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Trade Liberalization and Unemployment

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Abstract

This paper examines the effect of trade reform on wages and unemployment in a two-sector, three-good economy in which labor is imperfectly mobile across sectors. Wages in the export sector are set so as to minimize turnover costs. The analysis shows that a reduction in tariffs, coupled with an adjustment in lump-sum taxes to equilibrate the government budget, lowers wages in all production sectors in the short and the medium run but has an ambiguous effect on unemployment. Although employment and production of exportables expand in the medium run, the unemployment rate may rise or fall depending on whether the elasticity of wages in the export sector with respect to wages in the nontraded goods sector is lower or greater than unity. Potentially adverse effects may be mitigated in the long run, however, as a result of induced shifts in the structure of production activities.

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E24, F13, J42

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Summary

Increasing attention is being devoted to the role of labor markets in the design of macroeconomic and structural adjustment programs. This paper attempts to provide a theoretical framework for understanding the impact of labor market imperfections on the short- and medium-run effects of trade liberalization. The analysis considers a small open economy producing exportable and nontradable goods, with imperfect labor mobility across sectors. Firms in the export sector face significant labor turnover costs, with the quit rate depending on the wage differential across sectors. In equilibrium, wages in the export sector are shown to be positively related to the market-clearing wage in the nontraded goods sector. Private consumption expenditure depends linearly on "expected" disposable income, with the weight attached to current income (as opposed to permanent income) being positively related to the intensity of liquidity constraints faced by households.

A reduction in tariffs, coupled with an increase in lump-sum taxes to equilibrate the government budget, is shown to lower wages in all production sectors in the short and the medium run but has an ambiguous effect on unemployment in the export sector. Although employment and production of exportables expand in the medium run, the steady-state unemployment rate may rise or fall depending on whether the elasticity of wages in the export sector with respect to wages in the nontraded goods sector is lower or greater than unity. On impact, trade reform may lead to a reduction in the unemployment rate if (as a result of tight liquidity constraints) household consumption is a function mostly of current income. In addition to formal derivations, the paper provides a detailed intuitive discussion of the role of the relative wage elasticity and imperfect mobility of labor in determining the direction of the short- and medium-run effects of trade liberalization on employment and unemployment.

The analytical framework presented in the paper focuses on the short- and medium-term effects of trade reform programs that do not modify the set of production activities carried out in the economy. However, it is emphasized that a drastic trade liberalization package (or a package embedded in a comprehensive restructuring program) may, over the long term, encourage the formation of new activities, changing over time the sectoral composition of output. Under such conditions, even if trade liberalization entails significant adjustment costs in the short or the medium term, it may still be highly beneficial in the long run.

I. Introduction

Recognition of the adverse effects of import substitution strategies--an industrial structure heavily dependent upon imported intermediates and capital goods; slow export growth and recurrent balance-of-payments problems; and severe allocative distortions--has led an increasing number of countries in the developing world to adopt a more liberal external trade regime. Traditional economic arguments suggest that a reduction in trade barriers (such as tariffs, import licensing requirements, and import quotas) enhances efficiency by reducing the value of implicit rents captured by rent seekers, and fosters an adjustment in relative prices that leads to a reallocation of resources towards the exportable sector (Krueger, 1985). In the long run, the realignment of relative prices leads to an expansion of output of exportables and a contraction of activity in import-competing industries. To the extent that trade reform is accompanied by a real exchange rate depreciation--that is, a fall in the price of home goods relative to the weigthed average of prices of exportables and importables--a reduction in barriers to foreign trade may also lead to an overall transfer of resources from sectors producing nontradables towards those producing tradables.

While there appears to be broad agreement on the allocative effects of trade liberalization in the long run, the short- and medium-run impact of trade reform on the wage structure, the composition of employment and aggregate unemployment remains imperfectly understood. The evidence gathered in the comprehensive study of trade reform episodes in developing countries conducted in the early 1980s at the World Bank and summarized by Papageorgiou et al. (1990) appears to be largely inconclusive in that regard. 1/ While most individual country studies suggest that total employment in the manufacturing sector either fell or remained stable in the aftermath of the liberalization program, they often do not distinguish between traded and nontraded manufacturing goods, and are therefore unable to characterize changes in the distribution of employment across inward- and outward-oriented industries. In addition, they provide only limited evidence on changes in employment in nonmanufacturing production activities, or changes in the aggregate unemployment rate. These limitations (which in several cases result from the paucity of appropriate data) are compounded by the methodological shortcomings that affect many of the specific country studies. For instance, although in several cases trade reforms were implemented simultaneously with macroeconomic stabilization programs--and in an environment characterized be severe external shocks--few authors have attempted to disentangle rigorously the

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1/ An early review of trade liberalization programs by Krueger (1983) emphasized the long-run relation between trade orientation and the level of employment, rather than the measurement of the actual, direct effect of trade reform on wages and unemployment during the adjustment process.

employment effects associated with each set of measures (Edwards, 1993). Despite this important caveat, Papageorgiou et al. (1990) attribute the fall in manufacturing sector employment observed in a few cases in the aftermath of reform entirely to restrictive macroeconomic policies.

Some recent studies have attempted to study directly the effects of tariff reform on the labor market. Rama (1994) has examined the relationship between tariffs, employment and wages in the Uruguayan manufacturing sector. He finds no impact of the reform on wages, but a negative effect on employment. His estimates indicate that a reduction in the tariff-inclusive price of imports by 1 percentage point led to an employment drop in manufacturing of between .4 and .5 percentage points. In a study of the trade liberalization program implemented in Mexico between 1985 and 1988, Revenga (1994) has estimated that the reduction in tariffs during the period (of about 10 percentage points) 1/ led to a much smaller reduction in aggregate employment in the manufacturing sector (by 2 to 3 percentage points) and an increase in average wages. 2/ However, her study also suggests that, despite relatively limited aggregate effects, significant changes occurred in the composition of employment across industries. Currie and Harrison (1994) have found that the comprehensive trade reform that was implemented in Morocco between 1984 and 1990 (which led to a reduction in the coverage of import licenses from 41 percent of imports in 1984 to 11 percent in 1990, and a reduction in the maximum tariff rate from 165 percent to 45 percent) also had a small (albeit significant) impact on aggregate wages and employment in the formal manufacturing sector. As in the case of Mexico, pronounced sectoral shifts in employment appeared to have taken place, particularly in the manufacturing industries that were subject to large tariff reductions.

Despite these recent advances in the empirical literature, progress in understanding the conceptual issues involved in analyzing the effects of trade liberalization on the labor market has been more limited. Existing analytical models, in particular, abstract from potentially important factors that may affect the impact of trade reform on the composition of employment and the aggregate unemployment

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1/ Although Revenga focuses on the 1985-88 period, trade reform subsequently continued in Mexico. According to estimates provided by Dornbusch and Werner (1994, p. 261) the average tariff rate fell from 22.6 percent in 1986 to 13.1 percent in 1992. For consumer goods alone, the average tariff declined from 60 percent in 1983-84 to less than 20 percent. The import quota cover rate (the proportion of the total value of imports subject to quantitative restrictions) fell to 11 percent in 1992, from 28 percent in 1986.

2/ In the same vein, Feliciano (1994) reports no significant impact of the Mexican trade reform on manufacturing employment. She also finds an increase in wage dispersion across industries, rather than an effect on average manufacturing wages.

rate in developing countries. Buffie (1986), for instance, focuses on the potential short-run contractionary effect of trade liberalization in the presence of economy-wide nominal and real wage rigidity. Edwards (1988), by contrast, considers in his analysis of tariff reform an economy in which wages are rigid in only one sector. Both authors consider the case of absolute, rather than relative, wage rigidity--thus excluding potential interactions between wage formation in different sectors of the economy--and do not account for impediments to labor mobility in the short run. 1/ As shown in a related context by Agénor and Aizenman (1994), labor market imperfections of this type may have significant implications for evaluating the short- and medium-term effects of adjustment policies on the labor market.

Accordingly, the purpose of this paper is to examine the impact of trade reform on wages, the composition of employment and aggregate unemployment in the presence of a variety of labor market distortions. In contrast to the existing literature, we model explicitly interactions between wage formation mechanisms across sectors. Our analysis highlights the role of efficiency considerations induced by the existence of high turnover costs in the traded goods sector. Section II presents the basic framework, which consists of a two-sector, three-good economy with imperfect sectoral labor mobility. Section III examines the short- and medium-run effects of a permanent reduction in tariffs (coupled with an adjustment in lump-sum taxes to equilibrate the government budget) in this setting. Section IV provides an intuitive discussion of our results, emphasizing the role of the production structure and the modeling of labor market imperfections. Finally, section V summarizes the main implications of the paper and discusses some possible extensions.

II. The Framework

Consider a small open economy in which there are three types of agents: producers, households, and the government. All firms and households are identical. The economy produces two goods, a nontraded good which is used only for final domestic consumption, and an export good, whose output is entirely sold abroad and whose price is determined on world markets. 2/ The capital stock in each sector is

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1/ The models considered by Cox Edwards and Edwards (1994) are also subject to the first type of limitations, although they do address the issue of intersectoral labor mobility. In addition, their treatment of the dynamics associated with trade liberalization does not allow a full characterization of the adjustment process.

2/ There is no domestic import-competing sector in this economy. This assumption can be rationalized by assuming that efficiency losses induced by the initial level of tariff protection are so high that goods once produced in the importable sector have effectively become nontraded goods.

fixed during the time frame of the analysis. Labor is homogeneous and imperfectly mobile across sectors. Firms in the export sector determine both wages and the level of employment. Workers employed in that sector are paid an above-equilibrium real wage in order to reduce turnover costs--which include recruitment, hiring, training and firing costs--while the wage earned by workers employed in the nontraded goods sector is fully flexible. Although workers who are not hired in the export sector could find job opportunities at the going wage in the nontraded goods sector, imperfect labor mobility prevents an instantaneous reallocation of the labor force. Households consume nontraded and imported goods, supply labor inelastically and hold a traded bond, which bears a constant rate of return determined on world capital markets. The government consumes only nontraded goods, and collects lump-sum taxes as well as taxes on imported goods. Finally, wage and employment expectations are assumed to depend on prevailing conditions in the labor market.

1. Output, turnover costs, and wages

Production in the export sector takes place under a Cobb-Douglas technology and is given by

$$Q_E(t) = L_E(t)^{\alpha_E}, \qquad 0 < \alpha_E < 1 \tag{1}$$

where $Q_E(t)$ denotes output and $L_E(t)$ employment, measured in natural units. In addition to normal costs associated with the use of labor in the production process, firms in the export sector incur a total cost of $\Theta q_t L_E(t)$ in hiring and training new workers, where q_t is the quit rate, and Θ the cost incurred in recruiting and training each worker. Following Stiglitz (1974), the quit rate could be specified as depending on the product wage in the sector producing exported goods relative to the wage that workers could earn in the nontraded goods sector, as well as the aggregate unemployment rate u_t, which measures the degree of tightness of the labor market: 1/

$$q_t = q[\frac{\omega_E(t)}{\omega_N(t)}, u_t], \qquad q_\omega < 0,\ q_{\omega\omega} > 0,\ q_u < 0 \tag{2}$$

where $\omega_E(t)$ denotes the product wage in the export sector, $\omega_N(t)$ the real wage in the nontraded goods sector measured in terms of exported goods, and $\omega_t = \omega_E(t)/\omega_N(t)$ the wage ratio. If quits become less responsive to the wage ratio (so that q_ω becomes less negative) as the

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1/ Except otherwise indicated, partial derivatives are denoted by corresponding lower-case letters, while the total derivative of a function of a single argument is denoted by a prime.

unemployment rate increases, the quit function specified in equation (2) will also satisfy the condition $q_{\omega u} > 0$.

Setting the world price of exported goods to unity, the representative firm in the export sector maximizes its real profits given by

$$\Pi_E = L_E(t)^{\alpha_E} - \omega_E(t)L_E(t) - \theta q[\frac{\omega_E(t)}{\omega_N(t)}, u_t]L_E(t),$$

with respect to $\omega_E(t)$ and $L_E(t)$, for $\omega_N(t)$ given. The first-order conditions are

$$-\theta q_{\omega}[.] = \omega_N(t), \tag{3a}$$

$$\alpha L_E(t)^{\alpha_E - 1} - \omega_E(t) - \theta q[.] = 0. \tag{3b}$$

Suppose that $q_u \to 0$, and that the quit function takes the logistic form

$$q_t = 1/\left[1 + \delta\left\{\frac{\omega_E(t)}{\omega_N(t)}\right\}\right], \qquad \delta > 0 \tag{4}$$

where δ depends positively on the net nonpecuniary benefit--such as the proximity of activities from family and friends, and their physical location--associated with employment in the export sector. The assumptions underlying the derivation of equation (4) are presented in the Appendix.

Since q_{ω} is now independent of the unemployment rate, equation (3*a*) determines the product wage in the export sector independently of $L_E(t)$. Using equations (3*a*) and (4) implies

$$\omega_E(t) = \sqrt{\theta\delta^{-1}\omega_N(t)} - \delta^{-1}\omega_N(t), \tag{5}$$

which indicates that an increase in the unit cost of hiring and training raises the efficiency wage in the export sector, while an increase in the real wage in the nontraded good sector has in general an ambiguous effect. To understand this result, note that equation (3*a*) can be written in the form $1 = -\theta q_{\omega}[.]/\omega_N(t)$, which can be interpreted as equating the marginal unit labor cost in the exportable sector (which is unity) to the marginal unit labor benefit, which

results from a reduction in labor turnover costs. 1/ This equation indicates that an increase in the market-clearing wage has an ambiguous effect on the marginal benefit: it increases the quit rate on the one hand, thus raising the marginal benefit resulting from an increase in the efficiency wage in the export sector. On the other hand, it reduces the marginal benefit associated with a rise in the efficiency wage because a unit increase in that wage represents now a smaller percentage improvement in the relative wage (this is captured by $1/\omega_N(t)$). For low values of the market-clearing wage the first effect dominates, while for large values of $\omega_N(t)$ the second effect dominates. More specifically, it can be shown that if the net nonpecuniary benefit associated with employment in the export sector δ is sufficiently high (a condition that implies that the elasticity of the quit rate with respect to relative wages is also high), the net effect will be positive. 2/ It can also be established from (5) that the elasticity of the efficiency wage in the export sector with respect to the market-clearing wage in the nontraded goods sector is less than unity. As shown below, this result has important implications for the medium-run effects of tariff reform on the wage ratio, employment distribution, and unemployment.

Unit labor costs, defined as $\Omega_E(t) = \omega_E(t)+\theta q_t$, can be written as, using equation (5):

$$\Omega_E(t) = \Omega_E[\omega_N(t)] = 2\sqrt{\theta\delta^{-1}\omega_N(t)} - \delta^{-1}\omega_N(t),$$

so that $\Omega_E(t) > 0$ (since, from equation (5), $\Omega_E(t) = 2\omega_E(t)+\delta^{-1}\omega_N(t)$), and $\Omega_E' > 0$. The behavior of wages, unit labor costs and the quit rate are shown in Figure 1. For an internal solution to obtain (that is, for the wage ratio to be positive) we must impose the restriction $\omega_N(t) < \delta\theta$. We henceforth assume that the export sector operates along the upward-sloping portion of the wage curve shown in the upper panel of the Figure. As indicated in the lower panel, this assumption

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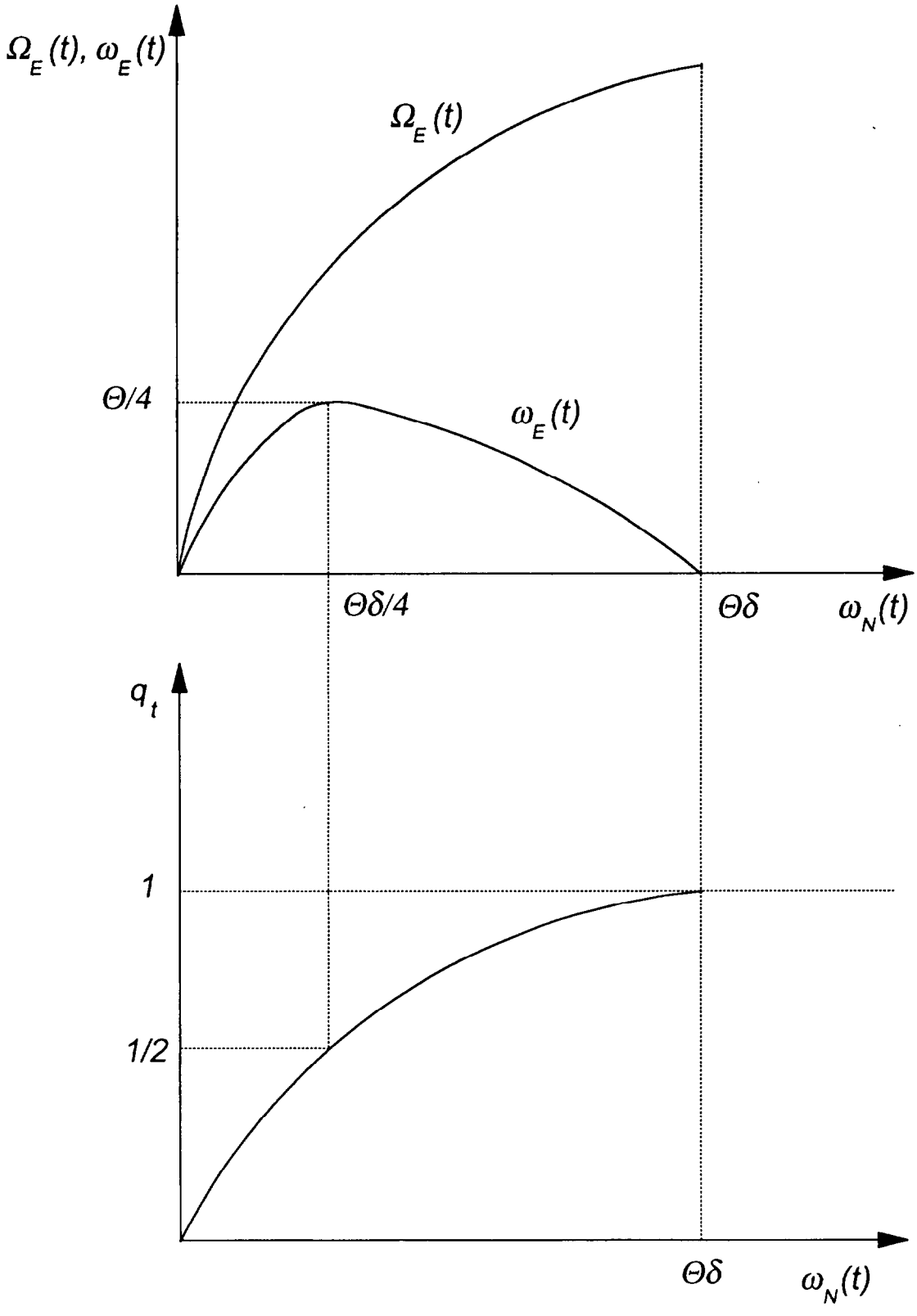
1/ Using equation (5), it can be shown that $q_\omega = -\delta/(1+\delta\omega_t)^2$. The marginal benefit curve is thus equal to $\theta\delta q_t^2/\omega_N(t)$ which, using (4), can be shown to be a decreasing function of $\omega_E(t)$ for $\omega_N(t)$ given.

2/ Formally, the condition for an increase in $\omega_N(t)$ on $\omega_E(t)$ to be positive is that $\delta\omega_t > 1$, or (see equation 4) that the quit rate be less than one half, as assumed below.

Figure 1

Wages, Unit Labor Costs and the Quit Rate



is equivalent to restricting the quit rate to be less than one half. This restriction appears quite reasonable in practice. 1/

Substituting the optimal value of $\omega_E(t)$ from equation (5) in equation (4) and the result in equation (3*b*) determines the demand for labor in the export sector, $L_E^d(t)$. Substituting this result in equation (1) yields

$$Q_E^S(t) = Q_E^S[\omega_N(t)], \qquad Q_E^{S\prime} < 0 \tag{6}$$

which indicates that a rise in the real wage in the nontraded goods sector lowers output in the export sector. 2/

Production in the nontraded goods sector also takes place under decreasing returns to labor, and can be written as

$$Q_N(t) = L_N(t)^{\alpha_N}, \qquad 0 < \alpha_N < 0 \tag{7}$$

and real profits (in terms of the price of exports) are given by

$$\Pi_N = z_t^{-1} L_N(t)^{\alpha_N} - \omega_N(t) L_N(t), \tag{8}$$

where $z_t = 1/P_N(t)$ denotes the real exchange rate (with the nominal exchange rate normalized to unity), and $P_N(t)$ the domestic price of

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1/ There exists little systematic evidence on quit rates for developing countries. Authors such as Renard (1984), however, suggest that the rate of turnover in modern sector jobs (which are relatively more secure) is very low. Relying on the evidence for industrial countries would not contradict the assumption made in the text. For instance, in a recent study of the manufacturing sector in the United States, Anderson and Breyer (1994) estimate the average quarterly turnover rate at 23 percent (varying from 14 percent in the industrial public sector to 48 percent in agro-industries). The quit rates associated with permanent and temporary separations are respectively 17 percent and 6 percent.

2/ This result holds regardless of the direction in which an increase in the real wage in the nontraded goods sector affects the product wage in the export sector. Formally, we have

$$Q_E^{S\prime} = -\left(\frac{\alpha_E}{1-\alpha_E}\right)\left(\frac{\tilde{Q}_E}{\tilde{\Omega}_E[.]}\right)\left(\frac{\tilde{\omega}_E}{\tilde{\omega}_N}\right) < 0,$$

where a tilde is used throughout to denote steady-state values.

nontraded goods. Profit maximization yields the familiar equality between marginal revenue and marginal cost:

$$\omega_N(t) = z_t^{-1} Q_N'[L_N(t)], \tag{9}$$

from which labor demand can be derived as $L_N^d(t) = Q_N'^{-1}[z_t \omega_N(t)]$. Substituting this result in (7) implies

$$Q_N^s(t) = Q_N^s[z_t \omega_N(t)], \qquad Q_N^{s\prime} < 0 \tag{10}$$

where $z_t \omega_N(t)$ measures the product wage in the nontraded goods sector. From equations (6) and (10), real factor income--measured in terms of the price of exported goods--is given by

$$y_t = z_t^{-1} Q_N^s[z_t \omega_N(t)] + Q_E^s[\omega_N(t)]. \tag{11}$$

The determination of the equilibrium wage in the nontraded goods sector is discussed below.

2. Consumption and the market for nontraded goods

Households supply a fixed quantity of labor inelastically and consume imported and nontraded goods. Total consumption c_t (measured in terms of the price of exportables) is given by

$$c_t = \lambda(i^* b_t + y_t) + (1-\lambda)(i^* \tilde{b} + \tilde{y}) - \tau_t, \qquad 0 < \lambda < 1 \tag{12}$$

where i^* denotes the world interest rate (assumed constant), b_t the real stock of traded bonds, τ_t real lump-sum taxes (both measured in terms of the price of exported goods), and $\tilde{y}$ and $\tilde{b}$ the steady-state values of net factor income and bond holdings. Equation (12) indicates that aggregate consumption depends on disposable income, which is given by substracting lump-sum taxes from "expected" gross income--measured as a weighted average of current resources (net factor income and interest payments) and long-term (or permanent) income. 1/ This specification allows us to capture, in a relatively simple and tractable manner, the forward-looking component of consumption behavior that has been emphasized in intertemporal optimizing models of economic adjustment (see, for instance, Agénor and Aizenman, 1994).

1/ Note that our measure of permanent resources abstracts from discounting considerations. The value of λ may reflect, for instance, the intensity of liquidity constraints faced by households, which may prevent them from smoothing consumption spending in line with the long-run expected stream of income.

Setting the world price of imports to unity implies that the domestic price of imported goods is given by

$$P_I(t) = \iota, \tag{13}$$

where $0 < \iota - 1 < 1$ denotes the ad valorem tariff rate on imports.

Assuming that the household's instantaneous utility function in terms of domestic and foreign goods is Cobb-Douglas, the optimal allocation of aggregate consumption expenditure is given by

$$c_I(t) = \alpha c_t/\iota, \qquad c_N(t) = (1-\alpha)z_t c_t, \tag{14}$$

where $c_I(t)$ denotes consumption of imported goods, $c_N(t)$ consumption of nontraded goods, and $0 < \alpha < 1$ the utility weight attached to imported goods.

The flow budget constraint of the household is thus given by

$$\dot{b}_t = i^* b_t + y_t - z_t^{-1} c_N(t) - \iota c_I(t) - \tau_t. \tag{15}$$

Given that total consumption in equation (12) is defined as being equal to "expected" disposable income (or equivalently that the saving rate out of disposable income is equal to unity), it follows immediately from equation (15) that the steady-state value of the stock of foreign bonds--obtained by setting $\dot{b}_t = 0$ in (15) and using equation (14)--will remain invariant to any shock affecting net factor income or private spending, such as a change in tariff rates or lump-sum taxes. In what follows we normalize the steady-state level of foreign bonds to zero.

Using equations (10) and (14), the equilibrium condition of the market for nontraded goods can be written as

$$Q_N^S[z_t \omega_N(t)] = (1-\alpha)z_t c_t + g_N, \tag{16}$$

where g_N is the constant level of public spending on nontraded goods.

3. The government

The government, as indicated earlier, consumes nontraded goods and collects taxes on imported goods as well as lump-sum taxes on households. Its budget constraint can be written as:

$$(\iota - 1)c_I(t) + \tau_t = z_t^{-1} g_N, \tag{17}$$

which indicates that proceeds from tariffs on imported goods are returned to households as lump-sum transfers or tax rebates as long as they exceed government spending on nontraded goods.

The initial equilibrium (which prevails until an instant before $t = 0$) is assumed to be such that lump-sum taxes are zero ($\tau_{0-} = 0$), and that the import tax rate is high enough to equilibrate the budget. 1/ Using (14), the initial budget constraint is thus

$$\alpha\rho c_t = z_t^{-1} g_N, \qquad t < 0 \qquad (17')$$

where $\rho = (\iota-1)/\iota$ is the percentage tariff rate.

Substituting (11), (12), (14), (16) and (17') in (15) yields

$$\dot{b}_t = i^* b_t + Q_E^s(t) - \alpha c_t/\iota. \qquad (15')$$

4. Labor market adjustment

In the labor market, available workers queue up continuously to seek employment in the export sector. As indicated earlier, firms in that sector determine the wage so as to minimize total labor costs. They hire randomly from the queue, up to the point where their optimal demand for labor is satisfied. Although workers who cannot find a job in the export sector could obtain one in the nontraded goods sector, reallocation of the labor force cannot occur instantaneously--as a result of, say, relocation and congestion costs. 2/ Imperfect labor mobility implies therefore that the distribution of the workforce across sectors is predetermined at any moment in time.

Formally, let $\bar{L}$ be the size of the total labor force in the economy. The equilibrium condition that equates supply and demand for workers in the nontraded goods sector is given by

$$\bar{L} - L_E^s(t) = L_N^d[z_t \omega_N(t)], \qquad (18)$$

where $L_E^s(t)$ denotes the supply of labor in the export sector.

1/ The assumption that lump-sum taxes are initially zero is made for simplicity only. It allows us to characterize the tariff/fiscal reform discussed below as being a switch from distortionary taxes to a nondistortionary form of taxation.

2/ Relocation costs would be important if the production sectors were physically separated--as would happen if the nontraded good were an agricultural commodity produced in rural areas, and the traded good a manufactured item produced in urban areas.

The mechanism through which workers migrate across sectors follows the formulation of Harris and Todaro (1970), and relates movements of labor to the expected differential between sectoral wages. The expected wage in the export sector is equal to the going wage weighted by the probability of being hired. Since hiring is random, this probability can be approximated by the prevailing employment ratio. The expected wage in the nontraded goods sector is simply the going wage, since the probability of finding employment is unity in that sector. Thus, the supply of labor in the export sector evolves over time according to

$$\dot{L}_E^s(t) = \kappa\left\{\frac{\omega_E(t)L_E^d(t)}{L_E^s(t)} - \omega_N(t)\right\}, \qquad \kappa > 0 \tag{19}$$

where κ denotes the speed of adjustment. Equation (19) implies that in the steady state, with $\dot{L}_E^s(t) = 0$, the wage ratio $\tilde{\omega}$ is equal to the inverse of the employment rate in the export sector.

III. Tariffs, Real Wages and Employment

Before examining the effects of tariff reform, it is convenient to examine first the effect of changes in the dynamic variables (the stock of foreign bonds and labor supply in the export sector) on the short-run equilibrium values of the real exchange rate and the real wage in the nontraded goods sector. Noting that from (7) and the labor market equilibrium condition (18) $Q_N^s(t) \equiv (\bar{L}-L_E^s(t))^{\alpha_N}$, the profit maximization condition (9) and the equilibrium condition of the market for nontraded goods (16) can be written as, together with equations (6), (7) and (12) and $\tilde{b} = 0$:

$$\Lambda(\bar{L}-L_E^s(t))^{\alpha_N} - z_t(1-\alpha)\left\{\lambda(i^*b_t+Q_E^s[.])+(1-\lambda)\tilde{y}\right\} - g_N = 0, \tag{20a}$$

$$z_t\omega_N(t) - \alpha_N(\bar{L}-L_E^s(t))^{\alpha_N-1} = 0, \tag{20b}$$

where $\Lambda = 1-\lambda(1-\alpha) > 0$. From this system, it can be established that

$$z_t = z[b_t, L_E^s(t)], \qquad \omega_N(t) = \omega_N[b_t, L_E^s(t)]. \tag{21}$$

Equations (21) indicate that an increase in the stock of bonds raises the market-clearing wage in the nontraded goods sector (since it raises consumption of home goods, and thus output and the demand for labor) and leads to a real exchange rate appreciation--an increase in the relative price of home goods--which helps restore equilibrium

between supply and demand. An increase in the labor force in the export sector raises wages in the nontraded goods sector (since it lowers the supply of labor in that sector) but has an ambiguous effect on the real exchange rate. On the one hand, there is a negative supply effect, since the fall in output of nontraded goods induced by the wage increase (initiated in the nontraded goods sector, and then transmitted to the export sector, as a result of efficiency considerations) leads directly to an appreciation of the real exchange rate. On the other, there is a demand effect, which results from the fact that the fall in output in the nontraded goods sector lowers factor income and reduces private expenditure, thus requiring a real depreciation to restore equilibrium in the market for nontraded goods. Formally, we have

$$sg\left\{\frac{\partial z}{\partial L_E^s}\right\} = - sg\left\{\lambda(1-\alpha)\left(\frac{1 - \alpha_N}{\bar{L} - L_E^s}\right)Q_E' + \Lambda\right\} \gtreqless 0,$$

which indicates that if aggregate consumption responds mainly to permanent rather than current income ($\lambda \to 0$) the supply effect will dominate, and the net effect of an increase in the labor force in the export sector will be an appreciation of the real exchange rate.

Since, as indicated above, $Q_N^s(t) \equiv (\bar{L}-L_E^s(t))^{\alpha_N}$, the supply of nontraded goods is independent of changes in the stock of foreign bonds. Equations (6) and (21) imply that output of the export sector is inversely related to holdings of foreign bonds and the size of the labor force in the export sector:

$$Q_E^s(t) = Q_E^s[\bar{b}_t, L_E^s(t)]. \tag{22}$$

Substituting equations (11), (12), (14), (16), (17′), (21) and (22) in equation (15′) yields

$$\dot{b}_t = \left(1 - \frac{\alpha\lambda}{\iota}\right)(i^* b_t + Q_E^s[.]) - \frac{\alpha}{\iota}\left\{\lambda z(.)^{-1} Q_N^s[.] + (1-\lambda)\tilde{y}\right\}, \tag{23}$$

which determines the rate of accumulation of foreign assets.

Finally, using equation (5), substituting out the short-run equilibrium solution (21) and using both results in equation (19) yields

$$\dot{L}_E^s(t) = J[b_t, L_E^s(t)], \tag{24}$$

where

$$\frac{\partial J}{\partial b} = \kappa\left(\frac{\partial \omega_N}{\partial b}\right)\left\{\left(\frac{\partial \omega_E}{\partial \omega_N}\right)\left(\frac{\tilde{L}_E^d}{\tilde{L}_E^s}\right) + \left(\frac{\tilde{\omega}_E}{\tilde{L}_E^s}\right)\left(\frac{\partial L_E^d}{\partial \omega_N}\right) - 1\right\},$$

$$\frac{\partial J}{\partial L_E^s} = \kappa\left\{\left(\frac{\partial \omega_N}{\partial L_E^s}\right)\left[\left(\frac{\partial \omega_E}{\partial \omega_N}\right)\left(\frac{\tilde{L}_E^d}{\tilde{L}_E^s}\right) + \left(\frac{\tilde{\omega}_E}{\tilde{L}_E^s}\right)\left(\frac{\partial L_E^d}{\partial \omega_N}\right) - 1\right] - \frac{\tilde{\omega}_E \tilde{L}_E^d}{(\tilde{L}_E^s)^2}\right\}.$$

As indicated earlier, equation (5) implies that the elasticity of $\omega_E(t)$ with respect to $\omega_N(t)$ is less than unity. Using this result and the fact that the wage ratio is equal to the inverse of the employment ratio in the export sector in the vicinity of the steady state (see equation 19) yields

$$\frac{\partial J}{\partial b} = \kappa\left(\frac{\partial \omega_N}{\partial b}\right)\left\{\left(\frac{\partial \omega_E}{\partial \omega_N}\right)\left(\frac{\tilde{\omega}_N}{\tilde{\omega}_E}\right) - 1 + \left(\frac{\tilde{\omega}_E}{\tilde{L}_E^s}\right)\left(\frac{\partial L_E^d}{\partial \omega_N}\right)\right\} < 0,$$

$$\frac{\partial J}{\partial L_E^s} = \kappa\left\{\left(\frac{\partial \omega_N}{\partial L_E^s}\right)\left[\left(\frac{\partial \omega_E}{\partial \omega_N}\right)\left(\frac{\tilde{\omega}_N}{\tilde{\omega}_E}\right) - 1 + \left(\frac{\tilde{\omega}_E}{\tilde{L}_E^s}\right)\left(\frac{\partial L_E^d}{\partial \omega_N}\right)\right] - \frac{\tilde{\omega}_E \tilde{L}_E^d}{(\tilde{L}_E^s)^2}\right\} < 0.$$

Equations (23) and (24) determine the behavior of foreign assets and the size of the workforce in the export sector over time. 1/ Substituting the solution values of this system in equations (21) yields the equilibrium levels of the real wage in the nontraded goods sector and the real exchange rate.

A linear approximation to equations (23) and (24) around the steady state yields

$$\begin{bmatrix} \dot{b}_t \\ \dot{L}_E^s(t) \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ (\partial J/\partial b) & (\partial J/\partial L_E^s) \end{bmatrix} \begin{bmatrix} b_t - \tilde{b} \\ L_E^s(t) - \tilde{L}_E^s \end{bmatrix}, \tag{25}$$

where $\tilde{L}_E^s \leq \bar{L}$. The coefficients a_{11} and a_{12} are given by

$$a_{11} = \left\{1 - \frac{\alpha\lambda}{\iota}\right\}\left\{i^* + Q_E^{s\prime}\left(\frac{\partial \omega_N}{\partial b}\right)\right\} + \frac{\alpha\lambda}{\iota}\left(\frac{\tilde{Q}_N^s}{\tilde{z}^2}\right)\left(\frac{\partial z}{\partial b}\right),$$

$$a_{12} = \left\{1 - \frac{\alpha\lambda}{\iota}\right\}Q_E^{s\prime}\left(\frac{\partial \omega_N}{\partial L_E^s}\right) - \frac{\alpha\lambda}{\iota}\left\{\left(\frac{\partial Q_N^s}{\partial L_E^s}\right)\tilde{z}^{-1} - \left(\frac{\tilde{Q}_N^s}{\tilde{z}^2}\right)\left(\frac{\partial z}{\partial L_E^s}\right)\right\}.$$

1/ Through appropriate substitutions, the dynamics of the economy could also be expressed in terms of the unemployment rate in the export sector and the stock of foreign assets.

Assuming that i^* is small, the first coefficient is negative. The second coefficient is in general ambiguous. Given that a_{11} and $(\partial J/\delta L_E^S)$ are both negative, global stability of the system described by (25) requires that its determinant--given by $a_{11}(\partial J/\delta L_E^S) - a_{12}(\partial J/\delta b)$--be positive. A sufficient (although not necessary) condition for this result to hold is $a_{12} > 0$. We will assume that this is indeed the case in what follows.

The steady-state equilibrium of the model is depicted in Figure 2. The upward-sloping locus $[\dot{b}_t = 0]$ gives the combinations of b_t and $L_E^S(t)$ for which the stock of foreign assets remains constant, while the downward-sloping locus $[\dot{L}_E^S(t) = 0]$ depicts the combinations of b_t and $L_E^S(t)$ for which the size of the labor force in the export sector does not change over time. 1/ The steady-state equilibrium obtains at point E. If the economy's initial position is at, say, point A--characterized by an excess supply of labor in the export sector and a current account surplus--the transition towards the steady state will be monotonic and characterized by a continuous reduction in the stock of foreign assets, associated with an initial reduction of the labor force in the export sector (between points A and C) followed by a gradual increase (between points C and E).

1. Steady-state effects

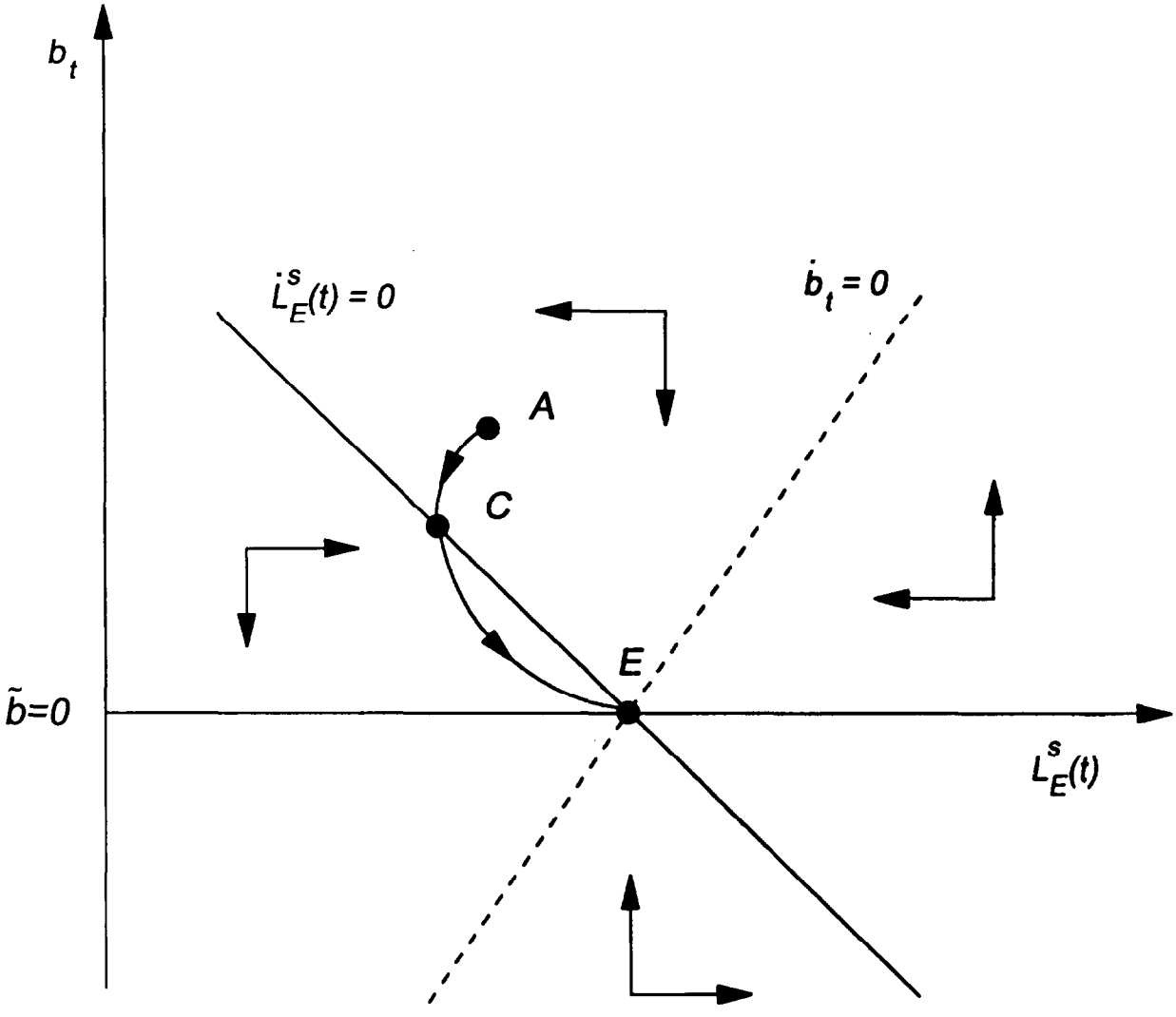
Consider now a tariff reform implemented at $t = 0$ starting from a situation in which, as described earlier, lump-sum taxes are zero and the tariff rate is high enough to generate sufficient revenue to cover government spending on nontraded goods. The reform consists in reducing the percentage tariff rate ρ, and simultaneously adjustming lump-sum taxes to equilibrate the government budget. 2/

1/ The locus $[\dot{b}_t = 0]$ is drawn as a hatched line in the figure to highlight the fact that its slope is not necessarily positive. If a_{12} is negative, $[\dot{b}_t = 0]$ will be also downward-sloping. Global stability then requires the $[\dot{L}_E^S(t) = 0]$ locus to be steeper than $[\dot{b}_t = 0]$.

2/ As indicated earlier, the assumption that lump-sum taxes are initially zero allows us to capture the case in which the country considered only has access to distortive means of taxation prior to reform. The policy experiment considered here involves therefore an element of fiscal restructuring, in that it consists of switching to less distortive taxation instruments.

Figure 2

Steady-State Equilibrium



To study the steady-state effects of the tariff reform, let us first consider the system prevailing before the adjustment. From equation (12), in the steady state, $\tilde{c} = \tilde{y} - \tilde{\tau}$. The government budget constraint (equation 17) can thus be written as

$$\alpha\rho(\tilde{y}-\tilde{\tau}) + \tilde{\tau} = z_t^{-1} g_N,$$

or, using equation (11):

$$\alpha\rho(\tilde{Q}_E+\tilde{z}^{-1}\tilde{Q}_N) + \tilde{\tau}(1-\alpha\rho) = \tilde{z}^{-1} g_N. \tag{26a}$$

The steady-state equilibrium condition of the labor market is given by, from equations (18) and (19):

$$\bar{L} = L_N^d(\tilde{z}\tilde{\omega}_N) + \tilde{L}_E^s = L_N^d(\tilde{z}\tilde{\omega}_N) + (\frac{\tilde{\omega}_E}{\tilde{\omega}_N})L_E^d(\tilde{\omega}_N), \tag{26b}$$

where, from equation (5), $\tilde{\omega}_E = \omega_E(\tilde{\omega}_N)$.

Finally, the long-run equilibrium condition of the nontraded goods market can be written as, using equation (16):

$$\alpha\tilde{Q}_N - (1-\alpha)\tilde{Q}_E\tilde{z} + (1-\alpha)\tilde{z}\tilde{\tau} = g_N. \tag{26c}$$

Equations (26) can be solved in terms of $\tilde{z}$, $\tilde{\omega}_N$, and $\tilde{\tau}$. Tedious but straightforward calculations show that 1/

$$\frac{d\tilde{\tau}}{d\rho} < 0, \qquad \frac{d\tilde{\omega}_N}{d\rho} > 0, \qquad \frac{d\tilde{z}}{d\rho} < 0, \qquad \frac{d\tilde{z}\tilde{\omega}_N}{d\rho} < 0.$$

A reduction in the percentage tariff rate raises lump-sum taxes, exerting a negative income effect on total consumption. The induced reduction in private spending on nontraded goods requires a depreciation of the real exchange rate to maintain market equilibrium. The real depreciation tends to increase the product wage in the nontraded goods sector, thereby lowering output and the demand for labor in that sector. The reduction in labor demand puts downward pressure on the market-clearing wage, thus partly offseting the effect of the real depreciation. But because the real exchange rate depreciation is proportionally larger than the reduction of the real wage in the nontraded goods sector, the product wage rises and lowers output and employment in that sector. By contrast, the reduction in the real wage in the nontraded goods sector leads to a fall in the

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1/ An Appendix providing the exact solutions is available from the authors upon request.

product wage in the export sector, which stimulates output and employment. The net effect on total employment is in general ambiguous, since employment rises in the export sector, and falls in the nontraded goods sector. Aggregate output measured in terms of traded goods, nevertheless, is likely to rise.

To determine how the relative wage ratio evolves, note that

$$\frac{d}{d\rho}\left(\frac{\tilde{\omega}_N}{\tilde{\omega}_E}\right) = \left(\frac{\tilde{\omega}}{\tilde{\omega}_N}\right)\left(\frac{d\tilde{\omega}_N}{d\rho}\right)\left\{\frac{d\omega_E/\omega_E}{d\omega_N/\omega_N} - 1\right\}, \tag{27a}$$

which implies that, if the elasticity of the efficiency wage relative to the market-clearing is less than unity (as implied by the quit function used here) the wage ratio increases ($d\tilde{\omega}/d\rho < 0$) as a result of tariff reform. Equivalently, the efficiency wage in the export sector falls proportionally less than the market-clearing wage. From this result, the effect of the tariff reform on the supply of labor in the export sector can also be determined. From equation (19), the steady-state solution for labor supply in the export sector is given by $\tilde{L}_E^s = \tilde{\omega}_E \tilde{L}_E^d / \tilde{\omega}_N$, which implies that

$$\frac{d\tilde{L}_E^s}{d\rho} = \left(\frac{d\tilde{\omega}_N}{d\rho}\right)\left[\tilde{\omega}\frac{d\tilde{L}_E^d}{d\rho} + L_E^d(\tilde{\omega}_N)\left(\frac{\tilde{\omega}}{\tilde{\omega}_N}\right)\left\{\frac{d\omega_E/\omega_E}{d\omega_N/\omega_N} - 1\right\}\right]. \tag{27b}$$

Given that the demand for labor rises in the export sector ($d\tilde{L}_E^d/d\rho < 0$) and that the wage elasticity is less than unity, equation (27*b*) indicates that the tariff reform raises the size of the labor force in that sector ($d\tilde{L}_E^s/d\rho < 0$). Moreover, as implied by equation (27*a*) and the equilibrium condition $\tilde{\omega} = \tilde{L}_E^s/\tilde{L}_E^d$, labor supply rises by more than demand, lowering the employment ratio. To the extent that tariff reform leads to a transfer of labor from the nontraded goods sector (where it earns its marginal product) to the export sector (where it is paid more than its marginal product), the use of production factors becomes less efficient.

The (sectoral) unemployment rate can be defined as

$$u_E(t) = [L_E^s(t) - L_E^d(t)]/L_E^s(t),$$

so that in the steady state, using equation (19): 1/

1/ Unemployment is thus positive in the steady state. Since the government operates no unemployment benefits scheme in this model, unemployed workers in the steady state are assumed to revert to a "subsistence" sector or to rely on support from working relatives.

$$\tilde{u}_E = 1 - (\tilde{\omega}_N/\tilde{\omega}_E).$$

Using the results derived earlier, it can be established that

$$\frac{d\tilde{u}_E}{d\rho} = \tilde{\omega}_E^{-1}\frac{d\tilde{\omega}_N}{d\rho}\left\{\frac{d\omega_E/\omega_E}{d\omega_N/\omega_N} - 1\right\}, \tag{27c}$$

which shows that a reduction in tariffs raises the unemployment rate in the steady state ($d\tilde{u}_E < 0$) if the elasticity of the efficiency wage with respect to the market-clearing wage is less than unity. In such a case, the increase in labor demand and actual employment in that sector is more than offset by the rise in the size of the labor force seeking employment in the export sector.

Finally, it can be shown that the reform has no effect on the steady-state stock of bonds--which remains, as indicated earlier, equal to zero--and that the purchasing power of workers' earnings in both sectors rises in terms of nontraded goods. However, the net welfare effect of tariff reform is in general ambiguous and depends on the magnitude of the wage differential across sectors.

2. Short-run dynamics

To examine the short-run dynamic behavior of the model after reform, note that equation (23′) becomes, after implementation of the tariff/fiscal adjustment:

$$\dot{b}_t = i^* b_t + Q_E^s[.] - \frac{\alpha}{\iota}\left[\lambda\left\{i^* b_t + Q_E^s[.] + z(.)^{-1}Q_N^s[.]\right\} - \tau_t + (1-\lambda)\tilde{y}\right], \tag{28}$$

with $\tau_t = z_t^{-1} g_N$ from equation (17). The dynamic system consists now of (24) and (28), and can be linearized to study its properties.

The impact effect of the trade liberalization program on wages, employment and output (given that the stock of bonds and the labor force in the export sector cannot change instantaneously) is in general indeterminate and depends on the degree to which consumption responds to long-run income or transitory income. Regardless of the value of λ, however, since labor reallocation across sectors cannot occur instantaneously, the product wage in the nontraded goods sector must remain constant on impact as a result of offsetting movements in the real wage and the real exchange rate:

$$\frac{dz_0\omega_N(0)}{d\rho} = 0. \tag{29a}$$

This result implies therefore (see equation 10) that output and employment in the nontraded goods sector do not change on impact. The instantaneous effect on total factor income--measured in terms of the price of exports--thus depends only on the direction of the initial effect on output of exported goods:

$$sg\left(\frac{dy_0}{d\rho}\right) = sg\left(\frac{dQ_E^S(0)}{d\rho}\right) = Q_E^{S\prime} sg\left(\frac{d\omega_N(0)}{d\rho}\right). \tag{29b}$$

For instance, if the consumption behavior of households responds essentially to changes in current resources ($\lambda \to 1$), we have

$$\frac{dz_0}{d\rho} < 0, \qquad \frac{d\omega_N(0)}{d\rho} > 0,$$

which indicate that the reduction in tariffs lowers wages in the nontraded goods sector (and thus in the export sector as well) and leads to a depreciation of the real exchange rate. This result obtains because the impact effect of tariff reform is an increase in lump-sum taxes and a reduction in consumption of both domestic and imported goods. As a result, the real exchange rate must depreciate to maintain equilibrium in the market for nontraded goods. Since, as shown in equation (29*a*), the product wage cannot change on impact in the nontraded goods sector, the market-clearing wage measured in terms of export goods must fall--thereby reducing the efficiency wage and raising the demand for labor and output in the export sector. The increase in exports--which translates, as shown in equation (29*b*), into an equivalent increase in net factor income--dampens the initial adverse effect of taxes on private expenditure. The short-run effect on the unemployment rate is

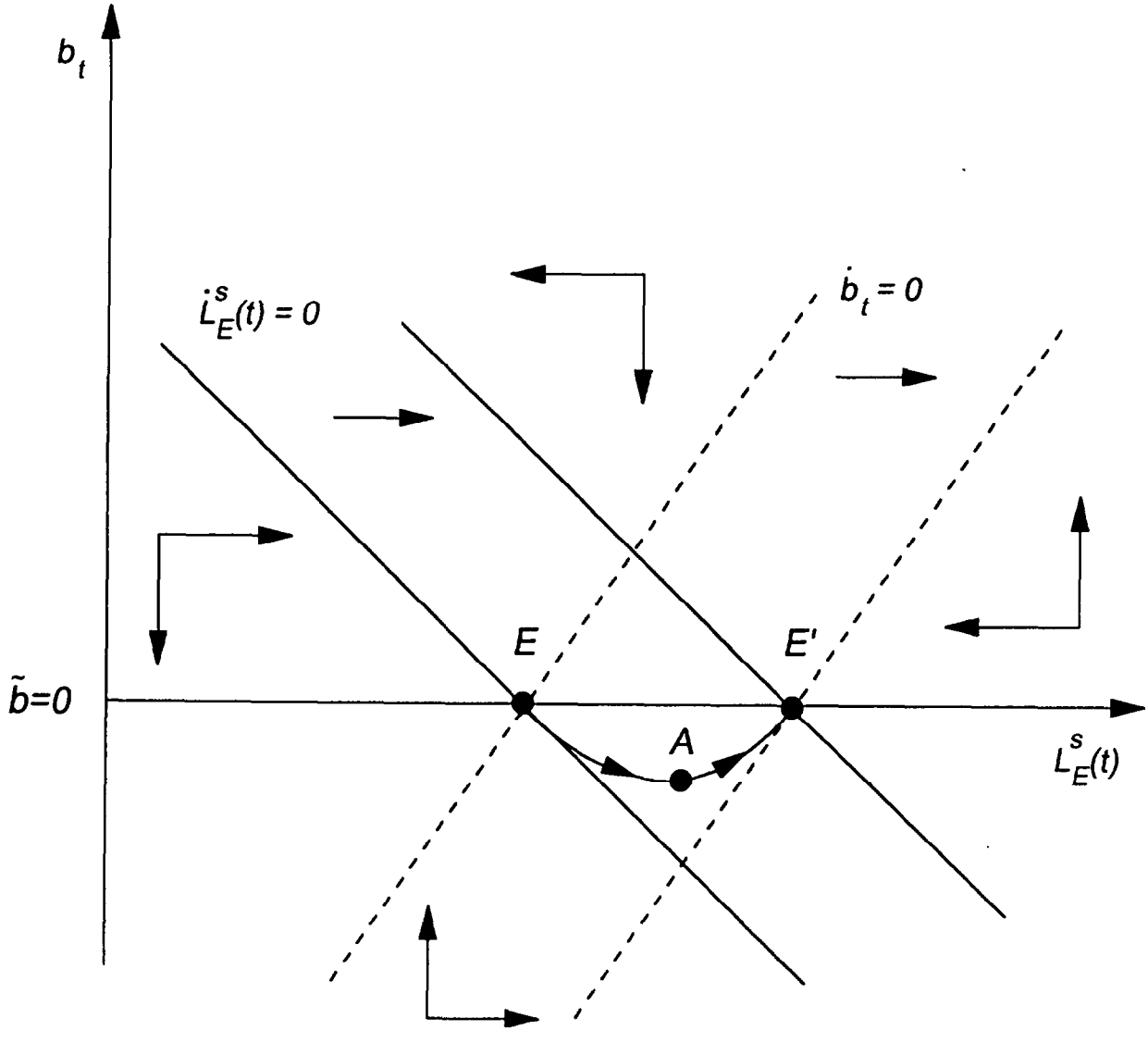
$$\frac{du_E(0)}{d\rho} = -\frac{L_E^{d\prime}}{L_E^S(0)}\left(\frac{d\omega_N(0)}{d\rho}\right) > 0, \tag{29c}$$

which shows that, as a result of the increase in labor demand and employment in the export sector, the unemployment rate in that sector falls on impact. Thus, while the steady-state effect of tariff reform on unemployment may be negative (if the elasticity of the efficiency wage relative to the market-clearing wage is less than unity), the short-run effect may be positive--assuming that consumption depends mostly on current income.

The dynamic adjustment path is shown in Figure 3. Suppose that the economy is initially located at the steady-state point E. The reduction in the tariff rate shifts both curves $[\dot{L}_E^S(t) = 0]$ and $[\dot{b}_t = 0]$ to the right. In the case shown in the figure, the reduction in the percentage tariff rate raises consumption of imported goods

Figure 3

Adjustment to Tariff Reform



during the transition period. The economy runs a current account deficit during the first stage of the adjustment process (between points E and A) and accumulates foreign debt ($\dot{b}_t < 0$), whereas in a second stage (between points A and E') it generates a current account surplus which reduces foreign debt ($\dot{b}_t > 0$). 1/ The new long-run equilibrium, which obtains at point E', is again characterized by a zero steady-state level of foreign bonds and an increase in the size of the labor force in the export sector.

IV. Intuitive Discussion of the Results

Because several of our results appear to differ markedly from the conventional view of trade reform, it is worth discussing in a more intuitive manner than previously done the mechanisms through which an adjustment in tariffs operates in our model. A convenient starting point for this discussion is a brief summary of the standard, trade-theoretic view of the effects of trade liberalization in a small open economy. We then attempt to highlight how the assumptions underlying our analytical framework depart from conventional ones, and how general these alternative assumptions are.

The "orthodox" or neoclassical view of trade liberalization rests on the assumptions of perfect flexibility of wages and prices, and perfect labor mobility across sectors. The absence of market imperfections implies that (as noted in the introduction) a reduction in tariff protection leads to changes in relative prices that affect both supply and demand, and leads to a full and instantaneous reallocation of resources across sectors. In the case for instance where the economy produces three categories of goods--importables, exportables, and nontradables--with sector-specific capital, trade reform leads to lower employment in the production of importables and an increase in employment in the production of exportables. If trade reform is associated with a depreciation of the real exchange rate (measured in terms of a weighted average of the prices of exportables and importables), the reduction in tariffs will also be associated with an overall transfer of labor from sectors producing nontradables towards those producing tradables, thus reducing employment in the home goods sector and mitigating the fall in employment in the import-competing industries. However, unemployment cannot emerge in

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1/ As can be inferred from equation (28), the adjustment path depicted in the figure corresponds to the case where adjustment is monotonic and aggregate consumption depends mostly on long-run income, that is, $\lambda \to 0$. The rise in expenditure therefore reflects the positive effect of tariff reform on the steady-state value of income. However, it should be noted that the reverse scenario would prevail if instead aggregate consumption were assumed to be mainly a function of current income ($\lambda \to 1$).

this setting, since workers are perfectly mobile across sectors and wages adjust continuously to clear the labor market. 1/

To address the possibility of unemployment--the main task of the present study--requires taking a stand on the nature of possible deviations from the frictionless, neoclassical world characterized above. Our approach--which makes no claim for generality--has been to focus on some possible ways of modeling market rigidities and to examine how standard predictions are altered as a result. Specifically, the predictions that we derived in the previous sections differ from the coventional view in two important aspects: the unemployment rate may fall in the short run, whereas it may rise in the longer run. To derive these results, our model departs from the "orthodox" approach in two major respects: the modeling of the labor market, and the specification of the production structure.

Regarding the modeling of the labor market, there are three major assumptions underlying our results: wage efficiency considerations are important and are relevant only in the export sector; the specification of the quit function is such that the elasticity of the wage in the export sector relative to the wage in the nontraded goods sector is less than unity; and labor reallocation across sectors is gradual and follows a Harris-Todaro migration mechanism. ALthough we are unable to support the assumption that efficiency factors matter only in the export sector by detailed empirical evidence, we view our approach as a plausible way of modeling wage formation in modern industries subject to world competition. The introduction of an intersectoral wage differential in equilibrium serves in our model as a necessary (although not sufficient) condition for unemployment to emerge. 2/ We view our assumptions regarding the quit function and the labor migration process as more debatable than the assumption of efficiency wages.

The Harris-Todaro migration mechanism embedded in our model plays a critical role in deriving the short-run and steady-state effects of trade liberalization. It prevents an instantaneous reallocation of the labor force across sectors, and requires the wage ratio to be equal in the steady state to the inverse of the employment rate in the export sector. It is precisely the equilibrium condition imposed by

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1/ To the extent that the income effect associated with trade reform affects the supply of labor, "secondary" wage and employment effects may occur. Such effects would not, however, lead to an increase in unemployment with perfect wage flexibility.

2/ It should be noted that in the absence of any type of frictions in intersectoral labor mobility, involuntary unemployment would not normally emerge in our model since wages in the nontraded goods sector are perfectly flexible. Voluntary unemployment might exist to the extent that the disutility associated with working in the nontraded goods sector is perceived to be higher than the cost of remaining unemployed.

the Harris-Todaro migration function that helps determine the steady-state effect of tariff reform on the wage ratio (and consequently on the employment rate in the export sector), the allocation of the labor force, and the unemployment rate, as shown in equations (27). In the general form in which equations (27) are written, they clearly indicate that the steady-state effects of tariff reform on the labor market depend critically on the elasticity of the efficiency wage in the export sector relative to the market-clearing wage in the nontraded goods sector. 1/ The quit function specified in our framework--which is derived from underlying microeconomic principles in the Appendix--implies that the wage elasticity is less than unity. As a result, labor supply in the export sector rises by more than labor demand, and the unemployment rate rises. Thus, an alternative (and perhaps equally plausible) specification of the quit function that would yield a wage elasticity higher than unity would imply a reduction in steady-state unemployment--as emphasized in the conventional view--whereas an elasticity exactly equal to unity would imply no long-run effect at all. A unit elasticity (or equivalently, a constant relative wage ratio) could be generated in the present framework by modeling efficiency considerations through a wage-productivity link, as rigorously derived by Agénor and Aizenman (1994) in a related context. Overall, therefore, the direction of the effects of tariff reform on the labor market discussed above depends essentially on the plausibility and generality of the Harris-Todaro migration mechanism and on our specification of the quit rate. 2/

The assumption that labor is imperfectly mobile across sectors also implies that the distribution of the labor force cannot change instantaneously. Fixed labor supply in the export sector has important consequences for the short-run effects of trade reform. Although most of these effects are ambiguous in general, we showed that "perverse" results can be obtained when consumption reacts mostly to changes in current disposable income. A reduction in tariffs in this case lowers wages in the nontraded goods sector--as a result of the real depreciation of the exchange rate induced by the need to offset the initial reduction in consumption spending and maintain equilibrium of the home goods market--and, given the efficiency wage mechanism embedded in the model, translates into lower wages in the export sector and an increase in labor demand. The employment ratio unambigously rises and the unemployment rate falls (equation 29c).

1/ The elasticity condition was also used in signing the partial derivatives of the function relating changes in employment in the export sector to the expected wage differential (equation 24).

2/ As can be inferred from the results of Arellano (1981) and Renard (1984), alternative specifications of the migration function (equation 19) may affect our results. Stark (1991) provides a thorough criticism of the Harris-Todaro migration mechanism, particularly with regard to the absence of any role played by nonpecuniary elements--such as family and religious ties--in the decision to migrate.

The assumption that labor is imperfectly mobile across sectors alters fundamentally the conventional transmission mechanism of trade reform, since the reallocation of resources in response to relative price signals can only take place over time. It has, however, considerable appeal from an empirical point of view and has been emphasized by a number of economists (see for instance Mussa, 1986).

Regarding the production structure, the model makes an important assumption: there is no domestic output of importables--or, more precisely, inefficiencies associated with the initial tariff structure are so large that goods that are potentially importable have effectively become nontraded. This specification implies that a key channel through which an adverse unemployment effect may emerge in the short-run (the elimination of protection to inefficient import-competing industries) is absent. As indicated above, in our model the main factors explaining why the unemployment rate may rise or fall in the short run are quite different: they relate to the presence of liquidity constraints (which make consumption depend mostly on current income), the existence of a (persistent) wage differential across sectors, and imperfect labor mobility. Since interactions between these factors are such that they tend to lower short-run unemployment in our model, whether the agggregate unemployment rate rises or falls in the presence of an import-competing sector cannot be established a priori. To the extent that both types of effects offset each other, trade reform will have no immediate perceptible effect on unemployment.

More generally, while our treatment of the production structure may carry some plausibility in the short- and medium run, it is clear that a large and sustainable trade reform may significantly alter the composition of production activities over time--for instance, importables that were once nontraded may be traded again. This in turn may lead to a reduction in the opportunity cost faced by workers in the exportable sector, which may stimulate employment and output in that sector. Trade liberalization may also induce the creation of new production activities over time, increasing thereby the demand for labor. Accounting analytically for this type of changes in the production structure is beyond the scope of the paper but provides an important caveat to our results. Accordingly, our "steady state" results are best characterized as related to the "medium run" rather than the "long run" effects of trade liberalization on output, wages and unemployment.

V. Summary and Conclusions

The role of labor markets in the design of macroeconomic and structural adjustment programs has been the subject of renewed attention in recent years. This paper has attempted to provide a theoretical framework for understanding the role of a particular set of labor market distortions on the short- and medium-run effects of trade liberalization. The analysis considered a small open economy

producing exportable and nontradable goods, with imperfect labor mobility across sectors. Private consumption expenditure was taken to depend linearly on "expected" disposable income, with the weight attached to current income (as opposed to permanent income) being related positively to the intensity of liquidity constraints faced by households. Firms in the export sector were assumed to face significant costs associated with labor turnover. Specifically, the production process in the export sector was assumed to be characterized by a fixed recruiting and training cost per worker, which occurs upon hiring a worker in order to replace the vacancy created by another worker quitting the firm. The quit rate (which we attempted to derive explicitly from underlying microeconomic considerations) was shown to depend on the wage ratio across sectors. As a result of this formulation, wages in the export sector (determined so as to minimize total labor costs) were shown to be positively related to the market-clearing wage in the nontraded goods sector. The analysis indicates that the interactions between the process of wage formation and the structure of production activities may lead to an adverse effect of tariff reduction (coupled with an increase in lump-sum taxes to equilibrate the budget) on unemployment in the steady state, despite an increase in output and employment (induced by a fall in real wages) in the exportable sector. The wedge between the efficiency wage and the marginal product of labor in the export sector implies that the sectoral reallocation of workers reduces production efficiency. Moreover, this adverse effect may not result from labor regulations inhibiting the reallocation of labor and wage flexibility--such as difficulties of firing workers, as argued for instance by Feliciano (1994) and Revenga (1994) in their recent analysis of the employment effects of trade reform in Mexico--but rather from considerations endogenous to firms. In the short run, trade reform may lead to a reduction in the unemployment rate if households are subject to liquidity constraints. The assumption of imperfect labor mobility and the size of the elasticity of wages in the export sector relative to wages in the nontraded goods sector were shown to play a critical role in determining the direction of both the short- and medium-run effects of trade liberalization on employment and unemployment.

The analysis developed here can be extended in a variety of directions. We have not examined here issues related to intersectoral capital mobility, or those raised by the need to compensate unemployed workers for jobs lost, although this issue bears considerable importance (from a welfare or political-economy point of view) in discussions related to trade liberalization. 1/ Introducing wage rigidity in the nontraded goods sector--along the lines of Djajic and Purvis (1987), for instance--would allow an analysis of generalized

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1/ Brecher and Choudhri (1994) have recently examined this issue--with a focus on taxation-based compensation schemes--in a static model in which efficiency wages (motivated by a wage-effort link) generate unemployment, as in the model developed here.

unemployment during the transition process. Another important extension would be to account for the existence of worker heterogeneity, along the lines of Agénor and Aizenman (1994). In her study of trade liberalization in Mexico, for instance, Revenga (1994) notes that the observed increase in average manufacturing wages may have reflected a change in the composition of the labor force--a shift towards high-skill, high-wage workers. A similar shift in the composition of the workforce was noted was Currie and Harrison (1994) in their analysis of trade reform in Morocco. Understanding the mechanisms through which tariff reductions affect the skill composition of the workforce is particularly important for studying their distributional effects.

Finally, it is worth reflecting on the gap that appears to exist between the evidence on the employment effects of trade liberalization (which, as discussed in the introduction, provides mixed results) and the favorable evidence on the growth effects of outward orientation, as documented in numerous studies (see, for instance, Edwards, 1993). This gap may be related to the difference between a medium- versus a long-run horizon, as well as the difference between evaluating trade liberalization in isolation versus comprehensive reform programs that enhance the efficiency of capital accumulation and the degree of intersectoral labor mobility. The present paper analyzed the short/medium-term effects of trade reform programs that do not modify the set of production activities carried out in the economy. However, as emphasized in Section IV, a very drastic trade liberalization package (or a package that is part of a comprehensive restructuring program) may encourage in the long term the formation of new activities, changing over time the sectoral composition of output. 1/ Analyzing such programs is likely to alter substantially the predictions of our model regarding the impact of trade reform on employment. Even if trade liberalization may entail significant adjustment costs in the short or the medium term, it may still be highly beneficial in the long run. It is, nevertheless, important to weigh carefully potential transitional costs--as emphasized in recent writings on the political economy and the credibility of adjustment programs--and devise reform strategies so as to minimize them and ensure the sustainability of the adjustment process.

1/ Note also that elasticities of substitution between production inputs are generally higher in the long run.

Appendix

Derivation of the Quit Function

This Appendix provides an explicit derivation of the quit function defined in equation (4), following in part McFadden (1973). Suppose that the net compensation of worker h when employed in the nontraded goods sector or the export sector are given by, respectively, the following equations:

$$V_N^h = c_N + ln\omega_N + \epsilon_N^h, \qquad (A1a)$$

$$V_E^h = c_E + ln\omega_E + \epsilon_E^h, \qquad (A1b)$$

where the terms c_N and c_E measure the non-pecuniary benefits of working in the nontraded and export sectors respectively, such as proximity to family and friends, and physical location of activities. The term in ϵ^h is a personal taste (or idiosyncratic) variable, whose distribution across agents is assumed to follow the Weibull (or extreme value) distribution. The density and cumulative functions of this distribution are given by

$$f(\epsilon^h) = exp[-\epsilon^h - e^{-\epsilon^h}], \qquad (A2)$$

$$F(\epsilon^h) = exp[-e^{-\epsilon^h}]. \qquad (A3)$$

A worker employed in the export sector decides to quit when the net compensation in the nontraded goods sector is likely to be higher than the current one, that is:

$$V_N^h > V_E^h. \qquad (A4)$$

Using equations (A1), equation (A4) implies

$$\epsilon_E^h < (c_N - c_E) + \epsilon_N^h + ln(\frac{\omega_N}{\omega_E}). \qquad (A5)$$

Let $c = c_N - c_E$. Using equations (A2), (A3), and (A5), the probability that an individual drawn randomly from the population of employed workers in the export sector will opt to quit is given by

$$Prob\left[\epsilon_E^h < \epsilon_N^h + c + ln(\frac{\omega_N}{\omega_E})\right] = \int_{-\infty}^{+\infty} exp[-e^{-\{\epsilon_N^h + c + ln(\omega_N/\omega_E)\}}] exp[-\epsilon_N^h - e^{-\epsilon_N^h}] d\epsilon_N^h$$

$$= \int_{-\infty}^{+\infty} exp\left[-e_N^h - e^{-\epsilon_N^h}\left\{1 + exp[-(c+ln(\frac{\omega_N}{\omega_E})]\right\}\right] d\epsilon_N^h.$$

Let $\Psi = ln\left\{1 + exp[-(c+ln(\frac{\omega_N}{\omega_E})]\right\}$. The above expression therefore becomes

$$\int_{-\infty}^{+\infty} exp\left[-e_N^h - e^{-\epsilon_N^h+\Psi}\right] d\epsilon_N^h = \int_{-\infty}^{+\infty} exp(-\Psi) exp\left[-e_N^h + \Psi - e^{-\epsilon_N^h+\Psi}\right] d\epsilon_N^h$$

$$= exp(-\Psi)\left\{\int_{-\infty}^{+\infty} exp\left[-e_N^h + \Psi - e^{-\epsilon_N^h+\Psi}\right] d\epsilon_N^h\right\} = 1/exp(\Psi),$$

since the integral expression in brackets is equal to unity. Setting $\delta = exp(-c)$ yields equation (5) in the text.

References

Agénor, Pierre-Richard, and Joshua Aizenman, "Macroeconomic Adjustment with Segmented Labor Markets," Working Paper No 4769, National Bureau of Economic Research (June 1994).

Anderson, Patricia M., and Bruce D. Breyer, "The Extent and Consequences of Job Turnover," Brookings Papers on Economic Activity, Special Issue (June 1994), pp. 177-236.

Arellano, José-Pablo, "Do More Jobs in the Modern Sector Increase Urban Unemployment?," Journal of Development Economics, Vol. 8 (April 1981), pp. 241-47.

Brecher, Richard A., and Ehsan U. Choudhri, "Pareto Gains from Trade, Reconsidered," Journal of International Economics, Vol. 36 (May 1994), pp. 223-38.

Buffie, Edward F., "The Macroeconomics of Trade Liberalization," Journal of International Economics, Vol. 17 (August 1986), pp. 121-37.

Cox Edwards, Alejandra, and Sebastian Edwards, "Labor Market Distortions and Structural Adjustment in Developing Countries, in Labor Markets in an Era of Adjustment, ed. by Ravi Kanbur, Susan Horton, and Dipak Mazumdar, the World Bank (Washington DC: 1994).

Currie, Janet, and Ann Harrison, "Trade Reform and Labor Market Adjustment in Morocco," unpublished, the World Bank (June 1994).

Djajíc, Slobodan, and Douglas D. Purvis, "Intersectoral Adjustment and the Dynamics of Wages," Weltwirtschafliches Archives, Vol. 123 (June 1987), pp. 849-64.

Dornbusch, Rudiger, and Alejandro Werner, "Mexico: Stabilization, Reform, and No Growth," Brookings Papers on Economic Activity, No 1 (June 1994), pp. 253-98.

Edwards, Sebastian, "Terms of Trade, Tariffs and Labor Market Adjustment in Developing Countries," World Bank Economic Review, Vol. 2 (May 1988), pp. 165-85.

———, "Openness, Trade Liberalization, and Growth in Developing Countries," Journal of Economic Literature, Vol. 31 (September 1993), pp. 1358-93.

Feliciano, Zadia M., "Workers and Trade Liberalization: the Impact of Trade Reforms in Mexico on Wages and Employment," unpublished, Harvard University (June 1994).

Harris, John, and Michael P. Todaro, "Migration, Unemployment and Development: A Two-Sector Analysis," American Economic Review, Vol. 60 (March 1970), pp. 126-43.

Krueger, Ann O., Trade and Employment in Developing Countries, Chicago University Press (Chicago, Il.: 1983).

———, "How to Liberalize a Small Open Economy," in The Economics of the Caribbean Basin, ed. by Michael B. Connolly and John McDermott, Prager Publishers (New York: 1985).

McFadden, Daniel, "Conditional Logit Analysis of Qualitative Choice Behavior," in Frontiers in Econometrics, ed. by Paul Zarembka, Academic Press, (New York: 1973).

Mussa, Michael, "The Adjustment Process and the Timing of Trade Liberalization," in Economic Liberalization in Developing Countries, ed. by Armeane M. Choksi and Demetris Papageorgiou, Basil Blackwell (Oxford: 1986).

Papageorgiou, Demetris, Armeane M. Choksi, and Michael Michaely, Liberalizing Foreign Trade in Developing Countries, the World Bank (Washington DC: 1990).

Rama, Martin, "The Labor Market and Trade Reform in Manufacturing," in The Effects of Protectionism on a Small Country, ed. by Michael Connolly and Jaime de Melo, World Bank Regional and Sectoral Studies (Washington DC: 1994).

Renard, Robrecht, "Rural-to-Urban Migration and the Shadow Wage in LDCs," European Economic Review, Vol. 24 (April 1984), pp. 401-07.

Revenga, Ana, "Employment and Wage Effects of Trade Liberalization: the Case of Mexican Manufacturing," unpublished, the World Bank (June 1994).

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

Stiglitz, Joseph E., "ALternative Theories of Wage Determination and Unemployment in LDCs: the Labor Turnover Model," Quarterly Journal of Economics, Vol. 98 (May 1974), pp. 194-227.