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Bargaining and Distribution: Essays on International Integration and National Regulation

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BARGAINING AND DISTRIBUTION: ESSAYS ON INTERNATIONAL INTEGRATION AND NATIONAL REGULATION

A thesis presented

by

Sanjay G. Reddy

to

The Department of Economics

in partial fulfillment of the requirements

for the degree of

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Abstract

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Title: Essays on International Integration and National Regulation

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This thesis consists of three related essays analyzing theoretically the impact of the national and international economic environment on the bargaining process within firms and thereby on the distribution of income between wage earners and owners. It demonstrates that paying attention to this 'bargaining channel' leads potentially to the reconception of standard views as to how the degree of openness of the trade regime, the degree of capital mobility, and industrial regulation influence profits and wages. The theoretical analysis implies that standard approaches to estimating the impact of policies on the distribution of income may require substantial corrections. This revision has substantial implications for political economy and for policy selection.

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1. CHAPTER ONE

LIBERALIZATION, DISTRIBUTION AND POLITICAL ECONOMY: THE BARGAINING CHANNEL AND ITS IMPLICATIONS

1.1. The Bargaining Channel: What Does it Offer?

This paper presents a framework for analyzing the effect of increased product market competition on the process of bargaining between workers and employers. Increased competition between firms can implicitly raise the 'employment cost' of wage increases and thereby cause workers to moderate their wage demands. This 'wage discipline' effect, which causes the employers' share of available surplus to shift in their favor, can be sufficiently large that it may cause profits to rise, despite diminished per-firm surpluses. The paper demonstrates, more fundamentally, that whether or not profits rise, increased competition among firms causes wage decline due to its raising of the implicit employment cost of wage increases.

Understanding this process may cast light on the consequences of freer trade between countries and of deregulation (which decreases barriers to entry). This result helps to rationalize how trade may adversely influence wages in developed countries despite movements in relative product prices which are too low or contrary in direction compared with those required in conventional theories in order for trade to do so. Indeed the model presented requires no trade to occur at all in order for the *threat* of trade to have the distributional effect described. As

well it may help to explain why the political dynamics and economic consequences of trade reform in developing countries are sometimes observed to be contrary to those predicted by conventional approaches (workers often vigorously oppose freer trade and employers welcome it).

Rodrik (1997) raises arguments closely related to that of this paper. He points out that trade-induced increased elasticities of labor demand can influence the well-being of workers in at least three ways. They shift the incidence of non-wage labor costs toward workers (making it correspondingly more costly to workers to bring about improvements in labor standards and benefits), they increase the volatility of wages and employment due to shifts in labor demand, and they alter the bargaining relationship between workers and employers. The third of these mechanisms is that which is considered here. Rodrik cites the "decline in bargaining power engendered by the differential global mobility of employers versus employees" as well as by trade-induced heightened elasticities of labor demand. The following attempts to illuminate especially the implications of this last channel of causation.

How does heightened product market competition influence the distribution of income between profits and wages? It has been long recognized that heightened product market competition can potentially lead to a reduction in wages. This

can occur simply because wages incorporate an element of 'rent-sharing' and increased product market competition leads to diminished per-firm rents. It can also occur because increased product market competition heightens the elasticity of product demand faced by any given firm. As a result, a given wage demand by workers leads to a larger fall in employment than previously if firms employ workers at the level given by their labor demand curve[1]. Organized workers who have some concern for the level of employment as well as the wage will therefore moderate their wage demands. This possibility has been noted elsewhere but its full implications have not been examined. In particular, we will exhibit a model in which diverse outcomes are possible, including realistic cases in which the reduction in wages initiated by product market competition are, despite the deleterious impact of increased competition itself, so large as to lead to an increase in firms' profits. In general, workers' ability to meet their objectives diminishes, and profits may rise or fall, as product market competition increases. Moreover, the interdependence between the decisions of workers at different firms accentuates this decline, causing a 'race to te bottom' among organized workers.

Liberalization which results in enhanced product market competition might in-

[1] However, as will be shown in chapter two, the assumption that firms are on their labor demand curve is not strictly required in order for the main results of the analysis to hold.

fluence wages in at least four possible ways. The first is that even under conventional models, the shrinking per-firm rents induced by liberalization might lead to reduced rents captured by workers in the form of wages, although in this case the amount of rent captured by employers would also correspondingly fall. The second is that liberalization induced increasing elasticities of labor demand would cause even workers acting in isolation to further moderate their wage demands. The third is that competition and strategic complementarity in wage setting between workers further magnifies these wage reductions through a 'strategic multiplier'. The fourth is that the diminishing rents realized by workers might cause an endogenous decrease in the extent of worker organization, which in turn would reduce the ability of organized workers to establish high wages. The first of these channels is widely accepted. In this paper we will seek to demonstrate the logic behind the remaining three.

The principle that an increased elasticity of product demand tends to lead to an increase in the elasticity of a firm's demand for labor was first explicitly identified by Alfred Marshall in the Principles of Economics, and examined in a general setting by J. R. Hicks (1968, 1932). There is considerable evidence for this so-called Hicks-Marshall law of derived demand [See Ehrenberg and Smith (1997), Hamermesh (1993)], in the form of statistical evidence that labor demand elas-

ticities are higher in contexts where product demand elasticities are also higher. This principle when combined with evidence that organized workers have some concern for employment as well as individual income [MaCurdy and Pencavel (1986), McDonald and Solow (1981)], and that contracts in which wages are set but firms are free to determine the level of employment are widespread, makes the degree of product market competition a key explanatory factor in determining wage bargains.[2]

There exists considerable microeconomic evidence from developed countries that diminished per-firm rents induced by greater competition resul in lesser wages. This observation goes back to Dunlop (1950) and Slichter (1950), but has also received more recent support. It has been observed, for example, that in two different segments of the trucking industry in the United States (namely that for "full truckloads" and that for "less-than-truckloads") which have very different degrees of competitiveness (in the latter the largest four carriers accounted for 11 percent of revenues and in the former they accounted for 37 percent) the level

[2] Organized workers exist whenever coalitions form within firms and exercise a degree of power. These organized workers may act as if exhibiting concern both for their own wages and for the level of employment of their fellow workers. In this sense, the "workers' objectives" might be thought of as a reduced form behavioral response which could reside in internal labor markets, norms, etc. The use of "organized workers" rather than "unions" through much of the paper is meant to assert that workers can have bargaining power within the firm even in the absence of unionization but it is not meant to deny that formal unions may be an especially important vehicle for workers to achieve their goals.

of union wages was dramatically different (28.4 cents per mile vs. 35.8 cents per mile, and a union to non-union wage ratio of 1.23 vs. 1.34 respectively) [Belzer (1994, 1995), Ehrenberg and Smith (1997)]. An independent example involving the trucking industry is that deregulation is reported to have led to "substantial relative wage reductions for union truckers and much less wage response for non-union truckers following deregulation", a view that is interpreted as "consistent" with the judgment that wages respond to increased product market competition [Freeman and Katz (1991), See also Rose (1987)]. Similarly, when deregulation of the airline industry in the United States increased competition on many routes after 1978, there were substantial reductions in the wages of unionized pilots, as a result of requests for concessions by airlines which were accepted by unions. By 1987, the real earnings of pilots had fallen 17 percent below the levels in 1978, and the real earnings of airline mechanics had fallen by 13 percent [Card (1986, 1989), Johnson (1991)]. Abowd and Lemieux (1993) find that, instrumenting quasi-rents by import competition shocks, firm-level wage bargains are considerably influenced by product market competition. Blanchflower, Oswald and Sanfey (1992), using an un-balanced panel from the US manufacturing sector, find strong evidence of a rise in a sector's profitability leading to an increase in the level of wages in that sector over time. Blanchflower and Machin (1995) find limited sup-

port from establishment-level data for an impact of product market competition on wages in Britain and Australia. Christofides and Oswald (1992) find from Canadian labor contract data that real wages are an increasing function of profitability in an industry. Nickell, Vainomaki and Wadhwani (1994) similarly find evidence from a large sample of British manufacturing firms that a firm's market power has a positive impact on wages, which is however not dependent on union status, suggesting that the sharing of rents is not dependent on unionization as such. Although all of this evidence affirms the view that wages reflect an element of rent sharing, they leave important questions unanswered. In particular, they do not much illuminate whether rents are shared in constant proportions, or in a manner which is itself *endogenous* to the degree of product market competition (as argued in this paper). It is also interesting to note that none of these studies seem to have examined the impact of deregulation on the profitability of firms.

The existing formal literature on the effect of product market competition on bargaining between workers and firms, particularly in the context of international trade, is relatively small. A notable contribution is that of Huizinga (1993) who considers a case in which two individual markets consisting of single union-firm bargaining units (i.e. a monopolistic producer facing a monopolistic union) are merged into a unified market with two bargaining units. There is a single good,

linear demand and production, Cournot competition among firms, Stackelberg wage setting by unions, and the assumption that unions maximize union rents (given by the union wage bill minus the (constant per-worker) total opportunity cost of union labor). In this simple environment, a wage setting game between unions in the integrated market arises, in which wages fall but, due to the output increasing effect of competition among a larger number of firms, employment rises to such an extent that union 'utility' rises. Prices fall due to increased competition, and firms' profits rise, due to the fall in union wages. The paper emphasizes that both workers and firms benefit in all cases, in this environment. The model we present below, by generalizing the environment to one in which workers' objectives, the extent of market integration, the number of firms, and the degree of worker organization in different regions undergoing integration, are allowed to vary, develops results which are usually divergent from these. Indeed, it is shown that Huizinga's result is a 'knife-edge' result which for a class of models is *only* possible in the specific case he analyzes. Importantly, in the model below, although profits can rise or fall, the degree of achievement of workers' objectives almost always falls.

Other papers addressing loosely related issues are those of Driffill and van der Ploeg (1995) and of Rama and Tabellini (1998). Both emphasize the complemen-

tarity between the level of tariffs and wage demands. A lower tariff environment is one in which the effective elasticity of product demand faced by domestic firms is higher, and which therefore causes unions to accept lower wages. Naylor (1998) finds a contrary result, that integration of markets (in the sense of a reduction in tariff rates) tends to lead to an increase in union wage demands, which leads to an increase in union 'utility' and a decrease in profits. This surprising result is driven by the special assumption that firms engage in "reciprocal dumping" [see Brander and Krugman (1993)] in which producers in each market engage in price discriminating sales to consumers in the other market as a result of the perceived difference in domestic and foreign elasticity of demand induced by the existence of a tariff. A tariff reduction reduces the incentive to engage in such foreign sales and thus paradoxically reduces the elasticity of derived labor demand, in contrast to the normal expectation that the tariff reduction would do the opposite. The model presented below will not rely on such specialized assumptions as do the models described above. Our intent is to present the logic of how liberalization may influence intra-firm bargaining in a general setting of imperfect competition.

1.2. The Model

The central logic of causation that will be explored here is that liberalization increases the implicit cost of pursuing the employment objective in terms of foregone production surplus at the firm level. The latter (surplus) is of joint interest to workers and to employers (since it may be divided between wages and profits), whereas the former (employment) is of direct interest to workers alone. This shift in the effective tradeoff between surplus and employment is reflected in a shift in the shape of the objective possibility frontier (which expresses the rate at which profits may be traded for the attainment of workers' objective) and in particular makes workers' objectives more 'costly' to attain in terms of foregone profits. This change in the rate at which the firm's objective may be traded for workers' is reflected in bargains which increasingly favour the firm in relative terms, even though the impact of increased competition on total surplus ultimately causes a decline in the ability of both parties to attain their interests. In a well defined sense, the 'outside options' of the firm and their relative bargaining power are both constant throughout this process. It is therefore the impact of the competitive environment on the *constraint* faced by the parties jointly (manifested in the changed shape both of the objective possibility frontier and more immediately of

the firm-level labor demand curve) which is the critical determinant of the change in the relative and absolute realization of their objectives.

In this chapter, we analyze how competition causes a shift in the 'residual' product demand curve faced by the firm and thereby in its labor demand curve that increases the elasticity of labor demand at any given wage. This change causes wage moderation, and a relative shift of surplus in favour of profits. The model explored in detail here assumes that firms choose the employment level and are therefore 'on the labor demand curve'.[3] Although this assumption is important to the specific dynamics discussed here, as shall be shown in chapter two however, increased competition can have an effect on relative shares of surplus favouring profits even in its absence, as competition can still influence the objective possibility frontier faced by the parties, if not always in as direct a manner.

1.2.1. Independent Worker Collectives Everywhere

(1) The Framework of the 'Benchmark' model:

The Initial Market:

[3] A simple heuristic example, as well as a discussion of the the more abstract general logic of wage decline and profit rise is presented in the Appendix.

In order to focus on the logic of intra-firm bargaining, and the effects of inter-firm and inter-worker-collective competition on this logic, we assume a simplified framework. Specifically, we assume a market for a single homogeneous good, and a single factor of production (labor) produced by a constant returns to scale technology $q(n) = n$, where $q(n)$ is the quantity produced by the firm and n is the level of employment by the firm. We assume that initial market demand is characterized by a linear demand curve $p = a - bQ$. We assume also that there are f firms, at each of which workers are organized into an independent enterprise level bargaining unit. A number of these assumptions will be relaxed subsequently.

The Integrated or Deregulated Market:

We will consider the experiment of fully integrating an arbitrary number, k , of identical regions, each having an identical number of firms, f ,with identical characteristics, and each furnished with its own identical demand curve. k will be referred to as the "scale of integration". It has the dual interpretation of the number of identical regions being integrated and the size ($(k-1)$ times the size of the initial region) of the region being integrated with. As integration proceeds, the number of firms as well as the scale of demand increase proportionately.

We can also consider the experiment of maintaining $k = 1$, while increasing

f. This experiment maintains a constant level of demand but increases market competition. It can be interpreted as a reduction in barriers to entry and will therefore be referred to as "deregulation". The initial number of firms f may be interpreted as that resulting from the existence of a particular level of initial barriers to entry.[4]

Workers' and firm's objectives:

The objectives pursued by each set of workers (or 'worker collective') are assumed to be described by the objective function

$$U = n^{\beta}(w - w_0) \qquad (1)$$

where $\beta \in [0, \infty)$ and w_0 is an "outside option" defined by a competitive labor market or other factors. This objective function encompasses the paradigmatic case of "rent maximization" corresponding to $\beta = 1$, that has been of considerable interest in the labor economics literature, as well as accommodating arbitrary alternative weights on employment.[5] Firms are assumed to maximize profits,

[4]If the costs of entry are less than infinite then a change in the profit rate may be expected to lead to an endogenous change in the number of firms. To the extent that such endogenous changes are not considered, the theory presented here is of a "short run" nature.

[5]The assumption of rent maximizing worker-collective behavior has been widely justified on the grounds that it has plausible "micro-foundations". Specifically, risk-neutral workers can under specific assumptions be expected to form rent-maximizing worker-collectives [See for example Oswald (1982)]. However, some empirical evidence suggests that unions pursue employment objectives to a larger extent than suggested by the "rent maximization" model [See MaCurdy and Pencavel (1986), McDonald and Solow (1981) etc.]. As well alternative theories which assign a

which are given here by $\pi = (p - w)n$, where p is the price level. Neither consider the impact of their decisions on the cost of consumption. In this respect the initial approach to the problem is of a 'partial equilibrium' nature. This assumption is relaxed subsequently.

Stages of the game:

We assume that there are two stages in the determination of the outcomes with which we are concerned (wages, employment, and profits). In the first stage, bargaining takes place between the firm and the workers over the level of the wage which will prevail in the second stage. Each firm-worker-collective pair is assumed to engage in separate and simultaneous bargaining in a manner which can be described by the generalized Nash bargaining model [see e.g. Svejnar (1986)]. The worker collective is assumed to have an arbitrary degree of bargaining power $\lambda \in [0, 1]$, with the firm having bargaining power $(1 - \lambda)$. The firm's outcome in the event of the breakdown of negotiations is assumed to be zero profits. i.e. in

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greater decision making role to older and more senior employee (who for example would be likely to prevail in a median voter model of worker-collective behavior) would suggest that worker-collectives pursue wage objectives to a larger extent than suggested by the "rent maximization" model. The characterization of worker-collective objectives here is meant to accommodate all of these possibilities. It does however have the feature of suggesting that the interests of the unemployed are at least partially taken account of in worker-collective decision making. This view, consonant with McDonald and Solow (1981) is disputed by, among others, Layard, Nickell and Jackman (1991). An alternative rationalization is that "union bosses" have employment as an objective as it is a component of total rent, or alternatively of derived social or political power.

the event of a failure to come to agreement with its own workers the firm cannot make recourse to the competitive labor market. In the event of a breakdown of negotiations organized workers find employment on the competitive labor market. It is important to note that although both workers' and firms' relative *bargaining power* (which describes the "weight" of the objectives of each in the composite "Nash maximand" – defined by λ and possibly varying) and their outside options in the event of the breakdown of negotiations (the competitive wage in the case of workers, zero profits in the case of firms) are both constant, this is not true of their *bargaining position*. The latter, which is a broader concept, should be understood as the totality of the advantage that can be realized by a particular party to the bargaining process. It will also be dependent on the particular nature of the opportunity set faced by the agents (which in this instance is *shifting*). It will accordingly be seen below that market induced changes to the form of the labor demand constraint faced by workers at each production site can generate changes in their relative outcomes vis-a-vis employers. The approach taken here allows us the advantage of separately analyzing the effects on final outcomes of changes in the general institutional regime which determines relative bargaining power (in a sense which is independent of the particular opportunity sets faced by workers and employers at particular sites, i.e. λ), from the effect of systematic

changes to those opportunity sets induced by competition (in the form of changes to the labor demand constraint faced by workers).

It is assumed that employment is determined in the second stage solely by the firm, which may hire as few or as many workers as it wishes at the wage rate determined at the first stage. We refer to this as the "right to manage" assumption. This assumption ensures that the firm is "on" its labor demand curve although the specific point along the curve that it takes up will be dependent on the prior bargaining process between employers and workers. This assumption is important to the subsequent analysis as it makes especially stark the effect of increased competition on the shape of the objective possibility frontier faced by the parties, and generates a clear interpretation of this change in terms of the increased 'employment cost' of wage increases.

What justification is there for the "right to manage" assumption? There are both empirical and theoretical grounds for arguing on its behalf. There is widespread agreement among labor economists that the characterization of collective bargaining as focused on wages while proffering a subsequent residual right to determine the employment level to the employer is often, if not usually, realistic.[6]

[6] Layard, Nickell, and Jackman (1991) state that "employment is almost never bargained over as such". Moreover they report that US contracts typically include a "management rights" clause, asserting "that the company 'will determine the extent of any required force

A theoretical justification for the "right to manage" assumption is also possible.[7]

At the second stage, competition among firms is assumed to take a Cournot-Nash form. Each firm takes its own and others' wage rates as given and competes in quantities so as maximize its profits.

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adjustments"'. Further, strike in pursuit of an employment objective is in the US typically illegal, in the sense that doing so risks loss of protection of collective bargaining under the National Labor Relations Board. They also report Oswald(1987)'s survey results to the effect that only 5 out of 120 British and American unions reported that they 'normally negotiate over the number of jobs as well as over wages and conditions'. Hall and Lilien (1979) also find that firms often set employment unilaterally.

[7] In the interests of space, it is only sketched here. Consider a one-shot two-stage game of the kind introduced above. Suppose that collective bargaining is a time-consuming and possibly costly process. Assume also that complete and enforceable contracts contingent on alternative future outcomes are not feasible. Further, suppose that unanticipable shocks (in demand, non-labor costs, etc.) make it probable that an initially agreed efficient combination of employment and wages will no longer be so after the shocks are realized. If collective bargaining is sufficiently time-consuming and costly, it will not be efficient to renegotiate this combination however. Consider instead three possible alternative ex-post decision-making regimes which are alternatives to maintaining inflexibly a fixed combination of employment and wages. For simplicity we consider only different allocations of authority to the firm, although this is not essential. In the first alternative, full authority to respond to the shocks by adjusting both wages and employment is given to the firm. In the second, authority is given to the firm to adjust wages alone, while maintaining the earlier agreed level of employment. In the third, authority is given to the firm to adjust employment alone while maintaining the earlier agreed level of wages. In both the first and the second case, firms would choose to adopt the new profit maximizing level of employment and output, while pushing wages down to the competitive level, thereby eliminating the entire workers's share of rents. As a result, workers would refuse to accept these arrangements. In the third arrangement in contrast, firms would adjust employment in the direction mandated by the shocks, benefitting both workers and firms, but would be unable to capture the entirety of the surplus from workers. Workers who are not excessively risk averse might agree to such an arrangement over one in which no adjustment was possible as the expected value of surplus might be higher in the former, making it possible and desirable for a risk-neutral employer to attract workers to accept it, if necessary by offering them higher wages than they would otherwise receive. This argument provides one possible theoretical justification for the "right to manage" assumption, which relies on the role of uncertain shocks, which are admittedly not modeled here. We do not believe however that the essential content of our results would be modified by doing so.

The wage which results from the Nash cooperative bargaining process in the first stage is:

$$\arg\max \quad N = [n^{\beta}(w - w_0)]^{\lambda} \cdot [(p - w)n]^{(1-\lambda)} \qquad (2)$$

subject to $n = n(w, ..)$

and $\qquad p = p(n, ...)$

where $n(w, ..)$ is the firm's implicit labor demand curve, which is also influenced by other factors; in particular the competitive environment among firms, and $p(n, ..)$ is given by the firm's residual product demand curve, which results at the equilibrium production quantities produced by other firms at the level uniquely consistent with Cournot-Nash equilibrium, given that an exactly identical wage setting problem (which must give rise to the same solution) has been previously solved at each of their sites.

Both parties to this bargaining process take into account the effect which the wage they set will have on their ability to achieve their preferred outcomes in the second stage, through anticipating the outcome of the second stage Cournot game among firms associated with each wage level. However as an identical bargaining process occurs at each production site, the wage which results from this bargaining process must also be the wage at which the resulting Cournot-Nash equilibrium among firms facing identical wages is such that unilateral deviation by a worker-

collective – firm pair choosing an alternative wage could not lead to a higher level of composite (Nash-bargaining induced) objective N.

(2) Results of the Analysis

The Equilibrium Wage:

The symmetric equilibrium wage (w^*) can be solved for in steps, proceeding backwards from the second to the first stage of the game. First, in the Cournot game between firms, given its own wage w_i, each firm solves

$$\underset{n}{Max} \quad (p(n) - w_i)n \tag{3}$$

for which the first order condition is

$$n = \frac{k}{b}(p - w_i). \tag{4}$$

However, given the fk firms in the market at any stage of integration, we have the equilibrium condition that

$$p = a - (\tfrac{b}{k}) \textstyle\sum_{j=1}^{fk} n_j = a - (\tfrac{b}{k}) \sum_{j=1}^{fk} \frac{k}{b}(p - w_j). \tag{5}$$

which implies that, for any given vector of wages in firms,

$$p = \tfrac{a}{(1+fk)} + \tfrac{1}{1+fk} \textstyle\sum_{j=1}^{fk} w_j \tag{6}$$

and in turn that

$$n_i = \frac{k}{b}\left(\frac{a+\sum_{j=1}^{fk} w_j}{(1+fk)} - w_i\right) \qquad (7)$$

Thus we have derived the output response of a firm to the wage chosen by its own workers, which is in turn indirectly dependent on the wages chosen by workers elsewhere.

It is valuable to note before proceeding to the deduction of the equilibrium wage that it can be readily shown from (7) that the elasticity of employment with respect to wages is given by

$$\frac{dn_i}{dw_i}\frac{w_i}{n_i} = \frac{-fkw_i}{\left(a-fkw_i+\sum_{j=1}^{fk} w_j\right)} \qquad (8)$$

If we now assume that as integration proceeds (i.e. f or k increase) new firms maintain the same average wage (call it $\underline{w}$) as all other firms other than firm i had in the pre-integration economy, then we can rewrite (8) as

$$\frac{dn_i}{dw_i}\frac{w_i}{n_i} = \frac{-fkw_i}{(a+w_i(1-fk)\ +(fk-1)\underline{w})} = \frac{-w_i}{(\underline{w}-w_i)+\left(\frac{(a-\underline{w}+w_i)}{fk}\right)} \qquad (9)$$

Further the non-negativity condition on firm profits requires that $(a-\underline{w})< 0$ from which it follows that the elasticity of employment with respect to wages rises unambiguously as liberalization proceeds (i.e. as k or f increases). This result confirms the presumption of Rodrik (1998). It differs from the results

of Panagariya (1999) as it arises out of a framework of imperfect competition, which is quite different in spirit from the perfect competition models which he discusses, in which trade can lead to falling elasticities of labor demand as a result of complete specialization in trade and other special cases.

We can now proceed backward to the first stage wage setting decision. We now solve (2) using the full expressions for $n(w)$, and for $p(w)$, conditional on the wages set at other production sites, which we have since deduced. Finally, noting that the unique equilibrium is symmetric, we derive:

$$w^* = w_0 + \frac{(a - w_0)}{\frac{fk}{\lambda}(2 - 2\lambda + \lambda\beta) + 1} = w_0 + \frac{(a - w_0)}{\frac{fk}{\lambda}\phi + 1} \qquad (10)$$

where $\phi = (2 - 2\lambda + \lambda\beta)$.

This expression has a natural interpretation. As noted earlier, it is possible to show that $w_0 \leq a$ is the non-negativity (or no-shut-down) condition on firm's profits. As well, a is the positive intercept of the demand curve. As such it is the maximum price that a consumer would be willing to pay for a unit (namely the first) of the good. The maximum wage that could possibly be supported without shutting down all firms is this amount. a is therefore a measure of the level of wages permitted by the "extent of the market", and $(a - w_0)$ is a measure of the maximum rent which it is feasible for a worker to capture. As well ϕ

can be interpreted as the joint (workers' and firm's) weight on employment in the individual worker–collective — firm bargaining problem.[8] Whereas a higher wage is desired by workers alone, a level of employment higher than zero is desired by both workers and the firm, both because it is (for the former) valued directly and (for the latter) at any given wage it is profit increasing.

Thus the numerator of the second term in (10) contains a measure of the surplus available to be extracted by firms in the form of wages and the denominator contains a measure of the desire at each site (inversely related to ϕ, the joint Nash bargaining weight on employment as against wages), and ability (directly propor-

[8]To see this first consider the first order condition of a rent maximizing worker collective with complete wage setting power:

$n + (w - w_0)\frac{dn}{dw} = 0$

This condition is straightforward. The worker-collective compares the gain in rent from an extra unit of wage realized by all employed workers to the loss in rent from the loss in employment due to a wage increase.

We may also observe that the first order condition of the Nash employment problem (2) can (after some algebra) be written in the form:

$n\lambda + (w - w_0)\frac{dn}{dw}(\lambda\beta + 2 - 2\lambda) = 0$

This expression is identical to the simpler first order condition above except for the different weights on the "wage gain" term and on the "employment loss" term which may therefore be interpreted in the manner suggested. These new weights may be interpreted as reflecting the relative importance attached to the dimension of wages and that of employment as such respectively in the composite maximand generated from the bargaining process. This insight can also be derived by using (4) to rewrite the profit term in (2) as $(n^2\frac{b}{k})$, from which the exponential weight 2, multiplied by the firm's bargaining power $(1 - \lambda)$ generates a weight $(2 - 2\lambda)$ on employment to which is added the exponential weight β placed on it in the workers' objective function which is in turn weighted by the workers' bargaining power λ. The total weight on employment is then $(2 - 2\lambda + \lambda\beta)$. Similarly the worker-collective alone values wages, at an exponential rate 1 , which is weighted by its bargaining power λ.

tional to workers' bargaining power λ and inversely proportional to the extent of inter-firm or inter-worker-collective competition as described by the total number of firms fk) to achieve high wages.

It is straightforward to show that

$$\frac{dw^*}{df} = \frac{dw^*}{dk} < 0$$
$$\frac{dw^*}{d\lambda} > 0$$
$$\frac{dw^*}{d\beta} < 0$$
$$\frac{dw^*}{dw_0} > 0$$
$$\frac{dw^*}{da} > 0 \qquad (11)$$

In other words, *ceteris paribus*, equilibrium organized workers' wages are higher when workers' bargaining power (as determined for example by institutional conditions) is higher, when the competitive wage (or outside option) is higher, and when consumers' willingness to pay for the good is higher, and it is lower when product market competition induced by market integration or deregulation is higher, and when the workers' preference for employment is higher. All of these relationships are as might be expected.

Also, it can be shown that

$$\frac{d^2w^*}{dk^2} > 0$$

$$\frac{d^2w^*}{df^2} > 0 \qquad (12)$$

In other words, wages drop at a diminishing rate as integration or deregulation proceed.

Further,

$$\frac{d}{dw_0}\frac{dw^*}{dk} > 0$$
$$\frac{d}{da}\frac{dw^*}{dk} < 0 \qquad (13)$$

i.e. the decline of wages with integration is less when the competitive wage is higher, and it is more when the consumer's willingness to pay is higher. Finally,

$$\frac{d}{d\lambda}\frac{dw^*}{dk} > 0 \text{ if } \lambda > \lambda^*$$
$$< 0 \text{ if } \lambda < \lambda^*$$
$$\text{where } \lambda^* = \frac{2}{(2-\beta+1/fk)} \qquad (14)$$

$\frac{d}{d\beta}\frac{dw^*}{dk}$ has the opposite sign as $\frac{d}{d\lambda}\frac{dw^*}{dk}$ under the same conditions.

These two "threshold" results suggest that there is considerable complexity involved in analyzing how increasing or decreasing workers' bargaining power (through for example changes to labor law or other aspects of institutions) or workers' level of employment preference would influence the impact of integration on wages. For example, it is conceivable that increasing bargaining power would

reduce the fall in wages resulting from integration if the level of bargaining power was already above a certain threshold but otherwise increase it. As will be seen below when we discuss the reaction functions of workers in the wage-setting game the underlying reason for the threshold result is the rise in strategic complementarity between groups of workers induced by liberalization.

How does integration affect the extent to which workers attain their overall objectives, inclusive of employment as well as wages? The equilibrium realization of the workers' objective may be calculated by substituting the equilibrium wage (10) and employment per firm (derived from (7)) into the workers' objective function (1). This allows us to derive that:

$$U = \left(\frac{(a-w_0)}{(fk\frac{\phi}{\lambda}+1)}\right)^{(1+\beta)} \left(\frac{k^2 f\phi}{b\lambda(1+fk)}\right)^{\beta} \tag{15}$$

By differentiating this with respect to k , and simplifying, we may derive that:

$$\frac{dU}{dk} > 0 \text{ iff } f^2k^2(-2+2\lambda-\lambda\beta) + fk(2\beta-2\lambda\beta+\lambda\beta^2-2+2\lambda) + 2\beta\lambda > 0 \tag{16}$$

The first coefficient is negative, the second may be positive or negative, and the last is positive. It follows that workers' objective fulfillment rises "early" in the integration process if it rises at all, and that it necessarily ultimately falls. It may be readily checked for example that in the case where workers have complete

wage setting power, and pursue the rent maximization objective (i.e. $\lambda = 1$, $\beta = 1$) the *only* economically relevant case for which workers' objectives rise is the case in which two economies with one firm in each merge. Thus the result identified by Huizinga (1993) of rising "union utility" in the presence of market integration is *not* robust to modification of hisextremely specific example.

Equilibrium profits:

What about profits? It can be shown that the equilibrium profit expression is given by:

$$\pi = \frac{k}{b}\left(\frac{a-w^*}{1+fk}\right)^2 \tag{17}$$

$$= \frac{k}{b(1+fk)^2}\left[(a-w_0) - \frac{(a-w_0)}{\frac{fk}{\lambda}(2-2\lambda+\lambda\beta)+1}\right]^2$$

$$= \frac{k}{b(1+fk)^2}\left[(a-w_0) - \frac{(a-w_0)}{\frac{fk}{\lambda}\phi+1}\right]^2 \tag{18}$$

This expression too has a natural interpretation, which becomes evident upon juxtaposition with the equilibrium wage expression.

The first term in the square brackets is as before a measure of the total surplus made feasible by demand conditions (the "extent of the market"). The second term in the square brackets is as before a measure of the total desire and ability of workers to extract wage concessions from firms. The difference between these generates a measure of the extent of available market surplus potentially remaining to be extracted by a firm. This potential is however deflated by the initial term,

which is a measure of product market competition and other constraining factors.

More rigorously, it can be shown that when all firms pay the competitive wage, w_0, profits are given by $\pi = \frac{k}{b(1+fk)^2}[(a - w_0)]^2$. Since the demand curve which results from integration of k regions is $Q = k(a - p)/b$, it follows that the maximum surplus which could be extracted by firms is the area under this demand curve and above the minimum cost level w_0, which is given by $(a - w_0)^2/b$. However, this maximum surplus is never fully extracted due to the combination of the inability to price discriminate and competition between firms, which ensures that the surplus is dissipated in proportion to $1/(1+fk)^2$. Surplus is however also shared between workers and employers. The extent of the surplus extracted by workers is determined by the level at which the wage is set. Specifically, analogously to the above, when wages are set at level w, this functions equivalently at the second stage of the game to raising the level of w_0 to w and so the maximum surplus remaining to be extracted by firms and its rate of dissipation are determined exactly as described above, except that w appears where w_0 had appeared earlier. This is the logic of equation (17). The determinants of the wage extracted by workers (the second term in the square brackets) are, as before, the willingness to pay for the good by consumers (given by $(a - w_0)$) and the desire and ability of workers to press for wage concessions (given by λ, a measure of workers' power

within firms, ϕ the extent to which the bargaining-derived composite objective at each production site jointly weights the employment objective instead, and fk, a measure of the extent of inter-worker-collective competition).

Now, can profits rise with integration or deregulation? It can be shown that for certain parameter ranges this is certain to happen.

In particular, by differentiating (18) it can be shown that:

$$\frac{d\pi}{dk} \geq 0 \quad \text{iff} \quad (kf)^2(-2+2\lambda-\lambda\beta)+kf(2+\lambda\beta-\lambda)+3\lambda \geq 0 \tag{19}$$

The first coefficient is negative and the other two are positive, unless $\lambda = 0$, in which case the last term is 0. Therefore profits always rise for k sufficiently small (possibly fractional). Also profits must eventually fall, and may do so throughout the economically relevant range (k and f integers). There is also only a single positive root to this expression, at which profits are maximized.

Similarly, in the deregulation case ($k = 1$) we can show that:

$$\frac{d\pi}{df} > 0 \;\; iff \;\; f < \frac{1}{k}\left(\frac{\lambda}{2-2\lambda+\lambda\beta}\right) \tag{20}$$

We are thus able to conclude that profits rise and then fall in f, and that they can rise for an indefinite range in f if β is sufficiently small and λ is sufficienetly high. We have thus shown that:

Theorem 1.1. *Profits generically follow an inverse-U shape in f and k.*

This theorem has a number of important political economy implications. For instance, smaller scale (e.g. regional) integration, which raises profits through its wage discipline effect without lowering revenues on the product market to such a degree as to overwhelm this benefit, may be viewed as preferable by firms to larger scale (e.g. global) integration. In the case of deregulation, this theorem helps to explain the observation that profits rise and then fall in some industries. This could be viewed as a "disequilibrium" tracing out of the pattern described in the theorem, as more and more firms enter an industry.

Also, for $\lambda = 1$ it is the case that for any k^*, however large, there exists a β^* such that if $\beta < \beta^*$, $\frac{d\pi}{dk} > 0$ for all $k \leqslant k^*$. Therefore in principle

Remark 1. *It is possible for profits to increase over an arbitrarily large 'range' of integration and deregulation.*

What about the economically relevant region of integration? Specifically, when is $\pi(k = 2) - \pi(k = 1) > 0$?

It can be shown that this is true iff

$$f^2((2^{1/2}-2)(2-2\lambda+\lambda\beta)+f(2^{1/2}-1)(2-\lambda+\lambda\beta)+(\lambda(2^{1/2}-1/2)>0 \qquad (21)$$

In general, this will be true when f is small, β is small, and λ is large.

As in the differential case, when $\lambda = 1$, it is true for arbitrarily large f as long as β is chosen to be sufficiently small. For all other λ, there is a maximum value of f (possibly very large) beyond which profits will not rise, however small is β. Also, λ must reach a certain minimum threshold in order for profits to rise in this economically relevant range. It can be shown that the condition for profits to rise holds true for a number of economically meaningful cases. The table below shows some of these:

f	1	3	9	70
λ	1	1	1	1
β	1	0.5	0.1	0.01

Why do profits rise?

It can be shown that

$$\frac{d\pi}{dk} = \left[\frac{1-fk}{(1+fk)^3}\left(\frac{(a-w)^2}{b}\right) - \frac{2k}{(1+fk)^2}\left(\frac{a-w}{b}\right)\frac{dw}{dk}\right] \qquad (22)$$

Thus, the change in profits due to integration is influenced by both the *level* of the wage and the manner in which integration affects it. As noted above, when the level of the wage is higher, the potential total market post-production cost

surplus out of which to generate profits is lower. The rate of change of profits is due to both the increased competition among firms to capture this available surplus (reflected in the first term - recall that $\frac{1}{2}\left(\frac{(a-w)^2}{b}\right)$ is the area under the demand curve and above the marginal cost curve, represented by w) and the declining wage (reflected in the second term). The relative role of competition among firms and of the declining wage in determining the rate of change of profit is also influenced by integration. The sole factor mitigating the adverse impact on profits of increased inter-firm competition is the wage decline. To understand the change in profits we must therefore understand more closely the determinants of wages.

To do this, it is possible to decompose the "reaction functions" of workers at individual sites against workers at all other sites, into "slope" and "intercept" components [This is derived simply from drawing on the predecessor "out-of-equilibrium" expression to (10) prior to the imposition of the condition that wages be symmetric]. Let w_i designate the wage of workers at a specific site, and w_{-i} be the average wage set at all other sites. Then,

$$w_i = \underbrace{\left[\frac{(fk-1)}{fk(\frac{2}{\lambda}-1+\beta)}\right]}_{\text{slope=S}} w_{-i} + \underbrace{\left[w_0 + \frac{(\frac{a}{fk}-w_0)}{(\frac{2}{\lambda}-1+\beta)}\right]}_{\text{intercept=I}} \tag{23}$$

The slope is positive in the economically relevant region. Therefore there exists

a "strategic complementarity" in the "wage-setting game" between production sites. Higher wages at one site are responded to by higher wages elsewhere.

We can study how the slope and intercept respond to changes in the parameters. It is straightforward to show that

$$\begin{aligned}
&\frac{dS}{d\lambda} > 0, \frac{dI}{d\lambda} > 0 \\
&\frac{dS}{d\beta} < 0, \frac{dI}{d\beta} < 0 \\
&\frac{dS}{da} = 0, \frac{dI}{da} > 0 \\
&\frac{dS}{dw_0} = 0, \frac{dI}{dw_0} > 0 \\
&\frac{dS}{dk} > 0, \frac{dI}{dk} < 0 \\
&\frac{dS}{df} > 0, \frac{dI}{df} < 0
\end{aligned} \tag{24}$$

In other words, higher bargaining power within the firm raises equilibrium wages by both increasing the 'sensitivity' to other firms' wages and by increasing the wage that would be set even in the absence of competition with other firms. A higher workers' weight on employment in contrast, lowers equilibrium wages for *both* of these reasons. A higher competitive wage and a higher consumer willingness to pay for the good raise equilibrium wages through their effect on the wages which would be set at firms in isolation, but not through any effect on the reaction to other firms.

How do the effect of integration or deregulation on profits operate? In both

cases they lower the intercept term and raise the slope term. In other words integration and deregulation lower the wages that would be set at each firm even in isolation. However, they also increase the sensitivity of firms to one another's wages. One might imagine that the increased sensitivity of firms to one another's wages could lead to either an increase or a decrease in the equilibrium wage. Why? An increased slope parameter implies a *greater* total response to the wage set by others, if that wage is held fixed. However for each unit of reduction in others' wages, the greater slope parameter also implies a *greater reduction* in response. Why can we be assured that equilibrium wages fall despite the possible ambiguity generated by a rise in strategic complementarity? The reason is made clear by the accompanying Figure, which graphs the reaction function (28) at two different levels of integration. At the higher level of integration k_2 the slope is higher and the intercept lower than at the lower level k_1. However the equilibrium wage necessarily falls due to the fact that both (indeed all) reaction functions run through point X. Why is this so? The reason is that when the wages at all other firms take on the maximum level possible ($w_{-i} = a$), the firm becomes a monopolist. But in this case, as shown in the appendix, an increase in demand due to market integration leads to no change in firm-level elasticities of labor demand at each wage and therefore the wage set by workers (or

indeed through bargaining between the firm and workers) is unchanged. Thus, all reaction functions run through this point, irrespective of the level of integration with which they are associated, and we can be assured that equilbrium wages must accordingly fall. Ultimately, the slope effect only acts to *multiply* the scale of the wage decline, and the strategic complementarity between worker-collectives works to ensure a 'race to the bottom'. A possible decomposition of the relative role of the firm-level bargaining effect (decline in intercept) and the increase in the strategic complementarity between workers at different production sites, in bringing about a decline in the equilibrium wage is outlined in the Figure.

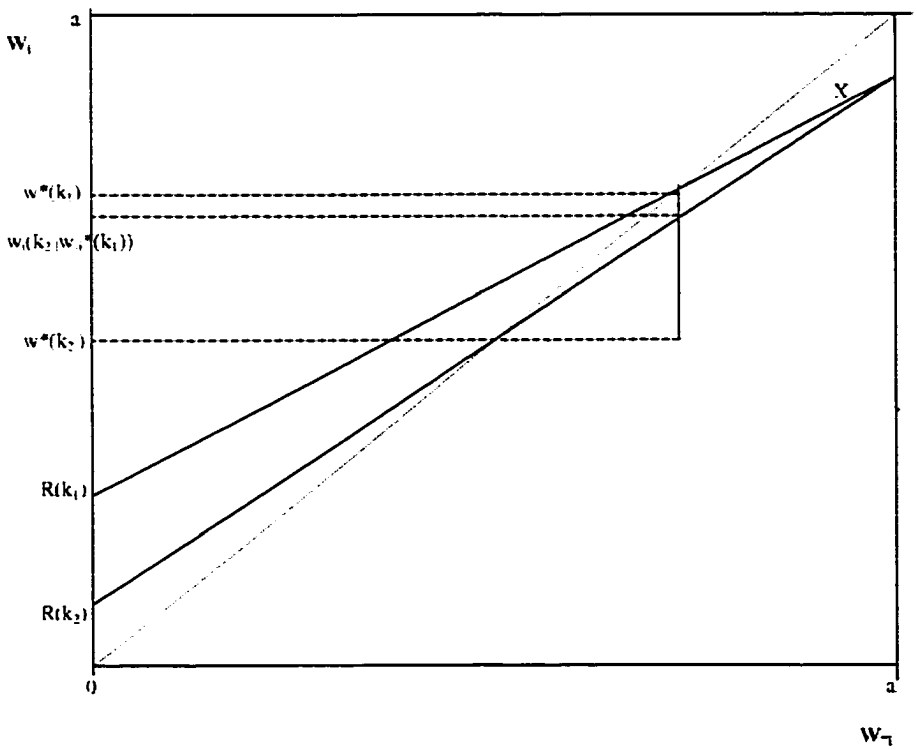
For the special case $w_{-i} = w_0$ (i.e. an isolated worker-collective faced with other firms hiring workers on the competitive market) it is possible to show that

$$\frac{dw}{dk} < 0$$
$$\frac{dw}{df} < 0 \qquad (25)$$

Thus, wages fall even at a firm with an isolated group of organized workers showing that the strategic complementarity between workers acts to multiply the wage decline but not to cause it.

As well, in this case:

THE EFFECT OF LIBERALIZATION ON THE WAGE-SETTING PROCESS



Decomposition:

Intra- firm bargaining effect = $w_i(k_2|w_{-i}^*(k_1))-w^*(k_1)$

Strategic Complementarity effect = $w^*(k_2)- w_i(k_2|w_{-i}^*(k_1))$

$$\frac{d}{d\lambda}\frac{dw}{dk} > 0$$
$$\frac{d}{d\beta}\frac{dw}{dk} < 0 \qquad (26)$$

Thus, greater bargaining power unambiguously reduces the extent of the wage fall due to integration and greater weight on employment unambiguously increases it. We can now conclude that the complex threshold effects observed in (14) are related to conflict between the effect of these variables in worker decision making at isolated production sites and their effect on strategic complementarity between workers at different sites. Indeed, it can be noted from (24) that only for these two variables (bargaining power and the workers' weight on employment) is the effect of an increase to heighten both the isolated wage (intercept) and the sensitivity to others' wages (slope). As noted above, however the total effect of this increased sensitivity is in principle ambiguous, in that it implies both a larger wage at any given level of others' wages, and a larger reduction in wage for any given reduction in others' wages. Since the direction of the effect of increasing the sensitivity to others' wages depends on the level of wages itself, whether this effect is in net positive or negative depends on the role of these variables in determining that level itself.

Analysis of the Objective Possibility Frontier in relation to the 'fear

of disagreement':

It is illuminating to study how the 'objective possibility frontier' (OPF) between firm and worker collective changes under the influence of integration in order to understand the essence of the process by which the bargained outcome may change to the absolute benefit of one of the parties:

The objective possibility frontier can be found by calculating the combination of profit and worker collective's objective which correspond to the different wage and employment combinations $(w_i, n(w_i))$ that can be selected at firm i given that the equilibrium wage is selected at all other firms (i.e. by calculating the 'residual' labor demand curve of firm i). The combinations of profit level (Π) and workers'objective (U) which are realized at different points along this residual labor demand curve constitute the objective possibility frontier under a given parameter configuration. By appropriate manipulation of the expression which defines the residual labor demand curve and substitution in to it of the expressions for the firms' profit level and the degree of realization of the workers' objective at an arbitrary (n, w), it is possible to derive the expression for the frontier itself:

$$U_i = \frac{k^{\left(\frac{\beta}{2}-1\right)}\Pi_i^{\frac{\beta}{2}}}{fb^{\frac{\beta}{2}}}\left[\frac{(a-w_0)\left(\frac{2}{\lambda}-1+\beta\right)}{\left(\frac{2}{\lambda}-2+B\right)+\frac{1}{fk}} - \Pi_i^{1/2}k^{-1/2}b^{1/2}(1+fk)\right] \qquad (27)$$

It may readily be checked that U_i has a value of zero at two points, at which Π_i respectively has value zero and a positive quantity. Also, $\frac{dU}{d\Pi_i} > 0$ at $\pi = 0$ and $\frac{d^2U}{d\Pi_i^2} < 0$. Therefore the expression describes an 'inverse-U' shape. However, since only the downward sloping portion of this expression corresponds to efficient bargains, the OPF is constituted by this portion alone. If profits may be 'thrown away', then the objective possibility set may be 'convexified' to produce one of conventional shape. How does the rate at which workers' objective and profits may be traded off along the frontier change with the degree of integration? It may be shown through calculation of the derivative that along the frontier:

$$\frac{d}{dk}\frac{dU}{d\Pi_i} > 0 \text{ and } \frac{d}{df}\frac{dU}{d\Pi_i} > 0 \ . \qquad (28)$$

Therefore the objective possibility frontier is *less steep* when the extent of liberalization is higher, entailing that a larger quantity of profits may be realized by giving up a unit of the workers' objective than when liberalization is lower.

An example of this feature of integration is shown in the accompanying figure which graphs the expression under different levels of integration ($K = 1, 2, 3, 4, 5$ and 6) at a given parameter configuration ($f = 2, \lambda = 1, \beta = 0.3, a = 100, b = 10, w_0 = 10$) . It may be seen that the slope of the OPF monotonically becomes smaller in magnitude as integration become higher. It is notable that it does so

most dramatically at the earliest stages of increased integration. The OPF does not shrink uniformly in the first stage of integration (from $k = 1$ to $k = 2$) as the enlarged scale of the integrated market creates a major rise in opportunities relative to the effects of the increase in competition. This is not repeated subsequently however and the objective possibility frontier everywhere shrinks. However the (initially rapid) shift in the shape of the OPF can give rise to bargained equilibria which are more profitable for the firm. The constant indifference surfaces corresponding to the Nash maximand are not depicted on this diagram but may readily be superimposed.

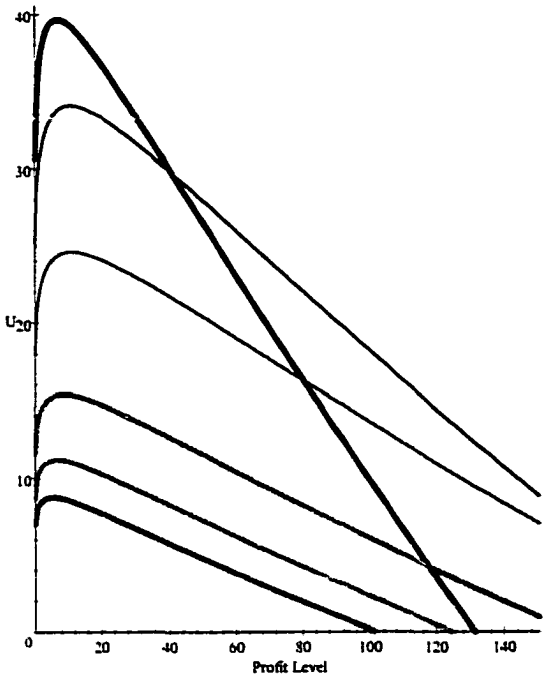


Figure 1.2:

THE OBJECTIVE POSSIBILITY FRONTIER AND INTEGRATION

In light of these results, it is useful to step back to seek a more intuitive interpretation of the phenomenon of endogenous change in the distribution of rents. A useful perspective on the issue is provided by the work of Svejnar (1986) which

introduced the generalization of the Nash bargaining model to arbitrary degrees of bargaining power that is used here. Svejnar (1986) derives the generalized Nash bargaining criterion on the basis of an axiom referred to as the "equalization of fear of disagreement relative to bargaining power". This axiom requires that the bargained solution should equalize the ratio of absolute to marginal gains from the resource being bargained over (referred to as the 'fear of disagreement' since it reflects potential total losses as compared to incremental gains from attempting to further one's interests at the risk of the breakdown of negotiations) weighted by the inverse of bargaining power. This criterion captures the idea that a stronger party will fear the total breakdown of negotiations as a result of their pushing for incremental gains less than a weaker party, and will thus be more likely to pursue marginal gains in the bargaining process.

Remark 2. *The "fear of disagreement" interpretation of the bargaining process clarifies why it is that the impact of liberalization on the shape of the objective possibility frontier is likely to have a considerable impact: A reduction in the potential marginal gains of one party relative to another (as reflected in the shape of the constraint they jointly face) increases that party's 'fear of disagreement'.*

1.2.2. Partial Degrees of Worker Organization

In this section we generalize the previous model to accommodate circumstances in which not all firms in an industry have organized workers. Further, we will seek to analyze the implications of integration between economies in which the proportion of firms that have organized workers differs.

We assume that $m < fk$ firms possess organized workers and that the rest make recourse to the competitive labor market. Firms without organized workers hire labor in the competitive labor market at rate w_0. Firms with organized workers in contrast hire labor at an equilibrium wage w^* determined as above by the strategic interaction among worker collectives.

We repeat from first principles in this more general environment the analogous exercise of equilibrium determination and comparative static analysis to that described above for the full organization case. It can be shown that:

$$w^* = w_0 + \frac{(a-w_0)}{(fk\frac{\varphi}{\lambda}+fk-m+1)} \tag{29}$$

from which it follows that:

$$\frac{dw^*}{dm} > 0 \tag{30}$$

As well, the sign of the effect of a and w_0 is as before and independent of the level of organization as such.

It can also be shown, by an analogous exercise to that described above in the full organization case, that:

$$\pi = \frac{k}{b(1+fk)^2}\left(\frac{(a-w_0)\frac{fk\phi}{\lambda}}{\frac{fk\phi}{\lambda}+fk-m+1}\right)^2 \qquad (31)$$

where π refers to the profit level of a firm with organized workers.

It will be noted that when $m = fk$, this expression reduces to (18) as expected.

It is also readily seen that:

$$\frac{d\pi}{dm} > 0 \qquad (32)$$

The first fact - that a higher number of firms with organized workers leads to higher wages, is unsurprising given what we have learned above regarding the importance of strategic complementarity in wage setting. The second fact, however, which is seen from the viewpoint of an already organized firm – that increased organization elsewhere leads to a rise in profits – is a slightly surprising one which is due to the price rise which results from a marginal firm becoming organized being dominant over the effect of increased organization on wages within the already organized firm. In fact it can be shown that price rises and therefore output does in already organized firms when organization increases, but overall supply falls due to the decreased output by the marginal firm which shifts from the level of output of non-organized firms to that of organized firms. It follows that:

Remark 3. *Any already organized firm, in a 'prisoner's dilemma' like logic, always has an interest in other firms' workers being organized although no firm wishes to have organized workers itself.*

Now let us consider the consequences of market integration. We note that at any given level of market integration,

$$m = \gamma f + \theta f(k-1) \tag{33}$$

where γ is the proportion of firms which have organized workers "at home" and θ is the proportion which do so "abroad" (i.e. in the region(s) with which integration is occurring). Substituting (33) into (29) gives us:

$$w^* = w_0 + \frac{(a-w_0)}{(fk\frac{\varphi}{\lambda}+fk+(\theta-\gamma)f-\theta fk+1)} \tag{34}$$

from which it follows that:

$$\frac{dw^*}{d\gamma} > 0$$
$$\frac{dw^*}{d\theta} > 0 \tag{35}$$

In other words:

Remark 4. *Post-integration wages at home are higher when more firms initially possessed organized workers "at home" and they are also higher when more firms have organized workers in the region(s) being integrated with "abroad".*

This is of course simply a consequence of the effect of the overall level of organization i nthe post-integration region on wages.

It can also be shown, by differentiating (34) that:

$$\frac{dw^*}{dk} < 0 \qquad (36)$$

In other words:

Remark 5. *Wages fall with integration regardless of the level of organization abroad, and regardless of that at home.*

Further,

$$\frac{d^2w^*}{dw_0dk} > 0$$
$$\frac{d^2w^*}{dadk} < 0$$
$$\frac{d^2w^*}{dk^2} > 0 \qquad (37)$$

irrespective of the values of θ and γ. These relations are as previously: The rate at which wages decline diminishes as integration proceeds, and is lower when the competitive wage is higher although it is higher when the consumer maximum willingness-to-pay for the good is higher.

How does the level of organization at home influence the effects of integration? It can be shown that:

$$\frac{d^2w^*}{d\gamma dk} > 0 \quad if \quad \theta > \gamma \quad and \qquad (38)$$

$$< 0 \quad if \quad \theta < \gamma$$

In short:

Remark 6. *Greater organization at home reduces the rate at which wages fall if foreign regions are more organized than at home. However, greater organization of workers at home increases the rate at which wages fall if the level of foreign organization is less than at home.*

This again is simply an effect of the overall level of organization in the post-integration region on wages.

Moreover we can deduce from (35) that

$$\frac{d^2w^*}{d\theta dk} > 0, \quad \text{i.e.} \tag{39}$$

Remark 7. *When two regions integrate it is necessarily the case that greater organization "abroad" reduces the rate at which wages fall.*

What about profits?

It can be shown, analogously to (21), which is a special case of the following, that profits rise between $k = 1$ and $k = 2$ iff

$$f^2((2^{1/2} - 4) + (2^{1/2} - 4)\phi + 2\theta + (2 - 2^{1/2})\gamma) + f((2^{1/2} - 4)$$
$$+(2^{1/2}-2)\phi+\theta+(1-2^{1/2})\gamma)+(2^{1/2}-1) > 0 \tag{40}$$

It can be seen that, as before, profits necessarily rise for small (possibly fractional) f.

Whether it is true in the economically relevant region $f \geq 1$ will depend on the other parameters.

In particular since in (40) both coefficients of γ are negative, and since both the coefficients of θ are positive, it is the case that:

Remark 8. *Higher rates of worker organization "at home" decrease the likelihood that profits rise, and higher rates of organization "abroad" increase the likelihood that profits rise.*

Both of these effects are due to the greater importance of the (positive) revenue as compared with the (negative) wage bargaining externalities generated by other firms' workers being organized. Greater organization abroad restrains the pro-competitive output and price effects of integration, without sufficiently raising the ability of workers "at home" to raise wages. Similarly higher organization at home increases the potential revenue losses from the pro-competitive effects of integration, which cannot be compensated by the possibility that lower organization abroad will lower the ability of workers "at home" to demand higher wages. It is imaginable that under alternative specifications of the nature of demand and

of imperfect competition, these factors may not have the same relative influence on outcomes derived above.

1.2.3. Workers Organized on a Larger Scale

Are the results derived above dependent on the assumption that the level at which workers organize to achieve their objectives is that of the individual firm? In this section we show that this is not the case, for the case of market integration (similar results may be readily derived for the 'deregulation' case). In this section we speak of "unions" rather than organized workers as this is a more natural way to refer to workers organized beyond the level of the enterprise.

We consider three cases. The first case is that of "trans-national" unions. In this case, in which some proportion (possibly all) of workers at "home" belong to a common (cross-enterprise) union, as market integration occurs workers in the newly integrated regions join this union in the same proportion as at "home".

In the second case examined, some proportion (possibly all) of workers at "home" belong to an analogous cross-enterprise union, which however gains no new members at home or abroad when integration occurs. Workers abroad are assumed not to be unionized.

In the third case, independent (cross-enterprise) unions representing an arbitrary proportion of workers in each region, enter into strategic interaction with each other once market integration occurs.

Remark 9. *In all three cases, wages fall as a result of integration, as long as the unions do not include all workers in the industry (in which case they may be constant). Wages are higher but also fall more as a result of integration, if more workers belong to the union. Wages always fall more when unions are "national" rather than "trans-national". Profits do not rise in the first two cases but they do rise in the third (competition between national unions), and indeed under reasonable conditions they necessarily do so regardless of the number of firms. This is due to the strategic complementarity in the wage-setting game between national unions.*

In all the cases we assume that the union sets the same wage for all of its working members and, for simplicity, we take the "Stackelberg" case in which unions have complete first-stage wage setting power (equivalent to $\lambda = 1$).

(i) Trans-National Unions:

Consider a trans-national union. Assume that it organizes workers at a constant $v \leq f$ firms in each region. Assume that the union sets a wage w_v and

that all other firms hire workers from the competitive labor market at wage w_0. In this case, we can derive from (7) above, that the level of employment at a unionized firm is given by:

$$n_i = \frac{k}{b}\left(\frac{a+w_v(kv-fk-1)+w_0(fk-kv)}{1+fk}\right) \tag{41}$$

from which it follows that the elasticity of labor demand is:

$$\varepsilon_{nw_v} = \frac{w_v}{n}\frac{dn_i}{dw_v} = \frac{w_v}{(w_v - w_0 + \frac{(a-w_0)}{(k(v-f)-1)})} \tag{42}$$

It can readily be seen that the magnitude of this elasticity rises as integration proceeds (i.e. as k rises) but falls when the number of unionized firms per region (v) rises as long as $v < f$. When all firms are unionized the elasticity is *independent* of the degree of integration. It is interesting that this is so, as in the case of a single monopolist, despite the fact that firms are still engaged in competition among themselves.

It may now be noted (see Appendix) that the first order condition which characterizes the wage (w^*) set by a union with complete wage setting power is:

$$w_v^* = \frac{w_0}{(1+\frac{1}{B\epsilon_{nw_v}})} \tag{43}$$

As a result, it is evident that the equilibrium wage falls as integration proceeds (as long as not all firms are unionized), and rises as the number of unionized firms rises.

Solving for w_v^* explicitly we derive that:

$$w_v^* = w_0 + \frac{a-w_0}{(B+1)(kf+1-kv)} \tag{44}$$

It can be readily derived from this that

$$\frac{d}{dv}\frac{dw_v^*}{dk} = \frac{(w_v-a)}{(B+1)}\frac{(1+kv-kf)}{(kv-kf-1)^3} \tag{45}$$

which has a negative sign. Therefore, higher unionization increases the negative impact of integration on wages, even under the assumption that a transnational union is formed in the post-integration region.

Can the wage fall enough for profits to rise?

To check this we substitute sequentially into the identity

$$\pi_v(k) = (p-w_v)^2\frac{k}{b} \tag{46}$$

expression (6) for the market price given a particular vector of wages at firms, and (44) for the wage set by the union. We can then derive after considerable simplification that:

$\pi_v(2) - \pi_v(1) > 0$ iff

$$(a - w_0)(B)(2v - 2f - 1)(v - f - 1)(1 - X) > 0 \tag{47}$$

where

$$X \equiv \left(\frac{1+4f+4f^2}{2+4f+2f^2}\right) \tag{48}$$

However in the economically relevant region of parameters, the first two terms

in (47) are positive and the remaining three are negative which ensures that the condition is never satisfied.

Thus although wages can fall they do not do so sufficiently for profits to rise in the case of trans-national unions.

(ii) Integration between a Region with a National Union and a Non-Unionized Region:

Consider now the case of a "national" union which integrates with a non-unionized region without changing its strength. The equilibrium wage of a unionized firm in this circumstance is equivalent to that in (44) where the number of unions per region falls as the number of regions increases in such a way as to maintain the total number of unions, v. Thus applying v/k where v appears in (44) we derive:

$$w_v^* = w_0 + \frac{a-w_0}{(B+1)(kf+1-v)} \tag{49}$$

It is evident that as before the wage rises as the number of unions rises, and that it falls as liberalization proceeds. It is straightforward to show that

$$\frac{dw_v^*}{dk} = -\frac{(a-w_0)(f)}{(B+1)(kf+1-v)^2} \tag{50}$$

from which it follows that the rate of reduction in wages as a result of further integration falls as integration proceeds, and that it is more when the number of unions is more. Thus, as in the trans-national union case, greater unionization

means both higher wages and more steeply falling wages.

Can profits rise in this case? Conducting an analogous procedure to that by which (47) was derived we find that:

$$\pi_v(2) - \pi_v(1) > 0 \text{ iff}$$

$$(a - w_0)(1 - X) > 0 \tag{51}$$

In the economically relevant region, the first term is always positive and the second is negative. Thus profits *never* rise when unions are organized nationally, if there are no unions in the region being integrated with.

(iii) Integration Between Two Regions with Independent National Unions:

Finally, let us consider the case of integration between regions which each possess their own cross-enterprise unions. After integration, these unions coexist and engage in strategic interaction when setting wages. For simplicity of exposition we consider the case of integration between only two regions with an equal number of enterprises unionized by the cross-enterprise union in each case, although the analysis may be conducted in a more general setting.

If workers at v firms belong to the union in each region (which respectively set wages w_1 and w_2) then by (7) the employment at a unionized firm in region one is given by:

$$n = \frac{k}{b}\frac{(a+(v-fk-1)w_1+(k-1)vw_2+k(f-v)w_0)}{(1+fk)} \qquad (52)$$

Then, by (43), it can be derived that the optimal wage of the union in region 1 is given by:

$$w_1 = \frac{w_0 B}{(B+1)} + \left(\frac{a+w_0 k(f-v)+w_2(k-1)v}{(B+1)(fk-v+1)}\right) \qquad (53)$$

Thus the wage before integration ($w^*(1)$) is given by

$$w^*(1) = w_1(k=1) = w_2(k=1) = \frac{w_0 B}{(B+1)} + \left(\frac{a+w_0(f-v)}{(B+1)(f-v+1)}\right)$$

$$= w_0 + \frac{(a-w_0)}{(B+1)(f-v+1)} \qquad (54)$$

The post-integration wage, $w^*(2)$, is given by the unique (symmetric) Nash equilibrium of the wage setting game between unions derived by setting $w_1 = w_2 = w^*$, in (53). It follows that

$$w^*(2) = w_0 + \frac{(a-w_0)}{(B+1)(2f-v+1)-v} \qquad (55)$$

It is straightforward to show that $w^*(2) < w^*(1)$. i.e. the union wage necessarily falls as a result of integration. It is also straightforward to show that $w^*(2)$ is less than the wage which would prevail if both of the unions were agglomerated (given by (44) with $k = 2$).

Can profits rise in the case of independent "national" unions? For simplicity we specialize to the case where all firms in each region are unionized (i.e. $v = f$) and where the unions pursue the "rent-maximization" objective (i.e. $\beta = 1$). Once again conducting an analogous procedure to that by which (47) was derived, and

simplifying, we can show that:

$\pi_v(2) - \pi_v(1) > 0$ iff

$$f^2(2-2\sqrt{2}) + f(5-4\sqrt{2}) + (2-2\sqrt{2}) < 0 \qquad (56)$$

However this is *always* true. Thus profits *necessarily* rise when two regions with independent unions merge, *regardless* of the number of firms, at least in the case where all workers are unionized and unions pursue the rent maximization objective. It is therefore evident that the possibility of rising profits is robust to the case where unions are organized at a cross-enterprise (indeed "national") level. It is also evident, by comparison with the previous two cases, that this possibility is however dependent on there being some element of inter-union competition (and the strategic complementarity in wage-setting linked to it) in the integrated region.

1.2.4. Endogenous Workers' Organization

We have until now in our discussion of workers at the enterprise level assumed that all workers are 'organized'. Here we depart from that assumption, in recognition that effective organizatiion may be more likely to arise in certain circumstances (in particular when the benefits of such organization are high relative to the

costs). As discussed in Part I, liberalization might influence wages in at least four possible ways. The first is that even under conventional models, the shrinking per-firm rents induced by liberalization would be expected to lead to reduced wages. The second is that liberalization induced increasing elasticities of labor demand would cause worker collectives acting independently to moderate their wage demands. The third is that inter–worker-collective competition and strategic complementarity in wage setting might further magnify these wage reductions. The fourth is that the diminishing rents realized by worker collectives might cause an endogenous decrease in the extent of organization, which in turn would reduce the ability of unionized firms to establish high wages. We have thus far discussed and confirmed the presence of the second and third channels of causation (the first is straightforward). Here we address the fourth.

To begin, how does the ability of worker collectives to realize their objectives vary with the extent of worker organization in the economy? It can be shown that $dU/dm > 0$. In other words, the ability of worker collectives to realize their objectives increases as the extent of their prevalence increases. Thus, both worker collectives and firms with already organized workers favor more widespread worker organization (recall (30) and (32)).

For the case of rent-maximization, in which the worker collective's objective,

U, can be measured straightforwardly in money terms, it can be shown that the ratio of equilibrium workers' rent to profit at any given level of integration is given by:

$$\frac{U}{\pi} = \frac{(1+fk)\lambda}{\phi fk} \tag{57}$$

This ratio is directly proportional to workers' bargaining power and inversely proportional to the joint weight placed on employment in the worker-collective–firm bargaining process. Further and most interestingly,

$$\frac{d(U/\pi)}{dk} < 0 \quad \text{and} \quad \frac{d(U/\pi)}{df} < 0. \tag{58}$$

from which it also follows that

Remark 10. *In the case of the workers' objective being rent maximization, the share of profits in total per-firm surplus, $\frac{\pi}{\pi+U}$, is rising uniformly as liberalization proceeds.*

Consider now a very simple model of endogenous worker organization. Assume that worker colectives can demise as a result of a "contest of resources" between collective organizers and firms, in which the potential costs of defending a collective's existence would have to be paid out of existing workers' rents, and in which the costs of fighting workers' organization would have to be paid out of existing

firm's profits. Further suppose that the party that expends more resources prevails. It follows from these assumptions that as long as profits are greater than workers' rent unions will be pushed out of existence and as long as profits are less than workers' rent unions will maintain their existence. Therefore, by (58):

Remark 11. *In the case of a "contest of resources" model with rent-maximizing worker collectives, as liberalization proceeds, a point is reached at which all collectives endogenously demise.*

Can we form a more complete theory of endogenous levels of worker organization? It is straightforward to show that the equilibrium level of realization of the worker collective's objective,U, which may also be interpreted as the benefit (B) to workers who organize, is given by:

$$B = U = \left(\frac{(a-w_0)}{(fk\frac{\varphi}{\lambda}+fk-m+1)}\right)^{(1+\beta)} \left(\frac{k^2 f\phi}{b\lambda(1+fk)}\right)^{\beta} \qquad (59)$$

from which it follows that B increases in m, the number of firms with organized workers. It can also be shown, from differentiating twice, that $B(m,..)$ is uniformly convex in m.

Consider now the costs, C, of forming a worker collective at a particular site. For simplicity, let us assume that these costs, measured in terms of units of the worker collective's objective, are an increasing function of the number of workers

employed at that site.

Now note that firm-level employment, $n(w(m),..)$ is increasing in m both at firms where workers are organized and firms where they are not. The reason for this, as noted earlier is that the output of already organized firms is able to increase without increasing market supply when a marginal firm shifts from the non-organized to the (lower) organized level of output. It can be shown further that $\frac{d^2n}{dm^2} > 0$ and that n is therefore convex to the origin in m.

Now, assume that $C(n)$ (the cost of organizing n workers) is not too concave (i.e. marginal costs of organization do not decrease quickly in the number of workers to be organized). Then $C(n(m))$ is convex in m.

Consider now the theory that worker collectives form when benefits > costs and demise if costs> benefits. Under the characterization of benefits and costs just derived (convexity of C and of B) it can readily be shown graphically that various patterns of equilibria (single and multiple equilibria; stable and unstable equilibria; worker organization at all, some or no firms) are possible. Integration, by shifting the worker organization total benefit or cost functions (recall for instance that in the case of the rent maximization objective, integration shifts the level of workers' objective attained at any given level of worker organization uniformly downward) can lead to union growth spurts or rapid declines. Consider

a simple example, depicted in the accompanying Figure, which is similar to the logic of the examples presented in Freeman (1997). It is clear that if the curve reflecting the benefits of worker organization falls sufficiently, the equilibrium can shift from one of universal worker organization to one of organization at some or no work sites. If integration is responsible for a shift in the worker organization benefit and cost curves which generates a 'growth spurt' or period of rapid decline, then it is clear that this helps to explain why such periods have some tendency to be correlated across countries [Freeman(1997)].

1.2.5. Efficient Bargaining with Endogenous Outside Options

We have observed above that increasing product market competition may lead to rising profits and falling wages. Is this outcome dependent on the assumption that contracts between firm and workers take a 'right to manage' form and are therefore 'inefficient'? Bargaining in the first stage of the model described above is only over wages and not over wages and employment jointly. It is for this reason that the employment level the firm chooses in the second phase is on its labor demand curve and that an externally induced increase in the elasticity of the labor demand curve can influence the wage determined in the first stage. The

RAPID DECLINE OF UNIONIZATION DUE TO LIBERALIZATION

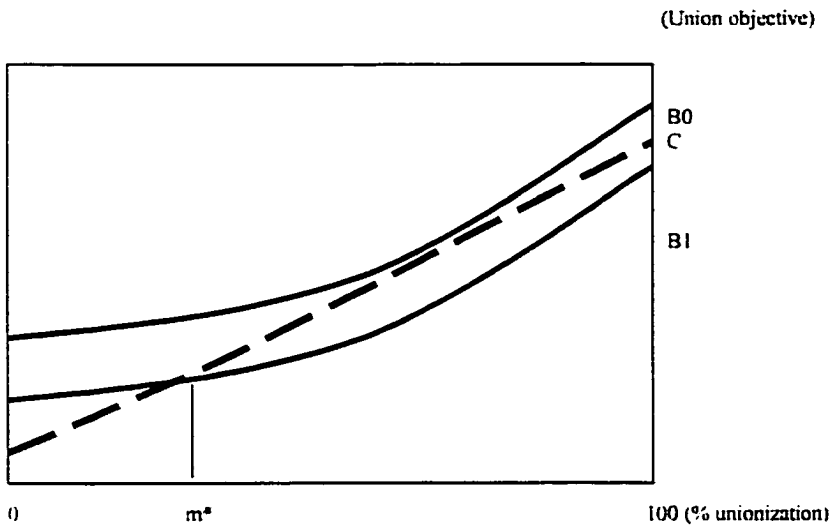


Figure 1.3:
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level of surplus available to be bargained over is of course smaller in this situation than when wages and employment are bargained over jointly.

It can be shown however that the distributional results highlighted above are not strictly dependent on the existence of this inefficiency. We consider a model in which unorganized workers (paid w_0) "threaten" to organize if they are not provided with at least as high an increment to total compensation as they would receive if they were organized and engaged in the bargaining game described in previous sections. The meaning of "organization" here is simply the imposition upon the firm of the non-cooperative game described earlier in this paper.[9]

It is assumed for simplicity that there are no worker collectives present in the economy, but that if an isolated worker collective were to exist it would pursue the rent-maximization objective.

We consider a structure in which workers make take-it-or-leave it demands of employers, at the beginning of the game, in order to decide whether or not to organize. Even in this extreme case, product market competition, by shifting the labor demand curve that would be made recourse to *in the event* that the threat was realized, can lead to changes in the distribution of surplus even in the absence

[9]It is assumed that workers are already 'organized' enough to 'threaten' the firm with this outcome.

of the threat being realized. In particular it can be shown that in this case it is possible for U (the rent which would be realized in the event a union were to be formed) and therefore workers' compensation, to fall, and π to rise, as market size is doubled ($k = 1 \longmapsto k = 2$), even while maintaining efficient outcomes (i.e. workers are paid w_0 for each unit of their labor services and an independent transfer of surplus) . This form of efficient bargaining is of the same general form as the "Separate Spheres" bargaining model described by Lundberg and Pollak (1993). [10]

The total production surplus (or gross profits, π_G) of a firm paying the competitive wage in an economy in which all firms pay the competitive wage is given by the profit expression (17) where w^* has been set to w_0. i.e. it is:

$$\pi_G = \frac{k}{b}\left(\frac{a-w_0}{1+fk}\right)^2 \qquad (60)$$

Now, the rent that workers could realize if they were to form a rent-maximizing union is given by setting $m = 1$, and $\beta = 1$ in (59):

$$U = \left(\frac{\lambda(a-w_0)}{(2fk)}\right)^2 \left(\frac{k^2 f\left(\frac{2}{\lambda}-1\right)}{b(1+fk)}\right) \qquad (61)$$

The difference $\pi_N = \pi_G - U$, (net profit) is the amount that the firm actually

[10]The next chapter shows that increased competiton can be profit increasing even in the setting of efficient bargaining with constant outside options, in a case where 'right to manage' bargaining does not appear even as an 'overshadowing' factor which determines the value of the firm's 'outside options'. The discussion of this important case is deferred until then, although analogous arguments would be possible here.

realizes after making payments to workers in order to prevent them from forming a union.

It can be shown that $\pi_N(k=2) - \pi_N(k=1) > 0$ iff

$$(\lambda^2 - 2\lambda)(-2f^2 - 3f - 1) + 4(1 - 2f^2) > 0 \qquad (62)$$

It is readily seen that there exists a very broad range of parameter values for which this statement is true. For instance, if we assume that unions would have complete wage setting power in the event of the formation of a union ($\lambda = 1$), the left hand side of (62) becomes $(3f + 5)$ which is greater than zero *for all* f. i.e. Profits rise regardless of the number of firms.

Remark 12. *The effect of integration on diminishing the threat effect of worker organization can be sufficient to raise profits, even where intra-firm bargaining is efficient.*

1.2.6. Non-Cournot Inter-Firm Competition:

Are the results identified above dependent on the special assumption that the process of competition among firms takes a Cournot form? It is shown in this section that this is not the case.

Specifically, we consider a "conjectural variations" model in which when a

firm increases its output by 1 unit, it expects that the rest of the industry will correspondingly change its production by $(c-1)$ units, where c is an arbitrary constant. The well-known cases of "perfectly competitive behavior", Cournot behavior and "cartel behavior" are all special cases of this model, in which c equals 0, 1 and F respectively, where F is the total number of firms in the industry (See Lindbeck and Snower (1992)).[11] Formally, we postulate the (common and commonly known) conjecture function as

$$d(Q^e/q_i)/dq_i = (c-1) \tag{63}$$

where Q^e is the expected total industry output and q_i is the output of any one firm.

We can now re-solve the model above from first principles using this far more general assumption regarding inter-firm competition. For ease of exposition, we specialize to the case where $\lambda = 1$ (i.e. workers have complete wage setting power), and where workers are organized at the enterprise level. However, neither of these assumptions are essential to the robustness result outlined here.

It can be shown through the procedure described earlier in the paper that in this case the equilibrium wage level is given by:

[11] "Cartel behavior" maximizes total profits of the set of firms subject to the constraint that no direct transfers are allowed. This corresponds to monopoly behavior only when all the cost conditions (including wages) are identical.

$$w^* = \frac{a}{(\beta+1)+\frac{\beta}{c}(fk-1)} \tag{64}$$

It is evident that wages are an increasing function of the degree of collusion as measured by the conjectural variation, c. This is an unsurprising result, as higher collusion among firms makes possible larger per-firm surplus, some of which is shared out in the form of higher wages.

However,

$$\pi^* = \frac{kc}{b(c+fk)^2}\left(\frac{(a-w_0)(c\beta+\beta(fk-1))}{(c(\beta+1)+\beta(fk-1))}\right)^2 \tag{65}$$

It may be readily shown that as long as the degree of collusion passes a minimal threshold ($c > (\beta(fk-1))^{1/2}$) profits *necessarily* decrease iwith additional collusion. That the threshold is not difficult to reach is illustrated by the fact that the level of conjectural variation required is always less than the square root of the number of firms, and may be much smaller if the degree of employment preference of worker collectives is low. This is a surprising fact which runs contrary to the usual presumption of the implications of collusion. Why is it so?

It can be shown that at any fixed wage, w,

$$\pi = \frac{k(a-w)^2}{b(c+fk)^2} \tag{66}$$

Moreover this expression is rising in c in the economically relevant region in which $c < fk$. Therefore, profits would rise along with collusion if wages were fixed. We can conclude that:

Remark 13. *Greater collusion often* lowers *profits, because it enables workers indirectly to command a greater share of the surplus generated in the form of wages, and to do so to a sufficient extent that the gains to firms from collusion are more than completely dissipated. This is another illustration of one theme of this study: greater competition can be profit raising.*

The paradoxical effect of greater collusion in lowering profits is because it implicitly lowers the magnitude of the elasticity of demand for labor, enacting backward the "profit rise" phenomenon focused on elsewhere in this paper. It follows that firms would if they are able wish to commit to the lowest degree of collusion possible, as the wage discipline effect this generates is more than sufficient to make up for the revenue losses due to greater competition among firms. It is also noteworthy however that firms still have an incentive to collude once wages have been determined (as at this point wages are "fixed"). If firms have the incentive and capability to collude therefore (i.e. to raise c) then in the absence of commitment devices such as externally enforced regulatory structures, they will do so once the second stage of the game is reached. The equilibrium in which firms do not collude and wage discipline occurs is therefore not sub-game perfect and cannot be attained. Accordingly, collusion will occur and firms' profits will be lower than otherwise. These arguments are discussed at greater length in

the next chapter.

It can also be shown, as before, that profits can rise as liberalization proceeds. Consider the experiment in which two regions are merged and the level of conjectural variation is held constant.[12] Specifically, it is possible to show that:

$$\pi(k=2) - \pi(k=1) > 0 \text{ iff}$$

$$c^2(2(2^{1/2}-1)) + c[(\tfrac{\beta}{1+\beta})f(2(2^{1/2})-2) + (\tfrac{\beta}{1+\beta})(1-2^{1/2}) + f(2^{1/2}-2)] +$$

$$(\tfrac{\beta}{1+\beta})f^2(2^{1/2}-4) + (\tfrac{\beta}{1+\beta})f(2-2^{1/2}) \geqq 0 \qquad (67)$$

It may be verified that this condition is consistent with (21) above. Further, this expression is rising in c as long as c is greater than $c^*= \left(3(2^{1/2})-2\right)/7 \approx 0.32$.

[12]Holding constant the conjectured output response of all other firms to a unit increase in output while doubling the number of firms amounts to decreasing the conjectured per-firm output response of all other firms. A possible justification of this assumption is that the implicit disciplining or monitoring power of an inter-firm "coalition" over individual firms may vary inversely with its size. The assumption of fixed conjectural variation is admittedly unsatisfactory, but it is unclear how best to model the idea of maintained 'degree of collusion' in the presence of an increasing number of firms. This assumption is therefore best viewed as providing only a possible benchmark. Certainly, if profits rise when the degree of effective collusion is thus diminished, the result that increased entry can cause profits to rise is made more rather than less notable, insofar as the degree of increase in competition entailed is effectively higher.

It can be shown that under the assumption of constant *per-firm* (as opposed to market level) conjectural variations, it is never the case that profit rises as a result of integration of two economies. However there is some level of post-integration conjectural variation higher than the pre-integration level but less than that implied by constant *per-firm* responses, such that all levels of post-integration market conjectural variation between the pre-integration level and this threshold imply a rise in profits if constant conjectural variations implied a rise in profits. Therefore whether profits rise or fall is greatly dependent on the hypothesis made about the manner in which integration influences collusion among firms, with profit-rise being *more* likely if post-integration collusion is *lower*.

Thus, we can conclude that, under the assumption of constant conjectural variation, in the case of market integration between two economies:

Remark 14. *If profits rise when inter-firm competition takes the Cournot form, then they do so whenever firms "collude " to a degree "more" than implied by the Cournot assumption.*

Finally, what occurs if inter-firm competition takes a "Bertrand" form? Assume, for purposes of exposition only, the "Stackelberg" setting in which workers have complete wage setting power. Consider first the "second stage" game among firms. If one firm enjoys a cost-advantage over other firms in the form of

lower wages then it will capture the totality of market demand by slightly underpricing all of its competitors, and will therefore always do so. Consider now the "first stage" game among groups of workers which determines the costs of firms. Any asymmetric distribution of wages cannot be an equilibrium because the workers with higher wages will not be employed at all and therefore would have an incentive to set their wages lower. Any symmetric distribution of wages above the competitive level cannot also be an equilibrium, however, as any one group of workers would have an incentive to set wages infinitesimally lower and expand employment substantially. The only equilibrium therefore is where work-

ers at all work sites set their wages at the competitive level, and prices are also set at this level. The Bertrand competition among workers "induced" by that between firms ensures therefore that no rents are realized by firms at any level of integration. This argument holds for all levels of organization by workers except that of "national" unions. In this case, workers set their wage at such a level as to capture the maximal level of rent from consumers, and firms earn no rent at all. In this case, if market integration is not accompanied by expansion of the union into the entire integrated region, workers' rents fall to zero as a result of integration. Under Bertand competition it is not feasible for market liberalization to result in a rise in profits.

1.2.7. Multiple Equilibria and Non-Linear Demand

Under the assumption of linear demand curves, the wage game between workers has a single equilibrium. However, if this assumption is relaxed, multiple equilibria can arise, giving rise to interesting political economy and policy implications.

It is well known that although Cournot competition among firms gives rise to

a single equilibrium when demand curves are linear, it can give rise to multiple equilibria when they are convex, for the reason that a rise in output by other firms can cause a firm's marginal revenue to *rise* to a sufficient extent that it triggers a rise (rather than the decline experienced in the linear case) in its output (see e.g. Vives (1999)). Since the wage game among workers is 'derivative' of the Cournot competition among firms, it is not surprising that a similar result appears here.

A simple example suffices to demonstrate the point, with the framework employed heretofore otherwise unchanged. Assume that workers have complete wage setting power (i.e. $\lambda = 1$), and consider the case of an isolated economy ($k = 1$).

Consider the family of demand curves given by

$$p = a + ce^{bQ} \tag{68}$$

where Q refers to the total market output and $a, b, c \in R$. It follows that at any firm i, the 'residual demand curve' conditional on production $\{q_j\}$ at other firms is given by:

$$p(q_i|q_{j\neq i}) = a + c(e^{b\sum q_{j\neq i}})e^{bq_i} \tag{69}$$

Employing this residual demand curve, the first order condition corresponding to the profit maximization condition of the firm, conditional on facing a wage w_i, can be derived:

$$ce^{b(\sum q_j)}(bq_i + 1) = (w_i - a) \qquad (70)$$

The first order condition of the worker collective seeking to maximize (1),

$$q_i + B(w_i - w_0)\frac{dq_i}{dw_i} = 0 \qquad (71)$$

can then be solved to give:

$$w_i = \frac{(a + ce^{b(\sum q_j)} + w_0 B)}{(1+B)} \qquad (72)$$

To solve for the wage (w^*) and output level (n^*) in symmetric equilibria, these can be substituted for all firms' wage and output levels in (70) and (72) to derive:

$$ce^{bfq^*}(bq^* + 1) = (w^* - a) \qquad (73)$$

and

$$w^* = \frac{(a + ce^{bfq^*} + w_0 B)}{(1+B)} \qquad (74)$$

The solutions to this system of equations are given implicitly by:

$$e^{bfq^*} = \frac{B(a - w_0)}{(-c)(q^* b(1+B)+B)} \qquad (75)$$

Now consider two relevant cases of parameters. When $b < 0, a > 0, c > 0$ then the demand curve is convex to the origin, and when $b > 0, a > 0, c < 0$ then it is concave to the origin. The solutions to (75) may then be described graphically. When demand is convex (though not wwhen it is concave) there can be more than one solution for relevant parameters. Such a case is depicted in the accompanying Figure, which graphs the exponential left hand side (marked A) and the hyperbolic right hand side (marked B) of (75). However by (74)

there is only one wage associated with each of these quantity solutions. Thus the wage selected by worker collectives in the preceding wage-setting game 'enforces' a particular quantity equilibrium (one with higher wage and lower output and one with lower wage and higher output).

There are two interesting points to note about the two equilibria which potentially arise in the case of convex demand. One is that the two equilibria can be pareto ranked if worker collectives' interests alone are taken in to account. Since the underlying symmetric wage game among workers is one in which there are positive spillovers (in particular an increase in wages set by all other worker collectives increase the payoff to any one worker collective), therefore the equilibria may be pareto ranked according to the degree of "effort" (level of wages set) (see Cooper (1999), Proposition 2). In particular the "higher effort" equilibrium (that with higher wages and lower output) is pareto superior from the point of view of the worker collectives.

The second interesting point is that the comparative statics are more complicated than in the case of a unique equilibrium. In particular a rise in the quantity of firms (the measure of the degree of competition in this example) has an 'ambiguous' effect since it causes an increase in the quantity produced in the lower quantity equilibrium and lowers that produced in the higher quantity equilibrium. This is evident from the attached Figure since a rise in the number of firms will cause a rise in the left hand side of (75), which will be reflected in a shift in the

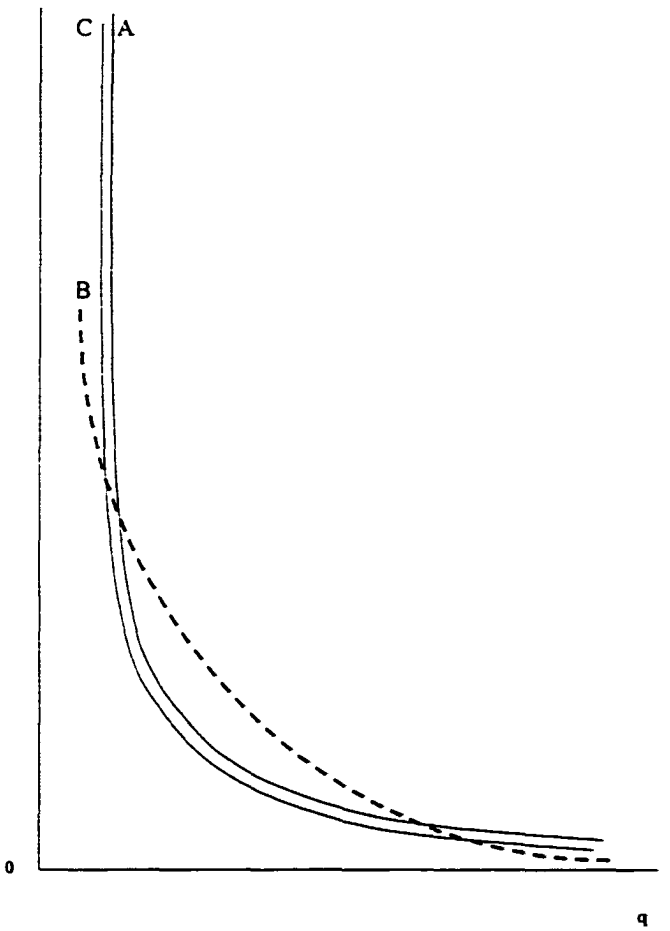

Figure 1.4:

exponential curve in the figure from (for example) A to C. it is evident that the two equilibria shift in distinct directions. The effect therefore depends entirely on which equilibrium is initially achieved. This is an illustration of a more general phenomenon in games with strategic complementarity. [See Cooper (1999)]. It can however be shown that under a reasonable condition increased entry always causes a decline in the wage.[13]

The possibility of multiple equilibria in the wage game among worker collectives raises interesting issues for the analysis of political economy and of policy. In particular it suggests the importance of history. Initial histories and policies which initiate high wage equilibria are likely to be self-enforcing and self-sustaining over time. Further, the impact of integration, although ambiguous, is likely to *accentuate* the differences between alternative possible equilibria.

Wage Decline and Profit Rise under Arbitrary Demand:

Is the core result of this paper, that liberalization leads to wage moderation, possibly to a sufficient extent to cause profits to rise, dependent on the assumption that market demand takes a linear form? The discussion of "general principles" in the Appendix suggests that this need not be the case. Indeed, the robustness of the wage moderation result can be easily shown. It is necessary only to note the

[13]The condition is that total market output increases when entry occurs.

readily demonstrated fact that the composition of differentiable market demand curves through market integration preserves the elasticity of market demand at any given price, as the integration of k markets increases the quantity of output sold at any price by k times, but also reduces by a factor of k the magnitude of the slope of the market demand curve. Thus, any wage setting rule which sets wages as a decreasing function of the magnitude of the elasticity of market demand

(which as shown in the appendix to this chapter is the class considered here) will not lead to a change in wage when a single firm inherits the entire (expanded) market demand curve. However when firms engage in Cournot competition, an individual firm's equilibrium residual demand curve shifts leftward as a result of the liberalization induced increased equilibrium total output of all other firms. As observed in the appendix for the linear case, this necessarily leads to increased per-firm elasticities of product demand at any given price and thereby to increased per-firm elasticities of demand for labor at any given wage. Wage moderation therefore results (as long as wages set are a decreasing function of the magnitude of the elasticity of labor demand (as they are under reasonable characterizations of workers' preferences). It is evident, from the geometry of profit rise (described in the appendix), that wages could fall to a sufficient extent to cause profits to rise, certainly in the case where the labor demand function is not "too non-linear" in the vicinity of the wage shift. Although it would be desirable to derive exact conditions for profit rise with more general demand functions, this exercise becomes rapidly analytically intractable.

A better heuristic understanding of the conditions under which liberalization would lead to wage decline and similar consequent effects to those derived above in the linear case can be made with the aid of the accompanying Figure, which

depicts a liberalization induced shift leftward of the residual labor demand curve of a firm for the case of Cournot competition (or more generally constant conjectural variation) from D1 to D2, for linear, concave, and convex demand curves. Since OE has higher slope than OF, therefore $\frac{W}{Q}$ is higher at A than at B. However since each curve D2 is simply a leftward translation of the original curve D1 (determined by the quantity which all other firms increase their output due to liberalization), therefore the slope of D2 at a given wage w is the same as the slope of D1. Hence the elasticity of labor demand $\left|\frac{dQ}{dw}\frac{w}{Q}\right|$ is higher at A (post-integration) than at B (pre-integration) regardless of the shape of the demand curve.

Note that the first order condition for workers with complete wage setting power who seek to maximize the objective

$U = n^{\beta}(w - w_0)$ is given by:

$$w^* = \frac{w_0}{\beta + \frac{1}{\epsilon_{nw}}} = \frac{w_0}{\beta - \frac{1}{|\epsilon_{nw}|}} \qquad (76)$$

where ε_{nw}represents the elasticity of labor demand of the firm.

A liberalization process that causes a shift inward of the labor demand curve from D1 to D2 and therefore a rise in $|\varepsilon_{nw}|$ at a given wage, is sure to lead to a reduction in wages if $|\varepsilon_{nw}|$ is a rising function of wages. This is because without a

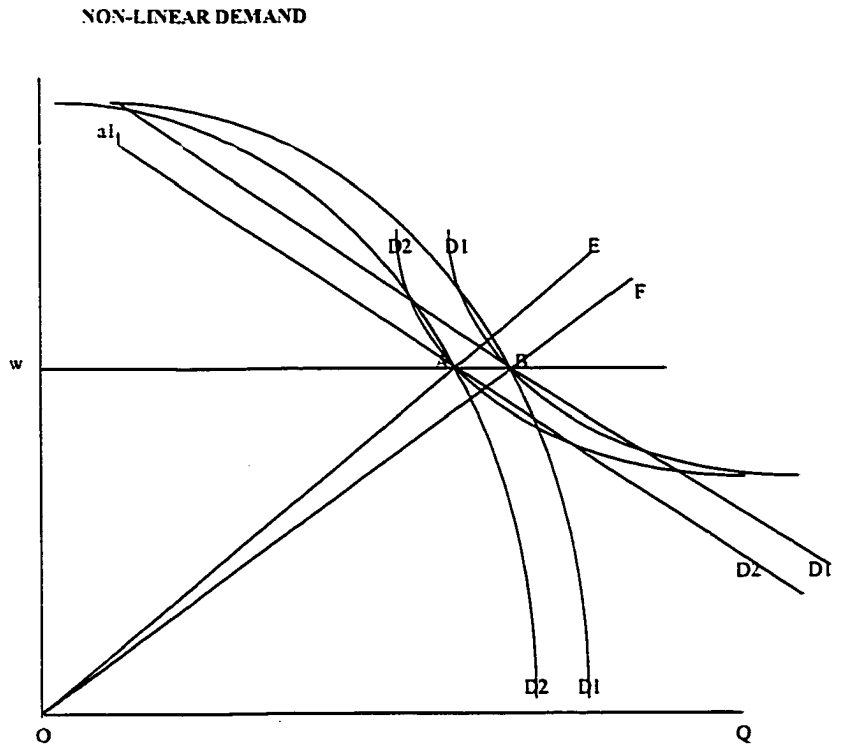

Figure 1.5:

change in w^* the left hand side of this expression would be larger than the right hand side after liberalization, since the right hand side is a decreasing function of $|\varepsilon_{nw}|$. A sufficient reduction in the wage w^* would be guaranteed to reestablish equality if $|\varepsilon_{nw}|$ is a rising function of wages since it would cause the right hand side to rise.

We can readily see from the definition of the elasticity of labor demand that a sufficient condition for this to be true is that the slope $\left|\frac{dQ}{dw}\right|$ rises as $\frac{w}{Q}$ rises, along the demand curve. Clearly this is satisfied by demand curves which are concave to the origin in the region of the wage adjustment. More generally the condition that $|\varepsilon_{nw}|$ is a rising function of wages will be satisfied if demand curves are not too convex to the origin in the region of the wage adjustment. This heuristic examination suggests that the result derived above of liberalization-induced wage decline and its attendant set of consequences is likely to continue to hold true for a range of non-linear demand curves.

1.2.8. General Equilibrium

It is shown below that there exist circumstances in which even when allowance is made for workers and employers to consume the goods of which the prices are

falling due to liberalization, profits rise in real terms, and wages fall in real terms. Moreover, there exist circumstances in which the utility of individual employed workers, and the ability of worker collectives to realize their objectives, falls while the utility of employers rises. Thus this main result of the paper is robust to consideration of "real" and not only nominal outcomes.

A model will be considered in which workers and firms do not take into account their effect on the general price level in their wage-bargaining and output setting decisions. As a result the model developed in earlier sections will be still applicable to determining the effects of liberalization on the nominal wage and price levels. In this section we will however evaluate the effect of liberalization induced changes in both nominal wages and prices on real wages and profits, workers' utility, worker collective objectives, and employers' utility. For simplicity we consider only the case of integration, as the analysis would apply similarly to the case of deregulation.

We will construct a model in which there exists a continuum of oligopolistic industries. In each, the number of firms is possibly small. Thus firms have a significant effect on the price level in their own industries but not on the general price level of either workers' or employers' consumption baskets. However the general price level is affected by integration as integration influences price determination

in each of the industries which make up the continuum.

We assume for simplicity that all industries have identical structures (demand curves and number of firms), although this is not requried for the results below to be derived. Assumptions regarding demand (elaborated below) are made such that the demand for each good is dependent only on its relative price vis-a-vis a numeraire good and independent of prices of other goods. It is assumed that w_0 is fixed, (perhaps because the number of potential workers available at a 'conventional' wage is large compared to the number ever employed. For simplicity, we also specialize to the case where all firms in the industries belonging to the continuum (jointly termed "the industrial sector") in all integrating regions possess organized workers who have complete wage-setting power (i.e. $\lambda = 1$) and where the objective that workers pursue is rent maximization (i.e. $\beta = 1$). We assume that workers supply one unit of labor inelastically, and receive only wage income, either at level w_0, if they work outside of the industrial sector, or w if they work within it.

In the specified circumstances, the partial equilibrium analysis above implies that the real wage in each industry measured in terms of the good produced in that industry (the 'own-good real wage') is:

$$\frac{w(k)}{p(k)} = \frac{a+fkw_0}{a+fkw(k)} = \left[\frac{a}{a+w_0fk} + \frac{fk}{(fk+1)}\right]^{-1}$$

(77)

from which it follows that $\frac{d(\frac{w}{p})}{dk} < 0$ iff $w_0 < \frac{a}{(fk)^2}$. (78)

Also, it can be derived from expression (77) that

$$\frac{w(2)}{p(2)} / \frac{w(1)}{p(1)} < 1 \text{ iff } w_0 < \frac{a}{2f^2} \quad (79)$$

It is easily seen that if (79) is satisfied then (78) is satisfied at $k = 1$ although it need not be satisfied at $k = 2$.

The condition (78) for a falling own-good-real-wage is automatically satisfied at the onset of integration, if each industry is a monopoly, since $w_0 < a$ is a necessary condition for profits to be non-negative. More generally, this real-wage falls with integration if the competitive wage (or outside option) is sufficiently low, and if the number of firms in each industry is sufficiently small. Wages fall more rapidly than prices in these circumstances. Since the wage and price declines are identical in each industry, it also follows that when (78) and (79) are satisfied, $\frac{d(\frac{w}{p})}{dk} < 0$, and $\frac{w(2)}{P(2)} / \frac{w(1)}{P(1)} < 1$, where P is any linear price index with fixed weights incorporating the goods produced by the continuum of oligopolistic industries (as well as possibly other goods with fixed prices, if a sufficiently small weight is attached to these). There thus exist sufficient conditions under which real wages, interpreted in terms of an arbitrary basket of goods with fixed weights,

fall. Further, since prices fall monotonically as integration proceeds, and since we have shown earlier that it is possible for profits to rise in the early stages of integration, as long as β and f are sufficiently low (which are conditions consistent with the satisfaction of (78) and (79)), it is possible for "real profits" to rise with integration at the same time that "real wages" fall.

Let us consider the impact of liberalization on living standards more rigorously. We consider as a starting point a circumstance in which all workers and employers have quasi-linear utility functions as follows:

$$u_1(x_1, m) = z_1 x_1 - z_2 x_1^2 + m \qquad (80)$$

where there is only one oligopolistic industry, the consumption of the produce of which by a representative consumer is represented by x_1, and m is a numeraire good. Workers earn only wage income and employers earn only profit income. Assume that all consumers have sufficient endowments of the numeraire good m such that there are no income effects. In these circumstances, in the case of industrial workers, $x_1^* = x_1^*(p_1(k))$ and $m^* = m^*(w(k))$,where (x_1^*, m^*) is the consumer's optimal bundle of goods and k as usual represents the level of integration. As is well known, this utility function is consistent with the linear demand curve earlier assumed. It is also evident that $du_1/dw > 0$ and $du_1/dp_1 < 0$.

Define a representative industrial worker's indirect utility function to be

$$v(k) = u(m^*(w(k)), x_{1^*}(p_1(k))) \qquad (81)$$

Let v_i refer to the indirect utility function associated with u_i. Then,

Lemma 1.2. *If $z_1 < z_2$ then $v_1(2) < v_1(1)$ always.*

Proof:

$$v_1(2) - v_1(1) = [z_1 x_1^*(p_1(2)) - z_2(x_1^*(p_1(2)))^2 + m^*(w(2))] -$$

$$[z_1 x_1^*(p_1(1)) - z_2(x_1^*(p_1(1)))^2 + m^*(w(1))] \qquad (82)$$

Now, substituting the consumer's budget constraint in:

$$m(k) = w(k) - p_1(k)x_1(p_1(k)),$$

and the consumer's optimization condition $x_1^* = \frac{(z_1 - p_1)}{2z_2}$,

we can derive that $v_1(2) - v_1(1) < 0$ iff

$$\left(\frac{p_1(2)^2 - p_1(1)^2}{4z_2}\right) + \left(\frac{p_1(1) - p_1(2)}{2z_2}\right) z_1 + (w(2) - w(1)) < 0 \qquad (83)$$

Since $p_1(2) - p_1(1) < 0$ and $w(2) - w(1) < 0$

therefore only the second term is positive.

A sufficient condition for the lemma to be true is therefore

$$\left(\frac{p_1(1) - p_1(2)}{2z_2}\right) z_1 < (w(1) - w(2)) \qquad (84)$$

Under the specified parameters, from the partial equilibrium analysis, $w(k) = \frac{(w_0 fk+a)}{(fk+1)}$ and $p(k) = \frac{a+fkw(k)}{(1+fk)}$. Substituting these expressions in the above sufficient condition, it is possible to show that $v_1(2) - v_1(1) < 0$ iff $\frac{z_1}{2z_2} < \tau(f)$ where

$\tau(f) = \frac{(f+1)(2f+1)}{f(4f+3)}$

It is easy to show that $\frac{d\tau}{df} < 0$. Moreover $\tau(1) = 6/7$ and $\lim_{f\to\infty} \tau(f) = 1/2$.

Therefore if $z_1 < z_2$ then, regardless of the number of firms, $v(2) - v(1) < 0$.

QED

In other words, under a fairly general assumption regarding the structure of preferences, industrial workers' utility falls with integration. The assumption in effect requires that utility be diminishing at a sufficient rate with respect to quantity consumed of the good the relative price of which is falling, in order that the benefit from the price reduction is limited. If profits are also rising (for which independent sufficient conditions were earlier identified) then an employer's utility rises, since she benefits from both rising income and falling prices.

Now, let us broaden the scenario to include n distinct industries.

Define

$$u_n(x_1, ...x_n, m) = \delta(z_1 x_1 - z_2 x_1^2) + ...\delta(z_1 x_n - z_2 x_n^2) + m \qquad (85)$$

where each x_i represents a distinct commodity, which trades at price p_i. Note

that this utility function implies identical linear demand functions for each commodity, 1 through n. The relative weight in the determination of utility on each of these n distinct commodities in relation to the numeraire good is given by δ.

Theorem 1.3. *For any n, and for an arbitrary number of firms, there exist preferences such that* $v_n(2) < v_n(1)$.

Proof:

$v_n(2) - v_n(1) = \delta(\sum_i((z_1x_i(p_2) - z_1x_i(p_1) - z_2x_i^2(p_2) + z_2x_i^2(p_1)) + m(1) - m(2)$

However, consumer optimization implies $x_i = \left(\frac{z_1\delta - p_i}{2z_2\delta}\right)$. As well the worker's budget constraint implies $m = w - \sum_i p_i x_i$. Substitution of these relations and considerable simplification allows us to deduce that:

$$v_n(2) - v_n(1) = \frac{n}{\delta}\left(\frac{p_1(2)^2 - p_1(1)^2}{4z_2}\right) + n\left(\frac{p_1(1) - p_1(2)}{2z_2}\right)z_1 + (w(2) - w(1)) < 0 \qquad (86)$$

It may be noted that this reduces to (83) when $n = \delta = 1$.

As before, a sufficient condition for the result is for the second term to be less in magnitude than the third. It can be shown, analogously to the proof in the lemma above that this will be achieved if $\frac{nz_1}{2z_2} < \tau(f)$ where $\tau(f)$ is as defined in the lemma. Therefore, utility will always fall if z_1 is sufficiently small with

respect to z_2. QED

Finally, if we now define

$$u_\infty = [\int_0^1 (z_1 x(q) - z_2 x^2(q)) dq] + m \tag{87}$$

where each $x(q)$ represents a commodity along a continuous commodity indexation space $[0, 1]$ it follows from previous theorem that:

Theorem 1.4. *: $v_\infty(2) < v_\infty(1)$ always.*

Proof: Let the weight on individual goods vary in exactly inverse proportion to their number (specifically $\delta = 1/n$). Now note that as $n \to \infty$ the first term in (86), which is negative, dominates the other two terms. Therefore the inequality is always satisfied in this limit. However, by the definition of an integral this is exactly the condition required for $v_\infty(2) < v_\infty(1)$. QED

We have thus proven that under the given assumptions,

Remark 15. *In the case of a continuum of oligopolistic industries, even when the impact of integration-induced price decline is taken into account, an individual industrial worker's utility always falls. If the independent conditions for profits to rise are satisfied, then an individual employer's utility simultaneously also rises.*

A final category is that of non-industrial workers, employed at the 'outside' wage w_0. The utility of these workers necessarily rises, since their income is constant and the price level is falling. The impact of integration on an aggregate measure of social welfare will depend on the relative proportions of employers, industrial workers and non-industrial workers initially, its impact on the utility of those who remain in each of these categories, and on the level of employment in the industrial sector.The impact of integration on social welfare is therefore in principle ambiguous.

1.3. Conclusion and Application to Empirical Issues:

This essay has developed a rigorous model of the effects of product market competition on intra-firm bargaining over rents and thereby on the distribution of income between wages and profits. The model accommodates the possibilities of market integration between asymmetrically organized economies and of deregulation in a single economy, as well as of workers being organized on different scales from the enterprise to the integrated market as a whole. The model shows the existence of an inverse-U-shaped relation between the extent of market liberalization and the level of profit. It also shows that product market competition affects wage levels potentially through four distinct and cumulative levels of causation, including

(i.e. non-Cournot competition structures) between firms and alternative (non-linear) demand conditions.

Can these theoretical results illuminate current debates on the consequences of trade?

The heated debate on the relation between trade and wages in developed countries, which has sought explanations as to the causes of wage stagnation of unskilled workers in the last two decades, has focused on the relative prices of goods and on measures of the extent of trade. The first focus arises from the fact that within the perfectly competitive setting of conventional international trade models, a necessary condition for real wages of workers in import-competing industries to fall is that the relative price of the goods they produce should fall. However empirical evidence of this condition is limited or lacking [see for example Bhagwati and Kosters (1994), Bhagwati (1998), Slaughter (1998), Krugman and Lawrence (1993)]. Thus for example, Bhagwati and Kosters (1994) conclude: "The contention that the factor prices changed as they did in the 1980s because of trade – when in fact goods prices changed in a way opposite to what would happen if trade were the explanatory factor – is illogical and hence unpersuasive". The bargaining approach, which does not depend on a particular movement of relative goods' prices, suggests otherwise however. Increasing product market

the presence of a 'race to the bottom' among workers linked to the presence of strategic complementarity in the wage-setting game between workers at different sites. The fundamental cause explored here of the change in the shares of surplus commanded by labor and capital is that liberalization induces shifts to the labor demand constraint which cause wage increases to have a heightened employment cost. These shifts are reflected in a change in the slope of the 'objective possibility frontier'faced by the firm and workers in the course of the bargaining process.

A number of "robustness" results have been proven. A central result of the paper (namely the possibility of rising profits and falling wages as a consequence of shifting shares of surplus induced by liberalization) is shown to stand in a general equilibrium setting with a continuum of oligopolistic industries. In this setting, in which the impact of increased competition on the general price level and therefore on the *real* wage is considered, the central result continues to hold. Further, it has been shown that when the "right to manage" assumption (that workers and employers bargain only over the level of the wage and not also over the level of employment) is relaxed the result continues to hold, as long as the 'threat point' of this efficient bargaining game is endogeneous in the sense that workers can threaten to unilaterally set wages alone in the event of a breakdown of negotiations. The result is also robust to allowing different degrees of collusion

competition induced by trade can in the model described above lead to wage reduction irrespective of whether prices of the good produced by the industry in question are falling more or less than those of other goods. [14] Further, unlike in the more conventional Stolper-Samuelson mechanism it is not *necessary* for wages for a type of labor to fall relatively more than the prices of the goods produced intensively with that type of labor, in order for wages to fall at all. Thus the observed absence of this phenomenon [see e.g. Deardorff and Hakura (1994)] is not a sufficient test of whether trade is influencing real wages.

The second focus, on the relation between wages and measures of the extent of trade, has also led to ambiguous and controversial conclusions. The bargaining approach suggests an inadequacy in the methodology of these studies as well however. In the model presented above, it is the *threat* of trade rather than trade itself which produces the observed outcomes. As a result it is unnecessary to observe *any* actual trade taking place (let alone an increase) in order for a reduction in trade barriers to have a significant effect on wages. For both of

[14] It may be readily demonstrated in the framework developed above that the effect of integration on relative prices of goods depends on the specific structure of the industries and their bargaining environments, including the number of firms and the degree of 'collusion' prevalent in each industry, the level of demand, the preferences of worker collectives, their relative bargaining power, and the magnitude of the appropriate 'outside wage', all of which might vary from industry to industry.

to increase in magnitude. Controversial evidence that labor demand elasticities for production workers have risen in recent years in the United States is provided by Slaughter (1998) and Richardson and Khripounova (1996). The former argues that between 1961 and 1991 demand for US production labor became more elastic in aggregate and for a majority of industries (considered at the two-digit level). The latter similarly contends that there was a rise in the elasticity of demand for US production workers between 1979 and 1991.[16] These results are suggestive, but do not confirm that elasticities of demand have been increasing at the firm level.

Comparatively little attention has been paid to the empirical consequences of trade liberalization for income inequality in developing countries, but that research which has been done suggests a more ambiguous picture than suggested by conventional theory. Under appropriate conditions, the Stolper-Samuelson theorem implies that freer trade raises the returns to the relatively more abundant factor of production in a country, and lowers those to the relatively less abundant factor of production. Therefore, the theorem suggests that in developing countries workers would favor freer trade and holders of capital would oppose it. Under alternative assumptions, other results are also possible, although the Stolper-

[16] However, trade related measures appear to incompletely explain this rise.

these reasons, current approaches to examining the impact of trade on wages are inadequate.

Is there evidence that the impact of trade on wages in developed countries operates through the channel of influencing rent sharing? Abowd and Lemieux (1991) econometrically analyze a large number of collective bargaining agreements alongside industry import and export data in the United States and Canada and find that "import competition has large employment effects in unionized establishments - larger than the effects one would predict by mechanically assuming that all imports replace domestic production dollar for dollar... For the United States, increased import competition is associated with relatively large decreases in real wage rates, but increased export activity is associated with real wage changes of modest magnitude". This is exactly the result that might be expected if owners of capital gain substantially in their intra-firm bargaining position as a result of the labor discipline effect induced by increased competition in existing markets.[15]

A necessary condition for the bargaining channel as described above to be an influential factor in wage stagnation is for elasticities of demand at the firm level

[15]This view is contrary to that presented by Lawrence and Lawrence (1985). Their so-called "end-game" interpretation describes the possibility of unions in a declining industry, who see little future for it, seeking to maximize their extraction of surplus in the short run, and therefore raising wages.

Samuelson theorem has provided the most influential way in which to reason about the consequences of trade in developing countries.[17]

Nevertheless, this approach appears imperfectly to account for observed phenomena in developing countries. Workers in developing countries often oppose freer trade, and owners of capital in developing countries often favor it. The evidence of protest by workers in developing countries against trade liberalization is extensive [see for example Haggard and Kaufman (1992), Haggard and Webb (1994), Nelson (1990), Rosen and McFadyen (1996)]. It is less well-documented, although fairly clear from individual examples, that considerable support from owners of capital for trade liberalization has arisen in these countries[18].

[17] For example, two-sector specific-factor models can produce alternative results. When labor is specific and capital mobile, such models suggest an ambiguous effect of increases in import competition on returns to capital, increased returns to the labor specific to the non-import-competing sector and decreased returns to the labor specific to the import-competing sector. When labor is mobile and capital specific, such models suggest an ambiguous effect on returns to labor, increased returns to the capital specific to the non-import-competing sector, and decreased returns to the capital specific to the import-competing sector. Alternatively, "if countries are sufficiently similar and there are important increasing returns - a state giving rise to the prevalence of intra-industry trade - scarce as well as abundant factors gain from trade" [Helpman and Krugman, 1991]. Further, under certain conditions in the presence of increasing returns, the converse of the Stolper-Samuelson theorem can hold, namely that "an increase in the relative price of a good will reduce the real reward of the factor used relatively intensively in its production and it will increase the real reward of the other factor of production" [Helpman, 1984; Panagariya, 1980]. Finally, if there is "complete specialization" in the production of certain goods, then a rise in the relative price of a good can raise the returns to both factors [e.g. Bhagwati, 1998].

[18] One example is that of India in the early years (1991-1994) of the current reform process.

Recent careful empirical research on the consequences of trade liberalization in less developed countries finds that wage reduction effects are large, with wages falling most in sectors where rents had been highest prior to trade liberalization. Revenga (1997) finds for the case of Mexico that "the effects of trade liberalization on firm wages appear to have been quite substantial: for an average tariff reduction of 20 percentage points, the implied wage response was on the order of 5%-6%." As well, reforms led to limited reductions in employment, even in previously protected sectors. A similar result is found for Morocco by Currie and Harrison (1997). These small employment effects of trade liberalization are consistent with the presence of substantial imperfect competition.

Examining the case of Mexico, Harrison and Hanson (1999) notes that wage inequality in Mexico (between skilled and unskilled workers) has been increasing, "which is puzzling in a Heckscher-Ohlin context if Mexico has a comparative advantage in producing low skill-intensive goods". They also provide evidence suggesting that tariffs fell most in sectors having a higher share of unskilled workers, which is consistent with the wage reductions having resulted from product market competition induced worsening of workers' bargaining position. Indeed, Hanson and Harrison (1995) write of Mexico that "the rising wage gap is associated with changes internal to industries and even internal to plants that cannot be explained

by Stolper-Samuelson effects". The presence of significant intra-firm bargaining effects combined with economic or political factors which enable skilled workers better to maintain their bargaining positions than unskilled workers would help to explain the observed phenomenon.

The "bargaining" approach developed above offers a tool with which to reason about the consequences of trade in ways which differ from conventional approaches and arguably provide some insight in relation to observed phenomena. On a more speculative level, the bargaining approach may offer insight into a range of related matters, such as why regional trading arrangements may be favored to global ones by owners of capital, why firms within an industry may welcome the reduction of barriers to entry, and why profits may rise and then fall in the period after barriers to entry are reduced. How important the 'bargaining channel' outlined here is in determining the effects of recent institutional changes on the distribution of income is a subject for further empirical investigation, which should for example consider more explicitly the impact of liberalization on *profits* as well as on wages, as well as examine *directly* the relationship between measures of protection and industry and firm level measures of the distribution of income. Empirical research into the 'bargaining channel' will require approaches which are formulated so as to take account of it.

1.4. Appendix

1.4.1. A simple example:

A simple special case is considered here, in order to illuminate the logic of wage decline and profit rise.

Consider an economy which possesses only a single producer of a particular good. The firm is assumed to behave as a profit-maximizing non-price-discriminating monopolist. Assume that it faces a downward sloping linear demand curve, and that it produces the good through a single factor of production, labor, according to a linear production technology such that one additional unit of labor produces one additional unit of the good. Assume that this labor is supplied only by a collective of workers at a wage which they determine, w^*, prior to the firm's production decision. Once the wage rate is determined, labor is supplied elastically at this rate as demanded by the firm. Workers pursue the objective of "rent-maximization", according to which total rent (the difference between the wage set by the collective, w^* and the fixed value of the outside option of workers, w_0 , multiplied by the number of workers, n , employed by the firm at wage w^*, or $(w^* - w_0)n$ is maximized. The share of the good produced by the

industry in the consumption baskets of both workers and employers is assumed to be "small" and so neither need consider the impact of the price of the good they produce on the cost of their consumption. Assume also that the firm ceases to exist after one period of production.

What happens to wages and profits when such an economy merges with another identical economy? What happens to wages is described by the accompanying Figure, which is drawn to scale for the case of Cournot competition between firms.

The initial (pre-integration) market demand curve is D1. The marginal revenue curve corresponding to this demand curve is MR1, which intersects the quantity axis half way between the origin and the quantity intercept of the market demand curve. What will be the wage set by workers? The worker collective recognizes that the firm will produce the quantity determined by the intersection of the marginal cost curve which it determines (the horizontal line at the level of the wage it sets) and the marginal revenue curve. The labor demand curve faced by the workers is therefore the marginal revenue curve. Note now that the workers' rent-maximization problem is *exactly* analogous to the monopolist's profit (net revenue) maximization problem except that units of labor are substituted for units

THE LOGIC OF WAGE DECLINE

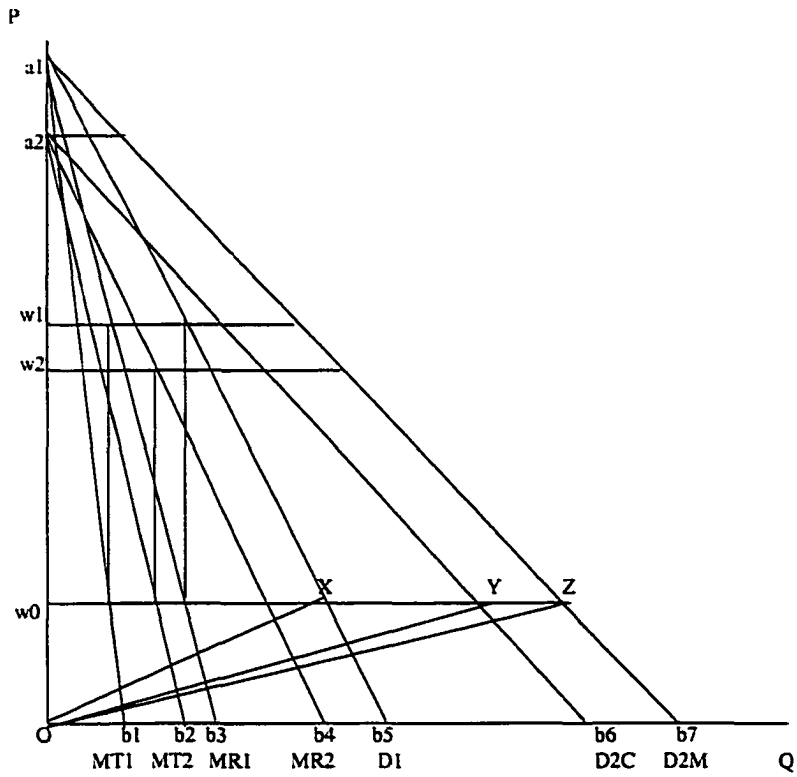

Figure 1.6:

of goods and the reservation wage is substituted for the marginal cost. Therefore the workers' optimal wage is determined by the intersection of the marginal wage bill curve MT1 (which stands in the same relation to the labor demand curve MR1 as MR1 stands to D1), and the marginal opportunity cost curve given by the reservation wage, w_0. The actual level of the wage, w_1, is determined by identifying the level of wage on the labor demand curve MR1 which corresponds to the same quantity of labor as equates the marginal wage bill and the marginal opportunity cost of labor.

Integration causes the market demand curve to shift from D1 to D2M. Since two identical regions integrate, the quantity demanded at any given price is exactly twice as much as before. It follows that the marginal revenue curve corresponding to the post-integration market demand curve is the pre-integration demand curve D1.

Note however that there are now two firms in the integrated market. Call the firm whose behavior is being considered firm 1. Let us consider the equilibrium "residual demand curve" of firm 1 defined as the relation between prices that would be faced by firm 1 and quantities of its production, given the assumption that the quantity of production of firm 2 is fixed at its "equilibrium" level. The residual demand curve therefore maps the price consequences of possible equilibrium and

"out of equilibrium" quantities of production by firm 1, given that firm 2 produces the quantity that prevails in equilibrium. It can immediately be seen that if firm 2 produces even one unit of output in equilibrium than the price intercept of the residual demand curve must be lower than that of the market demand curve as market price would already have been lowered from its maximum possible level by the production of firm 2. Additionally, the slope of the residual demand curve is identical to that of the market demand curve. Indeed, the residual demand curve *is* the market demand curve translated to the left by the amount of firm 2's production and appropriately truncated at the zero level of production. D2C depicts the residual demand curve of firm 1.

We may now construct the residual marginal revenue curve, MR2, from the residual demand curve D2C. As before we can note that the residual marginal revenue curve, MR2, is the residual labor demand curve faced by the workers at firm 1, although it is derived from the equilibrium quantity of output of firm 2 (which is in turn dependent on the equilibrium wage selected by workers at firm 2). Corresponding to this residual labor demand curve is a residual marginal wage bill curve, MT2, and the marginal opportunity cost of labor curve is given as before by w_0. Together these determine, as before, the wage selected by the workers, namely $w2$. It may be noted that $w2 < w1$. Therefore integration

causes wages to fall. It may be noted from the diagram that this result is robust to allowing some endogeneity to the integration process of the competitive wage, w_0. A fall in the competitive wage as a result of integration will only increase the extent of the wage decline whereas a rise in the competitive wage will still permit wages to fall if it is not excessively large.

What is the underlying reason for the occurrence of the wage fall? Compare points Z and Y, on the post-integration market demand curve and the post-integration residual demand curve respectively. Although the slope of the demand curve, dP/dQ , and therefore its reciprocal, dQ/dP has the same value at both of these points, the ratio of prices to quantities, P/Q varies along with the slope of the ray from the origin. It may be shown however that the value of the elasticity of product demand is identical at Z to what it is at X. This is because the composition of identical demand curves causes dQ/dP to double and P/Q to halve, keeping their multiple constant. It follows that the elasticity of product demand $\left|\frac{dQ}{dP}\frac{P}{Q}\right|$ has a value which is higher at Y than at X. Since these arguments can be repeated at any price level, it follows that at every price the elasticity of demand on the post-integration residual demand curve is lower than it was on the original demand curve. It may be observed from the diagram that this result regarding the elasticity of product demand carries over to the elasticity of labor demand.

The wage fall results from this increase in the elasticity of demand for labor, which implicitly increases the employment cost of wage increases and thereby induces workers who value both to moderate the wages they set. It may be checked from the diagram that the wage set by workers at a monopolistic firm facing the entire post-integration market demand curve D2M, which as noted has the same elasticity of demand at every price as the original market demand curve, is unchanged from the pre-integration level of w_0.

Can this wage decline cause a rise in profits despite the increased competition among firms? The second accompanying Figure shows the prices and quantities that prevail before and after integration ((p1, q1) and (p2,q2) respectively). These are determined by the intersection of the marginal revenue curves (MR1 before integration and MR2 after integration) and the wages set by workers (w1 before integration and w2 after integration). It follows that pre-integration profits are given by the sum (A+B) and post-integration profits are given by (B+C+D+E). It follows that profits rise if (C+D+E) >A. This is indeed the case in this diagram, which is drawn to scale for the case of Cournot competition among firms. Profits therefore rise as a result of the "wage discipline" effect.

THE LOGIC OF PROFIT RISE

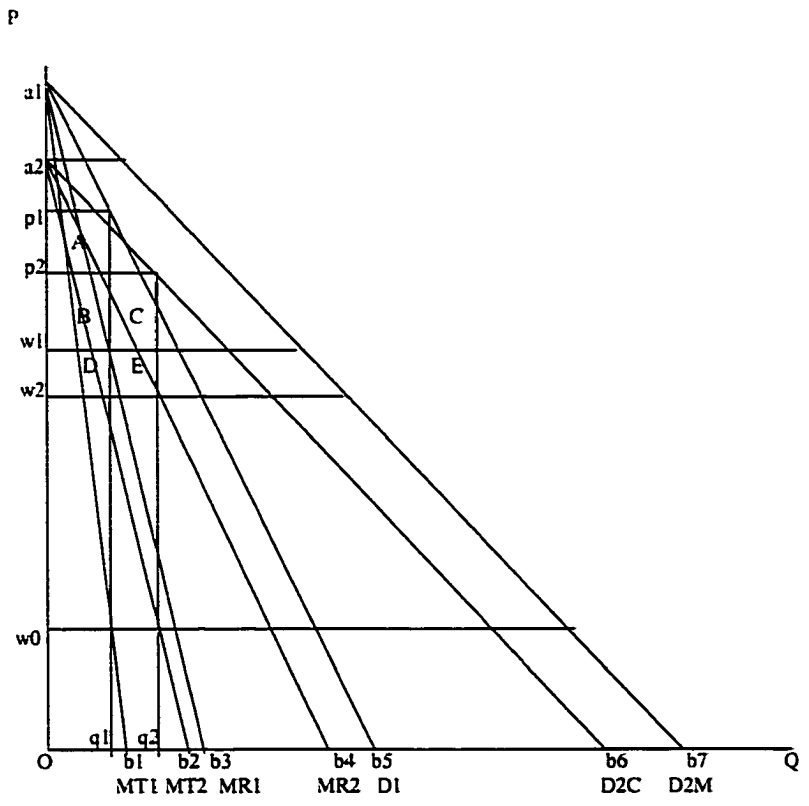

Figure 1.7:

1.4.2. General Principles:

Under what conditions can we expect liberalization to cause a reduction in wages? Under what conditions is this reduction sufficient actually to raise profits?

Consider a generalization of the example examined above, in which workers at a firm have complete wage setting power and the firm chooses to employ workers at the wage rate thus established. Assume that workers' objectives can be summarized by a differentiable objective function of the form $u(n, w - w_0)$ where w is the wage per worker employed in the firm, w_0 is the outside option of workers (which may be interpreted as the prevailing wage in the competitive labor market) assumed independent of w, and n is the number of workers employed in the firm, as determined by its labor demand curve $n(w)$, assumed to be differentiable. Assume that $u_n, u_w > 0$, that $u_{nn}, u_{ww} < 0$, and that $n_w < 0$, where the subscripts define derivatives. In this case the wage set by workers, w^*, is given by

$$w^* = \arg\max u(n, w - w_0) \tag{88}$$

subject to $n = n(w)$

We consider unique 'interior solutions' of this problem.

The first order condition characterizing such solutions is:

$$\frac{\partial u}{\partial n}\frac{dn}{dw} + \frac{\partial u}{\partial w} = 0 \tag{89}$$

This may be rewritten as:

$$\frac{\left(\frac{\partial u/\partial n}{\partial u/\partial w}\right)}{\frac{w}{n}} = -1/\varepsilon_{nw} \qquad (90)$$

where ε_{nw} is the elasticity of employment with respect to wage. Thus the optimal wage is dependent on the elasticity of labor demand. This expression may be further re-written as:

$$\frac{\partial u/\partial n}{\partial u/\partial w} = \frac{-1}{dn/dw} \qquad (91)$$

This statement may be interpreted as stating that workers set the wage at a point such that the marginal rate of substitution between employment and wages is equal to the implicit relative price ratio between employment and wages, where 1 is the cost of giving up a unit of wages and dn/dw is the amount of employment which can be "purchased" as a result, as defined by the firm's labor demand curve.

We see by analogy with the elementary consumer choice problem therefore that the case of rising wages as a consequence of increasing "implicit employment costs of wage increases" (in the form of rising elasticities of demand) cannot be wholly ruled out, as there exists the possibility of wages being a "giffen good" in the workers' objective function. However it is reasonable to expect that for "normal" cases, wages will fall as a result of liberalization induced increased implicit employment costs of wage increases.

For example consider the special case where $u = n^{\beta}(w - w_0)$. In this case (90)

may be re-written as:

$$w^* = \frac{w_0}{1+\frac{1}{\beta\varepsilon_{nw}}} = \frac{w_0}{1-\frac{1}{\beta|\varepsilon_{nw}|}} \qquad (92)$$

It is evident that as long as ε_{nw} is an increasing function of the wage in the region of wage adjustment, any process which increases the magnitude of ε_{nw} at every wage (as is true in the cases we study in this paper) will lead to a decrease in the equilibrium wage.

Under what general conditions might we expect the wage reduction induced by liberalization to be sufficient to cause profits actually to rise, despite increased inter-firm competition?

Let the "degree" of liberalization be defined by an increasing index L. Then we can write the equilibrium profit level of an individual firm, measured at other firms' "equilibrium" outputs (dependent on the degree of liberalization) as:

$$\pi^*(L, q^*(L)) = p(L, q^*(L))q^*(L) - c(q^*(L), L) \qquad (93)$$

where q^* refers to the profit maximizing quantity of output selected by the firm at a given level of liberalization. We assume $p_L, p_q < 0$ and $c_q > 0, c_L < 0$. Liberalization influences the level of prices both because it influences the output of other firms (captured implicitly in (93) through the direct effect of L) and because it influences the profit maximizing output of the firm itself. Similarly liberalization influences the level of costs both because it influences the level of

output of the firm and because it influences the cost function (for instance through the wage reduction mechanism described above).

Thus $p(L, q)$ is the "residual demand curve" (defined earlier) faced by an individual firm at each level of liberalization, and $c(q, L)$ describes the costs faced by a firm, which may vary according to the extent of liberalization for any reason. Totally differentiating (93), simplifying, and applying the first order condition which must be true at any one level of liberalization, $d\pi^*(q^*, L)/dq = 0$, we can write that:

$$\frac{d\pi^*(q,L)}{dL} = \frac{\partial p}{\partial L} q^* - \frac{\partial c}{\partial L} \qquad (94)$$

This condition is straightforward to interpret. It states that the liberalization process must lower the "residual" marginal revenue curve of a firm (as a result of its effect on the output of all other firms) less than it lowers the marginal cost curve of the firm if profits are to rise as a result. This is an intuitively straightforward condition for profits to rise.

2. CHAPTER TWO:

THE COLLUSION-PROFIT PARADOX AND THE POLITICAL ECONOMY OF INDUSTRIAL REGULATION

Why do some countries have aggressive anti-trust and other pro-competitive policies and others not? What accounts for when pro-competitive policies come in to existence, are enforced and sustained and when they are not? Why do firms which engage in collusion surprisingly appear often to have lower profits then those which do not?

This paper argues that these questions can better be understood than they have been through the lens of a (largely overlooked) 'view from labor relations'. Conventional approaches to the political economy of competition policies have stressed the impact of such policies on firms' pricing and output decisions, and thereby on their revenues. Although it has been widely acknowledged that workers may share in the 'rents' realized through impeded competition (whether due to the absence of public regulation or due to its presence[19], the process of bargaining over rents has not been seen as itself a fundamental determinant of firms' interests and position in relation to competition policies, but rather as derivative upon them[20]. In contrast, this study analyzes the effect of varying levels of competition on firms' profits in the presence of bargaining over rents between workers and employers. The paper distinguishes between increased competition

[19] On the latter, see for example Stigler (1975).

[20] For instances of the latter concern see for example Card (1989), Rose (1987), Freeman and Medoff (1984], Heywood (1986), Belman (1988)

due to increased entry and that due to decreased collusion. In particular, whereas increased entry is typically (although not always) harmful for profits (as shown in the first chapter), reduced collusion can readily be profit increasing with whether it is so determined by the form which bargaining takes and the nature of the objectives pursued by workers. Increased competition due to decreased collusion is profit increasing under much weaker conditions than is that due to increased entry. However, where collusion is not profitable firms may be unable to credibly commit to a regime of low collusion. Due to a 'time inconsistency' problem, workers will correctly assume that firms will ultimately collude, and therefore set higher wages than otherwise. Firms may hence be condemned to high levels of collusion and low levels of profits (a correlation observed empirically). Although this credibility dilemma may arguably be partially or wholly resolved through the development of appropriate credible threats or reputations in the course of long run interactions among firms, it can also be resolved through institutional means – the development of an external regulatory apparatus. It is shown that 'inclusive' regimes of labor relations in which bargaining is both 'inclusive in scope' (i.e. 'efficient bargaining jointly over employment and wages) and 'inclusive in concern' (i.e. it extends to the interests of 'outsiders' as well as 'insiders') are more likely to be ones where the interests of 'worker collectives' and of firms

are more closely aligned and which are thus likely to tolerate and sustain higher levels of collusion. This finding is broadly in keeping with a sometimes noted 'stylized fact': economies with stronger and more broad-based forms of worker organization exhibit higher degrees of industrial concentration[21].

2.1. The Model:

Chapter one examined the implications for the profits of firms engaged in bargaining with workers, of increased market entry in the setting of Cournot competition. It showed that profits could rise in the very early stages of entry as the 'wage discipline' effect of increased competition could potentially be stronger than its 'revenue reduction' effect. However, increased entry necessarily ultimately reduced profits beneath their initial level. This analysis provides an incomplete picture of the effect of competition on profits, however, as the degree of competition faced by firms is properly described not by the number of firms alone, but also by the nature of the relationship prevailing between firms, whatever their number. Chapter one implicitly took the nature of this relationship to be fixed, namely as Cournot competition. This chapter, however, considers the possibility that firms 'collude' with one another, and examines the consequences of such collusion for

[21] The causal direction of this relationship (possibly bidirectional) is of course open to debate.

the profit level. The extent of the 'collusion' (or conversely of the competition) among firms is taken to be summarized by a 'conjectural variation' parameter, c. The conjectural variation parameter reflects the change in market output that a given firm expects to accompany a one unit change in its own output. It captures the idea that firms expect to be 'punished more 'and 'followed more' when deviating from an established level of output in a more collusive environment. This parameter is 'subjective' (as the word 'conjectural' suggests) in that it reflects the best assessment of each firm of the response on the part of overall market output that can be expected to accompany its own action.

Specifically, it is assumed that when a firm increases its output by one unit, it expects that the rest of the industry will correspondingly increase its output by $(c-1)$ units, where c is an arbitrary constant.[22] The well-known cases of "perfectly competitive behavior", Cournot behavior, and "cartel behavior" are all special cases of this model, in which c equals $0, 1$ and F respectively, where F is the total number of firms in the industry (see for example Lindbeck and Snower

[22] Following convention [see Brander and Spencer (1985)], c is assumed a constant, irrespective of the number of units of increase, although it may be sufficient for most purposes to interpret it to be locally constant in the vicinity of an equilibrium output level. Indeed, Boyer and Moreaux (1983) show that such an interpretation enables conjectural variations otherwise considered to be 'inconsistent' (see the following footnote) to be "seen to be locally consistent with proper linear conjectural variation functions".

(1992)). Formally we postulate the (common and commonly known) conjecture function as:

$$d(Q^e)/dq_i = (c-1) \tag{95}$$

where Q^e is the expected total industry output and q_i is the output of any one firm.[23]

[23]The conjectural variation (or 'generalized Cournot') approach to modeling collusion (traced to Bowley (1924) and subsequently to Frisch (1933)) has been occasionally controversial. In particular, it has been accused of inconsistency, or at least incompleteness, for seeking to capture in a 'static' framework a phenomenon with a dynamic 'foundation'. Friedman (1977) for instance writes of the model that it "is not explicitly dynamic; however, unlike Cournot, no sense is to be made of it if it is not regarded as dynamic" (See also Vives (1999), p.186). This does not however seem to the author to be a decisive objection, insofar as conjectural variations are claimed precisely to provide a summary 'behavioral' rather than 'analytic' measure of inter-firm relations. As well, conjectural variations can be given a more explicit foundation as the outcome of a dynamic game (see Kalai and Stanford (1983) for a proof that various conjectural variations can be maintained as 'credible' equilibria of a repeated game). It has also been recognized even by critics that the framework offers a credible way of parameterizing the extent of collusion among firms (See for example Vives (1999), Dixit (1986), Brander and Spencer (1985)]. A second objection is that the conjectures it proposes need not be 'consistent' in the sense that the 'reaction' that a firm undertakes to other firms' actions given the posited level of conjectural variation need not be equal to that conjectured of it by other firms. This objection can be resolved by specializing to the class of 'consistent conjectures' (See Bresnahan (1981)), or more decisively by treating conjectures not literally, but as 'a proxy for the level of tacit (or explicit) collusion in the industry' [Seade (1980), Brander and Spencer (1985)]. The latter is the approach favoured by the author. In any event, the hypothesis that conjectures are consistent finds little empirical support [see Holt [1985].

2.1.1. The 'Right to Manage' case:

Consider now a model of the variety of the 'benchmark' model considered in Chapter One, in which firms are assumed to negotiate over wages with independently acting worker collectives. Employers are assumed to have a 'right to manage' so that employment is determined by employers alone in order to maximize profits at the wage level which has been previously set through bilateral bargaining. An identical model is considered here, with the exception that firms' relations with one another are assumed to be characterized by an arbitrary degree of collusion (or conjectural variation), c. As before, it is assumed that initial wage bargaining takes place according to the axioms of generalized Nash bargaining [Svejnar(1986)]. The following propositions, which mirror the results of chapter one, can then be proven.

Proposition 2.1. *An increase in collusion decreases the employment cost of wage increases at a given firm.*

Proof:

As previously, wages at each firm i are set according to the rule:

$$w_i = \arg\max N = (n_i^{\beta}(w_i - w_0))^{\lambda}((p - w_i)n_i)^{(1-\lambda)} \qquad (96)$$

subject to $n_i = n_i(w_i)$ and $p = p(\sum_{j=1}^{F} n_j(w_j)) = a - b(\sum_{j=1}^{F} n_j(w_j))$ (97)

As before, λ $(0 \leq \lambda \leq 1)$ is a measure of workers' relative bargaining power, β $(0 \leq \beta)$ is a measure of the worker collective's degree of 'employment preference', w_0 is the 'outside' wage available to workers (assumed constant) , n_i refers to output at firm i, and p is the price of the (homogeneous) good. Also, as before the first order condition of this 'wage setting problem' is:

$$n\lambda + (w - w_0)\frac{dn}{dw}(\lambda\beta + 2 - 2\lambda) = 0 \quad (98)$$

Now, it may be readily shown that each firm's optimal output level is given by the first order condition:

$$n_i = \frac{(p - w_i)}{bc} \quad (99)$$

By substituting this in to the price determination equation (97), solving for price level in terms of the vector of firms' wages, and substituting the resulting price determination equation in to the equation (99) governing output of firm i, we derive the 'residual' labor demand curve at firm i, given a vector of wages (and therefore output) at other firms:

$$n_i = \frac{ac + (\sum_{j \neq i} w_j) - w_i(c + f - 1)}{bc(c + f)} \quad (100)$$

from which it follows that

$$\frac{dn_i}{dw_i} = \frac{-(c+f-1)}{bc(c+f)} \quad \text{and} \quad \frac{dn_i}{dw_i}\frac{w_i}{n_i} = \frac{-w_i(c+f-1)}{ac+(\sum_{j\neq i} w_j)-w_i(c+f-1)} \tag{101}$$

It may be checked that $\frac{dn_i}{dw_i}\frac{w_i}{n_i} < 0$. (102)

It may also be checked that $\frac{d}{dc}\left(\frac{dn_i}{dw_i}\frac{w_i}{n_i}\right) > 0$ iff $\frac{\sum_{j\neq i} w_j}{(f-1)} < a$, which is always true as long as other firms' non-shut down condition ($w_j < a$) is met.

In other words, an increase in collusion can be expected to decrease the magnitude of the elasticity of labor demand at firm i. More pointedly, an increase in collusion decreases the employment cost of wage increases at firm i. QED.

Proposition 2.2. *The wage determination game among workers at different firms exhibits strategic complementarity and a 'strategic multiplier'.*

Proof:

Derive the reaction function at firm i, given a vector of wages elsewhere, by substituting (100) and (101) in to (98):

$$w_i = \left(w_0 + \frac{ac}{(c+f-1)(\beta+\frac{2}{\lambda}-1)}\right) + \left(\frac{\sum_{j\neq i} w_j}{(c+f-1)(\beta+\frac{2}{\lambda}-1)}\right). \tag{103}$$

It may be checked that both of the terms are positive, and that the best response wage at firm i is rising in the wages of firms elsewhere. The wage determination game thus exhibits 'strategic complementarity', as in the specific case of

Cournot competition. Further, the first (intercept) term rises as c rises, whereas the second (slope) term falls. Further if wages elsewhere are at their maximal feasible level ($w_j = a, \forall j$) then the best response of firm i is independent of the degree of collusion. Thus, analogously to the last chapter, there is a unique equilibrium wage which is symmetric, and rising in the degree of collusion among firms, c.

The equilibrium wage w^* may be derived by setting $w^* = w_i = w_j$ in (103):

$$w^* = w_0 + \left(\frac{(a - w_0)}{1 + (1 + (\frac{(f-1)}{c}))(\beta + \frac{2}{\lambda} - 2)} \right). \qquad (104)$$

Also, analogously to chapter one, and as is necessarily the case in games of strategic complementarity with unique symmetric equilibria[24], there is a 'strategic multiplier' such that an increase in the degree of collusion among firms may be interpreted as causing not only a 'first round' increase in the wages at particular firms, but through the strategic complementarity among firms' decisions, produces 'higher round' increases in the wages demanded until a new higher equilibrium wage is converged upon.QED.

In light of the above, we can check the effect of collusion on the equilibrium profit level(Π^*):

[24]"If there is a unique symmetric Nash equilbrium, strategic complementarity is necessary and sufficient for multipliers." [Cooper (1999), p. 23, Proposition Three].

Proposition 2.3. *When wages are fixed then increased collusion always raises profits. However, if collusion is above a minimal threshold ($c > f^{1/2}$) then increases in collusion lower profits, independently of the value of other parameters.*

Proof:

By the first order condition of the firm:

$$\Pi^* = (p^* - w^*)n^* = (n^*)^2 bc, \tag{105}$$

where p^*, w^* and n^* refer to the equilibrium price, wage and output levels respectively. Then, by equation (100),

$$n^* = \tfrac{(a-w^*)}{b(c+f)}, \text{ and } \Pi^* = \tfrac{(a-w^*)^2 c}{b(c+f)^2}. \tag{106}$$

It may be checked that for any fixed wage $w^* = \overline{w}$, Π^* rises in c in the relevant range. So collusion is always beneficial for firms if wages are fixed, as might be expected. What happens if wages are allowed to vary according to their determination by the intra-firm bargaining process? To check this, substitute equation (104) in to the expression for equilibrium profits (106) to derive:

$$\Pi^* = \tfrac{1}{b}\left(\frac{a-w_0}{c^{-1/2}(c+f)\left(\frac{1}{\left(1+\frac{f-1}{c}\right)(\beta+\frac{2}{\lambda}-2)}+1\right)}\right)^2 \tag{107}$$

Now, define $D(c) = (c^{1/2} + fc^{-1/2})\left(\frac{c}{(c+f-1)} + (\beta + \frac{2}{\lambda} - 2)\right)$, and consider $c_2 > c_1$.

Note that $(c_2^{1/2} + fc_2^{-1/2}) > (c_1^{1/2} + fc_1^{-1/2})$ iff $c_1^{1/2}c_2^{1/2} > f$, which is assured to be true if $c_1 > f^{1/2}$.

Now note that $\frac{c}{(c+f-1)} = \frac{1}{\left(1+\frac{f-1}{c}\right)}$ which is rising in c. But these two facts together assure that if $c_1 > f^{1/2}$ then $D(c_2) > D(c_1)$.

However, $\Pi^* = \frac{1}{b}\left(\frac{(a-w_0)(\beta+\frac{2}{\lambda}-2)}{D(c)}\right)^2$. Therefore, if $c > f^{1/2}$, then Π^* is falling in c. QED.

It is interesting to note that in the case of right-to-manage bargaining, the condition for profits to increase with reduced collusion is much more easily satisfied then that for profits to rise with increased entry, exhibited in chapter one. It seems reasonable to conclude that this is related to the fact that in the latter case, with increased competition sales per firm are reduced in addition to prices, due to the sharing of the higher sales with the new entrant, and wage reductions are the sole source of increased profits, whereas in the former case sales per firm are increased.

As in chapter one, it seems likely that multiple equilibria are possible in this game if demand curves are convex, which may complicate the analysis of compar-

ative statics, political economy and policy.

2.1.2. Efficient Bargaining Case:

To show that the achievement of the result that greater collusion may cause declining profits is not wholly dependent on the 'Right to Manage' assumption, the plausibility of which is an empirical question, and to shed greater light on the conditions under which this effect might be expected, the case of 'efficient' bargaining, in which the firm and worker collective bargain jointly over the wage and the employment level, is now explored. For the moment we take the prevailing degree of collusion among firms as a datum, rather than as a decision variable of the firm. Bargaining over employment and wages jointly leads to a constrained efficient outcome at the firm level given the constraint that collusion is fixed at a particular level. However, as unconstrained efficiency of the bargained outcome requires inclusion of *all* relevant decision variables, bargaining will not generally lead to an efficient outcome if the degree of collusion is itself a decision variable of the firm, unless the level of collusion is included as a relevant quantity over which bargaining occurs. It is therefore in the limited conventional sense (that the wage-employment combination selected is taken to be on the contract curve between firm and worker collective, for a *fixed* level of conjectural variation) that

we speak of 'efficient bargaining' here.

Proposition 2.4. *An increase in collusion reduces the extent of strategic interdependence between firms, causes a reduction in equilibrium output and an increase in the equilibrium wage. A lower employment preference on the part of workers causes an increase in collusion to increase wages and reduce employment more.*

Proof:

It is assumed as before that bargaining occurs according to the generalized Nash bargaining procedure. Thus, employment and wages at each firm are determined by:

$$(n_i, w_i) = \arg\max N = (n_i^{\beta}(w_i - w_0))^{\lambda}((p - w_i)n_i)^{(1-\lambda)} \qquad (108)$$

subject to $p = p(\sum_{j=1}^{F} n_j) = a - b(\sum_{j=1}^{F} n_j)$

This problem has the following first order conditions:

$$n_i = \left(\frac{p(n_i) - w_i}{\left(\frac{dp(n_i)}{dn_i}\right)}\right)(\theta)\ , \qquad (109)$$

$$w_i = (1 - \lambda)w_0 + \lambda p(n_i), \qquad (110)$$

where $\theta = \left(\frac{\beta\lambda}{\lambda - 1} - 1\right) < -1$.

These first order conditions define a reaction function $(n_i, w_i) = r_i(n_{-i})$. In particular, if $\overline{n}$ is the average level of output at all other firms, then

$p(n_i) = a - b(f\overline{n} + c(n_i - \overline{n})$ and $\frac{dp(n_i)}{dn_i} = -bc$ which implies (substituting these expressions in to (109) and (110) and solving simultaneously) the following reaction functions:

$$n_i = \left(\frac{(1-\lambda)}{bc((1-\lambda)-1/\theta)}\right)(a - w_0) + \left(\frac{(1-\lambda)(c-f)}{c((1-\lambda)-1/\theta)}\right)\overline{n}\ , \text{ and}$$

$$w_i = \left(\frac{(1-\lambda)(\theta-1)}{\theta(1-\lambda)-1}\right)w_0 + (a + \overline{n}b(c-f))\left(\frac{-\lambda}{\theta(1-\lambda)-1}\right) \qquad (111)$$

It follows that output and wages chosen at firm i respond negatively to higher output at other firms . Further, for the output reaction function a rise in c causes the 'intercept' term to fall at firm i, and causes the 'slope' term (the degree of responsiveness to output elsewhere) to fall in magnitude (i.e. to become less negative). For the wage reaction function a rise in c causes no change in the intercept term but causes a reduction in the magnitude of the response to output elsewhere. In both cases, increases in collusion (c) cause reductions in the extent of strategic interdependence. It may also be checked that a rise in β , the degree of employment preference, causes a rise in the slope and the intercept terms of the output reaction function of the same proportion, leading to an increase in output.

Now, to identify the equilibrium output and wage levels, we can set $n_i = \overline{n} = n^*$ to find:

$$n^* = \frac{(a-w_0)}{b(f+\frac{c}{(\lambda\beta+1-\lambda)})}$$

$$w^* = (1-\lambda)w_0 + \lambda\left(a - \frac{(a-w_0)}{(1+\frac{c}{f(\beta\lambda+1-\lambda)})}\right), \qquad (112)$$

It is evident that equilibrium output falls in c and f , rises in β and rises in λ if $\beta > 1$ and falls in λ if $\beta < 1$. It may also be verified that w^* is rising in c, falling in β, and rising in λ.That changes in c have a larger effect on w^* and n^* when β is lower is evident by inspection of the denominator in (112).QED.

Now, what is the effect of increasing levels of collusion on a firm's equilibrium profits in this scenario? The following proposition may be proved:

Proposition 2.5. *Suppose bargaining is 'efficient'. If worker collectives are 'employment preferring' ($\beta \geq 1$) then collusion has a conventional effect on profits. However if worker collectives are 'wage preferring' ($\beta < 1$) then collusion has the conventional effect only up to a certain threshold after which it is profit decreasing. This threshold is lower when wage preference and workers' bargaining power are higher. When worker collectives are wage preferring, profits behave according to an inverse U-shape in the degree of collusion.*

Proof:

To check this note that equilibrium profits are given by:

$$\Pi^* = (p^* - w^*)n^* = ((a - bfn^*) - w^*)n^*$$

$$= \frac{(1-\lambda)}{bf}(a - w_0)^2 \left(\frac{fc(\beta\lambda+1-\lambda)}{(f(\beta\lambda+1-\lambda)+c)^2}\right), \qquad (113)$$

It may then be derived directly that $\frac{d\Pi^*}{dc} \geq 0 \; iff \; c \leq c^{\pi \max} \equiv f(\lambda(\beta-1)+1)$

It can be seen that if $\beta \geq 1, c^{\pi \max} \geq f$, and if $\beta < 1$ then $0 \leq c^{\pi \max} < f$.

Clearly, $c^{\pi \max}$ is decreasing in λ when $\beta < 1$.QED.

It is clear that $c^{\pi \max}$ can be low for reasonable values of parameters. For instance if $\lambda = 1$ and $\beta = 0.5$ then $c^{\pi \max} = 0.5f$ and if $\lambda = 1$ and $\beta = 0.1$ then $c^{\pi \max} = 0.1f$.

Thus, collusion can be quite easily profit decreasing even under 'efficient' bargaining. What is the rationale behind this slightly surprising result?

The rationale is that even under efficient bargaining, there is a tradeoff between the *gain* in total production surplus (which is of joint interest to the firm and to workers since it is available to be divided between wages and profits) created by higher levels of collusion and the *cost* of higher levels of collusion in terms of reduced employment (as such of interest only to workers). Higher collusion reduces the 'marginal cost' (in the form of lost employment) of gains in production surplus, which are potentially valued both by the firm (if received in the form of profits) and the worker collective (if received in the form of wages), since each unit of

output reduction leads to a larger increase in prices. The maximization program defined by the joint bargaining objective (14) accordingly leads greater collusion to cause a shift of the wage-employment combination in favour of production surplus and against employment. However, as explained further below, this need not be profit increasing, as under certain conditions the worker collective's preferences may cause this change to be even *larger* than favored by owners.

Specifically, when workers pursue the rent-maximization objective ($\beta = 1$) a net gain in production surplus is always favoured by both workers and owners, and with constant bargaining shares increased collusion is always both profit and total worker rent increasing. A one percent increase in employment is valued equally to a one percent increase in rent (profit) per worker, by rent-maximizing worker collective and profit maximizing firm alike. A change in the level of employment which raises total surplus will therefore always be agreed to by both firm and worker collective, since it provides an opportunity for the interests of both to be furthered. The interests of the parties are therefore *perfectly aligned* in relation to the level of employment although not in relation to the wage. However, if workers are employment preferring ($\beta > 1$), then the employment cost of increasing the production surplus available to be divided is perceived as high by workers. More concretely, the worker collective values a one percent increase in employment

more than it does a one percent increase in rent per worker. Thus, when increased collusion reduces the 'marginal employment cost' of a gain in surplus (and therefore of both rent and profit) per worker, although this will cause both the worker collective's and the owners' preferred employment level to fall, it will cause a larger decline in the latter. The bargained outcome will accordingly cause a reduction in employment and an increase in wages, but the weight placed on the former relative to the latter in the joint bargaining problem will be larger than in the rent maximization case due to the worker collective's employment preference, and will mitigate the extent to which wage increases will erode the profit gains due to collusion, although the contraction in output (and therefore the rise in total production surplus) due to increased collusion will be less than in the rent maximization case (or equivalently that in which there is no worker collective). In effect, employment preferring worker collectives 'negotiate' a lesser reduction in output than firms would like to pursue in a newly more collusive environment in return for accepting lower wages.

Finally, if the worker collective is wage preferring ($\beta < 1$), then the value of a higher wage per employed worker is taken by the worker collective to be such that it is willing to accept a reduction in total worker rent in order to achieve this. Specifically, a one percent increase in employment is valued at less than is a

one percent increase in rent per worker. Accordingly, the wage preferring worker collective's preferred employment level is even lower than is that of the owners of the firm. Thus, when increased collusion reduces the 'marginal employment cost' of a gain in surplus per worker, although this will cause both the worker collective's and the owners' preferred employment level to fall, it will cause a larger decline in the former. The jointly bargained output is reduced beyond the total surplus maximizing point in order to increase surplus (and rent) per worker. The gains in surplus per worker must necessarily be realized by the worker collective in the form of higher wages. The rise in wages combined with the reduction in output beneath the profit maximizing level together create the possibility of a profit decline due to increased collusion.

The Contract Curve and a Diagrammatic Representation: The possibility of a profit decline due to increased collusion can be represented diagrammatically for both the 'right to manage' and the 'efficient bargaining' cases. To see how, it is helpful to derive the isoprofit frontiers of the individual firm and the indifference curves of the worker collective in wage-employment space at varying

levels of collusion. These curves are both special cases ($\lambda = 0$, and $\lambda = 1$ respectively) of the indifference surfaces of the Nash objective function (108). If $\overline{n}$ represents a 'reference' level of common output around which firm i conjectures the effect of different levels of its own output[25], then along an indifference surface of the Nash objective function we have:

$$\frac{dw_i}{dn_i} = \frac{-dN/dn_i}{dN/dw_i} = \frac{-n_i[\lambda(a-bf\overline{n}-bc(n_i-\overline{n})-w_i)-(w_i-w_0)(1-\lambda)]}{(w_i-w_0)[(a-bf\overline{n}-bc(n_i-\overline{n})-w_i)(\beta\lambda+1-\lambda)-n_i(1-\lambda)(bc)]}. \quad (114)$$

It may be checked that when $\lambda = 1$, $\frac{dw_i}{dn_i} = \frac{-(w_i-w_0)\beta}{n_i}$. These are conventional 'bow-shaped' indifference curves, the slope of which is increasing in the degree of employment preference, β.

Similarly, when $\lambda = 0$ $\frac{dw_i}{dn_i} = \frac{a-w_i-\overline{n}bf+cb(\overline{n}-2n_i)}{n_i}$. It may readily be checked that $\frac{d^2w_i}{dn_i^2} < 0$ and that $\lim_{n_i \to 0} \frac{dw}{dn_i} \to -\infty$ and $\lim_{n_i \to 0} \frac{dw}{dn_i} \to -2bc$. Thus the firm has conventionally inverse-U shaped asymmetrical isoprofit curves. It may also be checked in this case that $\frac{d}{dc}\frac{dw_i}{dn_i} < 0$.[26] This implies that as the degree of collusion rises, the isoprofit curves become *flatter* where they are rising and *steeper* where they are falling. Of course, increasing collusion also causes a shift to the left of the locus of isoprofit peaks (as this is the labor demand curve, representing optimal

[25] $\overline{n}$ can be take to be the level of equilibrium output of other firms at a given level of collusion, with respect to which the firm defines its own residual demand curve.

[26] This is strictly true only as long as ouput is not 'too far below' the reference level ($n_i > \overline{n}/2$). That such a requirement exists is not surprising, as if the slope of the isoprofit curve is initially less positive to the left of the reference quantity, it must become more positive further left in order to satisfy the asymptotic requirement as output approaches zero.

output at any given wage). The change in the shape of the isoprofit curves can be understood as reflecting the fact that revenue reducing output reductions are less costly when collusion is higher as a unit output reduction by firm i is associated with a larger decline in output by other firms and a larger price rise. Accordingly wages need fall less to maintain a given profit level. Similarly, revenue reducing output increases are more costly when collusion is higher, as they are associated with a larger increase in output by other firms which causes a larger decline in price and requires a larger wage decline to maintain a given profit level.

Finally, it is possible to derive the contract curve. It can be easily derived through manipulation of (111) that the locus of possible equilibrium output and wage combinations corresponding to a particular level of collusion (with each point on the locus corresponding to a different level of workers' bargaining power) is given by:

$$n^* = \frac{(a-w_0)+(B-1)(w^*-w_0)}{b(c+f)}, \quad (115)$$

This is evidently a straight line emanating upward from the point of the minimum wage (w_0) on the labor demand curve, and with slope $\left(\frac{b(c+f)}{(\beta-1)}\right)$. Thus the contract curve is vertical (reflecting the complete alignment of the incentives of firm and worker collective in regard to the employment level) when the worker collective is rent maximizing ($\beta = 1$), positively sloped when it is employment

preferring (reflecting the greater interest in employment of the worker colelctive as compared to the firm), and negatively sloped when it is wage preferring (reflecting the lesser interest in employment of the worker collective as compared to the firm).

In light of these facts, the effect of an increase in collusion in the case of efficient bargaining may be viewed in Figures 2.1 and 2.2. In each of these, π_0 represents the isoprofit curve at the initial level of profit (presumed to be realized at the initial bargained equilibrium), and π'_0 the isoprofit curve corresponding to the same level of profit at a higher level of collusion, and the initial and later levels of the workers' objective corresponding to the initial equilibrium and to the efficient bargain maintaining this constant level of profits are described by I_0 and I_1respectively. The labor demand curves at lower and higher degrees of collusion are referred to by AH and DG respectively. The initial contract curve is represented by AC and the later (higher collusion) contract curve by DF. Then if any point on the bottom segment (DE) of the new contract curve is chosen, profits increase, and if a point on the upper segment (EF) is chosen they decrease. There is however no *a priori* reason to think that the point on the contract curve chosen must be on one or the other of these segments. Indeed, as argued above, in the case of wage preferring worker collectives, the lower employment cost of gains in surplus

per worker when collusion is higher may cause a higher wage-lower employment point (higher on the contract curve) to be chosen, causing a decline in profits. More rigorously, it is evident that the slope of the contract curve reflects the slope of the objective possibility frontier between worker collective and firm. This is clear since when collusion increases, the indifference map of the worker collective is constant but the isoprofit curves of the firm become everywhere steeper in the region of bargaining. A shifting slope of the contract curve represents a change in the shape of the objective possibility frontier , which may make it more or less costly in terms of the interests of one party to satisfy the interests of the other. To see this, note that the slope of the contract curve represents the *degree of alignment of interests* over the allocation of productive resources between the firm and the worker collective. As discussed, when the contract curve is vertical, the interests of the parties in relation to employment are perfectly aligned and conflict is purely distributional. In contrast a less steep contract curve (in either direction) represents a greater *misalignment* of their interests over the level of employment. Straightforwardly then, the cost of increasing profits in terms of sacrificing the worker collective's objective is greater when the contract curve is less vertical (in particular, the slope of the objective possibility frontier becomes less close in magnitude to one, as the contract curve becomes less vertical).

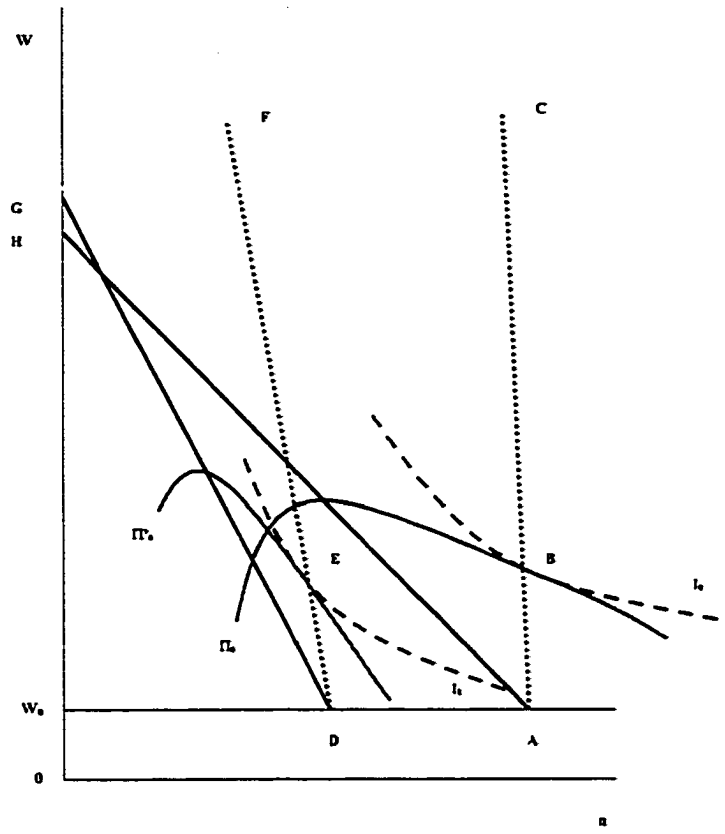

Figure 2.1:

. Now, as represented in Figures 2.1 and 2.2 and mandated by (115) the slope of the contract curve becomes higher when the degree of collusion among firms increases. However this makes the contract curve more close to vertical in the case of employment preferring worker collectives and less close to vertical in the case of wage preferring ones. This implies that:

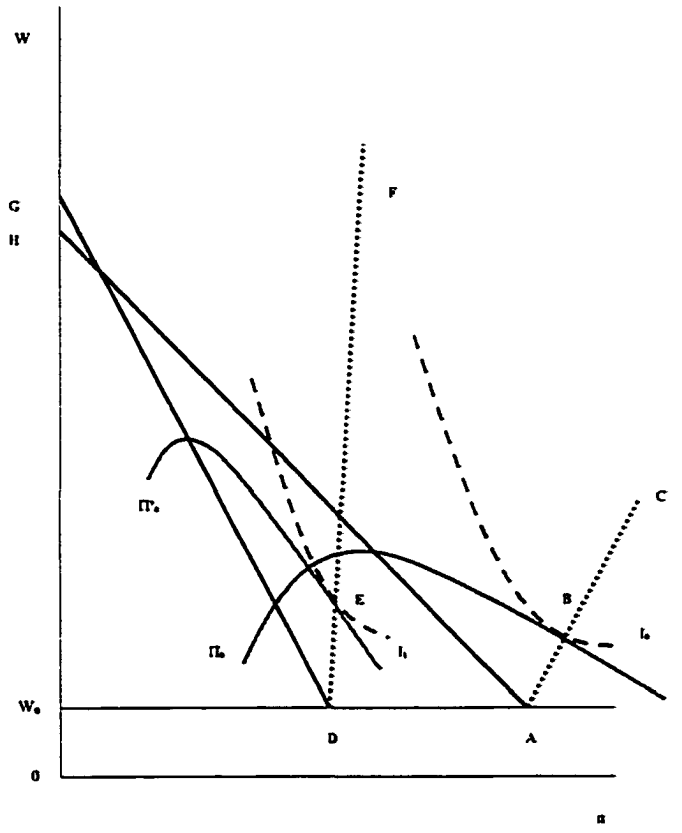

Figure 2.2:

Remark 16. *Increased collusion decreases the misalignment of interests when workers collectives are employment preferring but increases it when they are wage preferring. As a result, although it always leads to an increase in wages, it increases profits when worker collectives are employment preferring but can decrease them when they are wage preferring.*

The reason for this is that increased collusion makes it more costly in terms of lost profits for firms to pursue the employment objective, which is already pursued to a degree *more* than preferred by owners when worker collectives are employment preferring, and therefore *dampens* the degree of misalignment of interests. In contrast the employment objective is pursued by wage preferring worker collectives to *less* than the degree preferred by owners , so that this change in the costs of pursuing employment in effect *accentuates* the degree of misalignment. This causes the bargained compromise to generate lower profits than otherwise.

The case of 'right to manage' bargaining is represented in Figure 2.3. For simplicity we consider the 'pure Stackelberg' case in which the worker collective has complete wage-setting power. Here, again, π_0 represents the isoprofit curve at the initial level of profit (presumed to be realized at the initial bargained equilibrium), and π_0' the isoprofit curve corresponding to the same level of profit

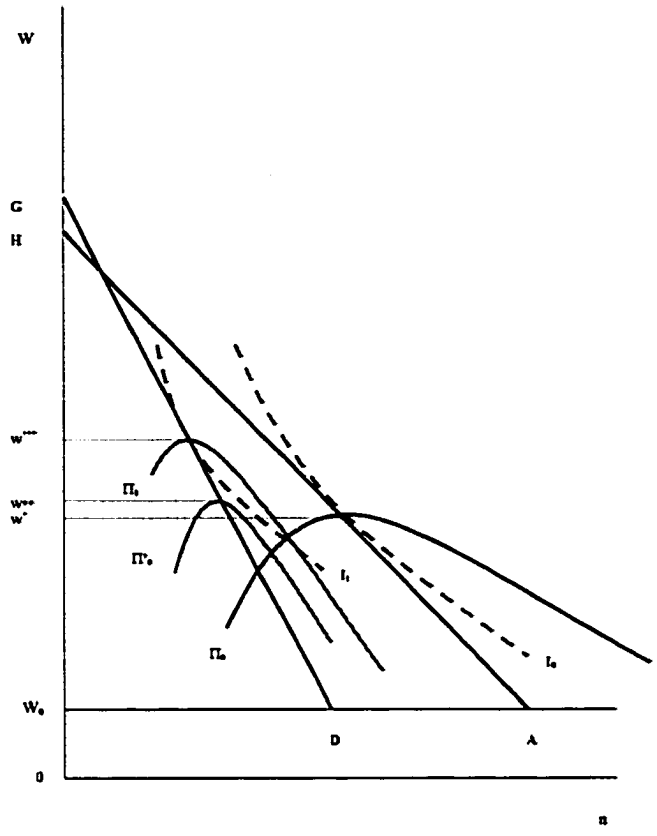

Figure 2.3:

at a higher level of collusion. It can be seen that if the worker collective's objective is best realized by setting wages at a point above w^{**}, such as w^{***} (the original wage is w^{*}) then profits will decrease with increased collusion.

2.1.3. Wage preferring or employment preferring worker collective?

Is the assumption that worker collectives are wage preferring or employment preferring more empirically and theoretically plausible? There are arguments on both sides of this issue, as has also been discussed in chapter one. This question, which concerns the nature of worker collectives' preferences,over wages and employment is a distinct one from that of whether bargaining is in practice inclusive of both considerations or only of the former.

Among the arguments for considering the assumption that worker collectives are often wage preferring to be plausible are the following. First, the decisive voices within worker collectives may be senior workers who are less likely to face unemployment if employment decisions follow a 'last in – first out' rule and who are therefore more concerned to raise their own wages. This decisiveness may owe either formally to the 'median voter' in the collective enjoying seniority or due to informal suasion. Second, the worker collective may consist of 'core' and 'non-core' members. 'Core' members do not face employment risks at the margin, but non-core members do. Although core members pay some heed to the welfare of non-core members, they do so to a lesser degree than they pay heed to their own concerns (primarily for wages). If core members are especially influential, then wage concerns will predominate over employment ones in decisions at the margin. Third, if worker collectives are on the contrary 'ultra-collectivist' in

the sense that they behave like a 'commune' [See McDonald and Solow (1981) and Oswald (1985)], equalizing the ex post (as opposed to ex ante) utility of their members (inclusive of the presumed disutility of work), through effective ex-post transfers among members, then they will prefer increases in wage per worker to increases in employment (since the latter entails a disutility of work). In all three of these situations, the worker-collective's indifference curves in wage-employment space will be relatively flat ($\beta < 1$), and the 'contract curve' between firm and collective will be negatively sloped.

The assumption that worker collectives are more 'employment preferring' is in contrast likely to be true in situations in which well-developed mechanisms for transfers among members do not exist, where individual employment is valued directly (for its psychic, social or political benefits), and where the interests of 'marginal' and 'outside' members are relevant to decision making. The appropriateness of these two descriptions of worker collectives is in the end an empirical matter which is likely to vary across national contexts and industries.

2.2. The collusion-profit 'paradox' and its resolutions:

In this section, we discuss the implications for the shape of institutions of the result that higher collusion can lessen profits. In particular we consider the

different implications of an 'agency-based' and of a 'norm-based' interpretation of the environment of collusion for the structure of resulting institutions.The

2.2.1. Agency-based Interpretation of Collusion: The Credibility Problem of the Firm and its Regulatory Resolution

In the 'agency-based' interpretation of collusion, the degree of collusion among firms is decided upon actively by individual firms. The degree of collusion is in this view in considerable part influenced by decision variables of firms (acting independently or jointly), although its final level may not directly be in the control of any one individual firm. The equilibrium level of collusion is perhaps best conceived of as emerging endogenously in a game of interaction among firms. In this chapter we have however sidestepped the explicit modeling of such a game (as analyzed for instance by Kalai and Stanford (1983)), by assuming a 'conjectural variation' parameter which summarizes its outcome.

If the agency-based interpretation is correct, can firms not avoid the potentially profit reducing effect of collusion by simply choosing to adjust the degree of their collusion downward? Let us consider if this is the case in a simple but illustrative framework. Consider now the case of 'right-to-manage' bargaining. Suppose

$c_1 < c_2$ and $\Pi^*(w^*(c_2)), c_2) < \Pi^*(w^*(c_1), c_1)$ (where $\Pi^*(w^*(c), c)$ represents the profit level of the firm that would be attained at a given level of collusion, c, among firms and at the wage, $w^*(c)$, set through bargaining with workers correctly anticipating this level of collusion). It has already been established that such a scenario can arise. Suppose for simplicity that a single firm i (or alternatively all firms acting in concert) can choose the level of collusion among firms which will prevail at any time and that the possible choice is between c_1 and c_2. Assume for ease of exposition that any level of collusion preferred can be attained (the setting of the level of collusion is not beset by, for example, collective action dilemmas) and that the 'time-line' of the 'one-shot' version of the game is as follows:

|A|————————|B|————————|C|————————|D|

A: Future collusion level is announced by firms

B: Wages are established through bargaining

C: Actual collusion level among firms determined

D: Production occurs

Given the profit inequality above, firms will choose to declare collusion level c_1. However the assertion that this will be the future collusion level is not

credible (given the assumptions of complete information and common knowledge), since worker collectives know that at any *given* wage, greater collusion is always more profitable. Accordingly, they will set wage $w^*(c_2)$. Finally, firms will indeed choose collusion level c_2, and so $(c_2, w^*(c_2), \Pi^*(w^*(c_2)), c_2))$ will describe the resulting subgame-perfect equilibrium.

This outcome of the one-shot complete information game is clearly inferior for employers, as will be that in any finite repetition of the stage game by the logic of backward induction. Can it be otherwise? The obvious gap facing firms is the lack of a suitable 'commitment device'. Any commitment device which makes it sufficiently costly for firms to deviate from their pre-announced collusion level that it will be sustained will increase profits. Consenting to anti-collusive regulation by the state is clearly one possible such device which may be profit-increasing. Second, the outcome may conceivably be less dismal for employers in the infintely repeated game, although this is far from certain. In particular, this is a 'repeated game with observed actions' in which the same constituent 'stage game' is repeated in each period. Since in the general version of this game the number of players is finite, the strategy sets are compact and convex, and payoffs are continuous and quasi-concave in the available strategies, the 'perfect folk theorem' of Friedman (1971) may be applied [See Friedman (1977) and Fu-

denberg and Tirole (2000)]. This ensures that *any* vector of feasible payoffs which is Pareto superior to that attained in the one shot stage game can be sustained as a subgame perfect equilibrium of the infinitely (or indefinitely) repeated game, given a sufficient discount rate, through the application of suitable threats in the event of deviation from the equilibrium-payoff generating strategies.

Consider the set of feasible strategy combinations in each period to be $S = \{(c, w_i, n(w_i))\}$ (i.e. assume that cooperation is over the (wage, collusion) combination but that bargaining continues to take a 'right to manage' form, in which employment is determined as a function of the wage). Then any $(c, w_i, n(w_i)$ which generates higher payoffs for both employer and worker collective than $(c_2, w^*(c_2), n(w^*(c_2))$ does is potentially sustainable as a subgame perfect equilibrium. Since any Pareto superior payoffs to those attained in the one-shot non-cooperative game can be attained, there is therefore a wide array, and there are no strong prior reasons to favour any one of them. Additionally, although effective cooperation through repeated play can raise profits above their level in the one-shot game, there is no guarantee that they will be raised above the level that external regulation of collusion would ensure. For instance only outcomes pareto superior to that which arise under c_2 can be sustained under repeated play. However, there may be pareto incomparable payoffs which realize higher profits.

In particular if the level of profits realized in the cooperative equilibrium is not higher than that realized non-cooperatively at $c^{\pi max}$, the profit maximizing level of collusion, then external regulation can always raise profits. Only if regulation plays the role of an 'outside option' which may be invoked by the firm in the event of the breakdown of bargaining can the firm be guaranteed of raising profits through cooperation. It seems unlikely however that regulation has this selective quality. Rather, firms collectively either exist within a regulatory regime or do not. External regulation may offer a resolution to the profit-collusion paradox which is favourable to employers, as well as to worker collectives which are sufficiently employment preferring, since both of these may prefer the enforcement of a low level of collusion. [27]

Consider now the case of 'efficient' bargaining. Can a credibility problem of the type described above arise in this case? Since both wages and employment are by definition determined simultaneously in the efficient bargaining case, it clearly cannot, unless the interpretation made of 'efficient' bargaining is that it does not operate directly upon the employment level but rather indirectly (for

[27] A second approach to modeling effective cooperation among firms in repeated play is that which conjectures incomplete information about the nature of players (in this case perhaps regarding the willingness of firms to collude) in the nature of Kreps and Wilson (1982) and Milgrom and Roberts (1982). This approach is however subject to similar difficulties in narrowing the range of plausible equilibria.

example through 'featherbedding' agreements which specify the number of workers per machine, or other such rules, which indirectly increase the marginal revenue product of workers, while leaving 'the overall aggregate to the discretion of the employer').[28] In this case, the interpretation of an 'efficient' wage-employment combination being agreed to is that it fixes such rules, but not the number of workers as such.[29] Setting production rules of this type may suffice to fix the number of workers for any given level of collusion (by framing the rule so as to raise workers' marginal revenue product by a just sufficient increment for the firm to be dissuaded from doing so at a given level of collusion, and therefore of 'base' level of marginal revenue product per worker), but it may not suffice if the level of collusion cannot be correctly anticipated. The employer may find it worthwhile to reduce the level of employment if the degree of collusion is higher as this decreases the 'base' level of the marginal revenue product of labor.[30] To analyze this situation interpret the marginal revenue product of labor (due to featherbedding

[28] On the likelihood of such indirect arrangements for influencing employments see McDonald and Solow, 1981

[29] This indirect approach to targeting a favoured level of employment may possibly arise as a response to uncertainty and to the difficulty of writing complete contingent contracts.

[30] In effect by choosing a higher level of collusion the employer reduces the marginal revenue product of labor at the initial level of output. This in turn justifies a decrease in employment given the effective labor costs determined by the union's featherbedding rules, which would not have been justified by profit maximization earlier.

or related requirements) faced by the employer as $z_1 + z_2$, where z_1 is the marginal revenue product faced in the absence of featherbedding requirements (and varying along the firm's collusion-influenced residual demand curve), z_2 is the increment added by featherbedding requirements, and where the wage paid out to employees is w^*. In this case, the bargained level of employment n^* is in effect made 'incentive compatible' by setting z_2 at an appropriate level such that n^* is the (profit maximizing) employment level corresponding to w^* on the firm's labor demand curve. However note that the firm's 'base' level of marginal revenue in relation to which z_2 is set is itself a function of the prevailing level of collusion.

In this case the credibility dilemma may conceivably arise in the case of 'efficient' bargaining as a derivative form of the credibility dilemma in the case of 'right to manage' bargaining, since bargains are still in a relevant sense 'on the labor demand curve'. Since the labor demand curve is positioned (through setting z_2 appropriately) in such a way as to 'enforce'the desired wage-employment combination (n^*, w^*). Note however that the firm's profit level at (n^*, w^*) is $\pi^* = n^*(p^* - w^*)$ and is independent of the level of z_2. We can then straightforwardly apply the earlier logic of the two cases, synthesizing appropriately. Consider the earlier case in which bargaining is both over wages and employment (set through establishing the 'featherbedding' increment to marginal revenue, z_2 appropriately)

and the inequalities, $c_2 > c_1$ and $\Pi^*(w^*(c_2), n^*(c_2), c_2) < \Pi^*(w^*(c_1), n^*(c_1), c_1)$ hold[31] over the alternative levels of collusion being considered by the firm (where $\Pi^*(w^*(c), n^*(c), c)$ represents the profit level of the firm that would be attained at a given level of collusion among firms and at the bargained wage and employment levels set by the firm through bargaining with workers who correctly anticipate the level of collusion). Note that although n^* is the level of employment chosen as before under 'efficient' bargaining it is 'enforced' by influencing the firm's labor demand curve through an appropriate choice of z_2. Suppose that the time-line of the game is as follows:

|A|————————|B|————————|C|————————|D|

A: Future collusion level is announced by firms

B: Wages and employment level are established through bargaining – the latter by setting indirect labor costs (featherbedding).

C: Actual collusion level determined

D: Production Occurs

In the 'one-shot' version of this game the firm would (if it would be believed)

[31] As has earlier been established can arise.

announce level of collusion c_1. However, if the levels of wage and employment were accordingly set at $\Pi^*(w^*(c_1), n^*(c_1), c_1)$ the firm would[32] then find it profitable to raise the level of collusion since at any given level of the wage, greater collusion will be still always profit increasing. Greater collusion lowers the 'base' marginal revenue z_1(whereas $z_2$is now fixed) and thereby justifies a decrease in employment as it is profit increasing. Anticipating this the worker collective will not believe the announcement and will instead anticipate level of collusion c_2, and the actual profit level will be the lower at $\Pi^*(w^*(c_2), n^*(c_2), c_2)$.

Thus, even in the case of 'efficient bargaining', the credibility dilemma of the firm can rearise, causing a high collusion, low profit equilibrium to ensue. However as the required inequality can hold only where worker collectives are wage preferring, and it is in this case that lower collusion leads to lower satisfaction of the workers' objective, it follows that they will be opposed to lower levels of collusion, necessarily creating in this case a pure conflict of interest over the value of a regulatory 'solution'. [33]

[32]Suppose that the sufficiency condition $c > f^{1/2}$ is satisfied.

[33] It has been assumed in this discussion ,as earlier, that bargaining occurs only over the wage, or over the wage and employment but not over the wage, employment, and the degree of collusion jointly. Bargaining in this more'super-inclusive' form will lead to a vector of collusion, wages , and employment being selected which is on the Pareto frontier. Bargained collusion and employment levels will of course be interdependent since the level of collusion influences the manner in which employment affects production surplus. As noted earlier, a higher level of collusion among firms makes the employment objective 'more expensive' to attain in terms of

In this section it has been assumed that firms are capable of adjusting the degree to which they collude with other firms through their own decisiosn. However, collusion is a phenomenon *among* firms, and so this si not a wholly reasonable premise. To the extent that the collective nature of collusion is relevant and truly joint decision making is foreclosed, it might seem likely that a particular level of collusion among firms could come to be 'locked in' as the result of difficulty of unilateral deviation from an established inter-firm equilibrium, even among firms that are fully cognizant of this situation (the susbequent section discusses the case where they are not). If collusion is thus locked in at a 'high level' the rationale for external regulation would continue to exist. If collusion is 'locked in' at a low level, external regulation would not be necessary.

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production surplus and thus shifts the shape of the contract curve. It might be expected that wage preferring worker collectives will favour higher levels of collusion than do employment preferring ones, and that this will be reflected in the bargained outcomes. It is however conceivable that a firm engaged in 'super-inclusive' bargaining and facing a wage preferring worker collective may realize higher profits if collusion is reduced by regulation and bargaining continues over employment and wages alone than if bargaining is inclusive of collusion itself, since the former may provide a set of payoffs to the parties which is pareto incomparable to that provided by the latter but offers superior profits. This conjecture requires further study.

2.2.2. The Norm-based Interpretation of Collusion: Gaining Control Through Regulation

In the 'norm-based' interpretation of collusion, the degree of collusion among firms is not a decision variable of the firms, acting independently or jointly. It is rather taken to 'pre-exist' their decisions, and to be instantiated in a culture, outlook, or cognitive pattern shared by decision makers. It is as a result not the product of conscious choice but rather reflects the particular dispositions of decision makers or the conditioning which they have undergone as a result of their participation in a given environment. This is a 'deep' view of norms, which takes them as being 'infra-conscious' and not necesarily interpretable as the outcome of individual decision making or strategizing in static or repeated play. They are thus adhered to by the agents not for a currently applicable reason but simply because they exist. Of course, this does not preclude the possibility that some norms understood in this sense will be more capable of surviving over time than others in a given social environment. If collusion is viewed as taking this form , then in either the 'right to manage' or the 'efficient bargaining cases, collusion may take on a level which is 'too high' (not profit maximizing) for the reasons discussed above. As noted earlier, whether or not firms recognize this, they may be powerless to individually reduce the degree of collusion, and find that it

is desirable for them to uphold it. One way to conceive of this possibility is that collusion is itself the outcome of an established (though admittedly non-optimal) non-cooperative equilibrium in a repeated setting, from which unilateral deviation is costly.[34] This seems especially plausible in a case in which the norm originated prior or in an alternative context to the phenomenon at hand (for example in a context of inter-firm competition which preceded the historical emergence of effective worker collectives). [35]

In this case, when as before lower collusion is profit reducing, anti-collusive regulation will be welcomed by firms (and possibly by worker collectives, if they are sufficiently employment preferring), since the more profitable lower level of collusion cannot be instituted directly by firms themselves.

[34] For this interpretation of collusion see for example Fudenberg and Tirole (2000), p.155. Friedman (1977) argues that a non-cooperative equilibrium cannot be called 'collusive' but this interpretation seems implausible. Sato and Nagatani (1967) show that Cournot dynamic oligopoly with conjectural variations exhibits stable 'collusive' equilibria when conjectural variations are sufficiently high. This result concerns stability in quantities rather than stability in the extent of conjectural variation, but it is suggestive. Whether such equilibria are stable to variations in the degree of conjectural variation supposed by *individual* firms remains to be explored.

[35] Some suggestive casual empirical evidence of the presence of 'collusive norms' is that low levels of collusion may be as unstable as high levels of collusion. For example, Kolko (1965, 1967) among others documents the substantial instability caused by the periodic rise and collapse of railroad and other cartels in the late 19th century United States. He argues that the instability created by these cycles was disfavoured by firms themselves to the stability (at a lower level of collusion) created by regulatory control. Firms were unable by themselves directly to institute low but stable levels of collusion due to the recurrent tendency for collusive arrangements to arise – due to owners' and managers' own deeply established propensities.

2.3. Empirical Implications and Evidence:

The analysis above has been of a 'partial equilibrium' nature and so it is necessary to be cautious in drawing from it implications either for the political economy of particular industries or of national economies. In particular, it ignores the effect of increased collusion in specific industries on the overall price level and thereby on workers' real wages, as well as the effect of the employment level on the 'reference' or 'outside' wage. These problems may be of lesser consequence in some contexts (for example small open economies in which the basket of wage goods has a high import content and in which the first effect can be considered minor, or 'labor surplus' economies in which the latter can be considered so) than in others. Nevertheless, some preliminary lessons can be drawn which may merit further empirical study:

The results of the theoretical analysis may be summarized by Figure 4. The 'conventional' effect of collusion on profits is attained when bargaining takes a 'right to manage' form but levels of collusion are in any event low, or when bargaining is both inclusive in scope (i.e. 'efficient' in that it extends to employment

REGIME OF LABOR RELATIONS:	EFFECT OF INCREASING COLLUSION ON PROFITS:	
	INCREASING:	DECREASING:
'RIGHT TO MANAGE'	IF COLLUSION IS 'LOW'	IF COLLUSION IS NOT 'TOO LOW'
'EFFICIENT'	IF WORKER COLLECTIVES ARE 'EMPLOYMENT PREFERRING' ($\beta>1$)	IF WORKER COLLECTIVES ARE 'WAGE PREFERRING' ($\beta<1$)

Figure 2.4:

levels as well as wages) and in concern (i.e. 'outsiders' and 'marginal' workers' interests are taken account of by the worker collective, which places a considerable weight on employment in its preferences. In this case, firms will be expected to oppose anti-collusive regulation. In contrast, when bargaining takes a 'right to manage' form but the level of collusion passes a certain threshold, then increased collusion is profit decreasing due to the effect it has on increasing bargained wages through reducing the employment cost of wage decreases. Increased collusion can also be profit decreasing when bargaining is inclusive in scope (i.e. 'efficient') if it is not inclusive in concern (i.e. favours the interests of 'insiders'). [36]

[36]The possibility that $\beta < 1$ because the worker collective behaves like a redistributive commune, equalizing ex post utility, (discussed earlier) is neglected as it appears to the author that the requireed degree of redistribution combined with indifference to the level of employment as

This theoretical perspective would lead us to anticipate the following empirical correlations, if the level of profits is an important determinant of realized institutional outcomes. To the extent that anti-trust regimes emerge to enforce the interests of consumers or of worker collectives in the industries concerned (who may or may not benefit from reducing collusion, as seen earlier, depending on the degree of their employment preference), rather than of firms, this analysis would require qualification.

First, vigorous anti-trust enforcement should be more likely to be found in countries (and industries) in which collective bargaining is 'narrow' rather than 'inclusive' in scope (and in particular takes a 'Right to Manage' form). Second, where collective bargaining is more inclusive in its concerns the model would suggest a higher level of anti-trust enforcement where worker collectives are dominated by 'insiders' (and especially senior and 'core' workers). The model would suggest a lower level of anti-trust enforcement in countries in which worker collectives show an 'inclusive' concern for marginal and 'outside' workers, especially if the impact on the general price level of industrial concentration in industries in which bargaining occurs is moderate.

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such required is incompatible with a plausible account of the nature of solidarity in a worker collective.

These propositions seem broadly consistent with certain casual observations, although data limitations and the scope of this paper, do not permit their being even partially evaluated here. The examples cited should accordingly be viewed as indicative and even speculative rather than as evidential.

First, there is some evidence that industries with higher levels of collusion (as identified by anti-trust enforcement actions against them) had *lower* levels of profits prior to action being taken against them than less collusive industries. Asch (1976) and Asch and Seneca (1975) find a robust negative association between collusive behavior and firm profitability. Both studies conclude that it is more likely that unprofitability causes collusion rather than the reverse, on the unargued presumption that the latter "does not seem to be a satisfactory explanation".[37] Another explanation is that collusion generates a'transitional gains trap' in which supernormal profits induce entry, but once a zero profit equilibrium is reached firms find themselves 'locked in' to collusion as they wish to avoid short run losses [Tullock (1975, Brander and Spencer (1985)]. However this expanation would still fail to account for the *lower* profits observed in colluding firms, and

[37]The possibility that enforcement actions are more often undertaken against 'weaker' low profit firms (suggested by Posner(1976)) is made less plausible by the result of Long, Schramm and Tollison (1973) which sought determinants of Department of Justice anti-trust actions and "found a relation between industry sales and enforcement, but no relation to profits, concentration, or to aggregate welfare losses". Similarly, Siegfried (1975), found that economic variables including the rate of return have little influence on prosecutions.

the failure to observe even transitional gains. The reasons for the surprising finding that collusive firms are less profitable -what may be called a 'collusion-profit paradox', remain therefore obscure, although this paper offers one explanation. [38]

Second, there is evidence that price-fixing cases are more vigorously and often enforced than other kinds of anti-trust infractions. This is consistent with the model presented in this chapter taken in conjunction with that in Chapter One. Increased competition due to increased entry is more likely to be profit reducing than is decreased collusion and thus firms themselves have a more widespread interest in the prosecution of such cases. Indeed, Holliday (2000) finds that price fixing (on a definition inclusive of 'bid rigging', 'resale price maintenance' and cartels) constitutes the 'great bulk' of anti-trust case filings over a period of almost a century (2066 out of 3748). Additionally, firms very frequently bring suit against other firms in the same industry under anti-trust statutes. This fact has proved puzzling to analysts (e.g. Easterbrook (1984)) who have presumed that collusive behavior can only benefit other firms already operating in an industry through its price raising effect.[39] Finally, there is considerable historical evidence

[38] In a related vein Brozen (1992) [in High and Gable (1992)] reports a number of results showing that industrial concentration (which might be expected to be related to collusion) shows no discernible relation to profits.

[39] Salop and White (1986) find that "Private suits have been the predominant form of litigation for at least forty years", and that in the years since the mid 1960s the ratio of private to public cases has varied between roughly ten and twenty to one. They also find that "horizontal price

that the rise of anti-trust policies was surprisingly favoured and even pushed for by the very industries which were most bound by it.[40]

Third, there is evidence that pro-competitive 'deregulation' of particular industries has been vigorously opposed by labour unions but less strongly opposed or even welcomed by owners. Thus, Derthick and Quirk (1985) report regarding airline and trucking deregulation in the United States that "By 1978 the airlines stopped trying to prevent passage of a deregulation bill; and when it appeared that the Ninety-fifth Congress might adjust without completing action, the industry pleaded for it not to do so. In much the same way, the trucking association, although long opposed to reform legislation, eventually urged Senator Howard Cannon to act and considered it "a great victory" when he and his House counterpart, James Howard, announced a schedule for passage of a bill.... When the Airline Deregulation Act finally cleared Congress in 1978, therefore, it seemed a product of a consensus that regulation should be abolished." In contrast labor unions appear to have been much more significantly opposed to degeregulation. The same authors report that "The [airline] industry's labor unions, also strongly

fixing" was the most frequent primary allegation, and that the second largest group of plaintiffs were competitors suing each other.

[40] For classic evidence in this direction for the U.S. case, see Kolko (1965, 1967). An argument in a similar spirit is that of Stigler (1975) . For alternative interpretations see for instance Lande (1982).

opposed to reform, did not change sides [unlike firms]". In the case of the trucking industry "The Teamsters opposed degregulation, if anything, more strongly than the industry". It is important for the present argument to note that whereas deregulation facilitated entry in to protected markets, it may have even more significantly increased the extent of competition over prices among existing actors, as under the previous regime, airlines were "largely prevented from competing against each other on price" [ibid]. There are of course alternative explanations for these phenomena, but they are suggestive of the possibly profit raising effects of pro-competitive policies. Also consistent with the approach taken here is evidence that wages fell sharply in both industries as a direct result of deregulation [See Rose(1987) and Card (1989)].[41]

Fourth, and most speculatively, anti-trust enforcement appears to be strongest in countries where collective bargaining takes a less comprehensive and cooperative form (especially the UK, Canada, and the USA) and may be weaker (as reflected in the level of oligopolistic concentration, and the high price level, which are very imperfect indicators of the level of collusion) in countries with more comprehensive, cooperative and inclusive forms of collective bargaining (perhaps

[41] There is of course also contrary evidence of labor unions actively pressing for pro-competitive policies, especially at a national level. An interesting example is that of the British Trade Union Congress support for the post-war Labour government's attack on 'retail price maintenance' [Freyer (1992)].

especially Scandinavian countries, such as Sweden) . Intermediate range countries with greater prevalence of efficient bargaining but a degree of insider power in labor unions are expected to be more likely to exhibit vigorous anti-trust enforcement and lesser industrial concentration than in similar countries in which labor unions have more concern for outsiders.. Germany is arguably an example of such a country. [12] Of course it is difficult to deduce whether such a correlation, if substantiated, is due to unions having an interest in high rents in order that they may acquire a share of these, and that they therefore succesfully oppose anti-trust policies in countries where they are stronger (which are also the countries where collective bargaining takes on a more comprehensive form), or whether it is because the form that labor relations take is an independent factor in whether firms oppose or support such policies.. Empirical research specifically directed toward distinguishing between these competing hypotheses is required.

2.4. Conclusion:

This paper has shown that higher levels of collusion can be profit reducing when firms are engaged in bargaining with workers. This is true under a minimal condi-

[12] Scherer and Ross (1990) write of (then West) Germany, "After a slow start, enforcement of the law has been vigorous - probably second only to that of the United States".

tion in the case of 'right to manage' and under a more stringent but still plausible condition under 'efficient' bargaining. This phenomenon generates a pressure for firms to reduce the anticipated degree of their collusion, either directly through their own decision making, or, where this is not possible or the commitment to do so is not credible, through sanctioning regulatory intervention. This logic helps to explain the rise of anti-collusive competition policies as well as (potentially) the pattern of their enforcement across industries, enforcement types, and countries. Further work on the 'collusion-profit' paradox and its implications should focus on extending the analysis to a general equilibrium framework, and on further assessing its consistency with facts.

3. CHAPTER THREE:

CAPITAL MOBILITY, TRADE LIBERALIZATION AND RELOCATION THREATS: THE BARGAINING CHANNEL AND THE DISTRIBUTION OF INCOME

3.1. Introduction

This paper examines the effects of the ability to profitably relocate production on the distribution of income. It analyzes the effects of increased capital mobility (understood in this sense) in the presence of free trade, as well as the impact of freer trade in the presence of capital mobility.

The first section of the paper exhibits a theoretical model of intra-firm bargaining in which an increase in capital mobility (modeled as decreases in the transactions cost of repatriation of profits) leads the "outside option" of employers to improve vis-a-vis that of workers, and intra-firm rents to shift accordingly in favor of employers. Two regions with integrated product and capital markets but with different prevailing 'outside' wage rates are modeled. Rents are assumed to arise from the varying presence of a fixed factor of production (which may be thought of as 'organizational capability') among firms, which in turn differ for a given firm among its different alternative 'locations' (at the current location, at a different location at home, and at a different location abroad).[43] The model shows in a general equilibrium context that under relatively conventional assumptions (efficient bargaining over rents, rent maximization by workers, profit maximiza-

[43] 'Location' may be interpreted broadly, as for instance encompassing both physical relocation and production at the same physical site with a different workforce.

tion and price-taking by firms, homothetic preferences, homogeneous production technologies which can be ranked by factor intensity), an increase in capital mobility can be expected to lead to a decrease in workers' rents at a broad range of firms, with constancy of these rents at others, even in the complete absence of any actual relocation, or changes in the prices and quantities of goods produced.

The model's assumptions regarding the rent-maximizing objective pursued by 'worker collectives' and the efficiency of bargaining help to establish a "duality" between the competitive and rent-sharing economies which simplifies the analysis. Consequently, changes in distribution have no effects on production allocation. The model therefore demonstrates the possibility of a pure "threat effect" of increased capital mobility, which does not depend in any way upon actual movement for substantial income distribution consequences to arise. If transactions costs of capital mobility decrease to a sufficient extent, actual relocation can be triggered. The consequences of such relocation, although more difficult to unambiguously characterize, are also examined. It is demonstrated that there exist up to three zones into which industries may be divided. The most labor intensive industries will actually relocate to the lower wage region since they are best positioned to take advantage of reduced labor costs. The most capital intensive industries, in contrast, will be unable to relocate or credibly threaten to do so. Industries at an

intermediate level of labor intensity will be the ones in which employers do not relocate yet in fact can strengthen their bargaining position, and thus their share of available rents, by credibly threatening to do so.

The second section of the paper analyzes the consequences of changes in trade policy in the presence of capital mobility, through its effects on 'relocation threats'. Once again a two country trading economy is examined. It is shows that the 'benchmark' competitive economy in the model reproduces many salient features of standard trade models - including a version of the Stolper-Samuelson theorem. It is then investigated how the threat effect of relocation is influenced by a fall in tariffs when rent sharing is present. Analogously to the first section, a tripartite division is identified wherein industries with intermediate labor intensity will be those for which the threat of relocation abroad will be that used by employers, although no actual relocation will occur. In this case, where no actual relocation is triggered by the reduction in tariffs, the bargaining position and income share of capital owners is unambiguously strengthened. It is further shown that this 'bargaining channel' will have an impact on wages which will tend to hurt workers in labor intensive industries in the more developed region the most. In principle, the absolute impact of a tariff reduction on the bargaining rents for workers is ambiguous, since the efficiency gains from trade increase demands for all goods.

However, it can be shown unambiguously that the bargaining rents of workers in labor intensive sectors will fall in *comparison* to their counterparts in more capital intensive ones. These results underline the claim that using prices to gauge the impact of trade on wages will in a rent-sharing economy underestimate the impact of trade as it will that of capital mobility. Moreover, the underestimation of the possibly deletrious effect of trade on wages is likely to be the most marked for the most labor intensive sectors.

3.2. The Model

The existence of two countries / regions ("North" and "South") which have integrated product and capital markets but distinct labor markets is assumed. The detailed structure of each economy is as follows:

Industry and Firm Structure:

A finite number of firms are assumed to exist in each industry in each country, with actually operating firms (possible zero in number) in any particular industry and country having identical production functions. The production function of each firm is represented by F_{ij} where the subscript i denotes the industry, and j denotes the country. The production functions are assumed to be constant

returns to scale, with diminishing returns in each input, and to have as their inputs, capital (K), labor (L), and a third factor, X, which is assumed to be fixed at a particular level ($\overline{X}$) at a particular production site. Accordingly, the production functions are characterized by decreasing returns to scale in capital and labor jointly. Further, it is assumed that production at a given site is characterized by

$$F_{ij}(K, L, \overline{X}) = A(\overline{X}) f_{ij}(K, L), \tag{116}$$

where $A \in R^+$ is a constant determined by $\overline{X}$ [44]. The 'fixed factor' giving rise to the factor neutral productivity parameter, A, may be interpreted in various ways. [45] Henceforth A is referred to as a firm-specific form of 'organizational capability' although this interpretation is not necessary. It is assumed that the 'effective' production function for each firm $Af_{ij}(K, L)$ is homogenous of the same degree $\alpha, \alpha < 1$.

[44] In effect, this requires that $F_{ij}(K, L, \overline{X}) = g(X) f_{ij}(K, L)$., which is a very weak if not wholly innocuous restriction.

[45] For example it may be interpreted as a measure of indefinable and non-reproducible "organizational capability". This "organizational capability" may derive from both a public good component (e.g. the quality of shared physical infrastructure, the average skills of the labor pool, the quality of contract enforcement) and a privately held component (e.g. the quality of a particular firm's work force, the quality of the matches established between the firm and its employees and between different employees, the extent of superiority of firm-specific knowledge of production techniques, and physical advantages deriving from location). The public good component of organizational capability may be imagined to be non-excludable and non-rivalrous. In contrast, the privately held component is presumably excludable and possibly rivalrous.

Price taking behaviour in each industry is postulated, as is a number of firms 'large enough' to make this a realistic assumption. However, crucially, it is assumed that entry does not fully dissipate "excess profits". It is assumed that potential entrants have significantly lower levels of organizational capability, A, than do incumbent firms, as well as face a fixed cost of entry, and thus do not find it profitable to enter in the relevant range of prices and factor costs discussed here. The model therefore examines competitive industries with firms which have been successful in producing good "matches" or other firm-specific advantages and therefore have knowledge or internal structures which enable them substantially to outcompete potential entrants. As a result, profits above those realizable elsewhere in the economy, or "rents", are realized by the owners of the firms.[46]

It is also supposed that industries can be ranked by an increasing index of their labor intensity $\gamma \in [\underline{\gamma}, \overline{\gamma}]$ and that there is a continuum of industries indexed by γ. In particular, the 'factor intensity' assumption that at any given set of factor costs, an industry with higher γ, has a lower optimal capital-labor ratio is made.

[46] It is also possible to think of these as "quasi-rents", or returns ex-post to entry - which may be zero ex ante of the entry-decision due to the entry costs - in which case the results below would be interpreted as of a "short term" nature. Long run effects would have to be investigated by examining how changes in total returns, influenced by all factors including bargaining, affect entry.

This may equivalently be stated as that if $C(w,r,y|\gamma)$ describes the average cost of producing a unit of a good (given a level of its production y, in a firm in an industry with labor intensity γ, at given factor costs w and r) and is differentiable, and if L represents the amount of labor employed on average to produce such a unit, then $\frac{\partial}{\partial\gamma}\left(\frac{wL(w,r,y|\gamma)}{C(w,r,y|\gamma)}\right) = \frac{\partial}{\partial\gamma}\left(\frac{wC_w(w,r,y|\gamma)}{C(w,r,y|\gamma)}\right) > 0$. i.e. the share of labor costs in unit costs is increasing in γ.

The Bargaining Situation:

It is assumed that at least part of the level of the fixed factor at a particular production site is associated integrally with the presence or cooperation of the firm's current workers, which potentially gives them power to extract some share of rent. For example, if the firm's rent is due to such factors as workers' firm-specific human capabilities and match-specific productivities, workers have some threat power since replacing them with other workers would lead to a lower level of output. It is therefore plausible that wages going to workers are negotiated in a bargaining situation. Although many of our results can be derived with individual level bargaining, for simplicity it is posited that there exist 'worker collectives' at each site which bargain with their respective employers in a decentralized fashion.

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The bargaining process is assumed to satisfy very limited requirements. Specifically, it is assumed that worker collectives and employers bargain efficiently (i.e. that bargained outcomes do not leave unused opportunities for the interests of all parties to be furthered), and that employers seek to maximize profits and that worker collectives seek to maximize rents. The latter assumption is a frequent one in the labor economics literature which can be justified on various grounds [see for example Oswald (1982)] although it is indeed specific. It is adopted here in order to facilitate analysis of the effects of policy changes on distribution as distinct from on productive allocation since under the rent maximization hypothesis the determination of productive allocation is, as shall be seen, 'separable' from that of distribution.

Further, it is assumed that the bargaining rule (which specifies an efficient production and allocation vector for any given set of "outside options", and any given "objective possibility set" of the parties) is monotonic in outside options in the sense that, all other things equal, a superior alternative to negotiated

[47] It is important to underline that these effects are likely important not only in unionized setting but also in non-unionized sectors where rent sharing occurs. See for example Blanchflower and Oswald (1996) and Nickell, Wadhwani, and Vainomakadis (1994) for evidence on the prevalence of rent sharing in non unionized settings in the United States and in the U.K. respectively.

agreement for one of the parties, causes that party's outcome in the negotiated agreement to be improved[48]. Formally, a (possibly firm specific) bargaining rule is postulated:

$$\beta : \Theta \rightarrow \{b = (n, k, w)\} \qquad (117)$$

where $\Theta = \{\underline{\Pi}, 0\}$ represents the "outside options" of the parties, and (n, k, w) represent the level of employment, utilization of capital and wage which prevail at the firm.

Specifically, $\underline{\Pi}$ is the highest level of profit available to the employer in the absence of a negotiated agreement with the current worker collective (it may for example entail hiring new workers at the same site or relocating elsewhere and doing the same). Similarly, the worker collective's best alternative to a negotiated agreement measured in units of rent is by definition zero. In particular, it is assumed that the best alternative for workers is to find employment on a competitive labor market on an 'outside' labor market at wage $\underline{w}$. The worker collective's objective can then be described by $U = (w - \underline{w})n$. In the absence of a negotiated agreement workers at the firm have wage $w = \underline{w}$ from which it follows that the worker collective's outside option has value $U = 0$.

[48]This assumption is innocusous. It is satisfied by all standard bargaining rules.

Efficiency requires that the bargained allocation vector $b^* = (n^*, k^*, w^*)$ be such that it is not possible by shifting to an alternative allocation $b' = (n', k', w')$ to strictly increase both the worker collective's rent and the employer's profit.

The outside options of the firm are assumed to be determined by the following logic. The outside option of the firm is the maximum of:

(1) The firm's domestic outside option: the maximum profit that may be gained if current workers are dismissed and operations proceed with new ones at the current or an alternative domestic production site. The adoption of the domestic outside option is costly in that the firm loses the currently high level of the fixed factor ('organizational capability') at its present site. It is assumed that in the event of exercise of the domestic outside option the firm can hire new workers at an 'outside' (or 'competitive') wage $\underline{w}$ prevailing in the country.

(2) The firm's foreign outside option: the maximum profit that may be gained by dismissing current workers and operating with new ones at a newly established production site 'abroad'. It is assumed that the reduction in the fixed factor is greater when a company relocates to a foreign country than when it pursues its domestic outside option. [49] The firm also faces a change in unit labor costs

[49] This could for example arise due to a decline in the private good component of organizational

when it moves abroad (a reduction if it moves from North to South and a rise if it moves from South to North). Finally, it is assumed that there is a cost of repatriating profits from productive enterprises, τ (a combination of taxes and other transactions costs) such that $0 \leq \tau \leq 1$, which applies to each unit of profits repatriated. It is assumed that in the event of exercise of the foreign outside option the firm can hire new workers at an 'outside' (or 'competitive') wage $\underline{w}$ prevailing in the foreign country.

The difference in organizational capability associated with different production alternatives of the firm is summarized by the following differentials in productivity parameters. The productivity parameters are given by $A = A_1$ if the firm does not relocate; $A = A_2$ if it relocates within the country, and $A = A_3$ if it relocates abroad. Then $A_1^i > A_2^i > A_3^i > A_4^i > 0$ $(i = N, S)$, where the last term refers to the productivity of potential entrants. To simplify the analysis, this profile of productivity parameters is considered to be the same for all firms operating within country although it may differ across coutnries. There are no transactions costs

capability (as relocation may involve forming new networks, learning how to recruit, train and manage workers in different ways, etc.) The public good component of organizational capability is also assumed to fall when a firm moves from North to South and to increase when a firm moves from South to North, but not enough to outweigh its loss of the privately held component. This is assumed purely to avoid dealing with the complicating case of Southern firms moving to the North, which is of limited empirical importance. There is no conceptual loss in this simpification.

to exercising the 'outside option'.

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Product Demand:

Individuals are assumed to have identical homothetic and strictly convex preferences. In the first section, fully integrated product markets (with zero tariffs) are assumed . In contrast, in the second section, in order to focus on the effect of trade policies a constant tariff rate on imports, t, in North and South is assumed for all goods. Finally, it is assumed that all taxes raised are returned to some consumer and that the costs of collection are zero.

Factor Markets:

Labor:

In each country, let $L_D = \sum_{ij} n_{ij}$ where n_{ij} is the level of employment of firm i in industry j . Let $\overline{L}$ refer to the country's fixed 'endowment' of labor.

The equilibrium 'outside' wage in each country is assumed to be determined by $\underline{w} = \underline{w}(L_D, \overline{L})$. Note that this accomodates the case of constant outside wages (e.g. due to reasons of 'labor surplus') in the relevant region of the model's operation, as well as that of variable wages. However this assumption is 'neoclassical' in the

sense that it discounts the possibility that the outside wage is itself responsive to bargained wages. [50]

As well it is assumed that equilibrium wages in North ($\underline{w}^N$) and South ($\underline{w}^S$) are such that $\underline{w}^N > \underline{w}^S$.

Finally the 'normalization' assumption that $\underline{w}^S = 1$ is made.

Capital:

It is assumed that units of capital may be rented at a constant rental rate per period of production r^i $(i == N, S)$, and that there are no barriers to operating firms' importing capital to the other country as such for productive investment projects, although there may be transactions costs entailed in allocating capital which create a differential in the rental rate.[51] It is assumed that $r^N \leq r^S$ so that Northern firms never strictly prefer to borrow on Southern capital markets.

It is assumed that a quantity of capital $\overline{K}^N$ is supplied to Northern firms (this may be a fixed amount or be determined residually to Southern borrowings from

[50] For instance, higher bargained wages may induce greater search effort and therefore lesser effective labor supply on the competitive labor market.

[51] In short, impediments to capital flow are modeled as solely affecting outflows, although the ultimate effects of such impediments on inflows is analyzed.

a fixed global pool of capital in the case of an integrated world market with a common rental rate).

Let $K_D^C = \sum_{ij} k_{ij}$ $(C = N, S)$ where k_{ij} is the level of use of capital of firm i in industry j in the country concerned (N or S). The rental rate on capital is accordingly determined by $r^C = r^C(K_D^C, \overline{K}^C)$. $(C = N, S)$. In the second section, where trade policies are the focus, autarkic capital markets are assumed, so that both $\overline{K}^N$ and $\overline{K}^S$ are interpreted as fixed quantities. These assumptions accomodate the case of an 'integrated' global capital market and of distinct capital markets, with firms having the ability to borrow freely on their home capital market for any real investment project available to them globally.

As a prelude to further characterization of the model, the following 'duality' proposition is proved:

Proposition 3.1. ***Duality of the Rent-Sharing and the 'Competitive' Economy:*** *(i) The productive allocation (level of output and utilization of factors of production) at each firm is the same in an economy with rent sharing as it is in the corresponding 'competitive' economy (without rent sharing). (ii) These economies differ only in the distribution of rents. Production and distribution are therefore independently determined in a rent sharing economy.*

Proof:

(i) Consider an economy with rent sharing, defined by a specific set of operating firms, configuration of parameters and bargaining rules as assumed above. Since worker collectives pursue the rent maximization objective, and firms the profit maximization objective, it must be the case that the bargained productive allocation vector at each firm, $b^* = (n^*, k^*, w^*)$ is such that (n^*, k^*) maximizes the level of production surplus (or total firm rent), R , available to be divided [If not, then by shifting to an alternative b^{**} both parties could have the fulfilment of their objectives strictly increased, which would violate the assumption of efficient bargaining]. The maximization of production surplus is however also the objective pursued by a profit maximizing firm. Since the maximization program has a unique solution, it follows that the (n^*, k^*) chosen by each firm in response to a given vector of prices is the same in the rent sharing and in the 'competitive' economy . Thus for a given vector of prices, production allocation (and therefore the supply of each good, and the level of aggregate income) are identical in the two cases. Moreover, since demand is homothetic, the distribution of income as determined by wage bargains within firms does not influence the demand for each good. Since demand and supply are invariant in the rent sharing and in

the competitive economy, so are prices. It may be concluded that the production allocation is identical in the competitive and in the rent sharing economy. (ii) A profit maximizing firm faced by a worker collective engaged in efficient bargaining will only operate in its current location if the maximal production surplus to be realized by doing so is at least as high as in the event of exercise of the domestic or foreign outside option. In the event of exact equality, the worker collective will have no ability to extract rent as the firm would do better by exercising its best outside option then by paying a wage above the outside wage ($\underline{w}$) and remaining. It follows from this fact, the assumption of monotonicity in outside options, and the fact that wages are the only instrument through which rent can be transferred to workers (since n^* is fixed), that in a rent sharing economy when production surplus is higher than in the best outside option, $w^* > \underline{w}$. Thus the rent-sharing economy is identical to a competitive economy in all respects other than in its distribution of income (more favourable to workers in all but the threshold case). QED

In light of the above proposition the characterization of the model can be completed.

First Order Conditions of the Firm:

Given production function $Af(n,k;\gamma)$, where f is homogeneous of degree α, it can be shown that the cost function is of the following form:

$$C(w,r,y|\gamma) = \frac{y^{1/\alpha}}{A} c(w,r|\gamma), \tag{118}$$

where c refers to the unit-cost function derived from a corresponding linearly homogenous (i.e. constant returns to scale) production function $(f(n,\alpha;\gamma)^{\frac{1}{\alpha}}$. Define the 'production surplus' or total rent of the firm as $v = py - C(w,r,y|\gamma)$. By the proposition on the duality of the rent sharing and the competitive economies, it is possible to specialize to the case of firms maximizing production surplus (equivalent to profits in the dual competitive economy) , in order to characaterize production allocation in general. The first order condition for maximization of production surplus is $p = \frac{1}{\alpha A} y^{\frac{1-\alpha}{\alpha}} c(w,r|\gamma)$ implying

$$y^* = \left(\frac{\alpha p A}{c(w,r|\gamma)|}\right)^{\frac{\alpha}{1-\alpha}} \text{ and}$$

$$v^*(A,\overline{w},r|\gamma) = (pA)^{\frac{1}{1-\alpha}} \left(\frac{\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}}{c(w,r|\gamma)^{\frac{\alpha}{1-\alpha}}}\right). \tag{119}$$

Here, each firm will potentially face a different A, p, r, and w depending on which industry and country they are producing in.

Market Clearing Conditions:

Factor market clearing conditions have been specified already above. Goods

market clearing is determined by the condition that product supply must equal product demand globally for each good. Let global income be given by I. First, consider the case of no tariffs. Then, under the assumption of homothetic demand, demand for good j is given by

$D_j = a_j(p_j, p_{-j})I$, where $0 \leq \alpha_j(p_j, p_{-j}) \leq 1$. It follows that prices for good j are determined by

$$a_j(p_j, p_{-j})I = p\sum_i y_i(p_j). \qquad (120)$$

where y_i is the output of firm i , and the summation is over all firms globally.

In the second section, the presence of a uniform tariff, t, is assumed. Thus, $P_\gamma^N = P_\gamma^S(1+t)$ for all goods that in equlibrium are imported to North. And likewise, $P_\gamma^S = P_\gamma^N(1+t)$ for goods imported to South. Prices will be determined by:

$$\left(a_j(p_j^N, p_{-j}^N) + a_j(p_j^S, p_{-j}^S)\right) I = \sum_i y_i(p_j^N) + \sum_i y_i(p_j^S). \qquad (121)$$

3.2.1. Capital Mobility and Relocation Threat Effects

In this section of the paper the effects of an increase in capital mobility (modeled as a decrease in the effective cost of repatriating earnings from productive enterprises) on income distribution is examined. The effects of such a change on the bargaining process within each firm are considered in light of the effect of the policy shift on the relative profitability to the firm of continuing to operate as it is doing, or to exercise its domestic or foreign threat, given the particular tradeoffs between labor costs and levels of the fixed factor ('organizational capability') which these alternatives entail. The comparative effect of an increase in capital mobility on industries at different levels of labor intensity is examined. It is demonstrated that within a certain range of increases in the mobility of capital, there occurs in some industries (at intermediate levels of labor intensity) a pure threat effect, which triggers changes in the distribution of income due to the threat of relocation, without any actual relocation being observed.

In this section free trade in goods between countries is assumed in order specifically to focus on the effect of increased capital mobility (understood in the specific sense described above).[52] As a preliminary step to analyzing the effect of ease of relocation on different kinds of industries in the North, it is shown that the relative

[52]Capital mobility may be also understood as an increase in the extent of integration of general markets for loanable funds. Although this is an important aspect of the issue, it has been analyzed extensively and convincingly elsewhere along established lines. See for instance Mundell (1968) and Bhagwati (1987).

benefits (measured in terms of total production surplus, or equivalently profits in the dual competitive economy) from relocating abroad are higher for more labor intensive industries:

Proposition 3.2. *For profit maximizing firms in the North facing a common rental rate of capital, relative benefits from relocation are monotonically rising in the labor intensity of production, γ.*

Proof: As noted earlier, given production function $Af(n,k;\gamma)$, where f is homogeneous of degree α, it can be shown that the cost function is of the following form:

$$C(w,r,y|\gamma) = \frac{y^{1/\alpha}}{A} c(w,r|\gamma) \tag{122}$$

where c is the unit-cost function derived from a linearly homogenous production function $(f(n,k;\gamma)^{\frac{1}{\alpha}}$,.and w and r refer to constant input prices. Firms maximizing $v = py - C(w,r,y|\gamma)$ have the following first order condition:

$$\begin{aligned} &p = \tfrac{1}{\alpha A} y^{\frac{1-\alpha}{\alpha}} c(w,r|\gamma) \text{ implying} \\ &y^* = \left(\tfrac{\alpha pA}{c(w,r|\gamma)|}\right)^{\frac{\alpha}{1-\alpha}} \text{ and} \\ &v^* = (pA)^{\frac{1}{1-\alpha}} \left(\frac{\alpha^{\frac{\alpha}{1-\alpha}} - \alpha^{\frac{1}{1-\alpha}}}{c(w,r|\gamma)^{\frac{\alpha}{1-\alpha}}}\right). \end{aligned} \tag{123}$$

Denote the relative profitability for a firm of remaining at home vs. relocating

abroad by the ratio

$$B(\overline{w}^N, \overline{w}^S, r, \gamma, \tau) = \frac{(1-\tau)v^*(A_3, \underline{w}_S, r|\gamma)}{v^*(A_1, \underline{w}_N, r|\gamma)}$$

$$= \frac{(1-\tau)A_{3N}^{\frac{1}{1-\alpha}} c(\underline{w}_N, r|\gamma)^{\frac{\alpha}{1-\alpha}}}{A_{1N}^{\frac{1}{1-\alpha}} c(\underline{w}_S, r|\gamma)^{\frac{\alpha}{1-\alpha}}}$$

$$= (1-\tau)\left(\frac{A_{3N}^{\frac{1}{\alpha}} c(\underline{w}_N, r|\gamma)}{A_{1N}^{\frac{1}{\alpha}} c(\underline{w}_S, r|\gamma)}\right)^{\frac{\alpha}{1-\alpha}}. \tag{124}$$

The gains from relocating abroad are rising in γ iff $B_\gamma(\underline{w}_N, \underline{w}_S, r, \gamma, \tau) > 0$.

The sign of the derivative of $B_\gamma(\underline{w}_N, \underline{w}_S, r, \gamma, \tau)$ with respect to γ will be positive iff

$$\frac{c_\gamma(\underline{w}_N, r|\gamma)}{c(\underline{w}_N, r|\gamma)} > \frac{c_\gamma(\underline{w}_S, r|\gamma)}{c(\underline{w}_S, r|\gamma)}.$$

Given that $\underline{w}_N > \underline{w}_S$, the condition for $B_\gamma(w, r, \gamma, \tau) > 0$ then reduces to

$$\frac{\partial}{\partial w}\left(\frac{c_\gamma(w, r|\gamma)}{c(w, r|\gamma)}\right) > 0.$$

$$\text{Bu}\frac{\partial}{\partial w}\left(\frac{c_\gamma(w, r|\gamma)}{c(w, r|\gamma)}\right) > 0.\frac{c_{\gamma w}(w, r|\gamma)}{c(w, r|\gamma)} - \frac{c_\gamma(w, r|\gamma)c_w(w, r|\gamma)}{c(w, r|\gamma)^2}.$$

$$\text{Th}$$
$$\text{But } \frac{\partial}{\partial w}\left(\frac{c_\gamma(w, r|\gamma)}{c(w, r|\gamma)}\right) > 0$$
$$\Longleftrightarrow c_{\gamma w}(w, r|\gamma)\, c(w, r|\gamma) > c_\gamma(w, r|\gamma)\, c_w(w, r|\gamma),$$

which has to be satisfied for $B_\gamma(\underline{w}_N, \underline{w}_S, r, \gamma, \tau) > 0$.

Note, however, that this condition is satisfied by the assumption that labor intensity is rising in γ. To show this rewrite our labor intensity condition:

$$\frac{\partial}{\partial \gamma}\left(\frac{wL(w, r, y|\gamma)}{C(w, r, y|\gamma)}\right) = \frac{\partial}{\partial \gamma}\left(\frac{wC_w(w, r, y|\gamma)}{C(w, r, y|\gamma)}\right) > 0 \text{ at all levels of y.}$$

$$\frac{\partial}{\partial \gamma}\left(\frac{wC_w(w, r, y|\gamma)}{C(w, r, y|\gamma)}\right) = \frac{\partial}{\partial \gamma}\left(\frac{wc_w(w, r, y|\gamma)}{c(w, r, y|\gamma)}\right)$$

$$= \frac{wc_{w\gamma}(w,r,y|\gamma)}{c(w,r,y|\gamma)} - \frac{wc_w(w,r,y|\gamma)c_\gamma(w,r,y|\gamma)}{(c(w,r,y|\gamma))^2}.$$

This will be positive iff

$$c_{w\gamma}(w,r,y|\gamma)\,(c(w,r,y|\gamma)) > c_w(w,r,y|\gamma)c_\gamma(w,r,y|\gamma)\ ,$$

which is precisely the condition necessary for $B_\gamma(w,r,\gamma,\tau) > 0$. QED

Using this proposition, it is possible to analyze the equilibrium pattern of firm location, and in particular, to show that it will in general be characterized (in the North) by the presence of three distinct zones, in which, respectively, firms relocate abroad, firms do not relocate abroad but use the threat of relocation abroad as their effective threat in bargaining with their workers, and firms do not either relocate or use the threat of relocation abroad. We assume that when the production surplus associated with domestic and foreign outside options is identical, the domestic one is used by the firm as its threat.

Proposition 3.3. *In equilibrium, there will exist three zones marked by two thresholds,* $\widehat{\gamma}$, $\gamma^* \in R$ *(not necessarily in* $[\underline{\gamma}, \overline{\gamma}]$*) with* $\gamma^* > \widehat{\gamma}$*, and such that: (1) in industries with* $\gamma \in [\underline{\gamma}, \widehat{\gamma}]$ *Northern firms will produce in the North, and use the domestic threat in bargaining; (2) in industries with* $\gamma \in (\widehat{\gamma}, \gamma^*]$*, Northern firms will produce in the North, but will use the foreign threat in bargaining; and 3) in industries with* $\gamma \in (\gamma^*, \overline{\gamma}]$*, Northern firms will actually relocate to the South.*

Proof: first, establish γ^*. Note that efficient bargaining dictates that Northern firms will move to the South iff $(1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma) > v^*(A_{1N}, \underline{w}_N, r, p|\gamma)$.

This can be proved by contradiction. Suppose

$(1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma) < v^*(A_{1N}, \underline{w}_N, r, p|\gamma)$,

but the firm moved abroad, so that workers received their outside wage $\underline{w}_N$. Then the worker collective could offer

$(1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma) + \varepsilon < v^*(A_{1N}, \underline{w}_N, r, p|\gamma)$

to the owners to stay in the North, and increases wages to

$\underline{w}_N + [v^*(A_{1N}, \underline{w}_N, r, p|\gamma) - (1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma) - \varepsilon]/n^*$,

where n^* is the number of those who would be employed by the firm were it to operate in the North. Yet this implies that the original decision and allocation left room for pareto improving moves, violating the assertion that it was efficiently bargained.

Moreover, since a firm will never accept a profit level lower than:

$(1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma)$,

workers will be unable to convince firms to stay if

$(1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma) > v^*(A_{1N}, \underline{w}_N, r, p|\gamma)$,

since even if they were to accept their outside option, $\underline{w}_N$, the firm's profit would be lower at home than abroad.

Moreover, the previous lemma established that:

$B(\underline{w}_N, \underline{w}_S, r, \gamma, \tau) = \frac{(1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma)}{v^*(A_{1N}, \underline{w}_N, r, p|\gamma}$ is rising in γ monotonically.

This implies that there will exist a $\gamma^* \in R$ satisfying:

$(1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma^*) = v^*(A_{1N}, \underline{w}_N, r, p|\gamma^*)$.

Note that it might be outside $[\underline{\gamma}, \overline{\gamma}]$: if it is greater than $\overline{\gamma}$, then no firms will actually relocate.

If it is less than $\underline{\gamma}$, all firms will relocate. Similarly, it is possible to establish $\widehat{\gamma}$. By our assumptions about the bargaining rule $\beta : \Theta \rightarrow b$, only the best "outside option" is relevant in determining the shares of the production surplus. Hence,

$\underline{\Pi} = \max\{v^*(A_{2N}, \underline{w}_N, r, p|\gamma), (1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma)\}$

since in both the cases of relocating abroad or using the best domestic alternative, the firm's owners can extract the full production surplus.

Define

$\widehat{B}(\underline{w}_N, \underline{w}_S, r, \gamma, \tau) = \frac{(1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma)}{v^*(A_{2N}, \underline{w}_N, r, p|\gamma}$.

It is then possible to use previous lemma (replacing A_{1N} with A_{2N}) to establish the monotonicity of $\widehat{B}$ in γ. Therefore, there will exist a threshold $\widehat{\gamma}$ such that only firms with $\gamma > \widehat{\gamma}$ will (conditional on their producing in the North) use relocation abroad as their threat. Moreover, $\widehat{\gamma}$ will be defined by:

$(1-\tau)v^*(A_{2N}, \underline{w}_S, r, p|\widehat{\gamma}) = v^*(A_{1N}, \underline{w}_N, r, p|\widehat{\gamma})$.

Finally, $A_{2N} < A_{1N}$ implies that $\gamma^* > \widehat{\gamma}$ QED.

This last proposition establishes that there is potentially equilibrium use of relocation threats in a range of industries with intermediate level of labor intensity. The most labor intensive industries are those which are best poised to take advantage of the cheaper labor cost abroad and will thus actually relocate. The rest of the industries will not find the cost savings from relocation enough to compensate for the loss of productivity. However, whereas the capital intensive industries do not even find the threat of relocation abroad useful, industries with intermediate factor intensity can credibly threaten to relocate abroad in the event of a breakdown in bargaining, which causes policy changes which influence the (counterfactual) value of such relocation to affect the bargains struck. The "threat effect" is thus binding for this group of industries.

In general , a fall in the cost of repatriation, τ, will lead to an immediate rise in the outside options of capital owners within the "threat zone." Hence, their profits will rise and wages will fall. Will they want to change their production levels or input combinations due to a change in τ? The change in outside options of firms in the 'threat zone' cannot by itself have this effect for, as we have seen, the equilibrium input and output vector of the firm is fixed by external market conditions. Moreover, due to the homotheticity of demand, the distributional shift

in itself has no impact on demand and therefore on prices. Can change in policy otherwise influence external market conditions? In the case of a continuum of industries, a rise in τ will also lead to a change in γ^*. In particular it will cause marginal industries to move abroad, which will cause them to produce different amounts and with different input combinations. Specifically, firms moving to the South will increase their labor intensity and increase production - which will (1) reduce the relative price of the good in the marginal industry; (2) will raise demands for all goods since the production surplus in that industry will rise; and (3) will have indeterminate impact on the cost of capital, r: on the one hand demand for capital goes down for firms in the marginal industry due to the substitution effect, but it rises because the aggregate production level is now higher. The demand and cost of capital effects could, in net, either reduce or increase the production surplus of the inframarginal industries. This general equilibrium effect from the relocation of the marginal industry may affect real wages and profits. However, it would be reasonable to conjecture that the effect of this change would be relatively small (as it is triggered by a marginal relocation of industries) in comparison to the direct change in the threat (which potentially has an inframarginal effect on a broad swathe of industries in which the threat of relocation abroad is that which is binding). The comparative statics for the

continuum economy are made very complicated by the general equilibrium effect from the marginal industries. However, in the case of a finite number of industries, there will be a range of changes in τ for which there will be no effects on productive allocation, yet which will have changes in distributional outcomes. The analysis of this range will be referred to as "intra-regime" analysis - where the relocation decision for any industry (but not necessarily its decision to threaten workers with relocation) is unchanged within the regime. This case will now be studied in depth to ascertain the key implications of the model.

Intra-Regime Analysis with a Finite Number of Industries Specialize to the case of a finite number, N, of industries, with equilibrium threshold γ^* such that a bounded change in τ will not lead to a change in industry's location. In particular, denote as $\{\overrightarrow{\gamma_i}\}$ the vector of labor intensities of the industries, indexed by i. Since the assumptions of the model satisfy all necessary conditions for the existence of a general equilibrium, therefore for any fixed initial profile of firms there will exist an equilibrium $< \overrightarrow{w}, \overrightarrow{p}, \overrightarrow{r}, \overrightarrow{y}, \overrightarrow{n} >$ in which all markets clear. This also defines an equilibrium γ^* satisfying

$$(1-\tau)v^*(A_{3N}, \underline{w}_S, r_N, p|\gamma^*) = v^*(A_{1N}, \underline{w}_N, r_N, p|\gamma^*). \tag{125}$$

As the 'interesting' case is that in which $\underline{\gamma} < \gamma^*$ (i.e. there are some industries

for which the foreign relocation threat is relevant) we assume that this is the case. Now define $H = (\gamma^* - \varepsilon, \gamma^* + \varepsilon)$ as an open interval around γ^*. Specifically, construct H by identifying an $\varepsilon > 0$ such that $\gamma_i \notin H \quad \forall i$.

It can easily be seen that holding $< \overrightarrow{w}, \overrightarrow{p}, r >$ constant, a rise in τ raises both γ^* and $\widehat{\gamma}$. This enables the conclusion that:

Proposition 3.4. *When the number of industries is finite (N), a sufficiently limited change in cost of repatriation of profits, τ, will have no effect on the production and input vectors, and on the prices of goods and capital.*

Proof:

Partition all industries into two groups $\{P_1, P_2\} : \gamma_i < \gamma^* \Leftrightarrow i \in P_1$. (A1) implies that a sufficiently small change in τ will not, holding $< \overrightarrow{w}, \overrightarrow{p}, \overrightarrow{r} >$ constant, affect the partition: i.e., a small change in τ will not lead to a change in the location decision. Can a small change in τ cause a change in $< \overrightarrow{w}, \overrightarrow{p}, \overrightarrow{r} >$? If it does not trigger any changes in firm location it will not do so since output of each good is fixed, as is therefore total income, for a given profile of firm locations and $< \overrightarrow{w}, \overrightarrow{p}, \overrightarrow{r} >$ by the duality theorem, and demand is invariant to changes in distribution alone.Moreover, by the definition of H and the efficiency of bargaining, sufficiently small changes in τ will not disturb the fact that $\gamma^* \in H$

and therefore will not cause any relocation. It follows that a sufficiently small change in τ will cause no change in productive allocation or prices. QED.

Although the equilibrium production decisions are unchanged by an 'intra-regime' change in τ, the same cannot be said for income distribution. In general, a fall in τ will improve the bargaining position of capital owners in industries in the "threat zone." As a result, wages will fall and profits will rise unambiguously in these industries. Moreover, if tax revenues are distributed equally, the requirement of budget balance will mean that all workers will face reduced transfers from government and net declines in income unless they have significant ownership stakes in benefitting firms. These points can be summarized by the following proposition.

Proposition 3.5. *When the number of industries is finite (N), a sufficiently bounded decrease in the tax on the repatriation of profits, τ, will have the following distributional impact: (1) in all industries with $\gamma_i \in (\gamma^*, \overline{\gamma}]$ profits of Northern firms will rise: this will effectively be a transfer from the government, reflected in turn in diminished transfers from government received by citizens; (2) in all industries with $\gamma_i \in (\widehat{\gamma}, \gamma^*)$ wages of Northern workers will fall and profits of Northern firms will rise, and this will be a pure transfer from workers to capital*

owners; (3) Wages and profits for all Southern firms and workers, as well as those in the North with $\gamma_i \in [\underline{\gamma}, \widehat{\gamma})$ *will be invariant to a change in* τ.

Proof: To show this, it is necessary first explicitly to define profits for Northern firms. Define a sharing rule s - potentially firm (j) and industry (i) specific - directly derived from the bargaining rule, β, which specifies the share of production surplus allocated to profits under given conditions: $s^{ij}(v, \underline{\Pi}, \underline{w}_{ij})$. Then,

$$\pi^* = \left\{ \begin{array}{l} \pi_1, \text{ if } \gamma_i \in (\gamma^*, \overline{\gamma}] \\ \pi_2, \text{ if } \gamma_i \in (\widehat{\gamma}, \gamma^*) \\ \pi_3, \text{ if } \gamma_i \in [\underline{\gamma}, \widehat{\gamma}) \end{array} \right\}$$

where

$\pi_1 =$

$(1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma)$

$\pi_2 =$

$s^{ij}\left[v^*(A_{1N}, \underline{w}_N, r, p|\gamma), (1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma)\right\}, \underline{w}_N,]\, v^*(A_{1N}, \underline{w}_N, r, p|\gamma)$

$\pi_3 =$

$s^{ij}\left[v^*(A_{1N}, \underline{w}_N, r, p|\gamma), v^*(A_{2N}, \underline{w}_N, r, p|\gamma), \underline{w}_N,]\, v^*(A_{1N}, \underline{w}_N, r, p|\gamma)\right.$

i.e. Profit is equal to the post-repatriation cost total production surplus in the South for those who relocate, and it is a share of total production surplus for

firms which remain in the North, where the share is calculated as influenced by the maximum of either domestic or foreign relocation threats, as appropriate.

With this, (1) immediately follows from $\pi^* = (1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma)$. A fall in τ raises profits for all the industries that choose to relocate. Moreover, given the assumption of government budget balance, it follows that this will be a one-to-one transfer from the government (and ultimately therefore from the beneficiaries of government expenditures) to the owners of firms in these industries.

For firms in industries with $\gamma_i \in (\widehat{\gamma}, \gamma^*)$, note that $\frac{\partial \pi^*}{\partial \tau} < 0$ follows from $\frac{\partial}{\partial \underline{\Pi}} s^{ij}(v, \underline{\Pi}, \underline{w}_N,) > 0$, and that $\frac{\partial}{\partial \tau}\underline{\Pi} = \frac{\partial}{\partial \tau}(1-\tau)v^*(A_{3N}, \underline{w}_S, r, p|\gamma) < 0$. Furthermore, since the production surplus $v^*(A_{3N}, \underline{w}_S, r, p|\gamma)$ and employment n are unchanged, this rise in profits in industries with intermediate factor intensity comes entirely out of a reduced wage, hence establishing (2).

Finally, note that the profit expression for $\gamma_i \in [\underline{\gamma}, \widehat{\gamma})$ is independent of τ, and that its other arguments are constant, as shown earlier, and hence is left unchanged by a movement in τ. Since $v^*(A_{1N}, \underline{w}_N, r, p|\gamma)$ is constant, it follows immediately that wages are unchanged as well. Analogous arguments apply to Southern firms and workers. QED

An Example: Two Industries and Two Countries The results above can

be observed clearly through a two industry, two country example. Assume an initial equilibrium configuration in which production is occuring in both countries in both industries, the wage is lower in the South, and the initially relevant outside option for enterprise owners in the North is the domestic one. Namely, $\gamma_i \in [\underline{\gamma}, \widehat{\gamma})$ for $i = 1, 2$. Here industry 2 is the relatively more labor intensive one. For the North, this may be graphically represented as:

$$|\underline{\gamma}\text{---}\gamma_1\text{---}\gamma_2\text{---}\widehat{\gamma}\text{---}\gamma^*\text{---}\overline{\gamma}|$$

It has been shown that both $\widehat{\gamma}$ and γ^* are rising in τ. Initially, as τ falls, this has no impact on either production or distribution since the relevant threat against workers for both industries is the domestic one. So, γ_1 and γ_2 are invariant to changes in τ. However, as $\widehat{\gamma}$ falls beneath γ_2, relocation abroad becomes the effective threat of industry 2. Now, changes in τ reduce the wages of northern workers in industry 2, and increase the rents of the capital owners in that industry. Again, changes in τ have no effect on productive allocation and all the prices (besides the wage) and quantities remain constant.

$$|\underline{\gamma}\text{---}\gamma_1\text{---}\widehat{\gamma}\text{---}\gamma_2\text{---}\gamma^*\text{---}\overline{\gamma}|$$

As τ falls further, two consequences may arise, although the order in which they first occur is indeterminate: the capital intensive industry 1 may start using relocation as a threat, or industry 2 may actually relocate. In order to stay within the realm of intra-regime analysis consider the first possibility. If relocation abroad is the threat of both industries, then wages of workers in both industries will be depressed by a fall in τ, while goods and capital prices (as well as quantities) remain unchanged. On the other hand if actual relocation is triggered and industry 2 actually relocates, then intra-regime analysis will no longer apply. Effects on productive allocation will arise, and the changes in real wages and profits will be more complex to analyze. We can do so qualitatively even though a quantitative evaluation is not permitted by the limited structure imposed on the model thus far. On the one hand, outside (or competitive) wages in the North will tend to fall due to reduced labor demand. However, added global income (from the increased production surplus) will tend to raise demand for all workers and hence their wages. If this relocation occurs after the capital intensive industry 1 is already in the 'threat zone', a fall in τ will influence those workers' wages in two ways. First will be the effect through the competitive channels - i.e., through the fall in overall labor demand in the North due to relocation as well as the rise in overall labor demand due to a rise in global income and the impact this has

on the demand for goods. The net effect of these two phenomena is in principle indeterminate. The effect of the rise in output on raising capital costs as well as the substitutability between capital and labor in production will add to this indeterminacy (as discussed further below).

However, the net effect on the productive allocation and competitive wage in the rent sharing economy are identical to that in the competitive economy by the duality theorem. Moreover, bargained wages are equal to the reservation wage plus a share of the surplus. Regardless of what happens to the reservation wage, a fall in τ will improve the 'outside option' from relocation for employers within the 'threat zone' and hence, *ceteris paribus*, reduce the share of the surplus going to workers. In this sense, a fall in the cost of capital mobility will have a purely 'additive' (or more correctly subtractive) depressing effect on wages in the North through the 'bargaining channel' as compared with the effects of this policy change through re-allocation of productive resources alone. This leads us to conclude that:

Remark 17. *An implication of the above discussion is that in the presence of bargaining, changes in capital market policies can have effects on wages and profits without any significant changes in equilibrium level of production or in equilibrium*

prices of outputs and non-labor inputs. In any case, the effect of increased capital market mobility is always (weakly) to further reduce workers' share of rents as compared with the effect of the policy change on competitive prices alone.

Further Remarks on Inter-Regime Analysis We have already substantially discussed the qualitative logic of inter-regime analysis. In general, a reduction in the tax on repatriation of profits will have both distributional effects and effects on productive allocation. The immediate effect would be to worsen the the bargaining position of workers employed by all the industries in the "threat zone" and thereby their wages. However, besides this "inframarginal" impact, it will also cause "marginal" industries to switch production to the South. The "marginal" firms will use more labor intensive techniques of production once they move to the South and produce a larger output, lowering prices of the goods the produce. The effects on capital demand are various - lower demand for capital due to substitution of a more labor intensive technique by the relocating firms, higher demand for capital due to higher production levels, higher demand for capital as a substitute for newly more expensive labor in the South, and possibly lower demand for capital as a substitute for (possibly newly cheaper) labor in the North. Competitive wages in the North may rise or fall depending on the net effect of enlarged global demand

and of workers released by relocating firms on to the competitive labor market. Depending on the elasticities of substitution and scale, capital demand may rise or fall. The overall effect on real wages of Northern workers is also indeterminate as prices of consumption goods produced by industries where relocation occurs will fall (although they may rise or fall for other goods due to the combination of changed competitive factor prices and enlarged demand.

It may seem that little can be said in light of this complexity, but one unambiguous statement is possible. Regardless of how wages are affected through the market, the bargaining channel implies that in a bargaining economy there will be an analytically separable and linearly additive loss due to the weakening bargaining position of workers in the 'threat zone' as compared to the outcome in the 'dual' competitive economy. Therefore, whether in intra-regime or inter-regime analysis, the total fall in workers' wages will be that predicted by the competitive model *plus* the fall due to their loss in bargaining power. Attempts to estimate the effects on workers' wages of increased capital mobility which fail to account for the bargaining channel will thus necessarily underestimate them.

3.2.2. Relocation Threat and Trade Policies

In this (second) section of the paper the implications of a change in import tariffs for the effect of relocation threats are considered. To do this, we examine a context in which factor markets are unintegrated, and in which there exists a uniform import tariff which impedes trade in goods. In order to focus on the 'interaction' of trade liberalization and relocation threats the case is considered in which profits are freely repatriatable (distinct from the assumption of section one). It is shown that reductions in the tariff lead to an increase in the threat effect associated with the possibility of relocation. Accordingly reductions in tariffs can, in addition to the direct conventional effects of changes in relative goods prices on changes in relative factor prices, lead to a reduction in bargaining rents. The attendant change in wages associated with trade liberalization can be more sizable than predicted on the basis of reallocation of resources alone. Moreover, as in the analysis of increased capital mobility above, no actual relocation need be observed in order for the threat of relocation (which is increased by trade liberalization) to have an adverse effect on rents.

The section begins by demonstrating that conventional (Stolper-Samuelson (relative version)) effects arise in the present model in the absence of rent sharing.

Subsequently it is demonstrated, analogous to the result in the capital mobility case, that the full effect of trade liberalization on wages will amount to the *sum* of this conventional effect and a rent-sharing effect, and that in the rent sharing economy, the ratio of workers' rents in labor intensive industries as compared to capital intensive ones will fall. As a result the extent of underprediction of wage changes by solely relying on prices is likely to be rankable by the factor intensity of industries.

As a background to the analysis of the effect of trade liberalization on relocation threats and thereby on rent-sharing the 'pure' effects of trade liberalization in a competitive economy without rent sharing are considered. In particular, it is now proved that a familiar result concerning the effect of trade liberalization on income distribution in a competitive economy continues to hold in the current model. For this purpose the case of 'intra-regime' analysis (i.e. changes in tariffs which do not trigger any actual relocation although they may influence the viability of such relocation as a threat) is the focus. Further, the remainder of this section specializes to the customary two good, two country case. For the case of intra-regime analysis the following 'standard' result can then be proved:

Proposition 3.6. *If both countries are diversified trading economies (both goods*

are produced in both countries and trade occurs), with competitive autonomous factor markets and fixed endowments of capital and labor, then a fall in tariffs (in the North) causes a rise in $r^N/\underline{w}^N$.

Proof: Consider as the initial equilibrium a circumstance in which both economies are 'diversified' and trade occurs. Let sector 1 be the capital intensive sector and sector 2 be the labor intensive sector. Then, in the initial circumstance good 2 is exported from South to North and good 1 is exported from North to South. Consider a reduction in the uniform tariff in North from τ to τ'. For fixed factor prices, this lowers the price of good 2 relative to good 1 in the North (since the tariff is not binding on the determination of the price of good 1 in the North, firms' effective production functions exhibit a uniform degree of homogeneity, and demand is homothetic). Since

$$y^* = \left(\frac{\alpha p A}{c(w,r|\gamma)|}\right)^{\frac{\alpha}{1-\alpha}}$$

at each firm therefore at a given $(r/\underline{w})$ the relative output of the two sectors is given by

$$\frac{Y_1}{Y_2} = \frac{f_1}{f_2}\left(\frac{p_1}{p_2}\frac{c(w,r|2)}{c(w,r|1)}\right)^{\frac{\alpha}{1-\alpha}} \tag{126}$$

where f_1 and f_2 refer to the number of (identical) firms in each sector. Accordingly, at the original factor price ratio, the output of good 1 relative to that

of good 2 rises in aggregate in the North. However, under the assumption of homogeneous production functions, the relative ratio of factor use $\left(\frac{k}{n}\right)$ at each firm is independent of the level of output and dependent only on relative factor prices. Since firms in each sector are identical the ratio of factor use $\left(\frac{k}{n}\right)$ in each firm is equal to the ratio of aggregate factor use $\left(\frac{f_i k}{f_i n}\right)$ in the sector to which it belongs. Since the number of firms is fixed, the economy wide relative demand for factors is given by

$$\frac{K^D}{L^D} = \frac{h(Y_1)K_1 + h(Y_2)K_2}{h(Y_1)L_1 + h(Y_2)L_2}, \tag{127}$$

where K_1, L_1 and K_2, L_2 are the amounts of capital and labor required to produce one unit of good 1 and good 2 respectively and h is a monotonically increasing function which represents the proportion at which absolute input demands change with output (constant at 1 in the case of constant returns to scale and increasing (and convex) in the current case of decreasing returns to scale). It may be checked that

$$\frac{d\left(\frac{K^D}{L^D}\right)}{d\left(\frac{h(y_1)}{h(y_2)}\right)} > 0 \; iff \; \frac{K_1}{L_1} > \frac{K_2}{L_2},$$

which is true by assumption.

Since the rise in output in the capital intensive sector implies that $\frac{h(y_1)}{h(y_2)}$ rises, therefore the economy wide ratio of total factor demands at the original relative factor prices is higher than that of the ratio of factor supplies $\left(\frac{\overline{K}}{\overline{L}}\right)$. This

circumstance is inconsistent with equilibrium. Since the ratio of factor demands at each firm is uniquely a function of (r/w), and since the number of operating firms in each sector is fixed, therefore the only manner in which equilibrium may be established is for (r/w) to rise, so as to reduce firms' demand for capital relative to that for labor. Equilibrium will of course be established at a point at which relative prices and production for good 1 have risen relative to that of good 2 in the North QED.

We can now establish the following result on the relative impact of trade through the bargaining channel:

Proposition 3.7. *A reduction in the import tariff leads to a relative decline in the surplus of labor intensive industries in the North.*

Proof: By the proof of our earlier proposition, it is known that a reduction in import tariffs in the North raises the relative prices and relative production of capital intensive industries. Comparing two firms in the two different industries, the relative production surplus may be written as:

$$\frac{v_2^*}{v_1^*} = \frac{y_2\, p_2^{1/\alpha}}{y_1\, p_1^{1/\alpha}} \tag{128}$$

where as before industry 1 is more capital intensive. A fixed number of firms then implies that the ratio $\frac{y_2}{y_1}$ falls. This, combined with the fact that $\frac{p_2}{p_1}$ falls in

equilibrium dictates that production surplus (per firm and industry-wide) in the labor intensive sector declines in relation to that in the capital intensive sector. *QED.*

Of more interest is not only the size of the production surplus, but how it is distributed. The following proposition builds upon the last to shed light on this issue. First, define the class of 'share monotonic' bargaining rules as those for which the relative share of rent allocated to workers in different bargaining situations is increasing in the relative disproportion between bargaining surplus and the firm's outside option. Formally,

Condition (Share monotonicity): A bargaining rule is *share monotonic* iff $\frac{s_2}{s_1} = b(\frac{\frac{v_2}{\pi_2}}{\frac{v_1}{\pi_1}})$ where b is a monotonically increasing function.

This is a broad class of rule accommodating standard cases. Adopting this definition, we have:

Proposition 3.8. *A reduction in import tariffs causes a decline in the ratio of workers' total rents in the labor intensive sector relative to their rents in the capital intensive sector, if the bargaining rule belongs to a broad class (share monotonic).*

Proof: The ratio of the total rent (TR) in the two sectors is defined by

$$\frac{TR_1}{TR_2} = \frac{s_2}{s_1}\frac{v_2}{v_1}. \tag{129}$$

By the last proposition $\frac{v_2}{v_1}$ declines with reduction in the tariff. Therefore it is sufficient to show that $\frac{s_2}{s_1}$ is constant or declining.

But $\frac{s_2}{s_1}$ falls as long as $\frac{v}{\pi}$ falls more for the labor intensive industry (sector 2) then for the capital intensive one (sector 1) by share monotonicity. But this is certainly true since

$$\frac{\frac{v_2}{\pi_2}}{\frac{v_1}{\pi_1}} = \frac{v_2}{v_1}\frac{\pi_1}{\pi_2}. \tag{130}$$

We have already established that $\frac{v_2}{v_1}$ is falling and moreover $\frac{\pi_1}{\pi_2}$ is certainly falling since for the intra-regime case the relative benefit of moving to the South has been increased relatively for the more labor intensive sector due to the reduction in the import tariff in the North. QED.

This last proposition establishes a result that rents decline relatively in the labor intensive sector in the North as a result of tariff reduction. However, it is difficult to derive conclusions as to the absolute impact of this change due to the general equilibrium gains from trade.

This proposition has implications for empirical approaches to measuring the impact of trade on wages. First of all, note that our assumptions about production imply the following equilibrium relations to exist amongst output and input prices:

$$p_\gamma = (\theta_\gamma^L(\underline{w}, r, p)\underline{w} + \theta_\gamma^K(\underline{w}, r, p)r))$$

$$\Longrightarrow \underline{w} = \frac{p_7}{k\theta_7^L(\underline{w},r,p)} - r\frac{\theta_7^K(\underline{w},r,p)}{\theta_7^L(\underline{w},r,p)}. \qquad (131)$$

Here the θs are functions of cost shares of each factor and of the level of output. This requirement is similar to that found in standard trade models in which the θs are exactly equal to the cost shares of each factor of production because of the assumption of constant returns to scale and zero profits. The argument is often made that for wages in an industry to have changed due to trade, output prices in that industry have also to change by an appropriate amount and in an appropriate direction, given by this requirement. It follows from these conventional assumptions that in any study of the effect of tariffs on wages there would be no need to include tariffs directly as an explanatory variable as long as price information is included since all of their effects would have been subsumed by price effects. In contrast, in the model described above the wage w in any industry with bargained wages is the sum of $\underline{w}$ and the worker's share of the bargained surplus. Although the regression described here would be an accurate one for estimating the impact of trade of reservation wages, it would be biased in its estimation of the impact of trade on bargained wages.

Further since individual workers' wages are given by the ratio of the wage bill to employment, unless employment falls sharply in labor intensive sectors

compared to capital intensive ones, due to large general equilibrium effects and small labor demand elasticities for the labor intensive sector, this bias will be the greatest for labor intensive sectors. At a minimum, in the presence of rent sharing in all industries, the divergence in the wage bill predicted by 'competitive' and by rent-sharing analysis would be the greatest for labor intensive sectors as suggested by the previous proposition.

More generally, the approach taken here suggests that inferences concerning the impact of increased capital mobility and trade openness on income distribution cannot rely on a supposedly straightforward relation between changes in product and factor prices, when there exists rent sharing. This criticism applies to a wide range of studies which implicitly apply a 'zero-profit' condition in their methods of estimation and analysis.[53] The analysis presented here does not of course suggest that no relation exists between product and factor prices but that in a rent-sharing economy the relation is likely to be substantially more complex than typically assumed. In particular, empirical work attentive to the importance of rent-sharing should attempt to examine more directly the effect of changes in policy on outcomes rather than to assume that these necessarily travel through

[53]See for example Bhagwati and Dehejia (1994), Deardorff and Hakura (1994), and Feenstra and Hanson (1999). See also Slaughter (1998).

a 'price pathway'. The analysis demonstrates that under reasonable conditions the effect of policy changes on incomes in a rent-sharing economy is always 'additive' in that this effect may be additively decomposed in to the conventional 'price' effect expected in a competitive economy and the distributional change associated with the impact of policies on the rent sharing process. The model demonstrates further that distributional changes may arise even in the absence of any conventional price effects. Econometric estimation which pays no heed to the effect of policies on the rent-sharing process will necessarily underestimate and mis-attribute the impact that they have.

The model also suggests the possible importance of 'interaction effects' between different forms of policy (and in particular those in regard to trade and capital mobility) as policy changes along one dimension may operate to accentuate the 'threat power' which derives from the ability to exploit opportunities associated most directly with another dimension of the policy environment. Second, although the analysis undertaken here has focused on the impact of capital mobility and trade openness on income distribution in the North, extensions of this logic may apply to other contexts, such as analyzing the impact of multilateral liberalization of trade and capital flows among rich countries and among middle-income and developing count ries, as it may be possible for workers even in similar

countries to face 'relocation threats' in relation to one another under appropriate conditions.[54] Third, although 'relocation' has been interpreted narrowly in the discussion above, there is no reason for this that is inherent to the logic of the analysis. 'Outsourcing' of intermediate inputs and other 'intra-firm' phenomena which increase employers' outside options vis-a-vis existing workers may also be readily interpreted within the framework established here.[55] Empirical work pursuing these and other issues will substantially enrich our understanding of the role of bargaining in the determination of the distribution of income, as well as allow a more confident attribution of cause and effect in the interpretation of recent developments in the world economy.

[54]Relocation threats may possibly affect all countries to the extent that some aspects of the economic environment are only revealed after firms' initial location decisions have been made.

[55]On the empirical importance of such 'outsourcing' in contemporary restructuring of firms see for example Feenstra (1998).

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