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An Overlapping-generations Model of Escape Clause Protection

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Abstract

The paper explores the efficiency consequences of using temporary protection to ease adjustment following an unexpected, permanent improvement in a country's terms of trade. In the model, workers trade off the potentially higher wage that the export sector has to offer with a lower job acquisition rate. An unexpected improvement in the terms of trade surprises old workers who cannot undo the decisions they made while young. Some old workers who had not planned to search for work in the export sector end up changing their plans, adding to the pool of searchers, creating congestion. Temporary protection can reduce congestion and make the transition to the new steady state smoother. Moreover, there are conditions under which the congestion externalities lead to multiple steady-state equilibria that can be Pareto-ranked. Temporary protection may lead to a permanent change in the allocation of resources, and this permanent change may be welfare-enhancing.

1. Introduction

> "A Member shall apply safeguard measures only to the extent necessary to prevent or remedy serious injury and *to facilitate adjustment*."
> Article 5, Uruguay Round Agreement on Safeguards (emphasis added)

> "If the Commission makes an affirmative determination, it recommends to the President the action that will *facilitate positive adjustment* by the industry to import competition."
> USITC (1998) (emphasis added)

Between January 1974 and January 2002, the United States International Trade Commission (USITC) completed investigations of 73 petitions for import relief filed under the aegis of section 201 of the Trade Act of 1974.[1] This act permits interested parties to petition the USITC for relief from injurious but fair foreign competition. Any relief granted is intended as a temporary measure, providing the industry with time to adjust to changing circumstances.

Of the 73 completed investigations, 40 resulted in affirmative findings by the Commission. After forwarding their recommendations to the President of the United States, 24 of these cases resulted in some form of import relief, almost half of which as recommended by the Commission, with the remainder being modified by the President.

As the excerpts from the Uruguay Round Agreement on Safeguards and the USITC indicate, safeguard measures are intended, in part, to facilitate adjustment to changes in the international environment. Adjustment typically entails becoming "leaner and

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meaner" to more effectively compete in the international marketplace. As such, part of "facilitating adjustment" can be viewed as providing time so that resources can be withdrawn from declining industries in an orderly fashion. It has been suggested that the government may also have equity considerations in mind when providing such relief, as this passage from Baldwin (1989) clearly articulates:

> "Other authors stressing the income distribution goals of government, like Cheh (1974) and Lavergne (1983), argue that trade policies of governments are motivated by a desire to minimize (or delay) adjustment costs, especially to workers. In examining the Kennedy Round of multilateral trade negotiations, Cheh found a pattern of low tariff cuts in industries with high proportions of elderly workers, declining employment, and rising import penetration ratios."

By providing temporary protection, the government gives young workers time to retrain and make a smooth transition to the growing export sectors while simultaneously softening the blow to the older workers who face bleak re-employment prospects if they try to change their occupation so late in life.

Our goal in this paper is to explore the efficiency consequences of using temporary protection to smooth out the adjustment process following an unexpected, permanent improvement in a country's terms of trade.[2] We assume that the government's primary motivation in providing such relief is twofold. First, it is intended to either reduce or delay the adjustment costs imposed on the young workers who switch occupations as a result of the terms-of-trade shock. Second, it is intended to lessen the blow to the older workers who find that they regret decisions made earlier in life because they could not anticipate the improvement in the terms of trade. Thus, while the government's primary motives may be equity driven, our goal is to assess the welfare consequences of the government's actions.[3] We do so in the context of a simple overlapping-generations model where all newborn agents must decide whether to seek employment in the export sector or the import-competing sector. In making their choices, agents trade off the potentially higher wage that the export sector has to offer with a lower probability of actually finding a job in that sector. Since young agents have a longer time horizon, more young workers than old choose to search for jobs in the export sector. An unexpected improvement in the terms of trade surprises old workers who cannot undo the decisions they made while young. As a result, some old workers who had not planned to search for work in the export sector end up changing their plans, adding to the pool of searchers. As the pool of searchers in the export sector swells, congestion externalities may arise, making it harder to secure employment. This is particularly harmful to old workers since they have less time left to find new jobs than their younger counterparts. By providing temporary protection, the government can stem the tide of searchers, reduce congestion, and make the transition to the new steady state smoother.

We are not the first to examine the broad issue of trade and adjustment costs, nor even the first to examine the more narrowly defined issue of temporary protection and adjustment costs. Several empirical studies—including those by Magee (1972), Baldwin et al. (1980), and Trefler (2001)—address the size and scope of adjustment costs. Theoretical work by Mayer (1974), Mussa (1974, 1978), Neary (1978), and Davidson and Matusz (2001) emphasizes the importance of taking the adjustment process into account when making welfare judgments. More directly relevant to this paper are the studies by Cassing and Ochs (1978), Lapan (1976, 1978, 1979), Michealy (1986), Mussa

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(1986), Ray (1979), Karp and Paul (1994, 1998), and Gaisford and Leger (2000) that explore the optimal policy path for liberalization in the presence of adjustment costs.[4] One key insight from this research is that, in the absence of factor market distortions, there is no justification on efficiency grounds for gradual liberalization. However, if there are factor market imperfections then some sort of government intervention, either in the form of temporary protection or some sort of labor market policy, is warranted.[5]

Several of these papers focus on congestion externalities as the source of the factor market distortion. Cassing and Ochs (1978) provide an explicit model of the search process and show that the market-induced rate of adjustment is suboptimal when congestion externalities are present. In contrast, Karp and Paul (1994, 1998) and Gaisford and Leger (2000) do not model the source of the externality—they simply assume that the social cost of adjustment exceeds the private cost of adjustment. Both papers then show that government intervention can raise welfare, although Karp and Paul (1994, 1998) focus on tariff policy while Gaisford and Leger (2000) argue that there are always superior policies available.

Our work is similar to Karp and Paul's in that we show that if a change in the terms of trade leads to a temporary enlargement of the pool of searchers, and if this creates congestion, then a temporary import tariff that slows down the movement of workers into the export sector might actually increase the value of output (measured at world prices). However, our work is unique in at least three respects. First, by using an overlapping-generations model in which the congestion externalities are carefully modeled, we are able to highlight how the unexpected improvement in the terms of trade affects the young and old as well as the current and future generations in fundamentally different ways. We consider this to be important, since, as we noted above, there is empirical evidence that concern about the welfare of older workers plays a role in the government's policy choices. Second, we show that there are conditions under which the congestion externalities in our model lead to multiple steady-state equilibria that can be Pareto-ranked. As a result, it is possible that with free trade the change in the terms of trade may push the economy into a new steady state characterized by low job acquisition rates and low output in the export sector. However, if the government intervenes by providing temporary protection to the import-competing sector, the adjustment process may be slowed down enough to steer the economy towards a different steady state that is characterized by higher job acquisition and production rates in the export sector. This leads to the third unique feature of our analysis. In previous work, when the new long-run free-trade equilibrium is reached, there are no lasting effects from the period of temporary protection. This need not be the case in our model—temporary protection may lead to a permanent change in the allocation of resources and this permanent change may be welfare-enhancing.

We present our model and examine the decision problem faced by workers in the next section. We then solve for the steady-state equilibrium and the transition path between equilibria in section 4, where we also demonstrate how temporary import protection can avert the congestion externality. Since a tariff is distorting, we include a discussion of the costs and benefits associated with a temporary tariff, and argue that it will be welfare-improving if the magnitude of the minimum tariff necessary to reduce congestion is relatively small. In section 5, we turn to the issue of multiple equilibria and show how a temporary tariff can have a permanent effect on the long-run allocation of resources.

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2. An Overlapping-generations Model

Assumptions

We consider an overlapping-generations model where labor is the only factor of production. Workers are indexed by ability a, which is distributed uniformly over [0, 1]. Each worker lives for two periods and is replaced by an identical worker upon death. We refer to a generation as "young" or "old" if it contains workers in their first or second period of life, respectively. Correspondingly, we use superscripts "y" and "o" to refer to variables that pertain to a given generation at a particular time. We normalize the measure of workers in each generation to 1. Combined with our assumption about the distribution of ability, this means that for any $a^g \in [0, 1]$, the measure of workers in generation g with $a < a^g$ is a^g, while the measure with $a > a^g$ is $1 - a^g$.

There are two goods which we label X (an export good) and M (an import-competing good). Each worker, regardless of ability, can produce one unit of M per period. By contrast, each worker employed in the export sector can produce a units of output per period. With competitive labor markets, constant-returns-to-scale technology, and no other inputs, each employed worker is paid the value of his or her marginal product, which also equals the total value of his or her production.

We assume that the economy is small, choose the export good as *numéraire*, and define P_t as the exogenously given world price of the import-competing good.

We assume that a worker can always obtain a job in the import-competing sector and keep that job for his or her entire life. By contrast, a worker who wishes to be employed in the export sector must search, and there is some positive probability the worker will not find a job in that sector. We use π_t to denote the probability of "success" for a worker searching for a job in the export sector at time t, and it is assumed that workers have rational expectations concerning π_t.

While we do not explicitly model the search process, what we have in mind is an underlying model in the spirit of the classic work by Mortensen (1982) and Pissarides (1990) in which firms in the export sector post vacancies while workers search for employment.[6] Workers know the number of jobs available and the size of the search pool, but they do not know which firms have unfilled vacancies until they visit them. In such settings, a worker who chooses to search for an export sector job makes it harder for the other searchers in that sector to find employment. These congestion externalities distort incentives and lead to suboptimal equilibria. Our focus is on how the government can use temporary protection to improve the efficiency of the adjustment process by controlling the rate at which workers switch sectors. Consistent with previous search theoretic models of unemployment, we are assuming that the government possesses the same information as the workers, and thus cannot eradicate the information problem that generates the equilibrium unemployment.[7]

The main reason that we do not explicitly model the search process is that its exact nature is not important for our purpose—all that matters is that the congestion externalities are present.[8] This can be captured in a simple manner by assuming that the probability of finding a job in the export sector is a decreasing function of the measure of workers searching for export-sector jobs, as we do in section 3 below. Carefully modeling the search process itself would greatly complicate the analysis without providing any additional insight.

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The Worker's Decision Problem

At the start of each period, unemployed workers (including all newborns) must decide whether to accept certain employment in the import-competing sector or search for employment in the export sector. Moreover, each worker who enters the period employed must decide whether to keep his/her job or look for a job in the other sector.[9]

The decision for workers in the old generation is simple. Expected one-period income from searching in the export sector at time t is $\pi_t a$, whereas the certain income of taking a job in the import-competing sector is P_t. Assuming risk-neutrality, workers who are not already employed in the export sector with $a \geq P_t/\pi_t$ will choose to search for a job in that sector, while the remaining workers will choose to work in the import-competing sector. We define this critical level of ability as a_t^o and refer to any old worker with this ability as the marginal old worker.[10]

The problem for workers in the young generation is more complicated. Define $V_{St}^y(a)$ as the expected lifetime income of a young worker who searches for a job in the export sector, and use $V_{Mt}^y(a)$ to denote the expected lifetime income for a young worker who accepts a job in the import-competing sector.[11] Then:

$$V_{St}^y(a) = 2\pi_t a + (1-\pi_t)\max\{P_{t+1}, \pi_{t+1}a\}, \tag{1}$$

$$V_{Mt}^y(a) = P_t + \max\{P_{t+1}, \pi_{t+1}a\}. \tag{2}$$

If a young searcher achieves success, she earns a while young, and a when old.[12] If the searcher does not find a job, she has the option of searching again when old, or taking a job in the import-competing sector. Similarly, a worker who accepts a job in the import-competing sector earns P_t while young, and has the option of searching when old.

We define a_t^y as the value of ability that equates (1) and (2) and refer to any young worker with this ability as the marginal young worker. Figure 1 illustrates two qualitatively different solutions for a_t^y. On the left, some workers who are young at time t will choose to search for a job in the export sector, but if they are not successful, they will return to the import-competing sector when they become old. These workers have ability $a \in [a_t^y, a_{t+1}^o)$. It is in their interest to "test the waters" of the job market. The potential to receive two periods of high wages is worth giving up one period of low wages. But as they near the end of their work life, the potential to receive higher wages no longer offsets the loss of a single period of low wages.

If the marginal young worker depicted on the left in Figure 1 fails in her search for an export sector job, she will not choose to repeat the search when old. Instead she will choose to accept a job in the import-competing sector. This implies that, for this marginal young worker, $\max\{P_{t+1}, \pi_{t+1}a_t^y\} = P_{t+1}$. We can now equate (1) and (2) and solve to obtain

$$a_t^y = a_t^o\left\{\frac{1+\pi_t(P_{t+1}/P_t)}{2}\right\}. \tag{3a}$$

The situation depicted on the right in Figure 1 is different. Fewer workers choose to search when young than when those same workers become old. For these delayed searchers, $\max\{P_{t+1}, \pi_{t+1}a_t^y\} = \pi_{t+1}a_t^y$. Equating (1) and (2) and solving yields

$$a_t^y = a_t^o\left\{\frac{1}{2-\pi_{t+1}}\right\}. \tag{3b}$$

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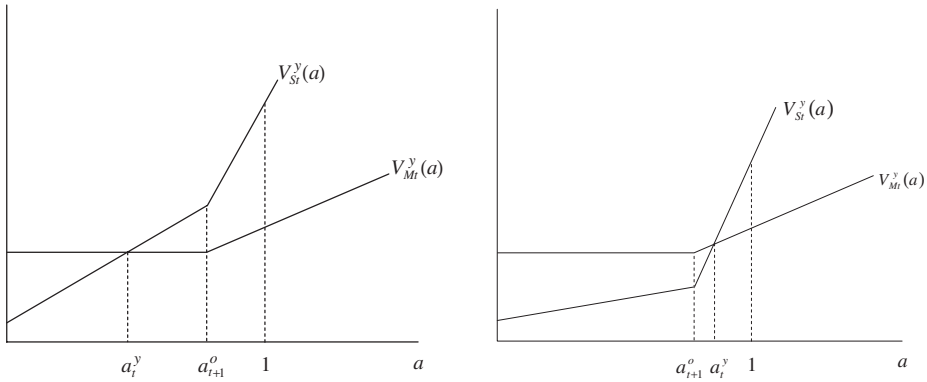

Figure 1. Solving for the Marginal Young Worker. Left: Testing the Waters. Right: Delayed Search

Alternative assumptions about the parameters underlie the qualitatively different solutions depicted in Figure 1. For example, in "testing the waters" it is the case that $a^y_t < a^o_{t+1}$. Using (3a) and our solution for a^o_t, we find that this inequality holds if

$$\frac{P_t}{\pi_t}\left\{\frac{1+\pi_t(P_{t+1}/P_t)}{2}\right\} < \frac{P_{t+1}}{\pi_{t+1}}. \tag{4}$$

For example, reducing π_{t+1} or P_t or increasing P_{t+1} will lead eventually to the satisfaction of the inequality expressed in (4). All of these partial derivatives are sensible. A reduction in π_{t+1} causes a fall in the expected wage of a worker searching in period $t + 1$, while an increase in P_{t+1} boosts the attractiveness of jobs in the import-competing sector.

Similarly, for "delayed search" it is clear that $a^y_t > a^o_{t+1}$. Using (3b) and our solution for a^o_t, this inequality is satisfied if

$$\frac{P_{t+1}}{\pi_{t+1}} < \frac{P_t}{\pi_t}\left\{\frac{1}{2-\pi_{t+1}}\right\}. \tag{5}$$

Since $\pi_{t+1} \leq 1$, delayed search can occur only if the price of the import-competing good falls between periods t and $t+1$ (which reduces the wage in the import-competing sector) or if $\pi_{t+1} > \pi_t$ (which increases the probability of a successful search).

3. Steady States and Transition Paths

The Steady-state Allocation of Resources

The measure of searchers at time t, (S_t), equals the sum of young searchers (S^y_t) and old searchers (S^o_t), where the measure of young searchers is $S^y_t = 1 - a^y_t$.

Finding the measure of old searchers is more difficult. Only old workers with $a \geq a^o_t$ *who are not already employed* in the export sector will search for a job in that sector. There are two possibilities. If $a^o_t > a^y_{t-1}$, then all workers with $a \geq a^o_t$ would have searched for a job in the export sector when they were young. With a success rate of π_{t-1}, we can deduce that $S^o_t = (1 - \pi_{t-1})(1 - a^o_t)$.

Alternatively, if $a^o_t < a^y_{t-1}$, then there are some old workers who choose to search in period t who did not search when they were young. In this case, we have $S^o_t =$

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$(1 - \pi_{t-1})(1 - a^y_{t-1}) + (a^y_{t-1} - a^o_t) = (1 - \pi_{t-1})(1 - a^o_t) + \pi_{t-1}(a^y_{t-1} - a^o_t)$. We can combine both possibilities into a single equation:

$$S^o_t = (1-\pi_{t-1})(1-a^o_t) + \pi_{t-1}\max\{0, a^y_{t-1} - a^o_t\}. \tag{6}$$

The second part of (6) can be interpreted as the measure of old searchers who would have gotten a job when young had they searched, and therefore would not be searching when old. Of course, this term is zero if all old searchers also searched when young.

In a steady state, $P_t = P$ and $\pi_t = \pi$ for all t. From our discussion at the end of the last subsection, we can rule out the possibility of delayed search in a steady state. Therefore, all steady states are characterized by the left of Figure 1. Let $\bar{S}^y$ and $\bar{S}^o$ denote the steady-state measures of young and old searchers, and define $\bar{S} = \bar{S}^y + \bar{S}^o$. We note that the steady-state measure of searchers in each generation is a function of both P and π. We focus on the relationship between P and the measure of searchers in the remainder of this section, turning to the relationship with π in section 4.

An Unexpected Improvement in the Terms of Trade

Suppose now that there is a permanent, unexpected improvement in the terms of trade. To help keep track of events, we normalize time by setting $t = 1$ when the terms of trade improve. We can then model a permanent improvement in the terms of trade by assuming that $P_t = P_H$ for $t \leq 0$ and $P_t = P_L$ for $t \geq 1$, where $P_L < P_H$. We begin by investigating how this change in world prices affects worker behavior and the value of output.

Intuitively, the improvement in the terms of trade will push some workers out of the import-competing sector to search for jobs in the export sector. As we noted earlier, it is standard to assume congestion externalities exist so that as the pool of searchers swells the probability that an individual worker will find a job falls. This notion is captured by assuming that π_t is a decreasing function of S_t. While it is natural to think of this function as continuous, doing so complicates our analysis considerably without providing any additional insight.[13] Thus, for illustrative purposes we postulate the following as a simple form for this function:

$$\pi(S) = \begin{cases} \pi_H & \text{if } S \leq \tilde{S}, \\ \pi_L & \text{if } S > \tilde{S}. \end{cases} \tag{7}$$

We assume that workers have rational expectations about the time path of π_t. As we show in section 5, there are cases in which there are multiple rational-expectations steady-state equilibria. In addition, there may be more than one rational-expectations transition path that leads from the initial steady-state equilibrium to the new one. Since we deal with this issue explicitly later in the paper, in this section we focus on the case in which the new steady-state rational-expectations equilibrium is unique as is the transition path that leads to it.

To solve for this equilibrium as well as the transition path, we first specify the workers' expectations regarding the time path for π_t, and then show that these expectations are consistent with equilibrium behavior. The case that we are interested in is the one in which congestion causes the probability of success to temporarily fall from its steady-state value of π_H to π_L immediately after the improvement in the terms of trade. We then want π_t to rise back up to π_H in the next period and remain there forever afterward. That is, we assume that $\pi_t = \pi_H$ for $t \neq 1$ and $\pi_t = \pi_L$ for $t = 1$. This set of beliefs will be rational if $S_1 > \tilde{S} \geq S_t$ for all $t \neq 1$.

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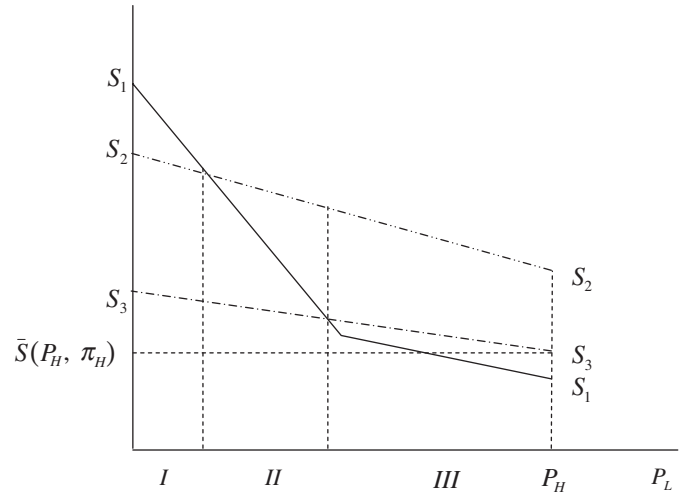

Figure 2. The Measure of Searchers during the Transition to the New Steady State

The measures of searchers in each of the three periods following the terms-of-trade shock are depicted in Figure 2 (the detailed derivations for this figure are provided in the Appendix). Since S_t (for $t = 1$–3) is shown as a function of P_L for $P_L \leq P_H$, this figure reveals how the total measure of searchers varies with the degree of improvement in the terms of trade. There are several features worth noting. First, as expected, the measure of searchers in each period is a decreasing function of P_L since smaller terms-of-trade improvements cause fewer workers to seek export sector jobs. Second, the curve S_1S_1 is kinked because small deviations of P_L from P_H do not produce regret in old workers. That is, all old workers who search when the price is P_L also searched when they were young. In contrast, large deviations of P_L from P_H induce some old workers to search for the first time. It is this surge of old workers entering the export-sector labor market for the first time that can cause the congestion that the government may want to ease. Finally, from Figure 2 it is evident that there are three ranges for P_L that lead to different patterns for the measures of searchers over time. A rational-expectations equilibrium of the type that we are seeking exists for relatively low values of P_L (those in region *I*).[14] That is, this is the region in which $S_1 > \tilde{S} \geq S_2 \geq S_t$ for $t \geq 3$.[15]

In region *I* of Figure 2, the change in the terms of trade is dramatic and congestion reduces the probability of finding a job in the export sector. In this case, there are important implications for the distribution of income between current members of the young and old generations, as well as between current and future generations. To sort out how the different groups of workers are affected, it is useful to consider the following four questions as they pertain to the old workers at $t = 1$: Does the change in the terms of trade alter their labor market behavior? Do they regret any decisions made when young? Are they harmed by the unexpected change in the terms of trade or do they benefit from it? Is their experience any different from the clones that replace them in the future?

The answers to these four questions are provided in Lemmas 1–4 below. However, before these lemmas can be stated, we need to introduce some new notation. Let $\bar{a}^y$ and $\bar{a}^o$ denote the ability levels of marginal young and old workers in the initial steady state, respectively; and let a_1^o represent the ability level of the marginal old worker in

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period 1. In addition, let $\tilde{a}^y$ denote the ability level of a marginal young worker at time zero *if the change in the terms of trade could be anticipated*.[16] From our earlier analysis, we know that $\bar{a}^y < \bar{a}^o$. It is also the case that (compared with the actual number of young searchers) more young people would search in period zero if they anticipated the improvement in the terms of trade. That is, $\tilde{a}^y < \bar{a}^y$. The only question is whether a_1^o is less than or greater than $\tilde{a}^y$. There are two cases to consider. Either $\tilde{a}^y < a_1^o < \bar{a}^y < \bar{a}^o$ or $a_1^o < \tilde{a}^y < \bar{a}^y < \bar{a}^o$, with the particular ordering depending upon the underlying parameters of the model.[17] For brevity, we consider the first case in the text and relegate treatment of the second case to the notes.

LEMMA 1. *When there is an unexpected terms-of-trade improvement the old workers who change their labor market behavior are the ones with* $a \in [a_1^o, \bar{a}^o]$ *who are not already employed in the export sector. These workers had planned on taking jobs in the import-competing sector but now search for export sector jobs instead.*

PROOF. *By the definition of* $\bar{a}^y$, *we know that workers born at* $t = 0$ *with* $a < \bar{a}^y$ *take jobs in the import-competing sector when young and plan on doing so again when old. By the definition of* $\bar{a}^o$ *we know that workers born at* $t = 0$ *with* $a > \bar{a}^o$ *search for jobs in the export sector when young and plan on doing so again when old if their initial search proves fruitless. Workers with* $a \in [\bar{a}^y, \bar{a}^o]$ *search for export sector jobs when young and then, if their search is unsuccessful, plan on taking jobs in the import-competing sector when old. By the definition of* a_1^o, *when the terms of trade unexpectedly change, all old workers with* $a > a_1^o$ *who are not already employed in the export sector search for jobs in that sector. Thus, it is the old workers who are not already employed in sector X with* $a \in [a_1^o, \bar{a}^o]$ *who change their behavior—they had planned on taking jobs in the import-competing sector but now, because P has fallen, they search for export sector jobs instead.* □

LEMMA 2. *The old workers who regret the decisions they made when young are those with* $a \in [\tilde{a}^y, \bar{a}^y]$. *Instead of taking jobs in the import-competing sector they would have rather searched for jobs in the export sector.*

PROOF. *This follows directly from the definitions of* $\tilde{a}^y$ *and* $\bar{a}^y$. *If the workers who are born at* $t = 0$ *could anticipate the change in the terms of trade, then they would search when young if* $a > \tilde{a}^y$ *and then, if necessary, search again when old if* $a > a_1^o$. *However, since they do not anticipate the change in P, workers with* $a \in [\tilde{a}^y, \bar{a}^y]$ *take jobs in the import-competing sector when young instead. Note that a subset of these workers, those with* $a \in [\tilde{a}^y, a_1^o]$, *regret not having searched when young, yet do not change their behavior when old.* □

LEMMA 3. *The unexpected terms-of-trade improvement benefits the old workers who are employed in the export sector and harms those who are employed in the import-competing sector. Those who seek X-sector jobs could gain or lose—they are harmed by the reduction in the job acquisition rate in period 1 but benefit from the fall in the consumer price index.*

PROOF. *Those employed in the export sector benefit from the fall in the consumer price index, while those employed in the import-competing sector see their real incomes fall.* □

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LEMMA 4. *If we compare the experience of the old workers in the current generation with the experience of the clones that replace them in future periods, there are two differences worth highlighting. First, the clones with* $a \in [\tilde{a}^y, \bar{a}^y]$ *are not surprised by the low price for good M and therefore search for export sector jobs when young. Second, by the time the clones age, the congestion will have abated and the job acquisition rates will have returned to the relatively high value.*[18]

PROOF. *The first difference follows directly from the definitions of* $\tilde{a}^y$ *and* $\bar{a}^y$. *The second difference is due to the fact that we are focusing on the rational-expectations equilibrium in which the job acquisition rate falls for only one period.*

With the aid of Lemmas 1–4, we are now in a position to examine the sort of equity considerations that the government might have in mind when instituting a temporary tariff on the import-competing good. If the decision is based on the welfare of the lowest ability workers, then the government must be primarily concerned with the old workers in this group—the temporary tariff keeps their real incomes from falling as far as they would without protection. Deardorff (1987), making use of Corden's Social Welfare Function, suggests that this may be one reasonable equity-based explanation for temporary protection. He argues that the government's goal may be to prevent a significant fall in the real income of a significant sector of the economy. However, it should be clear that a temporary tariff could achieve this goal only for the old workers with low ability levels. For the young, a temporary tariff may *delay* the fall in real income, but it cannot *prevent* it. If the government truly wanted to use tariffs to prop up the wages of the young workers with low ability levels, it would have to institute a permanent tariff.

It is also unlikely that the government is concerned about the workers with the highest ability levels. While it is true that these workers are harmed by the fall in π when they are old, most of them will already have high-paying jobs in the export sector and will benefit from the lower consumer prices. In addition, these are the workers at the highest end of the income distribution.

This leaves us with the workers with $a \in [\tilde{a}^y, \bar{a}^o]$.[19] Workers with ability levels in the low end of this range regret that they did not search when young (Lemma 2), and those with ability levels at the high end of this range are forced to change their behavior and search for export sector jobs when the prospects for finding such a job are relatively bleak (Lemma 1).[20] These are also the workers who are in a fundamentally different position than the clones that replace them because they were unable to anticipate the improvement in the terms of trade (Lemma 4). Of course, if the government tries to help these workers by instituting a temporary tariff, there are some additional benefits—the old workers with the lowest ability levels have their wages propped up temporarily, and those who are searching for export sector jobs face higher job acquisition rates if the tariff successfully reduces congestion. In addition, the young workers at $t = 1$, who are not surprised by the change in the terms of trade, benefit from the increase in π. These are the young workers we referred to in the introduction—government intervention can reduce or delay the adjustment costs imposed on them by instituting a temporary tariff. It is not clear, however, what the full welfare consequences of such an action would be since tariffs generate distortions as well. In the next subsection we demonstrate that a temporary tariff can alleviate the congestion. We defer the full welfare analysis to the subsequent section.

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Temporary Protection

The existence of the congestion externality leaves open the possibility that government intervention could successfully increase economic welfare. The fact that the congestion is temporary suggests that the policy need not be permanent. While the best policies would be those that directly target the externality, they may not be feasible. We therefore explore the effects of a temporary import tariff.

Suppose that the government levies a specific import tariff (τ) during the first period, removing it for all subsequent periods. The purpose of the tariff is to keep enough workers from searching in the first period so that the congestion externality is averted. Since congestion is not a problem in the longer run, the tariff is not needed and is therefore removed.[21]

It will continue to be the case that the economy will be in the new steady state for $t \geq 3$ and therefore the measure of searchers in periods 3 and beyond (both young and old) will remain unchanged.[22] However, the measures of old and young searchers during the first period, and the measures of old searchers during the second period, are impacted by the tariff.[23] In Figure 3, we show how S_1 and S_2 vary with τ, given a price P_L and assuming that $\pi_t = \pi_H$ for all t (the derivation of Figure 3 is provided in the Appendix). The measure of period-1 searchers is monotonically decreasing in the tariff. Higher tariff rates make the import-competing sector more attractive and fewer people search. By contrast, very small tariffs have no impact on the measure of searchers in the second period because all searchers who are old in period 2 also searched when young (in period 1). However, for high enough tariffs, some workers will choose to work in the import-competing sector in period 1 when they are young, but then search in the export sector when they become old and the tariff is removed. Higher tariffs increase the measure of these delayed searchers, implying that S_2 is increasing in the tariff rate.

From Figure 3, there exists a tariff rate ($\hat{\tau}$) such that $S_1 = S_2$. It follows that if $S_1(\hat{\tau}) = S_2(\hat{\tau}) \leq \tilde{S}$, there exists a range of tariffs $\tau \in [\tilde{\tau}, \hat{\tau}]$ that can alleviate the congestion externality. Because any tariff is distortionary, the optimal tariff is either zero or $\tilde{\tau}$.

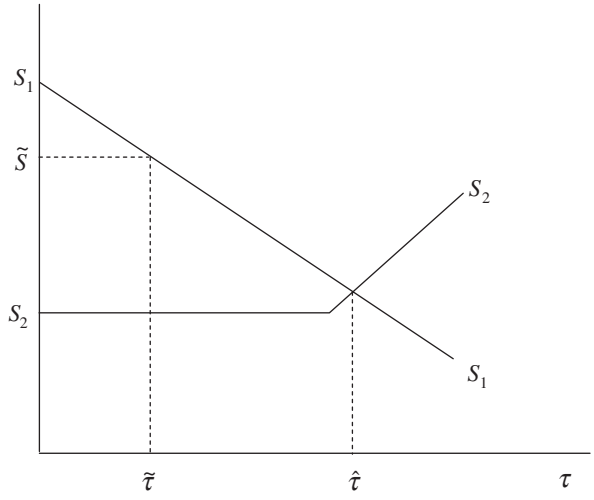

Figure 3. The Measure of Searchers per Period as a Function of the Tariff

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4. The Welfare Effects of a Temporary Tariff

A temporary tariff creates both gains and losses. The losses consist of the usual consumption distortion and a production distortion that arises because some workers who would have searched in the absence of the tariff would have found jobs in the export sector, and the value of their output measured at world prices would have been higher than the value of output that they produced in the import-competing sector. The gains occur because all of the workers who continue to search when a temporary tariff is imposed would have also searched in the absence of a tariff. However, because others are drawn to the import-competing sector and excluded from search, the probability of success for the remaining searchers is higher, therefore increasing the value of output obtained from this group of searchers.

Suppose that we measure the gains and losses as a function of the tariff. Suppose further that we have an economy in which $\hat{\tau} > \tilde{\tau}$. This means that in the free trade outcome $S_1 > \tilde{S} > S_t$ for all $t \neq 1$ (i.e., congestion is only a problem in period 1) and that there exists a temporary tariff that the government can use to alleviate the congestion. Then, as τ first begins to rise above zero, there are losses from the consumption and production distortions but there are no gains as long as $S_1(\tau)$ remains above $\tilde{S}$. These losses are a continuous, increasing function of τ. However, as the tariff continues to rise we eventually reach the point where $\tau = \tilde{\tau}$ and $S_1(\tau) = \tilde{S} > S_2(\tau)$.[24] At that point, a marginal increase in the tariff creates discrete gains as the job acquisition rate in period 1 jumps up from π_L to π_H. If these discrete gains dominate the losses accumulated by increasing τ from 0 to $\tilde{\tau}$, then the temporary tariff is welfare-enhancing. It should be clear that this *must* be the case if the free trade value for S_1 is close to (but above) $\tilde{S}$. In that case, it takes only a very small tariff to alleviate congestion and boost job acquisition rates in the export sector. As for the gains and losses, the consumption distortion generated by such a small tariff is of second-order importance, as is the loss due to inducing a very small measure of workers to refrain from search. However, the discrete change from π_L to π_H applies to all of those workers who continue to search, which is nearly all of the workers who would have searched under free trade. Thus, the gains must dominate the losses.

5. Multiple Equilibria

Increasing the steady-state job acquisition rate in the export sector has two contradictory effects on the steady-state size of the search pool. First, for each generation the pool broadens to include workers of lesser ability. This effect tends to increase the steady-state measure of searchers. However, given the breadth of workers who prefer to search for a job in the export sector, a higher success rate leaves fewer old workers unemployed, thereby reducing the steady-state size of the pool. For values of π near one, the second effect dominates and the steady-state measure of searchers is *decreasing* in the steady-state value of π. Formally:

$$\bar{S}(P, \pi) = \left\{1 - \frac{P}{\pi}\frac{1+\pi}{2}\right\} + (1-\pi)\left\{1 - \frac{P}{\pi}\right\}, \tag{8}$$

where the first term on the right-hand side of (8) (representing the steady-state measure of young searchers) is strictly increasing in π, while the second term (representing the steady-state measure of old searchers) is first increasing and then decreasing in π. Differentiating (8) with respect to π reveals that $\bar{S}$ is decreasing in π if $\pi > (3P/2)^{1/2}$.

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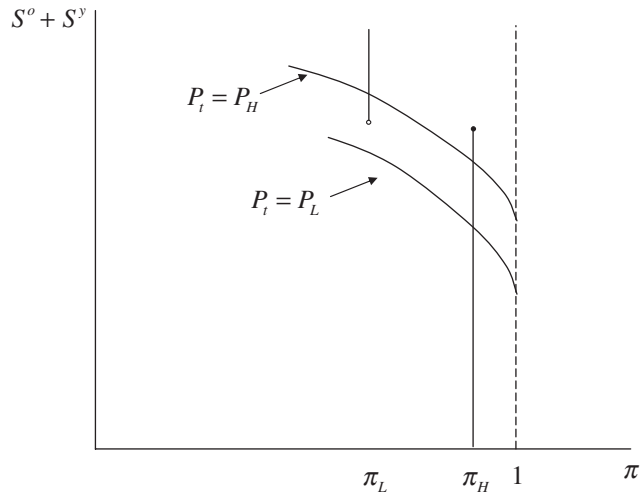

Figure 4. Multiple Steady States

Combining the fact that the steady-state measure of searchers may be decreasing in π with the existence of congestion externalities suggests that there are circumstances under which the economy has multiple steady states, with $\bar{S}(\pi_L) > \tilde{S} > \bar{S}(\pi_H)$. We illustrate this case in Figure 4 where we are assuming that the economy is initially in a steady state with a low level of search ($\pi = \pi_H$). Suppose that the terms of trade unexpectedly improve and that workers correctly anticipate that this will lead to an immediate increase in the size of the search pool. Suppose further that workers expect the job acquisition rate to fall to π_L and remain there permanently. If this is the case the permanent improvement in the terms of trade has pushed the economy into a new steady state with a permanently higher level of search and lower job acquisition rates in the export sector. This provides a new role for the government—it might be possible to use a temporary tariff to keep the economy from moving to the "bad" steady state. If so, the short-run loss associated with the temporary distorting effects of the tariff is likely to be more than offset by a perpetual stream of gains. This would be a situation in which *temporary* protection would lead to a *permanent* change in the allocation of resources.

To analyze this situation, we now assume that the probability of successfully finding a job in the export sector falls permanently to π_L concurrent with the improvement in the terms of trade. As before, young workers adjust immediately to any change. Since there are no changes in the environment beyond the first period, the steady-state measure of young workers is reached immediately. Similarly, it only takes two periods for the measure of old workers to reach its new steady-state value. In Figure 5 we show the total measure of searchers as a function of P_L (note that S_2 represents the size of the search pool in the new steady state since adjustment is complete after only two periods). If the terms of trade improve to a price within range I in Figure 5, then our initial conjecture about the probability of success immediately falling to π_L and remaining there forever is validated. As drawn, this range of prices can be further divided into two subsections. For relatively high prices in range I, the measure of searchers monotonically approaches the new steady state. For lower prices in this range, the measure of searchers overshoots the new steady-state level.

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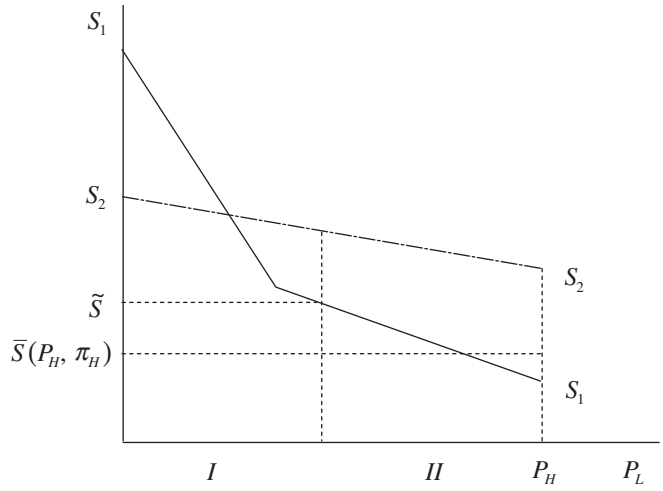

Figure 5. The Measure of Searchers per Period as a Function of Price

If there exists a steady state $\bar{S}(P_L, \pi_H) < \tilde{S}$, then a one-period tariff that holds the measure of searchers at $\tilde{S}$ during the first period of transition has *exactly the same effect* as in the case where the free trade measure of searchers would exceed $\tilde{S}$ in only the first period. In both cases, relieving congestion in the first period has the beneficial impact of reducing the measure of workers who are old searchers in the second period.

Of course, we are not the first to point out that externalities in the search process can lead to multiple steady-state equilibria. Diamond (1982, 1984) and Diamond and Fudenberg (1989) provided models in which positive search externalities may generate this outcome. In their models, workers must search for a trading partner and the fact that more people are trading makes it easier to find a match. If people do not expect many others to search, then it is not in their interest to search and we get an equilibrium with a relatively low level of output. On the other hand, if people expect many others to be searching as well, then their own expected return to search will be high. In this case, we get an equilibrium with a high level of search activity and a relatively high level of output. Diamond and Fudenberg argue that there is a role in their model for the government to try to manipulate expectations in order to steer the economy away from the Pareto-inferior steady state. If, by telling workers to expect a bright future with high production, the government can convince workers to search, the government's projections will turn out to be accurate. It is important to note that such a policy will not work in our setting. To see this, suppose we have an economy that, without government intervention, would be pushed into the bad steady state by the terms-of-trade shock. Suppose further that the government tried to avoid this outcome by telling workers that job acquisition rates in the export sector would remain high. If workers believed the government, then more of them would be attracted to the export sector, the size of the search pool would grow even larger, and job acquisition rates would turn out to be low. Thus, propaganda would not work—the government would have to use a temporary tariff instead.

6. Conclusion

It has been argued that if governments are going to liberalize trade that they should do so gradually. One of the rationales offered for this is that by doing so the govern-

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ment can smooth out the transition to the new equilibrium and reduce the adjustment costs imposed on workers. Equity concerns have also been raised about how liberalization will affect workers, particularly older ones, who are employed in the protected sector. Similar concerns arise when economies are hit by terms-of-trade shocks. As a result, governments occasionally provide temporary relief to industries that have been injured by unexpected changes in world prices.

In this paper we have presented an overlapping-generations model that highlights the manner in which current and future generations are affected by unexpected changes in the terms of trade. We have argued that if the government uses *temporary* protection due to equity concerns, then their concerns cannot be about the welfare of those workers who remain trapped in the injured sector. Instead, the government must be concerned about two groups—the older workers who regret the decisions made when they were young or who change their labor market behavior as a result of the terms-of-trade shock, and the young workers who would face low job acquisition rates in the export sector without protection. We have also shown how temporary protection affects the different groups of workers both in the current and future generations.

To capture the notion that adjustment is costly, we have assumed that workers must search for export sector jobs so it takes time for the economy to reach the new steady-state equilibrium. We have shown that if there are congestion externalities present in the search process, temporary protection may be welfare-enhancing, reducing adjustment costs for young and old workers alike. This result is not new—it can be found in Karp and Paul (1994) or Gaisford and Leger (2000). However, a result that is new to this paper is that these congestion externalities can give rise to multiple steady-state equilibria. If this is the case, then a terms-of-trade shock can *permanently* push the economy from a "good" steady state with high job acquisition rates and high output to a "bad" steady state with lower job acquisition and output rates. Government intervention aimed at steering the economy back to the "good" equilibrium is then warranted. However, propaganda aimed at influencing expectations is not enough. The government must also provide some sort of tangible protection to the injured sector. We have shown that there are cases in which a temporary tariff will do the trick.

Appendix

The purpose of this appendix is to provide the detailed derivation of Figures 2, 3, and 5. As for Figure 2, we begin by focusing on the younger generation. The measure of young searchers in the initial and terminal steady states, as well as those in the intervening period, are given in (A1)–(A3):

$$\bar{S}^y(P_H, \pi_H) = \left\{1 - \frac{P_H}{\pi_H}\frac{1+\pi_H}{2}\right\}, \tag{A1}$$

$$S_1^y = \left\{1 - \frac{P_L}{\pi_L}\frac{1+\pi_L}{2}\right\}, \tag{A2}$$

$$S_2^y = \bar{S}^y(P_L, \pi_H) = \left\{1 - \frac{P_L}{\pi_H}\frac{1+\pi_H}{2}\right\}. \tag{A3}$$

Young workers adjust immediately to new circumstances. In particular, they adjust immediately to the simultaneous fall in P and π, and they immediately adjust one more time to the increase in π. This follows since the young workers make all of their decisions after the terms-of-trade improvement occurs.

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In contrast, old workers can be surprised, since the change in price occurs in the middle of their life, after they have committed to a course of action based upon their expectations regarding future prices and labor market conditions. The measure of old searchers in the initial and terminal steady states, as well as those in the intervening period, are given in (A4)–(A7):

$$\bar{S}^o(P_H, \pi_H) = (1-\pi_H)\left\{1-\frac{P_H}{\pi_H}\right\}, \tag{A4}$$

$$S_1^o = (1-\pi_H)\left\{1-\frac{P_L}{\pi_L}\right\}+\pi_H \max\left\{0, \frac{P_H}{\pi_H}\frac{1+\pi_H}{2}-\frac{P_L}{\pi_L}\right\}, \tag{A5}$$

$$S_2^o = (1-\pi_L)\left\{1-\frac{P_L}{\pi_H}\right\}+\pi_L \max\left\{0, \frac{P_L}{\pi_L}\frac{1+\pi_L}{2}-\frac{P_L}{\pi_H}\right\}, \tag{A6}$$

$$S_3^o = \bar{S}^o(P_L, \pi_H) = (1-\pi_H)\left\{1-\frac{P_L}{\pi_H}\right\}+\pi_H \max\left\{0, \frac{P_L}{\pi_H}\frac{1+\pi_H}{2}-\frac{P_L}{\pi_H}\right\}. \tag{A7}$$

Combining (A1)–(A7), we obtain S_t as a function of P_L for $P_L \le P_H$. These functions are depicted in Figure 2. As discussed in the text, the curve S_1S_1 is kinked because small deviations of P_L from P_H do not produce regret in old workers while large deviations induce some old workers to search for the first time. This can be seen by examining the second term in (A5)—it is positive and decreasing in P_L for relatively small values of P_L, then turns to zero (and therefore becomes independent of P_L) once P_L surpasses a critical value.

Neither S_2S_2 nor S_3S_3 are kinked. The former is true because the value of P_L plays no role in determining whether the second term in (A6) is zero or positive. The latter is true because the second term in (A7) is always zero since the economy reaches the new steady state at time $t = 3$, and we have already shown that in any steady state there are no old searchers who were not also searchers when young.

As we noted in the text, it is region I of Figure 2 that is of interest to us since this is the range of values for P_L such that $S_1 > \tilde{S} \ge S_2 \ge S_t$ for $t \ge 3$. The existence of range I is guaranteed if $S_1 > S_2$ when both are evaluated at $P_L = 0$. Using (A1)–(A7), this condition reduces to

$$\pi_L > \pi_H\left\{1-\frac{P_H}{\pi_H}\frac{1+\pi_H}{2}\right\}. \tag{A8}$$

The incentive to search diminishes as π_L becomes smaller. If this probability is low enough, then the measure of searchers in period 1 is below the measure of searchers in subsequent periods, where the probability of success is higher. Thus, as long as π_L is not too low, a rational-expectations equilibrium of the type we are seeking exists.

Turn next to Figure 3. After the temporary tariff is imposed the measures of young and old searchers during periods 1 and 2 are now given by

$$S_1^y = \left\{1-\frac{P_L+\tau}{\pi_H}\frac{1+\pi_H}{2}\right\}, \tag{A9}$$

$$S_1^o = (1-\pi_H)\left\{1-\frac{P_L+\tau}{\pi_H}\right\}+\pi_H \max\left\{0, \frac{P_H}{\pi_H}\frac{1+\pi_H}{2}-\frac{P_L+\tau}{\pi_H}\right\}, \tag{A10}$$

$$S_2^o = (1-\pi_H)\left\{1-\frac{P_L}{\pi_H}\right\}+\pi_H \max\left\{0, \frac{P_L+\tau}{\pi_H}\frac{1+\pi_H}{2}-\frac{P_L}{\pi_H}\right\}. \tag{A11}$$

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Combining (A9)–(A11) yields Figure 3. Note that the above three equations differ from their counterparts in two ways. Obviously, the relevant price in the first period is now the tariff-inclusive price. This also shows up in the equation for the measure of old searchers in period 2 because this measure is determined, in part, by the measure of young workers who searched in period 1. The second difference is that all of the probabilities now equal π_H under the assumption that $S_t \leq \tilde{S}$ for all t. Of course, this will not be true for very low values of the tariff. In particular, it will not be true when $\tau = 0$. However, assuming initially that it is true allows us to solve for the minimum tariff that is consistent with this assumption.

Finally, turn to Figure 5. As before, the measures of young and old searchers in the initial steady state are given by (A1) and (A4). If the job acquisition rate falls to π_L and remains there permanently, then the measures of young and old searchers in subsequent periods are now given by (A12) and (A13):

$$S_1^y = \bar{S}^y(P_L, \pi_L) = \left\{1 - \frac{P_L}{\pi_L}\frac{1+\pi_L}{2}\right\}, \tag{A12}$$

$$S_1^o = (1-\pi_H)\left\{1 - \frac{P_L}{\pi_L}\right\} + \pi_H \max\left\{0, \frac{P_H}{\pi_H}\frac{1+\pi_H}{2} - \frac{P_L}{\pi_L}\right\}, \tag{A13a}$$

$$S_2^o = \bar{S}^o(P_L, \pi_L) = (1-\pi_L)\left\{1 - \frac{P_L}{\pi_L}\right\} + \pi_L \max\left\{0, \frac{P_L}{\pi_L}\frac{1+\pi_L}{2} - \frac{P_L}{\pi_L}\right\}. \tag{A13b}$$

Combining (A1), (A4), (A12), and (A13) yields Figure 5.

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Notes

1. See Bishop (2002).
2. Thus, our approach differs, in a fundamental way, from the equity-based explanation of temporary protection offered by Deardorff (1987) and the political economy explanation offered by Sykes (1991). Deardorff bases his explanation on Corden's Conservative Social Welfare Function and argues that the government's objective is to prevent a significant fall in real income of a significant sector of the economy. In his setting, safeguard policies "are not intended, as economists more often recommend, to facilitate 'adjustment' in the sense of an

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orderly transition to a new equilibrium" (Deardorff, 1987, p. 24). In contrast, the Sykes approach emphasizes that policymakers may experience a change in political support when the terms of trade change and it is therefore in their interest to respond to this change with newly adopted measures of temporary protection. Our analysis is, in no way, meant to dismiss such alternative explanations of temporary safeguard policies. Instead, our goal is to show that if the government is concerned about adjustment, as has been emphasized by a variety of authors in the past, there may be efficiency as well as equity concerns driving their decisions.

3. While we are concerned with the efficiency implications of temporary protection, we make no attempt to derive the *optimal* time path. Indeed, as one referee correctly notes, our two-period overlapping-generations framework precludes any deep analysis of this interesting and important issue.

4. For an excellent survey of the early work in this literature, see Falvey and Kim (1992).

5. Of course, if factor markets are distorted there are generally policy instruments that are preferable to tariffs. Thus, complete liberalization coupled with temporary labor market policies targeted at the source of the distortions is the optimal policy. It has been pointed out that such policies may be politically infeasible, leaving tariffs as the only way to slow down the adjustment process.

6. See also Diamond (1981, 1982, 1984) where the information problems that generate equilibrium unemployment are not explicitly modeled.

7. One way that the government could attack the source of the problem directly is through state-run employment agencies. We follow the standard approach in the search literature by assuming that the government does not do so because it would be prohibitively costly to do so.

8. For recent empirical evidence on the existence and magnitude of congestion externalities in the labor market, see Yashiv (2000).

9. The only people who have the opportunity to switch jobs are those in the middle of their life, who are just turning old.

10. Any old worker for whom $a = a_t^o$ will be indifferent between searching for an export sector job and taking a job in the import-competing sector. Without loss of generality, we break the tie in favor of search.

11. In order to lighten the notation, we assume that the discount rate is zero. This assumption has no substantive bearing on the qualitative features of the model.

12. Of course, this worker always has the option of quitting her job in the export sector when old and taking a job in the import-competing sector. However, since we are interested in the case in which the economy experiences an unexpected improvement in the terms of trade, the worker will never choose to do so.

13. In particular, if the probability of success is a continuous function of S_t, we would have to solve a thorny fixed-point problem in order to find equilibrium.

14. As we show in the Appendix, region *I* may not exist if π_L is sufficiently low. The condition for existence is given in (A8) in the Appendix.

15. Note that if $S_1 > \tilde{S}$, then it necessarily follows that $S_2 > \tilde{S}$ in range *II*, and $S_2 > S_3 > \tilde{S}$ in range *III*. In turn, this would imply that $\pi_2 = \pi_L$ when P_L is in range *II*, and $\pi_2 = \pi_3 = \pi_L$ if P_L falls within range *III*. This would contradict our assumption that the workers' expectations concerning π_t are rational.

16. It is straightforward to show that

$$\tilde{a}^y = \max\left[\frac{P_H + \pi_H P_L}{2\pi_H}, \frac{P_H}{\pi_H(2-\pi_L)}\right].$$

17. There is a third, less interesting case where $\tilde{a}^y < \bar{a}^y < a_1^o < \bar{a}^o$. In this case, the improvement in the terms of trade does not change behavior and does not induce regret.

18. For the sake of brevity, we have glossed over an important issue here—the economy does not reach the new steady state until $t = 3$. Thus, the low job acquisition rates faced by workers at $t = 1$ have effects on those workers born at $t = 2$ as well. While these workers are not surprised by the change in the terms of trade, the search pool that they are a part of may be larger than its steady-state value. As we show in the next subsection, a temporary tariff is effective at

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relieving congestion only if it reduces S_1 below $\tilde{S}$ without increasing S_2 above this value. Thus, effective temporary protection cannot harm these workers.

19. For the case in which $a_1^o < \tilde{a}^y < \overline{a}^y < \overline{a}^o$, this interval would be $[a_1^o, \overline{a}^o]$.

20. For the case in which $a_1^o < \tilde{a}^y < \overline{a}^y < \overline{a}^o$, all workers in the interval change their behavior and search for export sector jobs (rather than take jobs in sector M), while only those in the middle of the range (with $a \in [\tilde{a}^y, \overline{a}^y]$) regret their behavior when young.

21. It is possible to create numeric examples where a smaller tariff levied for two periods can also relieve the congestion externality. It is also conceivable that this could be a more efficient policy than the single-period tariff, since deadweight loss is proportional to the square of the tariff. However, our only purpose in this paper is to show that temporary protection can lead to welfare gains. Solving for the *optimal* policy is significantly more complex.

22. This follows because the value of the tariff is zero and the price of the import-competing good is at its new steady-state value from period 2 onwards. It follows that all people born during period 2 make their steady-state choices, as do all people born in subsequent periods. Thus, those who are old in period 3 made their steady-state choices when they were young in period 2.

23. As before, young searchers adjust instantly to any changes in the environment. Therefore the measure of young searchers attains its steady-state value starting in the second period.

24. Since the increase in τ does not push S_2 above the threshold level (by the definition of $\hat{\tau}$), there are no spillover effects on period 2 searchers—although the search pool increases, it does not increase enough to lower job acquisition rates.

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