

Import Competition in the High-Wage Sector and
Trade Policy Effects on Labor

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Abstract

This article evaluates the employment and welfare effects of increased trade competition and protection in economies with wage dualism, unemployment, and on-the-job search. A micro-based measure of economy welfare distinguishes between workers and other sectors of the economy is developed to deal with labor market imperfections and distributional issues. For example, increased competition in high-wage sector goods reduces high-wage employment, but may or may not increase overall unemployment. Policy may be chosen to mitigate loss in worker earnings that are partly or wholly offset by gains to consumers of the importable.

Trade competition affects US workers, both in the structure of their job opportunities and in the prices they pay as consumers. To determine how the impact of trade competition would change under alternative policies, a formal analytical framework is needed. The goals of this study are to develop a theoretical model that incorporates key aspects of international trade conditions and regimes as well as important features of the functioning of the US labor market.

As is well known, standard international trade theory asserts that free international trade is welfare-improving for both trading partners; or put differently, the absence of international trade can never yield higher welfare for either country. But the limitations of the standard argument are also well known. Free international trade often leads to unemployment and consequent welfare losses. The traditional literature assumes full employment. Not only is this assumption inconsistent with the facts — it also fails to consider the effects of various policy measures in situations in which the consequences of unemployment are a major consideration in deciding which policy is most appropriate.

In this article, we analyze the employment and welfare effects of trade using a labor market model that is more sophisticated than the labor market models used in trade theory to date. This model allows for three sectors and different wages in each, thereby incorporating wage diversity, unemployment and underemployment, on-the-job search, and job mobility — all of which must be considered in any analysis of the labor market effects of trade.

The labor market model and its solution are described in the second and third sections. The fourth and fifth sections use this model to analyze the labor market and welfare economic consequences of trade competition in the absence of policy intervention and with trade protection. The final section offers conclusions.

THE LABOR MARKET MODEL

The Need for Wage Dualism, Unemployment, and On-the-job Search

The question we address in this article is what effects import competition would have on US workers under alternative trade policies. Many studies do as we do in defining import competition as an additional supply of foreign goods that lowers the price of a domestically produced good. The treatment of labor markets differs among authors, however.

In one group of models, the authors have sought to describe the effects of trade in the presence of persistent unemployment caused by an economy-wide minimum wage. Among the major contributions in this literature are those of H. G. Johnson [20] and Richard Brecher [5] (see J. N. Bhagwati and T. N. Srinivasan [3, Chapter 22] for a summary). By assuming an economy-wide minimum wage, these authors assume the labor market to be homogeneous; there is no distinction between high-wage and low-wage sectors of the economy.

In another group of models, wage dualism exists. Among the models with this feature are those of James Cassing and Jack Ochs [7], E. J. Ray [26], Erling Steigum [27], R. E. Baldwin [1], and F. G. Barry [2]. However, in these models, the treatment of unemployment is less than satisfactory. Baldwin has no unemployment at all; he supposes that all workers displaced from one sector due to import competition take up employment in the other. In Cassing and Ochs's, Ray's, and Steigum's models, unemployment is found, but only in the short run; in the long run, the labor market adjusts so that all workers are employed in one sector or the other. Barry specifies work-sharing among all those in the high wage sector. Thus, while there may be unemployed labor *hours* in his model, there are no unemployed *people*. In all these articles, by

having unemployment not persist in equilibrium, the authors treat the labor market as more flexible than it is.

Yet other models of import competition have neither wage dualism nor unemployment in equilibrium. Among the models in this category are those by H. E. Lapan [21], D. O. Parsons [25], Michael Bruno [6], Peter Neary [24], B. A. Forster and Ray Rees [12], and Harry Flam, Torsten Persson, and L. E. O. Svensson [11].

We see all of the preceding models as useful up to a point, yet not fully consistent with certain basic empirical facts about employment and wages in the United States. One is that certain labor markets tend to have persistently higher wages than others for comparable workers (E. A. Hanushek [17]). This suggests that wage rigidity rather than market-clearing wages may typify certain segments of the labor market. Another is the finding of R. E. Hall [16] that high-wage labor markets are characterized by high unemployment rates. Hall and others interpret this pattern as reflecting the influx of job-seekers in pursuit of jobs in high-paying industries or localities. And finally, an important feature of the US labor market, as noted, for instance, by J. R. Matilla [22], is the prevalence of on-the-job search in many industries and occupations.

An analytical framework consistent with the first two of these observations was put forth by John Harris and Michael Todaro [19]. Tax-subsidy policy in a Harris-Todaro-type economy was analyzed by Bhagwati and Srinivasan [4]. G. S. Fields added on-the-job search and a third sector to the Harris-Todaro model [8] and distinguished between workers' ex ante choices among job search strategies and the ex post allocation of the labor force among labor market outcomes [10]. A modified version of Fields's model forms the basis for our analysis of trade competition.

The Formal Model

The model developed here is atemporal. The economy consists of a large number of homogeneous, risk-neutral individuals and a small number of economic sectors.¹ Primary attention is given to the supply side of the labor market. The production side of the model is specified only to the extent that it is necessary for the formulation of the labor market model. The various sectors differ from one another in three major respects: wages, job search opportunities, and the impact of trade competition.

The highest-paying sector is named “the high-wage sector” and is denoted by H . It is this sector that is affected by trade competition. The wage in this sector, w_H , is set by some combination of market and/or institutional forces, above market-clearing levels and higher than the wage elsewhere in the economy. All workers, being risk-neutral income-maximizers, aspire to jobs in the high-wage sector. They may elect to search for these jobs by being openly unemployed and searching full-time (assuming for simplicity that there is no unemployment compensation) or by accepting low-wage employment elsewhere in the economy at a positive wage and searching part-time. Two such low-wage sectors are assumed to exist. One of them, termed “the low-wage sector,” is assumed to be located some distance from the high-wage sector. Because of this distance, and because workers in the low-wage sector are occupied with their jobs for some number of hours each day, low-wage workers would probably face reduced job search prospects compared with their searching chances if full-time in the high-wage area. However, the wage in the low-wage sector, w_L , exceeds the wage if unemployed (0). The other economic sector, termed “free-entry sector,” is assumed to be located in the same place as the high-wage sector. The wage paid there is w_F . Workers may end up employed in one of these

three sectors or else unemployed. Thus: E_H = employed in high-wage job in the given location at wage w_H ; E_F = employed in free-entry job in that same location at wage w_F ; E_L = employed in low-wage job in another location at wage w_L ; U = unemployed. It is supposed that $w_H > w_F > 0$ and $w_H > w_L > 0$.

To search for high-wage jobs, three search strategies are possible:

1. Search While Openly Unemployed in the High-Wage Location

This is the search strategy specified in the models of Harris and Todaro [19], A. C. Harberger [18], Jacob Mincer [23], E. M. Gramlich [13], and J. E. Stiglitz [28] among others. Those who adopt Search Strategy [1] begin unemployed and search full-time. Each such worker faces the same probability of obtaining a job in the high-wage sector; π is specified further later. Those who are successful become employed at wage w_H , while those who are unsuccessful end up unemployed and earn 0.

2. Search from a Free-Entry Sector Job

It is quite common for those working in low-paying sectors of the economy to have a nonzero chance of finding jobs in the high-paying sectors of their economies. For instance, those who take jobs at fast food restaurants may search for better-paying jobs at night and on weekends, hear of jobs through friends and relatives already at work, or secure a position through an employment agency or labor exchange.

To allow for the possibility of on-the-job search by workers in low-paying activities, we formulate a model in which each person not in the high- wage sector has a positive, but reduced, chance of finding a job there.²

Denote the relative efficiency of on-the-job search while employed in the free-entry sector as compared with search while unemployed by ψ , which is best thought of as a relative job search parameter. Suppose ψ were equal to $1/2$. This would mean that any given job searcher has only half as good a chance of obtaining a high-wage job if he or she is working in a free-entry sector job when compared with the chance he or she would have were he or she searching full time.

3. Search from a Low-Wage Job to Another Location

This is defined analogously to the situation facing those searching while in free-entry sector jobs. On-the-job search is possible, but it is less efficient than full-time search. Analogously, therefore, think of job search being possible while employed in the low-wage sector and denote the relative job search parameter by θ . On-the-job search prospects are assumed to be better for workers in the free-entry sector than for low-wage workers in other locations, because the former are in closer proximity to the high- wage jobs than the latter. Therefore, the model is restricted so that $\theta \leq \psi$.

Workers are assumed to choose among alternative search strategies on the basis of the expected value of income associated with each. These are given by:

Search Strategy	Relative Search Efficiency	If Successful, Earn	If Unsuccessful, Earn
[1]	1	w_H	0
[2]	ψ	w_H	w_F
[3]	Θ	w_H	w_L

The associated expected values are denoted by V . The respective values are:

$$\begin{aligned}
 (1) \quad & V_{[1]} = w_H\pi, \\
 (2) \quad & V_{[2]} = w_H\psi\pi + w_F(1 - \psi\pi), \text{ and} \\
 (3) \quad & V_{[3]} = w_H\Theta\pi + w_L(1 - \Theta\pi).
 \end{aligned}$$

The expression for $V_{[1]}$ requires no explanation. The expressions for $V_{[2]}$ and $V_{[3]}$ each consist of two terms. Take the expression for $V_{[2]}$. The first term, $w_H\psi\pi$ is the wage in the high-wage sector multiplied by the probability of obtaining a job at that wage given that the individual has elected Search Strategy [2]. That probability is the probability π associated with full-time search multiplied by the relative search parameter ψ applicable to an individual who accepts a reduced search opportunity while working in the free-entry sector in the same location as the high-wage jobs. The product $\psi\pi$ is then the probability of successfully obtaining a high-wage job while working in the free-entry sector. In the event that this search is unsuccessful, which occurs with probability $(1 - \psi\pi)$, those who adopt this search strategy end up remaining in the free-entry sector and earning w_F . $V_{[2]}$ then consists of the wages in the two sectors weighted by the respective probabilities of receiving them under Search Strategy [2]. The expression for $V_{[3]}$ above is derived analogously.

Let us turn our attention to the probability of employment, π , defined as the ratio of high-wage jobs E_H to job-seeker-equivalents (defined later) J_H :

$$(4) \quad \pi = E_H/J_H.$$

Of course, the amount of employment in the high-wage sector, E_H , is a function of the wage in that sector, determined by the profit-maximizing behavior of firms in the high-wage industry; it may be written as

$$(5) \quad E_H = h(w_H/p_H), \quad h' < 0,$$

where $h(w_H/p_H)$ is the usual labor demand function. J_H is the number of “job-seeker equivalents” and has the following interpretation. Denoting the number of workers electing each search strategy by L_i , $i = [1], [2], [3]$, each of the $L_{[1]}$ workers has a full chance of obtaining any given job, each of the $L_{[2]}$ workers has Θ of a chance. If each job-seeker is weighted according to the relative chance of obtaining a job, then the number of job-seeker equivalents is:

$$(6) \quad J_H = L_{[1]} + \psi L_{[2]} + \Theta L_{[3]}.$$

The adding-up constraint can be examined to verify that on the assumption that high-wage sector jobs are filled in exact proportion to the number of job-seeker equivalents, this formulation indeed yields just the right amount of employment.

Next, we specify the wage determination process. As already stated, the wage in the high-wage sector w_H is determined exogenously above market-clearing levels. This may occur for a number of possible reasons including minimum wages, trade unions, or firms deliberately setting the wage above market-clearing levels for efficiency wage reasons. The wages in the other two sectors, the free-entry sector and the low-wage sector, are functions of their respective labor forces. Certainly, we wish these functions not to be increasing. They may either be constant or

decreasing. The wage being invariant with respect to the size of that sector's labor force would be relevant, for example, when the number of workers moving into or out of a sector is small relative to the number already there. A decreasing wage as a function of the size of the labor force would be consistent with the wage equaling a diminishing marginal product of labor or with a situation of 0 marginal product of labor and income-sharing among all those working in a given sector. Some special cases will be dealt with later. But at this point, it is useful to stick to the general wage functions

$$(7) \quad w_L = f(E_L), f' \leq 0,$$

and

$$(8) \quad w_F = g(E_F), g' \leq 0.$$

A bit of explanation may be in order regarding the sizes of the labor force in the different sectors. E_L and E_F in Equations (7) and (8) are the numbers of workers who ultimately end up in the low-wage sector and the free-entry sector, respectively. These numbers are *not* the same as the numbers initially electing Search Strategies [2] and [3]. Take, for instance, those who chose on-the-job search from the free-entry sector. Of those persons ($L_{[2]}$ in number), the fraction who successfully obtain free-entry employment is $\psi\pi$; only $(1 - \psi\pi)$ percent are left in the low-wage sector. Hence:

$$(9) \quad E_F = L_{[2]}(1 - \psi\pi).$$

By identical reasoning,

$$(10) \quad E_L = L_{[3]}(1 - \Theta\pi),$$

and

$$(11) \quad U = L_{[1]}(1 - \pi).$$

The adding-up conditions for the labor force are, ex ante,

$$(12) \quad L_{[1]} + L_{[2]} + L_{[3]} = L$$

and ex post

$$(13) \quad E_H + E_F + E_L + U = L.$$

Finally, we must have the rule specifying the allocation of the labor force between search strategies and sectors. If the solution is interior, meaning that all three search strategies have the same expected value, then

$$(14) \quad V_{[1]} = V_{[2]} = V_{[3]}.$$

For the solution in fact to lie in the interior, the parameters of the model must be restricted to take on certain values. For instance, suppose it were the case that on-the-job search is *as efficient* as search while unemployed, that is, $\psi = 1$. Then $V_{[3]}$ would dominate $V_{[1]}$ for any possible allocation of the labor force among search strategies. Because nobody would choose search strategy [1], there would be no unemployment, only underemployment in that case. Such corner equilibria are interesting but not germane to the points we wish to make later. Accordingly, we shall assume that the parameters are such that the solution in fact lies in the interior.

SOLUTION OF THE LABOR MARKET MODEL

The model given in the second section can be solved as follows. Once the wage Equations (7) and (8) are specified, the ex ante allocation of the labor force among search strategies (that is, $V_{[1]}$, $V_{[2]}$, and $V_{[3]}$) may be derived by substituting the other ex ante relations in the model (Equations 1-6) and the adding-up conditions (Equations 12 and 13) into Equilibrium Condition (14). Then, given $L_{[1]}$, $L_{[2]}$, and $L_{[3]}$ and using (9) and (10), we may derive the ex post allocations of the labor force among various types of employment and unemployment (E_H , E_F ,

E_L , and U). This gives an initial set of values, from which the effects of trade competition may be calculated.

It is inconsistent with an interior allocation for *all* wages to be fixed outside the model.³ At least one of them must vary with the allocation of the labor force. We proceed by endogenizing the free-entry sector wage, allowing it to vary with the size of the free-entry sector labor force. As stated earlier, we take the wage in the high-wage jobs as given, determined, perhaps, by union wage practices or other forces. We also take the price and wage in the low-wage sector as invariant with respect to the size of that sector's labor force. This may be justified by assuming that in the relevant range, the trade-affected sector is small relative to the rest of the economy, so that the price and wage elsewhere do not change appreciably if labor enters or leaves that sector.

We consider two alternative ways of endogenizing the free-entry sector wage:

$$(8.i) \quad \text{Case } i: w_f = Q_f/E_f.$$

In this case, the total income generated in the free-entry sector is fixed at some amount Q_f . (This assumption, made here for simplicity, is relaxed later.) The available income is shared equally among the E_f workers in the free-entry sector. The model given by Equations (1)–(14) with (8.i) substituted in place of the general function (8) may be solved to yield the following equations.⁴

For the ex ante allocation of the labor force among search strategies:

$$(15.i) \quad L_{11} = \frac{-\Theta L}{1 - \Theta} + \frac{E_H w_H}{w_L} + \frac{E_H \Theta}{1 - \Theta} - \frac{Q_f(\psi - \Theta)}{w_L(1 - \psi)} - \frac{Q_f \Theta(\psi - \Theta)}{w_H(1 - \psi)(1 - \Theta)};$$

$$(16.i) \quad L_{12} = \frac{Q_f(1 - \Theta)}{w_L(1 - \psi)} + \frac{Q_f \Theta}{w_H(1 - \psi)};$$

$$(17.i) \quad L_{13} = \frac{L}{1 - \Theta} - \frac{E_H w_H}{w_L} - \frac{E_H \Theta}{1 - \Theta} - \frac{Q_f}{w_L} - \frac{Q_f \Theta}{w_H(1 - \Theta)}.$$

For the ex post allocation of the labor force among employment in the various states and unemployment:

$$(18.i) \quad E_F = \frac{Q_F(1 - \Theta)}{w_L(1 - \psi)} - \frac{Q_F(\psi - \Theta)}{w_H(1 - \psi)};$$

$$(19.i) \quad E_L = \frac{L}{1 - \Theta} + \frac{E_H w_H}{w_L} - \frac{Q_F}{w_L} - \frac{\Theta w_L L}{\{w_H(1 - \Theta) + w_L \Theta\}(1 - \theta)};$$

$$(20.i) \quad E_H = h(w_H/p_H);$$

$$(21.i) \quad U = L - E_F - E_L - E_M.$$

The effects of trade competition may be found by performing comparative statics on (15.i) - (21.i) with respect to E_H (which is changed by the drop in P_H due to trade competition).

We find, for the ex ante allocation:

$$(22.i) \quad \partial L_{[2]} / \partial E_H = 0, \text{ since } L_{[2]} \text{ is only a function of parameters;}$$

$$(23.i) \quad -\frac{\partial L_{[1]}}{\partial E_H} = \partial L_{[3]} / \partial E_H = \frac{-w_H}{w_L} - \frac{\Theta}{1 - \Theta} < 0$$

(search declines from the high-wage sector as E_H falls and increases from the low-wage location).

For the ex post allocation, we have:

$$(24.i) \quad \partial E_H / \partial E_H = 1 \text{ by definition;}$$

$$(25.i) \quad \partial E_F / \partial E_H = 0;$$

$$(26.i) \quad \partial E_L / \partial E_H = \frac{-w_H}{w_L} < 0;$$

$$(27.i) \quad \partial U / \partial E_H = \frac{w_H}{w_L} - 1 > 0,$$

since $w_H > w_L$.

One effect may come as a surprise to the reader: trade competition in this case is found to *lower* unemployment when the new equilibrium is reduced. This happens because when the number of high-wage jobs is reduced, the payoff to the highly risky, search-while-unemployed

strategy is reduced. Therefore, fewer workers devote full-time to trying to get high-wage jobs. Instead, these workers are more willing to settle for jobs in lower-paying sectors of the economy and search for high-wage jobs only part-time. The result of such revised search behavior is that more workers search for high-wage jobs while employed in low-wage jobs, and unemployment falls as a consequence.

How robust are these results? We proceed now to:

$$(8.ii) \quad \text{Case ii: } w_F = Q_F/E_F, \text{ where } Q_F = \alpha E_H + \beta E_F.$$

In this case, the income generated in the free-entry sector depends on the number of workers in that geographic location. The E_H workers employed in the high-wage sector are assumed to spend α on free-entry-sector goods. Free-entry-sector workers themselves are assumed to spend β on the goods produced in their sector. As in case (i), the income generated in the free-entry sector is assumed to be shared equally among free-entry sector workers. Hence, the free-entry sector wage in case (ii) is given by $w_F = (\alpha E_H + \beta E_F)/E_F$.

Proceeding as before, the ex ante and ex post allocations of the labor force may be derived by substituting (8.ii) into the rest of the model, as follows:

For the ex ante allocation of the labor force,

$$(15.ii) \quad L_{11} = \frac{-\Theta_L}{1-\Theta} + \frac{E_H w_H}{w_L} + \frac{E_H \Theta}{1-\Theta} - \frac{(\alpha E_H + \beta E_F)(\psi - \Theta)}{w_L(1-\psi)} - \frac{(\alpha E_H + \beta E_F)(\psi - \Theta)}{w_H(1-\psi)(1-\Theta)};$$

$$(16.ii) \quad L_{12} = \frac{\alpha E_H [w_H(1-\Theta) + w_L \Theta]}{w_H \{w_L(1-\psi) - \beta(1-\Theta)\} + \beta w_L(\psi - \Theta)};$$

$$(17.ii) \quad L_{13} = \frac{L}{1-\Theta} - \frac{E_H w_H}{w_L} - \frac{E_H \Theta}{1-\Theta} - \frac{(\alpha E_H + \beta E_F)}{w_L} - \frac{(\alpha E_H + \beta E_F)\Theta}{(1-\Theta)w_H},$$

where E_F is endogenous and is given later. For the ex post allocation of the labor force among employment in the various states and unemployment,

$$(18.ii) \quad E_F = \frac{\alpha E_H [w_H(1 - \Theta) + w_L(\Theta - \psi)]}{w_H \{w_L(1 - \psi) - \beta(1 - \Theta)\} + \beta w_L(\psi - \Theta)};$$

$$(19.ii) \quad E_L = \frac{L}{1 - \Theta} - \frac{E_H w_H}{w_L} - \frac{(\alpha E_H + \beta E_F)}{w_L} - \frac{(\alpha E_H + \beta E_F)\Theta}{[w_H(1 - \Theta) + w_L \Theta]};$$

$$(20.ii) \quad E_H = h(w_H/p_H);$$

$$(21.ii) \quad U = L - E_H - E_L - E_F.$$

Performing comparative statics on (15.ii) - (20.ii) with respect to E_H : For the ex post allocation, we have

$$(25.ii) \quad \partial E_H / \partial E_H = 1 \text{ by definition};$$

$$(26.ii) \quad \partial E_F / \partial E_H = E_F / E_H > 0,$$

whenever parameter values are such that the solution is interior;

$$(27.ii) \quad \frac{\partial E_L}{\partial E_H} = -\frac{w_H}{w_L} - \frac{[w_H(1 - \Theta) + 2w_L \Theta]}{w_L [w_H(1 - \Theta) + w_L \Theta]} \left(\alpha + \beta \frac{E_F}{E_H} \right) < 0;$$

$$(28.ii) \quad \frac{\partial U}{\partial E_H} = \left(\frac{w_H}{w_L} - 1 \right) + \frac{[w_H(1 - \Theta) + 2w_L \Theta]}{w_L [w_H(1 - \Theta) + w_L \Theta]} \left(\alpha + \beta \frac{E_F}{E_H} \right) - \frac{E_F}{E_H}.$$

Proofs of the signs of these two expressions appear in the Appendix.

A number of these results differ from those derived in case (i). In particular, the ambiguity of the unemployment effect in case (ii) may come as a surprise, given the unambiguous result in case (i). The reason for this ambiguity in case (ii) is the following. When employment in the high-wage sector falls, the payoff for searching while unemployed falls. As in case (i), this effect by itself would tend to lower the number of unemployed. But unlike case (i), a second effect is present; the loss of high-wage jobs implies that the demand for free-entry-

sector output falls, which in turn results in less income to be shared among workers in that sector. This effect by itself reduces the attractiveness of the free-entry sector, causing the number willing to risk unemployment to increase. Depending on parameter values, unemployment can either increase or decrease in response to trade competition, reflecting the relative strength of these two effects.

Table 1 shows the summing up of our findings on the effects of trade competition on the equilibrium allocation of the labor force in the two special cases. We, thus, find that when the labor force reallocates itself among sectors in response to trade competition, the model predicts that the equilibrium will be characterized by the movement of workers from high-wage jobs into low-wage jobs and, for many parameter values, *not* into unemployment. Of course, in the short run, trade competition may cause unemployment, but this is not likely to persist indefinitely.

Insert Table 1 Here

WELFARE EFFECTS OF TRADE COMPETITION: AN ANALYTICAL FRAMEWORK

In what follows, we shall develop from trade and labor market fundamentals a formula for evaluating the welfare effects of trade competition. Our analysis, based on dual functions, goes beyond traditional analysis in two directions. First, since unemployment constrains worker/consumers in addition to their budget constraint, the dual forms must be modified to take into account the value of the nonbudget constraints. Second, we provide the welfare measure in a

form that can be applied either on a sector-by-sector or on an individual basis and that can be aggregated to a consistent economy-wide measure.

Consider a worker with conventional utility function $u(x)$, which is quasi-concave, increasing and continuous in $x = (x_H, x_F, x_L, -E_H, -E_F, -E_L)$, the available consumption goods being denoted by $x_k, k = H, F, L$ and the supply of labor by E_k (denoted with negative signs by convention). People work less than 24 hours per day, because their utility is assumed to approach negative infinity as the number of hours of work approach the total available hours of the worker. The positive signs on $x_H, x_F,$ and x_L mean that these goods confer utility, whereas the negative signs on $E_H, E_F,$ and E_L mean that the worker loses utility by having to work. The worker's primal problem is to maximize utility by choice of $x_H, x_F, x_L, E_H, E_F,$ and E_L subject to the budget constraint

$$p_H x_H + p_F x_F + p_L x_L + w_k(-E_k) = J,$$

where J is the nonlabor income of the worker, and $k = H, F, L$ denotes the type of employment of the worker. The choices for labor are $E_k = 1$ if the worker works, and $E_k = 0$ if the worker is unemployed. If the worker has no nonlabor income, then $J = 0$. We shall denote the maximum possible utility level arising from this problem by u^* .

The conventional dual to this problem is to minimize the expenditure needed to attain utility level u^* .⁵ This dual problem is represented by

$$(29.a) \quad \begin{aligned} e(p, u^*) = \min p \cdot x \\ \text{s.t. } u(x) \geq u^* \\ x_k \geq 0, k = H, F, L \\ E_k \in \{0, 1\}, k = H, F, L. \end{aligned} .$$

$e(\cdot)$ gives the minimum expenditure needed to reach utility level u^* when $p =$

$(p_H, p_F, p_L; w_H, w_F, w_L)$. From duality theory, we know that given prices p , the optimal choices

x^* corresponding to the utility level u^* are the same in the primal and the dual problems. We shall work with the dual problem in what follows.

We shall assume that the disutility of work is a function only of the amount of work and not of the type of job in which the worker is employed. From this, it follows that a worker whose labor market choices are unconstrained would always prefer working in the highest-wage job open to him or her. This sector is the high-wage sector with wage w_H .

If high wage jobs were open to all workers, the problem given by (29.a) would apply to everyone. However, the labor market we have described is one in which high-wage jobs are not available for all workers. Take the case of a worker who does *not* get a job in the high-wage sector. Such a worker would be constrained to the next-best labor market alternative. Write this constraint as $g(x) \geq 0$, wherein the E_H component of the x vector is constrained to equal 0. Given this constraint, the worker's constrained expenditure function is given by

$$\begin{aligned}
 \hat{e}(p, u') &= \text{Min } p \cdot x \\
 \text{(29.b)} \quad & \text{s.t. } u(x) \geq u' \\
 & g(x) \geq 0 \\
 & x_k \geq 0, k = H, F, L \\
 & E_k \in \{0, 1\}, k = H, F, L.
 \end{aligned}$$

Note that because the previous utility level u^* is no longer attainable, a different (and lower) optimal utility level u' appears instead.

Corresponding to the worker's constrained expenditure, there exists a corresponding notion of income. Suppose that the worker has a certain fixed amount of nonlabor income, J . Then the amount of purchasing power available to be spent on consumption goods is $w_k E_k + J$, where E_k is the labor supply of the worker. The worker's expenditure, however, includes "purchases" of leisure at level $-E_k$. Writing the budget constraint, $p_H x_H + p_F x_F + p_L x_L -$

$w_k E_k = J$ shows that J is the appropriate measure of income corresponding to the constrained expenditure function.

Since $\hat{e}(p, \cdot)$, given prices p , is a monotonic function of utility, $\hat{e}(p, u(x_H, x_F, x_L, -E_H, -E_F, -E_L))$ is also a utility function with different (but internally consistent) labelings of the indifference curves. The use of $\hat{e}(p, u)$ as the utility function simply relabels indifference curves by the amount of money needed to achieve that welfare level at prices p . Now let us suppose that we are comparing the worker's welfare in two situations labeled "0" and "1." The change in welfare (ΔW) for the worker is given by

$$(30) \quad \Delta W = \hat{e}(p, u_1) - \hat{e}(p, u_0).$$

We choose prices equal to those that prevail in one of the two situations (without loss of generality let this be situation 1 so that $p \equiv p_i$).⁶ Since $\hat{e}(p, u')$ is the amount of nonlabor income needed to achieve utility level u' when prices are p , this describes the situation actually faced by the consumer when his nonlabor income was J . Thus $\hat{e}(p, u') = J$ and the change in welfare is given by

$$(30') \quad J - \hat{e}(p, u'').$$

To apply this measure to the economy as a whole, we need to determine how the utilities of different individuals in the economy are affected. As wage-earners, workers are affected by trade competition, because the structure of earning opportunities changes. As consumers, workers are affected by trade competition, because they pay lower prices for the trade-affected good x_H . Also affected by trade competition are firms, shares of which are owned by persons. Workers are affected by this to the extent that they own shares in firms, directly or indirectly. Equation (30), when weighted by the changing numbers of workers in each group and the welfare changes within each, determines the overall welfare consequences of import competition

on workers. Summing (30) over workers means that an additional dollar of welfare to any worker is treated as equally socially valuable. Firms' welfare is given by total profit defined in the usual way.

In our analysis of the welfare effects of trade competition on workers, we assume that workers receive no income from government transfers or from the ownership of firms. Under these assumptions (30) can be written using the individual worker's budget constraint to show the separate channels of welfare influence discussed earlier,

$$(31) \quad \Delta W^i = - \underbrace{(p_1 - p_0)}_{(P)} \cdot z_0^i + \underbrace{(e^i(p_1, u_0^i) - \hat{e}^i(p_1, u_0^i))}_{(I)} + \underbrace{(p_1 \cdot x_0^i - e^i(p_1, u_0^i))}_{(S)},$$

where z_0^i is the vector $(x_H^i, x_F^i, x_L^i, 0, -E_k, 0)$, showing the worker's economic dealings with the rest of the economy ($-E_k$ denotes the worker's supply of labor in the appropriate category $k = H, F, \text{ or } L$).⁷ As indicated underneath, the three terms represent the "price," "income," and "substitution" effects of trade competition on the worker's welfare.

Consider price effects first. If p_H falls, the corresponding component of $-(p_1 - p_0)$ is positive. Since good H is a good purchased by the worker, $x_H > 0$ also. Thus the H component of $-(p_1 - p_0) \cdot z_0^i$ is positive, a welfare increase. This is true also for goods F and L . On the labor-supply side, if w_k falls, the corresponding component of $-(p_1 - p_0)$ is positive. But since $-E_k$ is negative, a falling wage indicates welfare loss for the worker (something he sells has a lower price). The net effect of all of the price changes on welfare is given by $-(p_1 - p_0) \cdot z_0^i$.

Term I represents the income effects of the employment constraints on the worker. It is the amount of money the worker would be willing to pay to have the constraints removed. If there are no constraints, for example, $e^i(\cdot) = \hat{e}^i(\cdot)$ then term I is 0. In general, however, it

equals lost labor income less the utility value of the increased leisure due to reduced work time from the constraint. In the special case in which leisure does not have utility value, then term I is just lost income from the labor supply constraint.

Term S is the savings to the consumer from choosing a mixture of goods different from x_0 to achieve utility level u_0 at prices p_1 . For small changes in prices, or if the consumer has no willingness to substitute, term S is 0. A Taylor approximation to S shows that all terms are of second or higher order in price changes.

WELFARE ANALYSIS

Absence of Government Intervention

Let us denote the situation before trade competition by subscript 0 and the situation after trade competition by subscript 1. Trade competition changes the prices facing worker i , and possibly his or her employment or wage as well. The effect of trade competition is to change worker i 's utility from $\hat{e}^i(p_1, u_0^i)$ to $\hat{e}^i(p_1, u_1^i)$. To get to the change in welfare for all workers and the entire economy, we sum (31) over workers and account for the effects of trade competition on firm profits and income to the nonlabor sector. The effects of this summation are shown in Table 2.

Insert Table 2 Here

In deriving Table 2 we have assumed that the utility value of additional leisure to workers who are unemployed, or who are employed at a job that is not their first choice, is 0. The two new terms in Table 2 that have not appeared before are $p_1 \cdot (y_1 - y_0)$, which is the change in firm net revenues at prices p_1 after subtracting out labor costs (that is, return to nonlabor factors), and $(T_1 - T_0)$, which is the change in income transfers to the economy. By assumption, workers do not receive transfers so $T_1 - T_0$ is assigned to nonworkers.

Several simplifications to the components of Table 2 occur for small changes. First, the substitution effects go to 0. This has already been noted for terms of the form $p_1 \cdot x_0^i - \hat{e}^i(p_1, u_0^i)$. To see it for $p_1 \cdot (y_1 - y_0)$ note that $p_1 \cdot (y_1 - y_0)$ approaches $p \cdot dy$ for small changes. The wage-equal- to-marginal-product hiring condition for labor,

$$p_k dy_k - w_k dE_k = 0 \quad k = H, F, L,$$

is equivalent to

$$\begin{aligned} p \cdot dy &= (p_H, p_F, p_L, w_H, w_F, w_L) \cdot (dy_H, dy_F, dy_L, -dE_H, -dE_F, -dE_L) \\ &= \sum_{k=H,F,L} (p_k dy_k - w_k dE_k) \\ &= 0. \end{aligned}$$

The second simplification occurs by combining the wage-related terms of $-dp \cdot z_0$ with the corresponding terms $d[w_k E_k]$ of the laborers' income effects.⁹ The resulting welfare effects for small changes are given next. Economy welfare changes for small changes:

$$\begin{aligned}
 \text{Workers} & \quad -dp_H \sum_{iW} x_H^i - dp_F \cdot \sum_{iW} x_F^i - dp_L \sum_{iW} x_L^i \\
 & \quad + w_H dE_H + w_L dE_L + w_F dE_F; \\
 (32) \quad \text{Non-Workers} & \quad -dp_H \sum_{iR} z_H^i - dp_F \sum_{iR} z_F^i - dp_L \sum_{iR} z_L^i + dT; \\
 \text{Economy Total} & \quad -dp_H z_H - dp_F x_F - dp_L z_L + dT + w_H dE_H \\
 & \quad + w_L dE_L + w_F dE_F.
 \end{aligned}$$

Notes: $z_k \equiv \sum_i z_k^i = \sum_{iW} x_k^i + \sum_{iR} z_k^i$ for $k = H, F, L$ is the economy's net imports of good k . $p_k \cdot z_k$ is the corresponding value of imports. If there were no imperfections in the labor market, the sum of terms in dE would drop to 0, and welfare would resemble the conventional welfare measure for an open economy.¹⁰

Using dW to denote change in economy welfare and substituting from (25.1)—(27.i) into (32) gives,¹¹

$$(33.i) \quad dW = \frac{p_H z_H}{\eta_H} \frac{dE_H}{E_H} > 0,$$

if case (i) applies, where

$$\eta_H = \frac{w_H}{p_H E_H} h' < 0$$

is the elasticity of high-wage employment with respect to the real wage (see Equation (5)) and

$$\begin{aligned}
 (33.ii) \quad dW & = \frac{p_H z_H}{\eta_H} \frac{dE_H}{E_H} + w_F E_F \frac{dE_H}{E_H} \\
 & \quad - \frac{w_H(1 - \Theta) + 2w_L \Theta}{w_H(1 - \Theta) + w_L \Theta} \left(\alpha + \beta \frac{E_F}{E_H} \right) dE_H > 0,
 \end{aligned}$$

if case (ii) applies. In case (i) consumers of good H gain welfare by the drop in price of good H , while high-wage workers lose welfare from their loss of high-wage employment. Looking just at employment and earnings effects, unemployed workers as a group gain just enough to balance the losses of the high-wage workers since a portion of their number end up being employed in the low-wage sector. That is, from (26.i) and (27.i),

$$\begin{aligned}
 w_H dE_H + w_F dE_F + w_L dE_L &= w_H dE_H + w_F \cdot 0 + w_L \left(-\frac{w_H}{w_L} \right) dE_H \\
 &= w_H dE_H - w_H dE_H \\
 &= 0.
 \end{aligned}$$

The net effect for the economy, therefore, is a welfare gain equal to the consumption gain given by $\frac{p_H z_H}{\eta_H} \frac{d_H E_H}{E_H} > 0$. In case (ii) the effect of trade competition could be to raise unemployment so that the net effect on welfare is ambiguous. Aggregate welfare could rise or fall according to (33.ii).¹²

In summary, the disaggregated and aggregated effects of trade competition on economy welfare in the absence of tariff or government intervention are given in Table 3. By the use of the term “disaggregated” we mean that we have separated the component welfare effects on the worker depending on his or her role as a consumer and as an employee. In each of the two cases the effect of trade competition is to harm workers in the high-wage sector while helping consumers in the country as a whole. In case (i) the net effect of trade competition on the earnings of all labor is neutral; but because labor as a whole benefits by paying lower prices as consumers, welfare *increases*. In case (ii) earnings may increase or decrease, and so the effect of trade competition on aggregate welfare is ambiguous.

We now turn to the effects of trade competition in the presence of active tariff policy.

Insert Table 3 Here

Effects of Government Intervention

Since the impact of trade competition operates in the form of reduced prices for the import-competing good, it is feasible to insulate the domestic economy partially or wholly from changes by the imposition of a countervailing tariff or quota. Any benefit to the country from such restrictions on world trade is due to induced improvements in the terms of trade plus its effect on reducing or eliminating labor market consequences of trade competition.

Let t be the tariff (that is, $t - 1$ is the *ad valorem* tariff rate), T be tariff revenue, ϵ^l the total price elasticity of domestic import demand for good H , and K a shift parameter representing the level of trade competition.¹³

Then $T = \frac{t-1}{t} p_H z_H(p_H)$ Writing the expression for welfare change (32)

when the economy responds to trade competition by raising the level of the protective tariff on the import-competing good gives the following,

$$(34) \quad dW = -z_H dp_H + \frac{(t-1)}{t} z_H (1 - \epsilon^l) dp_H + p_H z_H \frac{1}{t^2} dt \\ + \left[w_H + w_L \frac{\partial E_L}{\partial E_H} + w_F \frac{\partial E_F}{\partial E_H} \right] \left(\frac{dE_H}{dp_H} dp_H \right),^{14}$$

where

$$(35) \quad dp_H = \frac{\partial p_H}{\partial K} dK + \frac{\partial p_H}{\partial t} dt.$$

For a tariff, or its quota equivalent,

$$(36) \quad \frac{\partial p_H}{\partial t} = \left[\frac{\gamma' + \epsilon_S''}{\epsilon^l + \epsilon_S''} \right] \frac{p_H}{t},$$

where superscript I refers to the home country and II to the rest of the world, ϵ_S^{II} is the total price elasticity of foreign supply of good H , and γ is the marginal propensity to consume importables.¹⁵ Employment changes are determined by the elasticity of demand for labor in the high-wage industry,

$$(37) \quad \frac{dE_H}{dp_H} \frac{p_H}{E_H} = - \frac{w_H}{p_H} \frac{h'}{h}$$

and by $\frac{\partial E_F}{\partial E_H}$ and $\frac{\partial E_L}{\partial E_H}$ as determined by Equations (25) and (26).

Four options are particularly relevant in discussing the response of the home country to increased trade competition:

- Laissez-faire

The welfare and distributional effects of doing nothing have already been discussed.

- Fixing the domestic price p_H

By choosing the tariff or quota to hold domestic price p_H constant as the world price p_W^H falls, it is always possible to insure welfare gains equal to the value of increased tariff revenues,

$$(38) \quad dW = dT = p_H z_H \frac{1}{p^2} dt > 0,$$

provided that the rest of the world does not retaliate with tariffs of its own. Under this option, consumers benefit not from lower prices but by receiving their pro rata share of tariff revenues.

- Choosing the tariff on Imports of H to maximize domestic welfare

This is not really a viable option in the context of the world trading community. It requires using the tariff to influence the world terms of trade in favor of the home country as in the conventional optimal tariff argument. As such, it is an option that is always available

independently of trade competition. At the optimum, the tariff is determined by the condition that dW/dt equal 0.

- “Voluntary” Export Restraint to hold imports of H constant at original levels

If instead of a tariff or domestically administered quota, a “voluntary” export restraint is negotiated, then any resulting revenues accrue to foreign suppliers and the term for dT drops out of (32). Other options can be evaluated using (32).

SUMMARY

We have described a framework for analyzing the labor market consequences of increased trade competition on US workers and its impact on the welfare of the country. The model allows for on-the-job search, unemployment, and underemployment. Using this framework we have derived the domestic-welfare consequences of a reduction in the price for the import-competing good due to increased trade competition.

The main labor market results are summarized in Table 1. Trade competition in the high-wage sector reduces the number of workers employed in high-wage jobs. In response, some of these workers will seek out low-wage jobs elsewhere in the economy. Workers may or may not leave free-entry sector jobs located near the high-wage jobs, depending on the nature of demand in that sector. Unemployment may rise or fall, also depending on the particular parameters of the model. Thus, after the economy has had time to adjust, trade competition does not necessarily increase unemployment; very possibly unemployment might fall.

The welfare effects of trade competition in the absence of government intervention are summarized in Table 3. Apart from employment effects, all who purchase the high-wage good are better off when its price falls. Offsetting this, though, is the loss of high-wage employment. Workers as a whole may suffer a total loss of earnings. Aggregate welfare may increase or decrease as a result of trade competition, depending on the sizes of these offsetting effects.

The aggregate welfare effects of trade competition with government intervention were derived in the last section. In the absence of foreign retaliation, the country can always raise total welfare by a judicious choice of tariff that neutralizes the effect of trade competition. Thus, our

analysis leads to the conclusion that rather than prohibiting trade competition through quotas or through “voluntary” export restraints, the country might do better to impose a tariff.

These welfare effects rely for their validity on the use of total welfare as the reference measure. Distributionally sensitive welfare functions might well yield different results, especially if workers’ welfare is weighted more heavily than the rest of the economy’s. Since we have disaggregated the welfare effects, the preceding analysis could also serve as a starting place for discussion of constituency-sensitive issues in providing trade protection.

APPENDIX A

Proof that $\frac{\partial E_L}{\partial E_H} < 0$:

In the expression for $\frac{\partial E_L}{\partial E_H}$ in the text, note that $w_H/w_L > 0$ and the bracketed term is comprised of only positive terms. Taking account of the minus signs in front of each, we thus have the sum of two negative terms, so the result is clearly negative.

Proof that $\frac{\partial U}{\partial E_H} > 0$:

Start with the expression for $\frac{\partial U}{\partial E_H}$ in the text. To show that this expression is of ambiguous sign, it must be shown that both positive and negative signs are possible for particular parameter values:

(a) *Demonstration of possibility that $\frac{\partial U}{\partial E_H} > 0$:*

$$\text{Suppose } \beta = 0 \text{ and } \psi = 0. \text{ Then } \frac{\partial U}{\partial E_H} = \left(\frac{w_H}{w_L} - 1 \right) + \frac{\alpha}{w_L} - \frac{E_F}{E_H} \text{ and } E_F = \frac{\alpha E_H}{W_L}.$$

Combining these yields $\frac{\partial U}{\partial E_H} = \frac{w_H}{w_L} - 1$, which is positive for $w_H > w_L$.

(b) *Demonstration of possibility that $\frac{\partial U}{\partial E_H} < 0$:*

$$\text{Suppose } \beta = 0, \theta = 0, \psi > 0, \alpha = w_H. \text{ Then} \\ \frac{\partial U}{\partial E_H} = \frac{(w_H - w_L)(1 - 2\psi)}{w_L(1 - \psi)}.$$

Given $w_H > w_L > 0$ and $0 \leq \psi < 1$, it follows that $\frac{\partial U}{\partial E_H}$ for all $\psi > 0.5$.

(c) *The ambiguity of $\frac{\partial U}{\partial E_H}$ follows from (a) and (b).*

APPENDIX B

Change in Welfare Terms If the Import-Competing Good and Import Goods are Imperfect Substitutes

Minor modifications of the analysis are needed if the import-competing good H and the import good H' are imperfect substitutes. Instead of the vector x in the fifth section, the extended vector

$$x' = (x'_H, x_H, x_F, x_n, -E_L, -E_F, -E_H)$$

should be used. The corresponding net trade vector becomes

$$z' = (z'_H, z_H, z_L),$$

indicating that cross-hauling of goods H and H' is possible. Equation (34) (or (38)) becomes,

$$(34') \quad \Sigma \tilde{e}' du' = -z_H dp_H - z'_H dp'_H - z_L dp_L + dT + p \cdot dy \\ + w_H dE_H + w_L dE_L + w_F dE_F,$$

$$\text{where } dT = \frac{(t' - 1)}{t'} z'_H (1 - \epsilon') dp'_H + p'_H z'_H \frac{1}{t'^2} dt'$$

$$dp'_H = \frac{\partial p_H}{\partial p'_H} dp_H, \\ dp_H \frac{\partial p'_H}{\partial K} dK + \frac{\partial p'_H}{\partial t'} dt',$$

and the prime indicates variables relating to good H' . Implementation of policy requires information on

$$\frac{\partial p_H}{\partial p_{H'}} = \frac{\partial p_H}{\partial x_H} \frac{\partial x_H}{\partial p'_{H'}}$$

which depends on the cross-price elasticity of domestic demand for good H with respect to $p'_{H'}$ in the obvious way.

NOTES

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1. Heterogeneity of labor adds additional complexity that is not warranted at this point. Future work could examine the implications of allowing workers to differ in terms of seniority, specific human capital, and other characteristics that would create differential probabilities of getting and/or keeping high-wage jobs.
 2. Unlike those job-search models in which searchers have discretion over the amount of searching they will engage in and, hence, the margin of interest is the intensive margin (how intensively to search on the job), the formulation here treats the amount of on-the-job search as parametric, so the action takes place on the extensive margin (that is, how many engage in on-the-job search rather than search while unemployed).
 3. In such a case, it may be shown that one search strategy will always be dominated by the other two.
 4. Derivations are available from the authors upon request.
 5. Because the worker loses utility by having to work, the expenditure to be minimized is “full expenditure,” taking account both of the expenditure of money on goods and of the expenditure of effort to earn income.
 6. It is important not to confuse the measure ΔW with equivalent variation. ΔW differs from equivalent variation in two respects. First, equivalent variation makes use of unconstrained expenditure $e(p_1, u)$ rather than the $\hat{e}(p_1, u)$ used in ΔW and, second, ΔW

is an exact measure of utility in dollar terms, whereas equivalent variation measures consumer surplus:

$$\Delta W \equiv \hat{e}(p_1, u_1) - \hat{e}(p_1, u_0);$$

$$EV \equiv \hat{e}(p_1, u_1) - \hat{e}(p_0, u_1).$$

7. By construction of \hat{e} we have,

$$\hat{e}(p_1, u_1) = p_1 \cdot x_1$$

$$\hat{e}(p_0, u_0) = p_0 \cdot x_0$$

But since the worker has no nonlabor income, $x_0 = z_0$ and the left-hand side of both terms above is 0. (31) follows by direct substitution.

8. In this and the following section we assume that the high-wage good and import good are perfect substitutes. Appendix B discusses the case of imperfect substitutes.

$$\begin{aligned} 9. \quad (-dp \cdot z_0) + \sum_{k=H,F,L} d(w_k E_k) &= -(dp_H \cdot (z_0)_H + dp_L \cdot (z_0)_L + dp_F \cdot (z_0)_F \\ &\quad + dw_H \cdot E_H + dw_L \cdot E_L + dw_F \cdot E_F \\ &\quad + dw_H \cdot E_H + dw_L \cdot E_L + dw_F \cdot E_F \\ &\quad + w_H dE_H + w_L dE_L + w_F dE_F \\ &= -dp_H \cdot (z_0)_H - dp_L \cdot (z_0)_L - dp_F \cdot (z_0)_F \\ &\quad + w_H dE_H + w_L dE_L + w_F dE_F, \end{aligned}$$

where $(z_0)_k$ $k = H, F, L$ is the k th component of z_0 .

10. With full employment $w_H = w_F = w_L$, and

$$dE_H + dE_L + dE_F = 0$$

The simple form of the distortion term in (32) comes from the assumption of equal disutility of all labor and the fact that workers are at corner solutions in their labor market choice of how much labor to supply. Otherwise utility-related terms would appear in (32) replacing the terms in dE_k $k = H, F, L$.

11. By (25.i) - (27.i)

$$\begin{aligned} w_H dE_H + w_L dE_L + w_F dE_F &= \\ \left(w_H + w_L \frac{dE_L}{dE_H} + w_F \frac{dE_F}{dE_H} \right) dE_H &= \\ \left(w_H + w_L \left(-\frac{w_H}{w_L} \right) + w_F \cdot 0 \right) dE_H &= 0. \end{aligned}$$

Since $z_F = 0$ (it is not an internationally traded good), $dp_L = 0$ by choice of p_L as numeraire, and by assumption tariffs are 0 ($dT = 0$), welfare is determined by $z_H dp_H$, which varies with dE_H according to (5).

12. Suppose $\beta = \theta = \alpha - w_F = 0$. Then (33.ii) reduces to $dW = \frac{p_H z_H}{\eta_H E_H} dE_H +$

$w_F [E_F - E_H] \frac{dE_H}{E_H}$. If imports are small (z_H small), then the sign of dW is dependent on the sign of $E_F - E_H$, which can be positive or negative.

13. Heretofore, p_H (hence E_H) has represented the level of trade competition. Since policy in this section is chosen to influence p_H (hence E_H), we need to distinguish the underlying level of trade competition, indexed by K , from p_H . For example, K can be thought of as a parameter that shifts the foreign supply of the imported good. In the absence of a policy response to trade competition, p_H is a function of K alone, and p_H , K , and E_H move monotonically relative to each other. If policy responds to trade competition, then p_H is a function of K and t .

14. $dp_L = 0$ by choice of numeraire good, $z_F = 0$ since good F is not traded. Equation (34) follows from (32) by noting that

$$dT = \frac{(t-1)}{t} z_H (1 - \epsilon') dp_H + p_H z_H \frac{1}{t^2} dt.$$

15. If foreign supply is perfectly elastic at the world price p_H^W then $\epsilon_S^H \rightarrow \infty$ and $\frac{\partial p_H}{\partial t} \rightarrow \frac{p_H}{t}$.

Since $\epsilon_S^H = \epsilon^H - 1$, Equation (36) could also be written in terms of the rest of the world's elasticity of import demand (see [3, p. 382]).

Table 1

Table 1

EFFECTS OF TRADE COMPETITION ON THE NUMBER WHO END UP

	Case i	Case ii
Employed in high-wage jobs	-	-
Employed in free-entry jobs	No change	-
Employed in low-wage jobs	+	+
Unemployed	-	+ or -

Table 2

Table 2

ECONOMY WELFARE EFFECTS

	Price Effects	Income Effects	Substitution Effects
Workers	$-(p_1 - p_0) \cdot \sum_{i \in W} z_0^i$	$w_H L - w_H E_H - w_F E_F - w_L E_L$	$p_1 \cdot \sum_{i \in W} x_0^i - \sum_{i \in W} \hat{e}'(p_1, u_0^i)$
Non-workers	$-(p_1 - p_0) \cdot \sum_{i \in R} z_0^i$	$(T_1 - T_0)$	$p_1 \cdot \sum_{i \in R} x_0^i - \sum_{i \in R} \hat{e}'(p_1, u_0^i) + p_1 \cdot (y_1 - y_0)$
Economy Total	$-(p_1 - p_0) \cdot z_0$	$w_H L - w_H E_H - w_F E_F - w_L E_L + (T_1 - T_0)$	$(p_1 \cdot x_0 - \sum_{i \in C} \hat{e}'(p_1, u_0^i)) + p_1 \cdot (y_1 - y_0)$

Notes:

1. $i \in W$ denotes summation over all workers, $i \in R$ denotes summation over the rest of the economy, $i \in C$ denotes summation over the entire country.

2. $z_0 = \sum_{i \in C} z_0^i$

$x_0 = \sum_{i \in C} x_0^i$

$y = (y_H, y_F, y_L, -E_H, -E_F, -E_L)$, the vector of domestic production of goods H, F, L and labor inputs E_H, E_F, E_L used.

Table 3

Table 3

SUMMARY OF DISAGGREGATED AND AGGREGATED WELFARE EFFECTS OF TRADE COMPETITION IN ABSENCE OF INTERVENTION

	Case (i)	Case (ii)
Consumption effects on consumers of good <i>H</i> :	Increase	Increase
Earnings effect on those employed in high-wage sector:	Decrease	Decrease
Earnings effects on those employed in free-entry sector:	No change	Decrease
Earnings effects on those employed in low-wage sector:	Increase	Increase
Earnings effects on workers as a whole:	No change	Increase or Decrease
Aggregate Welfare:	Increase	Increase or Decrease

References

1. Robert E. Baldwin, "Rent-Seeking and Trade Policy: An Industry Approach," *Weltwirtschaftliches Archiv*, Vol. 120, No. 4 (1974), pp. 662-77.
2. Frank G. Barry, "Declining High-Wage Industries and Structural Adjustment Policy," Department of Economics, University of California, Irvine, Working Paper No. 32 (October 1985).
3. Jagdish N. Bhagwati and T. N. Srinivasan, *Lectures on International Trade* (Cambridge, MA: The MIT Press, 1983).
4. -----, "On Reanalyzing the Harris-Todaro Model: Policy Rankings in the Case of Sector-Specific Sticky Wages," *American Economic Review*, Vol. 64, No. 3 (June 1974), pp. 502-08.
5. Brecher, Richard, "Optimal Commercial Policy for a Minimum Wage Economy," *Journal of International Economics*, Vol. 4 (1974), pp. 139-49.
6. Michael Bruno, "Import Competition and Macroeconomic Adjustment under Wage-Price Rigidity," in Jagdish N. Bhagwati, ed., *Import Competition and Response* (Chicago: University of Chicago Press, 1982).
7. James Cassing and Jack Ochs, "International Trade, Factor-Market Distortions and the Optimal Dynamic Subsidy: Comment," *American Economic Review*, Vol. 68, No. 5 (December 1978), pp. 950-55.
8. Gary S. Fields, "Rural-Urban Migration, Urban Unemployment and Underemployment, and Job Search Activity in LDCs," *Journal of Development Economics*, Vol. 2, No. 2 (1975), pp. 165-85.

9. -----, "A Markovian Analysis of Labor Force Migration," *Review of Economics and Statistics*, Vol. 58, No. 4 (November 1976), pp. 407-15.
10. -----, "On-the-job Search in a Labor Market Model: Ex Ante Choices and Ex Post Outcomes," Cornell University, mimeo (August 1986).
11. Harry Flam, Torsten Persson, and Lars E. O. Svensson, "Optimal Subsidies to Declining Industries: Efficiency and Equity Considerations," *Journal of Public Economics*, Vol. 22, No. 3 (1983), pp. 327-46.
12. Bruce A. Forster and Ray Rees, "The Optimal Rate of Decline of an Inefficient Industry," *Journal of Public Economics*, Vol. 22, No. 2 (1983), pp. 227- 42.
13. Edward M. Grämlich, "Impact of Minimum Wages on Other Wages, Employment, and Family Incomes," *Brookings Papers on Economic Activity* 2 (1976), pp. 409-62.
14. Earl L. Grinols, "Trade Distortions and Welfare under Uncertainty," *Oxford Economic Papers*, Vol. 37, No. 3 (September 1985), pp. 367-74.
15. Earl L. Grinols and Kar-Yiu Wong, "An Exact Measure of Welfare Change," *Canadian Journal of Economics*, Vol. 24, No. 2 (1991), pp. 428-49.
16. Robert E. Hall, "Why Is the Unemployment Rate So High at Full Employment?" *Brookings Paper on Economic Activity* 3 (1970), pp. 369-410.
17. Eric A. Hanushek, "Alternative Models of Earnings Determination and Labor Market Structures," *Journal of Human Resources*, Vol. 16, No. 2 (1981), pp. 238-59.
18. Arnold C. Harberger, "On Measuring the Social Opportunity Cost of Labour," *International Labour Review*, Vol. 103, No. 6 (June 1971). pp. 559-79.
19. John Harris and Michael Todaro, "Migration, Unemployment, and Development: A Two-Sector Analysis," *American Economic Review*, Vol. 60, No. 1 (March 1970), pp. 126-42.

20. Harry G. Johnson, "Optimal Trade Intervention in the Presence of Domestic Distortions," in Robert E. Baldwin et al., *Trade, Growth and the Balance of Payments: Essays in Honor of G. Haberler* (Rand McNally, 1965), pp. 3-34.

21. Harvey E. Lapan, "International Trade, Factor Market Distortions, and the Optimal Dynamic Subsidy," *American Economic Review*, Vol. 66, No. 3 (June 1976), pp. 335-46.

22. J. Peter Matilla, "Job Quitting and Frictional Unemployment," *American Economic Review*, Vol. 64, No. 1 (1974), pp. 235-39.

23. Jacob Mincer, "Unemployment Effects of Minimum Wages," *Journal of Political Economy*, Vol. 84, No. 4 (July-August 1976), Part 2, pp. S87-S104.

24. Peter Neary, "Intersectoral Capital Mobility, Wage Stickiness, and the Case for Adjustment Assistance," in Jagdish N. Bhagwati, ed., *Import Competition and Response* (Chicago: University of Chicago Press, 1982), pp. 39-69.

25. Donald O. Parsons, "Unemployment, the Allocation of Labor, and Optimal Government Intervention," *American Economic Review*, Vol. 70, No. 4 (September 1980), pp. 626-35.

26. Edward J. Ray, "Factor-Market Distortions and Dynamic Optimal Intervention: Comment," *American Economic Review*, Vol. 69, No. 4 (September 1979), pp. 715-17.

27. Erling Steigum, Jr., "Intersectoral Transfer of Labour in a Small Open Economy," *European Economic Review*, Vol. 24, No. 2 (March 1984), pp. 225-37.

28. Joseph E. Stiglitz, "The Structure of Labor Markets and Shadow Prices in LDCs," in Richard H. Sabot, ed., *Migration and the Labor Market in Developing Countries* (Boulder, CO: Westview Press, 1982), pp. 13-64.