\partial n_U^d/\partial\omega_S) + (\partial n_U^d/\partial p_G)]}{\tilde{n}_U^s - n_G},$$

$$H_{n_U^s} = \frac{\omega_m(\partial n_U^d/\partial\omega_S)\Lambda_{n_U^s}}{\tilde{n}_U^s - n_G} - \frac{\omega_m\tilde{n}_U^d}{(\tilde{n}_U^s - n_G)^2} - \upsilon_z\theta_{n_U^s} - \upsilon_{n_U^s}.$$

Eq. (32) shows that an increase in n_U^s lowers migration flows to the formal economy. There are three effects at play here; the first is partial equilibrium in nature, whereas the other two are general equilibrium in nature. First, there is an *employment prospect* effect. The increase in n_U^s raises the number of job seekers in the exportable sector; at a given level of labor demand in that sector, the employment probability falls. This effect tends to lower migration flows. Second, there is a *labor supply* effect. The increase in n_U^s lowers the number of workers seeking employment in the informal sector, which tends to raise wages (and thus the opportunity cost of queuing) in that sector. This effect tends also to lower migration flows. Third, there is a *relative price* effect. The increase in n_U^s, by raising informal sector wages, dampens output in that sector—requiring a real exchange rate appreciation to maintain equilibrium of the market for informal sector goods. The real appreciation, in turn, has two effects. On the one hand, it raises the informal sector wage (thereby reinforcing the previous effect), and tends to reduce migration flows to the formal sector; on the other, it tends to increase the skilled product wage. This increase lowers the demand for unskilled labor (as a result of gross factor complementarity), which tends to reduce the expected wage in the exportable sector and thus migration flows to the formal economy.

[19] Again, note that $H_c \to 0$ when $\delta \to 0$, because then θ_c, $\Lambda_c \to 0$.

An increase in the real price of government services, in general, has an ambiguous effect on migration flows—essentially because the net effect on the demand for unskilled labor (as noted earlier) cannot be signed a priori. The direct effect of an increase in p_G, because it reduces the demand for unskilled labor in the exportable sector, n_U^d (and thus the probability of employment in that sector), is clearly negative. At the same time, however, the increase in p_G lowers the wage demanded by the union and thus the product wage for skilled workers in the exportable sector—thereby raising (as a result of the complementarity effect) the demand for unskilled labor in the formal economy. If the weight attached by the union to employment deviations is low (that is, if v is low), the direct effect will dominate and $H_{p_G}<0$. Otherwise, as long as $\phi'(\partial n_U^d/\partial \omega_S)+\partial n_U^d/\partial p_G>0$, then $H_{p_G}>0$. This condition on ϕ' is in fact equivalent to Eq. (30), because $\partial Y_E^s/\partial x=(\partial Y_E^s/\partial n_U^d)(\partial n_U^d/\partial x)$, for $x=\omega_S,p_G$, and $\partial Y_E^s/\partial n_U^d>0$. Thus, this result can be summarized in the following proposition:

Proposition 2. *If the union in the formal sector cares sufficiently about skilled employment, that is, if condition (30) is satisfied, the net effect of a rise in the price of government services is an increase in the flow supply of unskilled labor in the formal sector.*

Eqs. (29), (31) and (32 represent the compact dynamic form of the model. As shown in Appendix A, these equations can be written as a system of first-order differential equations in c, D^*, and n_U^s. c is a jump variable, whereas D^* and n_U^s can change only gradually over time. Stability of this system, as also shown in the Appendix A, requires that the speed of adjustment of the unskilled labor force across sectors, β, be sufficiently large. This condition (which will be assumed to hold in what follows) accords well with the evidence available for a number of low-income developing countries, because unskilled workers cannot afford to remain openly unemployed for long, as a result of the lack of assets to draw on and the absence of a government-provided safety net.[20]

In the long-run equilibrium, with $\dot{c}=0$, Eq. (31) implies that

$$\tilde{D}^* = \left(\rho - i_f^*\right)/\kappa' , \tag{33}$$

which indicates that the more impatient domestic agents are (the higher ρ is), the higher foreign borrowing will be. Setting $\dot{D}^*=0$ in Eq. (27) and using Eq. (28) implies that in the steady state, the current account must be in equilibrium:

$$i^*\tilde{D}^* + (1-\delta)\tilde{c} - Y_E^s\left[\omega_S\left(\tilde{c}, \tilde{n}_U^s; p_G\right); p_G\right] = 0. \tag{34}$$

Finally, Eq. (22) implies that in the steady state, with $\dot{n}_U^s=0$, the ratio of wages earned by unskilled workers in the formal and informal sectors (hereafter the unskilled wage ratio) is equal to the inverse of the employment ratio of that category of labor in the private formal economy:

$$\omega_m/\tilde{\omega}_N = \left(\tilde{n}_U^s - n_G\right)/\tilde{n}_U^d. \tag{35}$$

[20] Evidence of a relatively high degree of mobility across the informal and formal sectors is provided, for instance, by Funkhauser (1997) for El Salvador.

This condition shows that, as long as the minimum wage is higher than the informal sector wage ($\omega_m > \tilde{\omega}_N$), unskilled unemployment will emerge in equilibrium, because in this case $\tilde{n}_U^s > \tilde{n}_U^d + n_G$. As noted earlier, in the present setting the condition ω_m, $\tilde{\omega}_S > \tilde{\omega}_N$ is in fact necessary to avoid a corner solution, that is, a situation in which no worker has an incentive to seek employment in the formal economy.

Analyzing the transitional dynamics of the full system in c, n_U^s and D^* to the long-run equilibrium is in general difficult. However, the adjustment process can be studied graphically by using a result due to Dixit (1980). As shown in Appendix A, the jump variable c can be eliminated from the dynamic system, thereby allowing an analysis of the adjustment process through the use of a phase diagram in $n_U^s - D^*$ space. This diagram and the steady-state equilibrium are shown in the right-hand panel of Fig. 1. The locus D^*D^* gives the combinations of n_U^s and D^* for which external debt remains constant, whereas the locus NN depicts the combinations of these variables for which the supply of unskilled labor in the formal sector does not change over time. The steady-state equilibrium is obtained at point E. The left-hand panel shows the relationship between c and D^* implied by Eq. (31) with $\dot{c}=0$. The locus shown in that panel is horizontal, because changes in the rate of growth of consumption are independent of the level of private expenditure; it only depends on the level of foreign debt, through its impact on the risk premium.

Suppose that the initial position of the economy is at point A. The adjustment process to the steady-state equilibrium entails either a monotonic reduction in the level of external debt (or, equivalently, persistent current account surpluses) associated with an increase in the supply of unskilled labor in the formal sector (see path AE), or a process through which a sequence of current account surpluses is followed by a sequence of external deficits (see path ABE). In the first case, private consumption increases throughout the adjustment period (see path FG), because the anticipated reduction in foreign debt, by

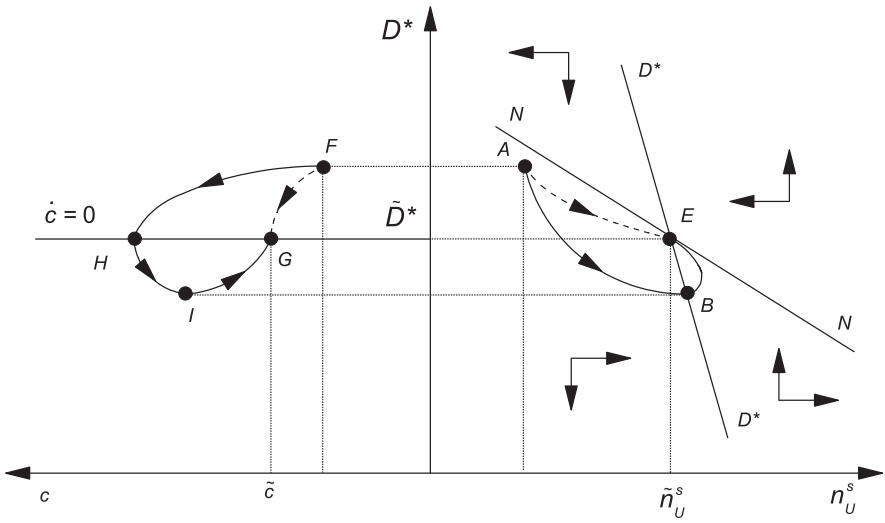

Fig. 1. Transitional dynamics and steady-state equilibrium.

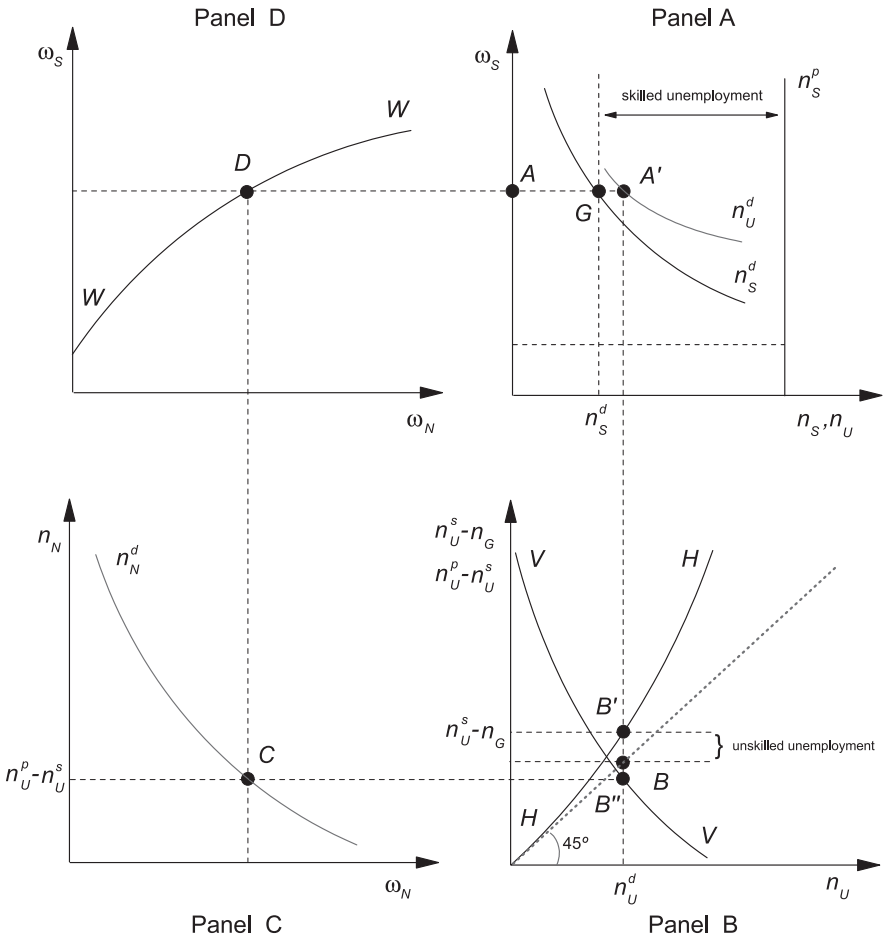

Fig. 2. Labor market equilibrium and unemployment.

lowering the cost of borrowing abroad, leads agents to bring spending forward in time. In the second case, consumption increases at first and falls subsequently (see path FHIG), because during the second phase of adjustment households shift spending toward the future. Consumption starts increasing before the current account switches from a surplus to a deficit (at point B), as agents anticipate the future increase in the cost of borrowing associated with the rising level of debt (segment BE).[21] Persistent cycles may also emerge, as the adjustment path may cross NN after reaching point B. The path AE corresponds to the case where the speed of adjustment of the supply of unskilled labor in the formal sector, β, and the elasticity of the premium with respect to foreign debt, $\kappa' \tilde{D}^*/\kappa$, are high.

[21] Of course, during the first (second) phase, the rise (fall) in output of exportables must exceed the increase (fall) in consumption, in order for the current account to generate a surplus (deficit).

As shown in Appendix A, a sufficiently high value of β is indeed necessary for the model to be stable.

A partial equilibrium depiction of the long-run equilibrium position of the labor market is presented in Fig. 2. Panel A depicts the demand functions for labor in the formal sector. The demand curve for skilled labor, n_S^d, is downward-sloping, because it is negatively related to ω_S, the wage earned by skilled workers. The demand curve for unskilled labor in the exportable sector, n_U^d, is also downward-sloping, because skilled and unskilled workers are gross complements. From Eq. (35), the long-run supply of unskilled workers in the formal sector, net of public sector employment, $n_U^s - n_G$, is given by the demand for unskilled labor in the exportable sector, AA′, times the unskilled wage ratio, $\omega_m \tilde{n}_U^d / \tilde{\omega}_N$. This relationship is depicted in Panel B by curve HH, which has a positive slope that is greater than unity, because (as noted earlier) the unskilled wage ratio must be greater than unity in equilibrium. Curve VV is given by $n_U^p - n_U^s$; it is thus a linear transformation of HH. It determines the supply of labor (and thus actual employment) in the informal economy (point B″). Given the labor demand curve in the informal sector n_N^d, the market-clearing wage is determined at point C in Panel C.[22] The positive relationship between the skilled wage and the informal sector wage implied (for c given) by Eqs. (19) and (24), $\omega_S = z(\omega_N, c)^{-\delta} \omega_S^c(p_G)$, is displayed as curve WW in Panel D. Skilled unemployment is given in Panel A by the distance between the supply of skilled labor n_S^p and the equilibrium point on the demand curve n_S^d (point G). The vertical distance between points B (located on the 45° line) and B′ (located on HH) in Panel B gives unskilled unemployment. Thus, unemployment of both categories of labor ("quasi-voluntary" unemployment for skilled workers, and "wait" unemployment for unskilled workers) prevails in equilibrium, despite the existence of wage flexibility in the informal sector.[23]

4. Increase in public sector prices

The above framework can be used to study the impact and steady-state effects of a variety of fiscal policy instruments that have often been part of both stabilization and structural adjustment programs implemented in developing countries. For the reasons highlighted in Introduction, in what follows the analysis confines itself to a permanent increase in the price of government services.

4.1. Steady-state effects

Consider first the long-run effects of an increase in p_G. The first noticeable result is that such a shock, as implied by Eq. (33), has no effect on the economy's steady-state level of

[22] From Eqs. (7) and (21), n_N^d is a function of z and n_U^s. From the equilibrium condition of the market for nontraded goods (Eq. (24)), z is negatively related to ω_N. Substituting this last result in Eq. (7) shows that the n_N^d curve in Panel C is downward-sloping.

[23] Because there is no unemployment benefit scheme in the present framework, unemployed workers (skilled and unskilled) are implicitly assumed to either turn to a subsistence activity (home production) or to rely on other members of the household for their survival.

foreign debt, $\tilde{D}^*$. Second, using Eqs. (34) and (35), it can be shown that the net effect on consumption and labor supply in the formal economy is in general ambiguous. As formally derived in Appendix A, if the degree of openness is sufficiently high (that is, if δ is small), the impact on consumption and the supply of labor to the formal sector depends on whether the direct effect of an increase in p_G on the supply of exportables and the demand for labor in that sector dominates or not the indirect effect resulting from the reduction in the skilled wage. In the first case, that is, with $\Psi_{p_G}>0$ (and also $H_{p_G}<0$), both consumption and labor supply in the formal economy fall. If, on the contrary, $\Psi_{p_G}<0$, in which case condition (30) holds and $H_{p_G}>0$, both variables increase.

Consider first the case where the direct, adverse effect of a rise in p_G on output dominates. The increase in p_G (at the initial level of wages) tends to lower the supply of exportables and the demand for both skilled and unskilled labor in the exportable sector. From Eq. (34), and as shown formally in Appendix A, because $\tilde{D}^*$ does not change, consumption must also fall to maintain current account equilibrium, at the initial levels of the real exchange rate and the supply of unskilled labor in the formal economy. The real exchange rate must therefore depreciate to maintain equilibrium in the market for informal sector goods. At the initial level of labor supply in the informal sector, the real depreciation requires a fall in wages in that sector to maintain labor market equilibrium. At the same time, the direct reduction in the demand for skilled labor in the exportable sector induced by the increase in the price of government services leads the union to lower the desired *consumption* skilled wage; this, together with the real depreciation, tends to exert downward pressure on the *product* skilled wage and stimulate demand for all labor categories. Indeed, from Eq. (19), the general equilibrium effect on ω_S is given by

$$\frac{d\tilde{\omega}_S}{dp_G} = \phi' - \delta\left(\frac{d\tilde{z}}{dp_G}\right), \tag{36}$$

which is unambiguously negative because $\phi'<0$ and $d\tilde{z}/dp_G>0$.

Nevertheless, under the assumptions given above, the net effect on total demand for labor in the exportable sector is negative. Thus, output of exportables falls, proportionally to consumption, because from Eq. (34), together with $d\tilde{D}^*/dp_G=0$,

$$\frac{d\tilde{c}}{dp_G} = (1-\delta)^{-1}\frac{d\tilde{Y}_E^s}{dp_G}.$$

From Eq. (35), the supply of unskilled labor in the formal economy is given by $\tilde{n}_U^s=n_G+\omega_m\tilde{n}_U^d/\tilde{\omega}_N$. Although the fall in informal sector wages tends to increase the unskilled wage ratio, the fall in the demand for unskilled labor in the exportable sector, $\tilde{n}_U^d$, is sufficient to lead to a reduction in the supply of that category of labor in the formal economy. Intuitively, the drop in the employment probability in the formal sector makes looking for a job there less attractive, even though wages in the informal sector have fallen. As shown in Appendix A, the unskilled unemployment rate increases unambiguously in the steady state; thus, the fall in labor demand in the exportables sector exceeds the reduction in labor supply to the formal economy. As long as v is finite, the skilled unemployment rate also increases, because the demand for labor falls and the supply of labor is constant. Fiscal adjustment therefore exerts contractionary long-term effects on consumption, as well as activity and employment in the formal economy.

Consider now the case where the general equilibrium effect of the increase in p_G dominates, so that output of exportables increases. As indicated earlier, this would be the case if the union cares sufficiently about employment, that is, if condition (30) holds. In that case, the increase in p_G would tend to raise the demand for all categories of labor in the formal sector, as a result of the fall in ω_S. Again, because $\tilde{D}^*$ does not change, private consumption must move in the same direction as output of exportables to maintain current account equilibrium—that is, consumption must now increase. The effects described earlier therefore operate in the reverse direction—the real exchange rate must appreciate, and informal sector wages must increase. This tends to draw unskilled labor into the informal economy, but at the same time, the increase in the probability of employment in the formal sector tends to provide greater incentives to queue for jobs there; as shown formally in Appendix A, the net effect on the number of job seekers in the formal sector is positive. The consumption wage falls and if δ is small (that is, if the economy is sufficiently open), the product wage falls also, as implied by Eq. (36). Thus, unemployment of both categories of workers falls in the new long-run equilibrium. These results can be summarized in the form of the following proposition:

Proposition 3. *If the union in the formal sector cares sufficiently about skilled employment, so that Eq. (30) holds, and if the economy is sufficiently open, the general equilibrium effect of a rise in price of government services is to lower skilled and unskilled unemployment rates in the steady-state.*

4.2. Transitional dynamics

Consider now the transitional effects of an increase in p_G. As shown in Appendix A, if the economy is sufficiently open, the direction of the impact effect on consumption is the same as the long-run effect. From the equilibrium condition of the market for home goods (Eq. (25)), and because n_U^s cannot change instantaneously, the real exchange rate must move in opposite direction to consumption. From the informal labor market equilibrium condition (Eq. (21)), ω_N and z must also move also in opposite directions, and by exactly the same proportion, because the supply of labor in the informal sector (given by $n_U^p - n_U^s$) cannot change on impact either. Output and employment in the informal sector therefore remain constant on impact. From Eq. (28), the impact effect on the skilled wage is always negative if the economy is sufficiently open, that is, if δ is small (because then the direct, adverse effect of p_G always dominates), and therefore output of exportables may either increase or fall on impact, depending on whether Eq. (30) holds or not. By implication, whether the current account, $\dot{D}_0^*$, improves or deteriorates on impact cannot be ascertained a priori, despite the fact that $dD_0^*/dp_G=0$.

Despite these ambiguities, some other qualitative features of the transitional dynamics are worth highlighting.[24] Because $d\tilde{D}^*/dp_G=0$, current account surpluses (or deficits) must be offset eventually by movements in the opposite direction. Thus, the adjustment process

[24] As noted earlier, the transitional dynamics depend significantly on both the speed of adjustment of the unskilled labor force between sectors, and the elasticity of the risk premium with respect to foreign debt.

over time must entail non-monotonic movements in foreign debt. By implication, changes in other variables will also display non-monotonic behavior. Consider, for instance, the case where the current account moves into surplus on impact ($\dot{D}_0^*<0$), as a result of a fall in consumption and a less-than-proportional drop in output of exportables. The real exchange rate therefore depreciates initially. Over time, the fall in unskilled employment in the formal sector leads to a reduction in the probability of finding a job there, thereby reducing the expected wage in the formal sector at the initial level of ω_N, and ensuring that migration flows toward the formal sector are negative ($\dot{n}_U^s<0$). This puts downward pressure on informal sector wages. During the first phase of the adjustment process, the current account remains in surplus and the economy's foreign debt continues to fall. Because the increase in the supply of labor in the informal sector continues to lower wages there, and because the real exchange rate continues to depreciate (as a result of the fall in private consumption), the skilled wage continues to fall as well; and although initially this positive effect on output of exportables is outweighed by the increase in p_G, over time it tends to raise production in the exportable sector. At the same time, the reduction in the stock of foreign debt during the first phase of adjustment tends to lower the risk premium, and thus the cost of borrowing—leading agents to increase consumption. This increase in private spending tends to gradually exceed the rise in output of exportables, and the trade and current account surpluses begin to fall. During the second phase of the adjustment process, the current account moves into deficit. The stock of debt starts to increase (with labor supply in the formal sector continuing to fall) and continues to do so until the economy reaches its new long-run equilibrium position-characterized by the same level of foreign debt as in the original steady state, and a reduction in the supply of unskilled labor in the formal sector.

5. Discussion

How general are the results established in the above propositions? To answer this question, it is first important to note that some of the assumptions underlying the analysis serve mainly to enhance tractability. Consider, for instance, the assumption that no substitution can take place between government services, on the one hand, and the composite bundle of labor services, on the other, neither in the short run nor in the long run. The implication is that the adverse effects of an increase in the domestic price of government services are magnified, compared to a situation where some degree of substitutability between factors is allowed. However, the absence of substitutability between government services and private inputs is quite appropriate here, given the time frame of the analysis and the (implicit) assumption of a constant capital stock. Moreover, using a more general production function, while at the same time assuming a low (short-run) elasticity of substitution between each labor category and government services, would yield results qualitatively similar to those obtained here.

It was also assumed that the public sector does not employ skilled workers, and that the minimum wage is fully indexed on the price of exportables rather than the overall price level. The former assumption can easily be dispensed of. The second implies that the analysis abstracted from the supply-side effects induced by the impact of changes in the

relative price of exportables in terms of the consumption basket on the cost of unskilled labor in the formal economy. Clearly, this assumption is not entirely innocuous, because (as shown earlier) the ratio of unskilled workers' wages in the formal and informal sectors determines the sectoral allocation of unskilled labor in the steady-state and the equilibrium unemployment rate. Accounting for these effects, however, would make the analysis more complex with little additional insight.

Similarly, instead of focusing on a "monopoly union" setting, the analysis could consider bargaining between firms and the union over wages, with firms setting employment (the so-called "right to manage" model), without affecting qualitatively the results discussed earlier.[25] The same conclusion would hold if the country risk premium, κ, was assumed to depend not only on the economy's total foreign debt, D^*, but on other variables as well. For instance, following Murphy (1991), the ratio of debt to output of exportables, D^*/Y_E^s, could be used as a determinant of the risk premium. Alternatively, following Agénor and Aizenman (1999) and Agénor and Santaella (1998), the steady-state ratio of traded-to-nontraded output could be introduced in addition to the level of foreign debt. The latter specification captures the idea that the world interest rate faced by a small country also depends inversely on its potential capacity to repay, which in turn depends on the economy's ability to produce traded goods as opposed to nontraded goods in the long run. Both extensions, however, would make the analysis more involved with little additional insight. The important point is that assuming an endogenous foreign interest rate simplifies the analysis of the stability properties of the model and the uniqueness of its steady state.[26]

By contrast, there are two fundamental assumptions that underlie the results summarized in the above propositions. The first is that the union representing skilled workers in the formal sector is concerned about both wages and employment; the second is that the degree of openness must be sufficiently high. The first assumption results from the fact that $\phi' = \partial \omega_S / \partial p_G$ is negative, and that $|d\phi'/dv| > 0$. Thus, the weight attached to employment by the union, v, can always be made sufficiently high to ensure that the net effect of a rise in the price of government services (holding consumption and unskilled labor supply in the formal sector constant) is an increase in output of exportables, as implied by Eq. (30), as a result of gross complementarity between labor inputs. The assumption that unions care about both wages and employment is fairly general, and has been used extensively in the relevant literature, as discussed for instance by Layard et al. (1991) and Booth (1995), and in recent studies such in the work of Imoto (2003). Of course, showing that the union in the formal sector cares *sufficiently* about skilled employment to ensure that Eq. (30) holds is a different matter. This is actually an important testable implication of the model.

[25] Considering a framework in which firms and unions bargain directly over both wages and the level of employment would be more involved. As shown by Creedy and McDonald (1991), for wage determination, it does not make much difference whether bargaining is over wages only, or over wages and employment. In addition, as is well known (see, for instance, Booth, 1995), the equilibrium outcome in the latter case would not necessarily be consistent with firms being on their labor demand schedule.

[26] With a constant world interest rate, the steady state would depend on initial conditions; in that case, a stable trajectory would exist, but the steady state toward which the economy evolves would depend on where it starts. See Turnovsky and Sen (1991) for a further discussion of this "hysterisis" property.

In addition, a condition similar to Eq. (30) can be derived from a framework in which firms set wages based on efficiency considerations, as for instance in the woks of Agénor (2001, 2002) and Agénor and Aizenman (1999). The key assumption in that context is that unemployment must act as a "discipline device", in the spirit of Shapiro and Stiglitz (1984). Consider for instance the case where, as in Agénor (2002), the level of effort of skilled workers varies not only with relative wages, but also inversely with the level of unemployment. Put differently, workers are more productive when the probability of finding a job is low. By implication, because unemployment is inversely related to labor demand, the optimal wage set by profit—maximizing firms will be positively related to labor demand. Thus, the direct effect of a rise in the price of government services, to the extent that it reduces labor demand, is a fall in skilled wages—which therefore play an offsetting role similar to the one highlighted earlier. As long as the impact of unemployment on the level of effort is sufficiently strong, output of exportables may increase.

A similar result could be obtained in a framework in which efficiency-wage considerations stem from the existence of high turnover costs, as for instance in the work of Agénor (2001). Suppose that the propensity to quit by skilled workers is related inversely to the prevailing unemployment rate (and thus positively to labor demand). A reduction in the demand for skilled labor induced by a hike in the price of government services, by putting upward pressure on unemployment, may well lower the quit rate and reduce the skilled wage sufficiently to end up, on net, increasing demand for all categories of labor and stimulating output of exportables. Once again, the general equilibrium effect may dominate the partial equilibrium effect. In both cases, of course, it is the individual's "preferences" (the form of the quit function, or the particular shape of the effort function) that matter, rather than the preferences of a union. But the results are qualitatively the same.

Consider now the second assumption, which is that the degree of openness must be sufficiently large. The reason for it is that it is the consumer wage, not the product wage, that enters in the union's preferences. In an open economy, this distinction matters because the former depends on relative prices, or the real exchange rate. The degree of openness in the model plays an important role, because it determines the general equilibrium effect of p_G on the product wage, through its indirect effects on consumption and labor supply in the formal sector. If the economy is completely open (δ=0), then from Eq. (28) Λ_c and $\Lambda^s_{n_U}$ are both zero, and consumption and labor supply in the formal sector have no effect on the skilled product wage through the real exchange rate. As a result, H_c and $\Psi^s_{n_U}$ are also zero. In general, when the real exchange rate depreciates, the consumption wage being constant, the product wage must fall. The lower the value of δ, the smaller this effect. But because it operates in the same direction as the direct effect of p_G on the product wage, there is no ambiguity in the movement of ω_S. By contrast, when the real exchange rate appreciates, it tends to offset the direct effect, and therefore leads to an ambiguous net effect—unless the value of δ is small. A high degree of openness (a low value of δ) is a *sufficient* condition to ensure that the general equilibrium effect on ω_S, as measured by the expression for $d\tilde{\omega}_S/dp_G$ given in Eq. (36), is negative. It is not, however, a necessary one; a high value of ϕ' would do.

The assumption that the skilled product wage in the formal sector and the real exchange rate are negatively related (as implied by Eq. (19)) is a fairly plausible one, and can also be derived from various efficiency-wage models. For instance, in the presence of turnover costs, the quit rate could be specified as a function of the *consumption* wage, with producers setting the *product* wage. As can be inferred from the results by Agénor (2001), the real exchange rate would then affect the (equilibrium) skilled wage, in the same direction as hypothesized here. A similar relationship could be derived in the presence of a wage-productivity link, as long as it is, again, the consumption wage that affects the level of effort (see Agénor, 2002). The existence of a negative relationship between the skilled product wage in the formal sector and the real exchange rate is a second testable implication of the model.

In sum, the model provides a fairly general argument to support the view that the direct adverse effects of a rise in public sector prices may be outweighed, in both the short- and the long-term, by expansionary effects resulting from general equilibrium interactions. Other features of the labor market that are accounted for in the present framework (such as a binding minimum wage for unskilled workers) do make a difference in terms of the qualitative features of the adjustment path. However, several of these assumptions (which are meant to capture realistic features of the labor market in a developing-country context) could be relaxed without affecting the main result—the possibility that increases in the price of public sector services may well reduce unemployment in the long run, depending on the structure of trade union preferences and the degree of openness of the economy.

6. Concluding remarks

The role of the labor market in the process of economic reform in developing countries has been the subject of renewed interest in recent years. The purpose of this paper has been to study the effects of fiscal adjustment in an intertemporal macroeconomic framework that captures some of the most salient features of these markets. The model developed here accounts, in particular, for the existence of a large informal sector and the use of public intermediate inputs in the production of tradables in the formal sector. Labor market segmentation was introduced through minimum wage legislation for unskilled labor and the assumption that wages earned by skilled workers in the exportable sector are determined by a utility—maximizing trade union. Despite wage flexibility in the informal sector, "quasi-voluntary" unemployment of both skilled and unskilled workers was shown to typically emerge in equilibrium. Skilled unemployment emerged as a result of the assumption that the opportunity cost of leisure is lower (and/or the reservation wage is higher) than the going wage in the informal sector, whereas unskilled unemployment resulted from "wait" or "queuing" considerations in the tradition of Harris and Todaro (1970).

The model was used to study the macroeconomic effects of an increase in the price of government services. The main result of the analysis is that if indirect effects on skilled workers' wages are sufficiently strong (or equivalently if unions care sufficiently about skilled employment), and if the degree of openness of the

economy is sufficiently high, unemployment of both skilled and unskilled labor may actually fall in the long run. It was also pointed out that the assumption that unions care about both wages and employment is fairly general and that results qualitatively similar to those derived here could be obtained in models in which firms set wages on the basis of efficiency considerations, as long as unemployment serves a sufficiently strong role as a "discipline device." The policy implications of the analysis are thus quite important—arguments against adjustment in the price of government services based on possible adverse employment effects are therefore not necessarily valid once general equilibrium interactions are taken into account. It was also noted that there are two testable assumptions in the model: the first relates to the structure of unions' preferences (namely, the fact that unions in the private formal sector must care sufficiently about employment), and the second to the assumption that the skilled product wage in the formal sector and the real exchange rate are negatively related. Unfortunately, there is no convincing work at the moment that would allow reliable statements about the direction and strength of these effects.

The model developed in this paper could be extended in a variety of ways, by considering for instance the case in which government services are also used as intermediate inputs in the production process in the informal sector. In such conditions, output of informal sector goods would also fall on impact following an increase in the price of government services, rather than remaining unchanged; otherwise, however, the effects of this shock would remain qualitatively similar to those described earlier. Perhaps a more fruitful extension would be to introduce money and distortionary taxation, and to assume that informal sector activities are taxed at a lower rate (possibly zero) than those performed in the formal sector. Because, as shown earlier, fiscal adjustment policies typically lead to a reallocation of production activities and employment across sectors in the long run, they also affect tax revenue. Such changes in revenue may have important implications for alternative sources of deficit financing, notably the degree of reliance on the inflation tax. Extensions of this type, together with detailed empirical work on labor demand elasticities, the degree of labor mobility, and the degree of relative wage rigidity across sectors, are essential for improving further our understanding of the aggregate effects of adjustment programs on wages and employment.

Appendix A

Eqs. (29), (31) and (32 form a dynamic system in c, $n_{\mathrm{U}}^{\mathrm{s}}$ and D^* which can be linearized around the steady state to give

$$\begin{bmatrix} \dot{c} \\ \dot{n}_{\mathrm{U}}^{\mathrm{s}} \\ \dot{D}^* \end{bmatrix} = \begin{bmatrix} 0 & 0 & G' \\ \beta H_c & \beta H_{n_{\mathrm{U}}^{\mathrm{s}}} & 0 \\ \Psi_c & \Psi_{n_{\mathrm{U}}^{\mathrm{s}}} & \Psi_{D^*} \end{bmatrix} \begin{bmatrix} c - \tilde{c} \\ n_{\mathrm{U}}^{\mathrm{s}} - \tilde{n}_{\mathrm{U}}^{\mathrm{s}} \\ D^* - \tilde{D}^* \end{bmatrix}. \tag{A1}$$

Saddlepath stability requires one unstable (positive) root. A necessary condition is thus that the determinant of the matrix of coefficients **A** in Eq. (A1) be positive (in order to exclude one or three negative roots), whereas a sufficient condition is that its trace be negative (in order to guarantee at least one negative root):

$$\mathrm{tr}\mathbf{A} = \beta H_{n_{\mathrm{U}}^{\mathrm{s}}} + \Psi_{D^*} < 0, \tag{A2}$$

$$\det\mathbf{A} = G'\,\beta(H_c\Psi_{n_{\mathrm{U}}^{\mathrm{s}}} - \Psi_c H_{n_{\mathrm{U}}^{\mathrm{s}}}) > 0. \tag{A3}$$

A sufficient condition for tr**A**<0 is that the speed of adjustment, β, be sufficiently large. The condition on det**A** requires $H_c\Psi^{\mathrm{s}}_{n_{\mathrm{U}}} - \Psi_c H^{\mathrm{s}}_{n_{\mathrm{U}}} > 0$, which is independent of β. If the degree of openness is high, that is, if $\delta \to 0$, then H_c, $\Psi^{\mathrm{s}}_{n_{\mathrm{U}}} \to 0$ (as noted in the text) and this expression tends to $\Psi_c H^{\mathrm{s}}_{n_{\mathrm{U}}}$ which is indeed positive.

The long-run effect of the increase in p_{G} on $\tilde{c}$ and $\tilde{n}^{\mathrm{s}}_{\mathrm{U}}$, given that $\mathrm{d}\tilde{D}^*/\mathrm{d}p_{\mathrm{G}} = 0$, is determined by the solution of the system consisting of Eqs. (29) and (32), with $\dot{D}^* = \dot{n}^{\mathrm{s}}_{\mathrm{U}} = 0$:

$$\begin{bmatrix} \Psi_c & \Psi_{n_{\mathrm{U}}^{\mathrm{s}}} \\ H_c & H_{n_{\mathrm{U}}^{\mathrm{s}}} \end{bmatrix} \begin{bmatrix} \mathrm{d}\tilde{c}/\mathrm{d}p_{\mathrm{G}} \\ \mathrm{d}\tilde{n}^{\mathrm{s}}_{\mathrm{U}}/\mathrm{d}p_{\mathrm{G}} \end{bmatrix} = \begin{bmatrix} -\Psi_{p_{\mathrm{G}}} \\ -H_{p_{\mathrm{G}}} \end{bmatrix},$$

that is

$$\frac{\mathrm{d}\tilde{c}}{\mathrm{d}p_{\mathrm{G}}} = \frac{H_{p_{\mathrm{G}}}\Psi_{n_{\mathrm{U}}^{\mathrm{s}}} - \Psi_{p_{\mathrm{G}}}H_{n_{\mathrm{U}}^{\mathrm{s}}}}{\Delta}, \frac{\mathrm{d}\tilde{n}^{\mathrm{s}}_{\mathrm{U}}}{\mathrm{d}p_{\mathrm{G}}} = \frac{H_c\Psi_{p_{\mathrm{G}}} - \Psi_c H_{p_{\mathrm{G}}}}{\Delta},$$

where $\Delta = \Psi_c H^{\mathrm{s}}_{n_{\mathrm{U}}} - H_c\Psi^{\mathrm{s}}_{n_{\mathrm{U}}}$. In general, the sign of these expressions is ambiguous. If the degree of openness is high, that is, $\delta \to 0$, then again H_c, $\Psi^{\mathrm{s}}_{n_{\mathrm{U}}} \to 0$, and $\Delta \to \Psi_c H^{\mathrm{s}}_{n_{\mathrm{U}}} < 0$. Thus

$$\frac{\mathrm{d}\tilde{c}}{\mathrm{d}p_{\mathrm{G}}} \to \frac{-\Psi_{p_{\mathrm{G}}}}{\Psi_c}, \quad \frac{\mathrm{d}\tilde{n}^{\mathrm{s}}_{\mathrm{U}}}{\mathrm{d}p_{\mathrm{G}}} \to \frac{-H_{p_{\mathrm{G}}}}{H_{n_{\mathrm{U}}^{\mathrm{s}}}},$$

which implies that

$$\frac{\mathrm{d}\tilde{c}}{\mathrm{d}p_{\mathrm{G}}} < 0, \frac{\mathrm{d}\tilde{n}^{\mathrm{s}}_{\mathrm{U}}}{\mathrm{d}p_{\mathrm{G}}} < 0, \text{ if } \Psi_{p_{\mathrm{G}}} > 0 \text{ and } H_{p_{\mathrm{G}}} < 0,$$

or

$$\frac{\mathrm{d}\tilde{c}}{\mathrm{d}p_{\mathrm{G}}} > 0, \frac{\mathrm{d}\tilde{n}^{\mathrm{s}}_{\mathrm{U}}}{\mathrm{d}p_{\mathrm{G}}} > 0, \text{ if } \Psi_{p_{\mathrm{G}}} < 0 \text{ and } H_{p_{\mathrm{G}}} > 0.$$

From Eq. (25),

$$\frac{\mathrm{d}\tilde{z}}{\mathrm{d}p_{\mathrm{G}}} = \theta_c\frac{\mathrm{d}\tilde{c}}{\mathrm{d}p_{\mathrm{G}}} + \theta_{n_{\mathrm{U}}^{\mathrm{s}}}\frac{\mathrm{d}\tilde{n}^{\mathrm{s}}_{\mathrm{U}}}{\mathrm{d}p_{\mathrm{G}}},$$

from which it can be established that $\mathrm{d}\tilde{z}/\mathrm{d}p_{\mathrm{G}} > 0$ if $\Psi_{p_{\mathrm{G}}} > 0$ and $H_{p_{\mathrm{G}}} < 0$, and $\mathrm{d}\tilde{z}/\mathrm{d}p_{\mathrm{G}} > 0$ in the opposite case. From Eq. (19),

$$\frac{\mathrm{d}\tilde{\omega}_{\mathrm{S}}}{\mathrm{d}p_{\mathrm{G}}} = \phi' - \delta\left(\frac{\mathrm{d}\tilde{z}}{\mathrm{d}p_{\mathrm{G}}}\right),$$

which implies that $\mathrm{d}\tilde{\omega}_{\mathrm{S}}/\mathrm{d}p_{\mathrm{G}} < 0$ if $\mathrm{d}\tilde{z}/\mathrm{d}p_{\mathrm{G}} > 0$, and ambiguous otherwise. In the latter case, if δ is sufficiently small, $\mathrm{d}\tilde{\omega}_{\mathrm{S}}/\mathrm{d}p_{\mathrm{G}}$ is likely to be negative.

The effect on the unskilled unemployment rate in the urban formal sector is

$$\frac{\mathrm{d}}{\mathrm{d}p_{\mathrm{G}}}\left(\frac{\tilde{n}_{\mathrm{U}}^{\mathrm{s}}-n_{\mathrm{G}}-\tilde{n}_{\mathrm{U}}^{\mathrm{d}}}{\tilde{n}_{\mathrm{U}}^{\mathrm{s}}-n_{\mathrm{G}}}\right)=\frac{\mathrm{d}}{\mathrm{d}p_{\mathrm{G}}}\left(1-\frac{\tilde{n}_{\mathrm{U}}^{\mathrm{d}}}{\tilde{n}_{\mathrm{U}}^{\mathrm{s}}-n_{\mathrm{G}}}\right),$$

that is, using the equilibrium condition (35):

$$\frac{\mathrm{d}}{\mathrm{d}p_{\mathrm{G}}}\left(1-\frac{\tilde{\omega}_{\mathrm{N}}}{\omega_{\mathrm{m}}}\right)=-\omega_{\mathrm{m}}^{-1}\frac{\mathrm{d}\tilde{\omega}_{\mathrm{N}}}{\mathrm{d}p_{\mathrm{G}}}.$$

From Eqs. (21) and (25),

$$\frac{\mathrm{d}\tilde{\omega}_{\mathrm{N}}}{\mathrm{d}p_{\mathrm{G}}}=\upsilon_z\theta_c\left(\frac{\mathrm{d}\tilde{c}}{\mathrm{d}p_{\mathrm{G}}}\right)+\left(\upsilon_z\theta_{n_{\mathrm{U}}^{\mathrm{s}}}+\upsilon_{n_{\mathrm{U}}^{\mathrm{s}}}\right)\left(\frac{\mathrm{d}\tilde{n}_{\mathrm{U}}^{\mathrm{s}}}{\mathrm{d}p_{\mathrm{G}}}\right),$$

so that $\mathrm{d}\tilde{\omega}/\mathrm{d}p_{\mathrm{G}}<0$ if $\Psi_{p_{\mathrm{G}}}>0$ and $H_{p_{\mathrm{G}}}<0$. From the previous equation, given the negative sign in front of $\mathrm{d}\tilde{\omega}$sub N/$\mathrm{d}p_{\mathrm{G}}$, the unemployment rate rises. If, on the contrary, $\mathrm{d}\omega_{\mathrm{n}}/\mathrm{d}p_{\mathrm{G}}>0$, the unemployment rate falls. Note also that because $\mathrm{d}\tilde{n}_{\mathrm{S}}^{\mathrm{d}}/\mathrm{d}p_{\mathrm{G}}$ is negative if $\Psi_{p_{\mathrm{G}}}>0$ and $H_{p_{\mathrm{G}}}<0$, and positive otherwise, and because the labor supply curve is inelastic, the skilled unemployment rate also increases in the first case and falls in the second.

To solve for the initial jump in c, the technique suggested by Dixit (1980) is used. As shown by Dixit, if the system evolves along the stable manifold, it must be the case that, at each point in time:

$$c-\tilde{c}=-h_{13}^{-1}h_{23}\left(n_{\mathrm{U}}^{\mathrm{s}}-\tilde{n}_{\mathrm{U}}^{\mathrm{s}}\right)-h_{13}^{-1}\left(D^{*}-\tilde{D}^{*}\right), \tag{A4}$$

where h_{13} and h_{23} are elements of the (appropriately normalized) left eigenvector of $\mathbf{A}$ corresponding to the positive characteristic root μ_3. Thus, h_{13} and h_{23} satisfy the following equation:

$$[h_{13}\ h_{23}\ 1][-\mathbf{A}+\mu_3\mathrm{I}]=[0\ 0\ 0]. \tag{A5}$$

This equation can be solved for h_{13} and h_{23} as a function of μ_3 to give

$$h_{13}=(\mu_3-\Psi_{D^{*}})/G',\quad h_{23}=\frac{\Psi_{n_{\mathrm{U}}^{\mathrm{s}}}}{\mu_3-\beta H_{n_{\mathrm{U}}^{\mathrm{s}}}}>0, \tag{A6}$$

where h_{13} is in general ambiguous. Note also that $h_{23}\rightarrow 0$ if $\delta\rightarrow 0$, because then $\Psi_{n_{\mathrm{U}}}^{\mathrm{s}}\rightarrow 0$ (as noted earlier).

From Eq. (A4), the impact effect of an unanticipated permanent reduction in p_{G} on consumption is given by, because $\mathrm{d}n_{\mathrm{U}}^{\mathrm{s}}(0)/\mathrm{d}p_{\mathrm{G}}=\mathrm{d}D_0^{*}/\mathrm{d}p_{\mathrm{G}}=0$:

$$\frac{\mathrm{d}c_0}{\mathrm{d}p_{\mathrm{G}}}=\frac{\mathrm{d}\tilde{c}}{\mathrm{d}p_{\mathrm{G}}}+h_{13}^{-1}h_{23}\frac{\mathrm{d}\tilde{n}_{\mathrm{U}}^{\mathrm{s}}}{\mathrm{d}p_{\mathrm{G}}}+h_{13}^{-1}\frac{\mathrm{d}\tilde{D}^{*}}{\mathrm{d}p_{\mathrm{G}}}.$$

From Eq. (32) with $\dot{n}_{\mathrm{U}}^{\mathrm{s}}=0$, we have

$$\frac{\mathrm{d}\tilde{n}_{\mathrm{U}}^{\mathrm{s}}}{\mathrm{d}p_{\mathrm{G}}}=-\left(\frac{H_c}{H_{n_{\mathrm{U}}^{\mathrm{s}}}}\right)\left(\frac{\mathrm{d}\tilde{c}}{\mathrm{d}p_{\mathrm{G}}}\right)-\frac{H_{p_{\mathrm{G}}}}{H_{n_{\mathrm{U}}^{\mathrm{s}}}}.$$

Substituting this result in the previous expression yields

$$\frac{\mathrm{d}c_0}{\mathrm{d}p_\mathrm{G}} = \left(1 - h_{13}^{-1}h_{23}\frac{H_c}{H_{n_\mathrm{U}^\mathrm{s}}}\right)\frac{\mathrm{d}\tilde{c}}{\mathrm{d}p_\mathrm{G}} + h_{13}^{-1}\frac{\mathrm{d}\tilde{D}^*}{\mathrm{d}p_\mathrm{G}} - h_{13}^{-1}h_{23}\frac{H_{p_\mathrm{G}}}{H_{n_\mathrm{U}^\mathrm{s}}},$$

As discussed in the text, $d\tilde{D}^*/dp_\mathrm{G}=0$. Thus, denoting by Θ the expression in parentheses on the right-hand side of the previous equation,

$$\frac{\mathrm{d}c_0}{\mathrm{d}p_\mathrm{G}} = \Theta\frac{\mathrm{d}\tilde{c}}{\mathrm{d}p_\mathrm{G}} - h_{13}^{-1}h_{23}\frac{H_{p_\mathrm{G}}}{H_{n_\mathrm{U}^\mathrm{s}}},$$

As noted above, $h_{23}\rightarrow 0$ if $\delta\rightarrow 0$. Thus, the last term on the right-hand side also tends to zero, $\Theta\rightarrow 1$, and $\mathrm{d}c_0/\mathrm{d}p_\mathrm{G}\rightarrow\mathrm{d}\tilde{c}/\mathrm{d}p_\mathrm{G}$; consumption increases (falls) on impact if the steady-state effect is positive (negative).

To examine the transitional dynamics of n_U^s and D^*, Eq. (A4) can be used to reduce the system (A1) to only two differential equations:

$$\begin{bmatrix}\dot{n}_\mathrm{U}^\mathrm{s}\\ \dot{D}^*\end{bmatrix} = \begin{bmatrix}\beta(H_{n_\mathrm{U}^\mathrm{s}} - H_c h_{13}^{-1}h_{23}) & -\beta H_c h_{13}^{-1}\\ \Phi & \Psi_{D^*} - \Psi_c h_{13}^{-1}\end{bmatrix}\begin{bmatrix}n_\mathrm{U}^\mathrm{s} - \tilde{n}_\mathrm{U}^\mathrm{s}\\ D^* - \tilde{D}^*\end{bmatrix}, \tag{A7}$$

where $\Phi=\Psi_{n_\mathrm{U}}^\mathrm{s} - \Psi_c h_{13}^{-1}h_{23}$.

Suppose that $h_{13}<0$, a condition that requires that the elasticity of the risk premium with respect to the level of debt be sufficiently large.[27] Thus, in the matrix of coefficients, $\beta(H_{n_\mathrm{U}}^\mathrm{s} - H_c h_{13}^{-1}h_{23})$ and $-\beta H_c h_{13}^{-1}$ are both negative, whereas $\Psi_{D^*} - \Psi_c h_{13}^{-1}$ and Φ are both positive. The slopes of both NN and DD in Fig. 1 are therefore negative.[28]

Let $\mathbf{M}$ denote the matrix of coefficients in system (A7). Necessary and sufficient conditions to ensure local stability of the system (that is, that the system's two characteristic roots have negative real parts) are

$$\mathrm{tr}M = \beta\left(H_{n_\mathrm{U}^\mathrm{s}} - H_c h_{13}^{-1}h_{23}\right) + \left(\Psi_{D^*} - \Psi_c h_{13}^{-1}\right) < 0,$$

$$\det\mathbf{M} = \beta\left[(H_{n_\mathrm{U}^\mathrm{s}} - H_c h_{13}^{-1}h_{23})(\Psi_{D^*} - \Psi_c h_{13}^{-1}) + \Phi H_c h_{13}^{-1}\right] > 0.$$

The first condition is always satisfied if the speed of adjustment, β, is sufficiently high. The second condition implies that

$$\frac{H_{n_\mathrm{U}^\mathrm{s}} - H_c h_{13}^{-1}h_{23}}{H_c h_{13}^{-1}} > \frac{-\Phi}{\Psi_{D^*} - \Psi_c h_{13}^{-1}},$$

or equivalently (given that both expressions in this inequality are negative) that the slope of $\mathrm{D}^*\mathrm{D}^*$ be steeper than the slope of NN in absolute terms, as shown in Fig. 1.

[27] For $h_{13}<0$, one must have $\Psi_{D^*}>\mu_3$. From the definition of $\Psi_{D^*}=i_\mathrm{f}^*+\kappa+\kappa'\tilde{D}^*$ given in the text, this expression can be written as $(i_\mathrm{f}^*/\kappa)+1+\eta_{\kappa/D^*}>\mu_3/\kappa$, or equivalently, $\eta_{\kappa/D^*}>(\mu_3-i_\mathrm{f}^*)/\kappa-1$, where η_{κ/D^*} is the elasticity of the premium with respect to the level of foreign debt.

[28] Note that the assumption $h_{13}<0$ is sufficient, but not necessary, for the signs of the coefficients appearing in Eq. (A7) to be as posited.

References

Agénor, Pierre-Richard, 1996. The labor market and economic adjustment. IMF Staff Papers 43, 261–335. (June).

Agénor, Pierre-Richard, 2001. Employment effects of stabilization policies. European Journal of Political Economy, 853–875. (November).

Agénor, Pierre-Richard, 2002. Macroeconomic Adjustment and the Poor: Analytical Issues and Cross-Country Evidence, Policy Research Working Paper No. 2788, the World Bank (February). Forthcoming, Journal of Economic Surveys.

Agénor, Pierre-Richard, 2004. The Economics of Adjustment and Growth. (second edition)Harvard University Press, Boston, Mass.

Agénor, Pierre-Richard, Aizenman, Joshua, 1996. Trade liberalization and unemployment. Journal of International Trade and Economic Development 5, 265–286. (September).

Agénor, Pierre-Richard, Aizenman, Joshua, 1999. Macroeconomic adjustment with segmented labor markets. Journal of Development Economics 58, 277–296. (April).

Agénor, Pierre-Richard, Santaella, Julio A., 1998. Efficiency wages, disinflation, and labor mobility. Journal of Economic Dynamics and Control 22, 267–291. (February).

Banerjee, Biswajit, Bucci, Gabriella A., 1995. On-the-job search in a developing country: an analysis based on Indian data on migrants. Economic Development and Cultural Change 43, 565–583. (April).

Bhattacharya, Prabir, 1993. Rural–urban migration in economic development. Journal of Economic Surveys, 243–281. (September).

Booth, Alison, 1995. The Economics of the Trade Union. Cambridge University Press, Cambridge.

Buffie, Edward F., 1992. Stabilization policy and public sector prices. Journal of Monetary Economics 29, 253–276. (April).

Buffie, Edward F., 1998. Public sector price increases, credibility and welfare. Journal of Monetary Economics 41, 127–151. (February).

Creedy, John, McDonald, Ian, 1991. Models of trade union behavior: a synthesis. Economic Record 67, 346–359. (December).

Dabalen, Andrew, 2000. Alternative Views of the Labor Market in sub-Saharan Africa: A Review. World Bank. (June, unpublished).

Dixit, Avinash, 1980. A Solution Technique for Rational Expectations Models with Applications to Exchange Rate and Interest Rate Determination. University of Warwick. (November, unpublished).

Fortin, Bernard, Nicolas, Marceau, Luc, Savard, 1997. Taxation, wage controls and the informal sector. Journal of Public Economics 66, 293–312. (November).

Funkhauser, Edward, 1997. Mobility and labor market segmentation: the urban labor market in El Salvador. Economic Development and Cultural Change 46, 123–153. (October).

Harris, John, Todaro, Michael P., 1970. Migration, unemployment and development: a two-sector analysis. American Economic Review 60, 126–143. (March).

Hirata, Helena, Humphrey, John, 1991. Workers' response to job loss: female and male industrial workers in Brazil. World Development 19, 671–682. (June).

Horton, Susan, Kanbur, Ravi, Mazumdar, Dipak, 1994. In: Horton, Susan, Kanbur, Ravi, Mazumdar, Dipak (Eds.) Overview, in Labor Markets in an Era of Adjustment vol. I. World Bank, Washington, DC.

Imoto, Shin, 2003. An example of nonlinear endogenous business cycle model: build in the trade union. Journal of Economic Dynamics and Control 81, 117–124. (October).

Layard, Richard, Nickell, Stephen, Jackman, Richard, 1991. Unemployment: Macroeconomic Performance and the Labor Market. Oxford University Press, Oxford.

Maloney, William F., 1997. Labor Market Structure in Mexico: Time Series Evidence on Competing Views. University of Illinois at Urbana, Champaign. (April, unpublished).

Moene, Karl O., Wallerstein, Michael, Hoel, Michael, 1993. Bargaining structure and economic performance. In: Flanagan, Robert, Moene, Karl O., Wallerstein, Michael (Eds.), Trade Union Behavior, Pay Bargaining and Economic Performance. Oxford University Press, Oxford.

Murphy, Robert G., 1991. Macroeconomic adjustment under alternative lending arrangements. Journal of Economic Dynamics and Control 15, 103–127. (March).

Nelson, Joan, 1994. Organized labor, politics, and labor market flexibility in developing countries. In: Horton, Susan, Kanbur, Ravi, Mazumdar, DipakLabor Markets in an Era of Adjustment vol. I. World Bank, Washington, DC.

Rodrik, Dani, 1998. What drives public employment? Journal of Political Economy 106, 997–1032. (October).

Shapiro, Carl, Stiglitz, Joseph E., 1984. Equilibrium unemployment as a worker discipline device. American Economic Review 74, 433–444. (June).

Stark, Oded, 1991. The Migration of Labor. Basil Blackwell, Oxford.

Turnovsky, Stephen J., Sen, Partha, 1991. Fiscal policy, capital accumulation, and debt in an open economy. Oxford Economic Papers 43, 1–24. (January).

Yilmaz, Akyuz, Boratav, Korkut, 2003. The making of the Turkish financial crisis. World Development 31, 1549–1566. (September).

World Bank, Workers in An Integrating World, World Development Report (Washington, DC: 1995).

World Bank, 2003. MENA's Employment Challenge in the 21st Century: From Labour Force Growth to Job Creation. World Bank, Washington, DC.