

Abstract

This thesis examines the effect of integration on wages when the economy is partially unionized. The first part sets up a general equilibrium model where wages in one sector are set by a monopoly union. The unionized sector of the economy also utilizes a factor (capital) which is internationally mobile. Capital mobility is explicitly modeled in terms of mobility costs. The model is characterized by inter-industry wage differentials and unemployment. Integration is modeled in terms of reduced barriers to product trade, or easier factor (capital) mobility. I show that though capital mobility weakens unions, the net effect on workers may not be negative if this either raises domestic investment, or if the union distortion is large enough. In general the impact of trade liberalization on real wages is ambiguous. However workers bear a larger burden from trade liberalization when capital is more footloose.

This second half of the thesis empirically examines whether unions face a threat from outward foreign direct investment by their industry, and whether this changes their response to tariff protection. I combine worker level data for the US, with industry level data on openness and other industry characteristics for the years 1990-1996. The results suggest that unions do face a threat from FDI, though this threat effect is not large in comparison to other industry characteristics. I also find evidence that union response to tariff changes vary with the level of the threat effect. Our results suggest that unions use protection to raise employment in low threat industries, and to raise premiums in high threat industries.

ESSAYS ON LABOR MARKET EFFECTS
OF INTEGRATION IN UNIONIZED
ECONOMIES

by

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DEDICATION

To my wife, Shilpa

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Chapter 1

Introduction

The past few decades have seen many countries around the world becoming more closely connected with each other through the forces of trade and investment. Declining trade barriers since the 1970s have led to closer integration of countries' product markets, and a rapid expansion of international trade. Since the 1980s there has also been a spurt in foreign direct investment, leading to production becoming internationalized in many industries. This has been facilitated both by falling legal barriers to such investment in many countries, as well as improvements in transport and communication technology. Such integration has generated a lot of benefits for participating countries, but like any change, it has also given rise to its own set of concerns.

One particular concern has been the manner in which globalization has affected workers. While labor has not been afforded the same degree of international mobility as is available to goods or capital, it is clear that globalization has had a significant impact on labor markets. The channels through which workers have been affected, and the extent to which they have benefited or been hurt are not well understood. However the fear that they have been adversely affected has gained popularity, especially in the industrialized economies. For workers in

many OECD countries, particularly unskilled workers, the past few decades have been distressful. In some countries, especially the US and UK, wage growth has slowed down (Bosworth and Perry, 1994; Mishel and Bernstein, 1994), and has also become more unequal. In others, unemployment has risen. There is also some evidence of an increase in wage volatility (Gottschalk and Moffit, 1994). The concurrence of these events with increasing openness has led many to believe that globalization is to blame. This belief has often been used to make a case against integration.

Support for this proposition is, however, limited. Traditional trade models could be used to argue that trade could hurt workers in capital abundant industrialized countries by reducing domestic wages.¹ However this effect operates through changes in factor demands induced by changes in relative goods prices, and empirical research suggests that openness to trade operating through this channel could have had little effect on wages.² Other empirical research has examined the effect of trade protection on wages (for example Harrison and Revenga, 1995; Gaston and Trefler, 1994, 1995; MacPherson and Stewart, 1990), the impact of foreign ownership on wages (as Driffield, 1999), and of trade on

¹See Bhagwati (2000)

²Evidence for US comes from Revenga (1992) who finds that changes in import prices have a small effect on wages. Other studies have focussed on the prediction that an increase in international competition from countries abundant in unskilled labor should be reflected in lower prices for products utilizing such labor intensively. Several such price studies have, however, found little evidence that trade contributed to the larger relative price increases for skilled-labor intensive products compared to unskilled-labor intensive products that would be consistent with a decline in the wages of unskilled workers (Lawrence and Slaughter, 1993; Krugman, 1995; Leamer; 1996; Neven and Wypolosz, 1996). See Slaughter and Swagel, 1997 for survey

job displacements (see Kletzer, 1998). The results from most of these studies generally point towards integration having a relatively small effect on wages and employment.³ Similarly, it is not clear that closer integration of capital markets should necessarily hurt workers. Indeed, when such integration promotes more foreign direct investment (FDI) in the country, it may benefit workers by creating new jobs and raising wages.⁴ Since most FDI in the world both originates and ends up in the OECD countries themselves, and many member countries are net recipients of FDI (see Table 1), it is difficult to conclude that capital mobility has hurt workers in all these countries.

At the same time, globalization can have labor market impacts beyond simply shifting the labor demand across industries. It can also affect them through its effect on institutions which impact wage determination. Labor markets are often characterized by non competitive wage setting, where such institutions play an important role. One important example are labor unions. Studies in the US, for example, point towards large and persistent inter-industry differentials in wages earned by seemingly equivalent workers. While there is no consensus over what these differentials represent, at least in some industries like automobiles and steel,

³Indeed Slaughter and Swagel (1997) note that though "the average estimate of trade on wages and employment is not zero, but it is certainly lower than what might be expected from purely anecdotal evidence, and certainly far from the claim that import competition makes a giant sucking sound."

⁴Bhagwati (1999), for example, cites the case of Interstate 85 in North Carolina where the loss of employment due to the decline of the traditional textile industry has been more than made up by the influx of new foreign firms. Sturgeon and Florida (1997) note that while the globalization of production by the big three US companies has contributed to job losses in the important automobile industry in the US, it has also promoted new investments by Japanese manufacturers, which have benefited workers by adding new jobs.

these might reflect rent seeking by organized labor unions. Labor unions remain important in many industrialized economies, though unionization rates have been falling in many cases. They play an important role in wage determination in many key industries, and are widely assumed to raise wages for their members above their competitive level. They also enhance labor welfare in other ways.⁵

Casual observation suggests that unions are deeply affected by integration, since they have often been active in campaigning against it.⁶ Theory also suggests that unions may be more vulnerable to integration for many reasons. Not only could they be affected through the conventional channel of an inward shift in their sector's labor demand curve (on account of increased competition from abroad), but increasing openness could also erode their ability to secure rents for their members. In part this may be because integration gives firms the opportunity to shift production and capital abroad more easily, beyond the grip of local unions. This "threat effect" could lead unions to lower their wage demands. At the same time, a lowered labor demand could also put higher pressures on unions to reduce wages closer to their competitive level to maintain employment. Rodrik (1998) suggests that the channel through which globalization puts more pressure

⁵Unions play a role in reducing inequality by standardizing wages among workers, and compressing wage differentials across different skill classes (Kahn, 2000). Evidence that declining unionization has played a role in increasing wage inequality in the US comes from Freeman (1993) and Card (1998), who find that roughly about a fifth of the total rise in inequality can be attributed to declining union power. They also play an important welfare enhancing role by protecting workers from abuse or victimization, and monitoring health, safety and other working conditions.

⁶In the US, for example, the AFL-CIO campaigned hard to prevent the ratification of the North American Free Trade Agreement (NAFTA), and against granting trade negotiation authority to President Clinton. It has also been active in protests against the WTO.

on unions is through making the labor demand elasticity they face more elastic. Integration makes domestic labor more easily substitutable with foreign factors, raises the domestic elasticity of demand, and reduces the bargaining power of workers. This suggests that if a large part of the labor force is unionized, or if unions are located in key sectors which affect wage determination elsewhere, globalization may have a larger effect on wages and employment than would be suggested by conventional trade models which assume competitive labor markets.

My thesis examines the effect of integration on wages in unionized markets. The first half of my thesis theoretically examines Rodrik's proposition that globalization increases the elasticity of the labor demand curve facing unions.⁷ Assuming that such changes in elasticity are the channel through which unions are affected, I examine in a general equilibrium setting how increased integration of a country's product and capital markets into the world economy affects unions and wages. I model a two-sector economy where one of the sectors is unionized. The union is able to set sectoral wages because of its position as a monopoly supplier of labor. The unionized sector also utilizes capital as one of the factors of production. Increasing union wages comes at the cost of reducing union jobs, with the cost being higher, the cheaper it is for firms to move capital abroad. Unlike previous work, I model capital mobility explicitly in terms of mobility costs, which restrict the extent to which capital (in the sense of direct foreign investment) can move across borders in response to the difference between its returns at home and abroad. The advantage of this definition is that I am also

⁷Labor demand is interpreted as sectoral labor demand, and not national labor demand as in Leamer (1995) and Panagariya (1999). For a discussion of the impact of openness on national labor demand see Panagariya (1999).

able to account for the effects induced by the movement of capital in or out of the domestic economy, since this is bound to affect the general wage when the unionized sector is large. Workers choose between joining the union and being eligible for a higher paying union job albeit with some probability of unemployment, or joining the lower paying non-unionized sector but with certainty of employment. Both union wages and membership are endogenously determined.

In the model, economic integration is modeled in terms of reduced barriers to product trade, or easier factor (capital) mobility. I identify two channels through which union wage demands are impacted by globalization, the “elasticity effect” and the “scale effect”. The elasticity effect measures the effect induced by a change in the elasticity of labor demand facing the union, a la Rodrik. Other things remaining the same, the higher the labor demand elasticity the union faces, the lower is the mark-up it can charge over competitive wages. However integration can also change the level of domestic investment desired by firms, which in turn will shift labor demand. This is the scale effect which tends to pull all wages in the economy up or down, depending on whether investment in the country rises or falls. In this framework I show that whether closer integration benefits or hurts workers depends on the extent to which capital is mobile, the size of the union distortion and on the ability of the non-unionized sector to absorb employment changes in the unionized sector without much effect on wages in that sector.

Closer integration of factor markets is modeled as a reduction in the cost of moving capital across borders. Under the assumed Cobb-Douglas production structure, we show that increased capital mobility raises labor demand elasticity and tends to lower the union’s monopoly premium. However whether this decline

in premium translates into a decline in union wage depends on whether domestic investment by firms rises or falls, and the volume of this change. For a country where domestic rates of return on capital are higher than international rates, enhanced capital mobility leads to greater investment by domestic firms and pushes the competitive wage level up. This tends to push union wages up too. If investment rises fast enough, the scale effect may dominate the elasticity effect so that wages rise, and if markets are integrated enough, unemployment falls even in the unionized sector. For a country where the opposite is true, the scale effect reinforces the elasticity effect, and union wages must decline. However falling union wages create more jobs in that sector, and moderate the impact of reduced investment on the competitive wage level. I show that if the difference in the domestic and international rate of return on capital is small and union distortion large, the competitive wage may possibly even rise as more jobs are created by union wage declines than are lost due to reduced investment. Thus we show that though capital mobility reduces the bargaining power of the union, this does not necessarily imply that such mobility is detrimental to worker interests.

The other aspect of integration is reduced product trade barriers. We assume that the unionized sector produces the import competing good, and closer product market integration is modeled as a reduction in that sector's good price. Contrary to Rodrik, I show that changing product prices have no direct impact on sectoral labor demand elasticity, but affect it indirectly through their impact on domestic investment. Elasticity may go up or down when product price falls, depending on the extent to which capital is mobile. In general the impact on wages is subject to the neo-classical ambiguity characteristic of the specific factors model, but I am able to show that workers face a larger burden from trade liberalization when

it is easier for capital to move to greener pastures abroad. Thus liberalization in industries which are footloose is more costly for workers than in industries where such mobility is difficult.

The third chapter of the thesis is an empirical exercise to determine how integration affects union wage premiums. We examine how important threat effects from outward foreign direct investment are in explaining differences in union wage premiums across industries and over time. We also examine the nature of union wage response to tariff protection, and whether this response is affected by the size of the threat effect they face. We do this by combining worker level data for the US obtained from the Current Population Surveys for the years 1990-1996, with industry level data on openness and other industry characteristics. Our study is different from previous literature in some important respects. Firstly, in terms of how we define and estimate the industry union wage premium. These are estimated as the wage differential that union members obtain over similar non-members in the same industry. Secondly, we use the share of industry capital invested in the US to the total worldwide industry capital stock, as the measure of the threat unions face from outward foreign direct investment. This is suggested by our theoretical model, and may arguably be a better measure than looking at employment shares. Thirdly, we check for whether union response to changes in trade policy measures (tariffs) differs systematically with the level of the threat effect they face.

In line with theory, after controlling for industry and time fixed-effects, we find evidence of a threat effect operating on unions. Unions were able to charge higher premiums in industries that were mostly domestically invested, than in industries that had significant amount of capital invested abroad. To the extent

that the share of foreign direct investment to total investment is a reflection of the opportunities for investing abroad, our findings confirm the prediction that easier capital mobility increases labor demand elasticities. We also find evidence that union response to tariff changes vary with the level of the threat effect. Tariffs (lagged one year) were negatively related with union premiums for more domestically invested industries, but positively related with them for industries that were heavily invested abroad. This suggests that unions use protection to raise employment in more domestically invested industries, and to raise premiums in more globalized industries.

The rest of the thesis is organized as follows: chapter 2 builds up the basic theoretical model, and analyzes the impact of greater integration on factor incomes in the economy. Chapter 3 presents the empirical exercise. Chapter 4 includes the appendices of chapter 2. Tables and figures are at the end.

Chapter 2

Labor Market Effects of Integration in a Unionized Economy

2.1 Introduction

In countries that move towards integrating markets by liberalizing trade and capital accounts, there is often a preoccupation with the effects of these policies on wages and employment. The standard trade models address these issues in the context of markets characterized by perfectly competitive labor markets and full employment. These models ignore the effect of labor market institutions, which often play an important role in wage determination. One such important institution are the labor unions. These continue to be important in many economies, though unionization rates have been falling in many cases. In such economies globalization can have impact workers on two fronts: Not only through shifting labor demand between industries, but also by affecting the ability of unions to set wages. If unions are large or if they are located in key wage setting sectors of the economy, the wage and employment effects may be quite different than those predicted by models which ignore this second effect.

Theory suggests that unions might be very vulnerable to pressures generated by the process of integration. These pressures are thought to come from two fronts. On the one hand, trade liberalization implies greater competition for the employer, possibly lower rents to be fought over, and greater pressure on unions to reduce wages in order to maintain employment. Brander and Spencer (1988) and Mezzetti and Dinopoulos (1991) model union-firm interaction in a Nash bargaining framework. They show that tariff protection allows unions to collect part of the increased firm level rents for its members in the form of higher wages. The relationship between tariffs and union wages in their models is thus positive, and liberalization reduces union wage. This sort of direct relationship need not always hold though. Unions have the choice to respond to pressures either by adjusting their wage and maintaining employment, or by just letting employment fall. Grossman (1984) analyses how unions choose between the two from a political economy perspective. He constructs a model of a seniority-based union. As import competition drives down domestic prices, a conflict of interests arises between the marginal member who wants to lower wage demands to maintain his chances of getting employment, and the more senior union members who wish to raise wages (even at the cost of shrinking membership) since the probability of their getting unemployed is small. He shows that whether unions adjust by reducing wages or accepting a lower membership depends on the elasticity of demand they face. Lawrence and Lawrence (1985), in a different context, show that declining industries may be characterized by perverse union wage responses to price declines, as the union tries to extract maximum rents at the cost of firm profitability. Unions are able to raise wages since firm capacity is largely fixed in the short run and capital is "stuck". Other research suggests that unions may

be affected by product market integration even when this does not significantly alter domestic prices. Reddy (2000a) shows that when firms compete monopolistically, integration increases the number of competing firms in the industry, raises the employment cost of raising wages, and leads unions to moderate their wage demand. Rodrik (1998) argues that trade and capital mobility make domestic labor more substitutable with foreign labor and raises the elasticity of the labor demand curve facing unions. This reduces workers' bargaining power over firm rents and thus their bargained wage, even if the labor demand curve does not shift.

The other potential vulnerability arises from the peculiar characteristic of the current phase of integration which allows much more international mobility to capital compared to labor. This is thought to have made capital "footloose," and shifted the balance of power within the firm in favor of capital. Mezetti and Dinopoulos (1991) show that when firms have the option to relocate production abroad, they can force local unions to accept lower wages. Zhao (1995) shows that foreign direct investment by a firm increases its bargaining power vis-a-vis the workers, since it can continue operating its foreign plant in case negotiations with the domestic union fail. Rodrik (1999) argues that capital mobility, interpreted as an improvement in capital's outside options, strengthens capital's position vis-a-vis labor in wage bargaining. Similarly, Reddy (2000b) models capital mobility in terms of cheaper relocation opportunities because of reduced transaction costs of repatriating profits from abroad. He shows that even when no relocation or price change takes place and production decisions are unchanged, a pure "threat effect" may operate because of the international option allowed to capital which leads to a decline in the negotiated workers' share in rents.

While these models are instructive in identifying potential channels union vulnerabilities to integration, the effects on wages and employment need to be studied in a general equilibrium model. This approach is warranted on two grounds. Firstly, because this allows us to capture the effects of the integration process on labor demand in different sectors of the economy, and thus on the union's outside wage option. Ignoring these effects can bias our conclusions. Secondly they allow us to take account of the fact that unions distort labor markets, and that workers may potentially benefit from a reduction in this distortion. This chapter sets up a specific factors model of a two-sector economy where one of the sectors is unionized. The union is able to set sectoral wages because of its position as a monopoly supplier of labor. This sector also utilizes capital as one of the factors of production, and this factor of production is internationally mobile. Unlike previous work, I model capital mobility explicitly in terms of mobility costs, which restrict the extent to which capital (in the sense of direct foreign investment) can move across borders in response to the difference between its returns at home and abroad. The advantage of this definition is that I am also able to account for the effects induced by the movement of capital in or out of the domestic economy, since this is bound to affect the general wage when the unionized sector is large. The model economy is usually characterized by both inter-industry wage differentials, and unemployment.¹ Workers choose between joining the union and being eligible for a higher paying union job, or joining the lower paying non-unionized sector but with certainty of employment. Both union

¹The existence of such interindustry wage differentials has been extensively documented by Katz and Summers (1989) who contend that "these wage differentials largely reflect rents earned by workers in high-wage industries".

wages and membership are endogenously determined.

In this set-up, I examine Rodrik's (1998) proposition that globalization (understood as reduced barriers to trade or enhanced capital mobility) increases the elasticity of the labor demand curve facing workers. I interpret "labor demand" to be the sectoral labor demand, and not national labor demand as defined by Leamer (1995) and Panagariya (1999). I examine how increased integration of a country's product and capital markets into the world economy affects unions and wages. I identify two channels through which wages are impacted by globalization, the elasticity effect and the scale effect. The elasticity effect measures the ability of the union to distort labor markets, and depends on the elasticity of labor demand facing it. Under the assumed Cobb-Douglas production structure, I show that increased mobility raises labor demand elasticity,² and thus the employment cost to the union of distorting wages in its favor. The scale effect measures the spillover effects, in terms of how employment changes in the unionized sector impact outside wages, and hence the union's wage demand.

I show that contrary to the existing claims in the literature, increased capital mobility need not lower wages either in the unionized sector, or economy wide. Greater capital mobility does increase the elasticity of labor demand and hurt unions. However it also increases the volume of capital flows. The scale effect reinforces the elasticity effect when capital flows out of the country, but counteracts it when capital flows in. For a capital importing country, we show that enhanced capital mobility increases the general wage level, and may also increase

²However depending on the production function the effect of falling mobility costs on labor demand elasticity may be outweighed by the effects of changing capital intensity along the labor demand curve. Holding wage constant, the elasticity of the shifted sectoral labor demand curve may thus be higher or lower depending on the form the production function takes.

wages in the unionized sector and union membership, thus benefiting labor in general. For a capital exporting country, greater mobility leads to a decline in union wages. However, this decline moderates the fall in the general wage level. I show that when capital outflows are small, all workers may even benefit from increased mobility. The paper captures the effects of increased international competition in terms of a reduction in the unionized sector's product price. I show that changing product prices have no direct impact on sectoral labor demand elasticity, but affect it indirectly through their impact on domestic capital usage. Elasticity may go up or down when product price falls, depending on the extent to which capital is mobile. The effects of liberalization are shown to be different depending on the degree of integration with the world capital market. When the economy is not well integrated, union wages fall along with product price, but at a lesser pace. Union members also benefit from increased employment probability. However when capital can move abroad relatively freely, union wages may fall even faster. The effect of liberalization on wages thus depends crucially on the existing degree of capital mobility.

The following section builds up the basic model, and explains the equilibrium in this integrated economy. Section 2.3 examines the impact of enhanced capital mobility on the economy. Section 2.4 examines how country-specific price changes affect agents in the economy and the impact on factor incomes. Section 2.5 concludes.

2.2 A model of a unionized economy

The economy consists of two sectors producing goods 1 and 2. Both goods are produced by a large number of identical firms producing an undifferentiated prod-

uct with a constant returns to scale technology. For notational ease, the number of firms producing good 1 is normalized to one. While labor is assumed to be mobile between sectors, each sector also utilizes one specific factor in production. Production in sector 2 requires labor (L_2) and a specific factor, land (T). Land is immobile between sectors, and also internationally. Its total supply in the economy is assumed to be fixed at \bar{T} . In sector 1 production requires capital (K) and labor (L). The production functions in the two sectors can be denoted as:

$$Q_1 = K^\alpha L^{1-\alpha} ; Q_2 = G(L_2, T);$$

A Cobb-Douglas production function is chosen in the case of sector 1 because the tractability it provides because (holding capital fixed) the elasticity of the marginal product of labor ($= LF_{LL}(\cdot)/F_L(\cdot) = -\alpha_1$) is constant. This condition allows attention to be focussed on the effect that capital mobility alone has on labor demand elasticity in this sector.

The home country is assumed to be a small, open economy. Both goods are internationally traded and we assume that international prices are such that the economy remains diversified. Goods prices are determined in the world market, and are taken as exogenous by both producers and consumers in the economy.³ Good 2 is the numeraire good, whose price is normalized to one. The relative price of good 1 is p . Thus the basic set-up corresponds to the standard two good, three factor model as analyzed by Jones (1971). We depart from the traditional

³This assumption makes the model more tractable by preventing domestic output changes from affecting domestic goods prices. Consequently union wage demands do not affect prices in the economy. This confers two advantages. Firstly, union does not have to worry about price effects while setting wages . Secondly, we can also abstract from demand changes caused by changes in goods prices induced by union wages.

model in two respects.

(i) *Capital Mobility* : Firstly in terms of assuming that the specific factor in sector 1, capital, is mobile internationally. We assume that a well developed international market exists for this factor where domestic firms, being small, can borrow or lend any amount of capital they own at the international rental rate (r^*). To keep the model simple, we also assume that the home country is small in world capital markets and that the world rental rate remains unaffected by the firms decisions.⁴ A firm will want to buy units of capital and increase domestic investment if the domestic rate of return on capital exceeds the international rental rate. If the opposite is true, then the firm will sell domestic capital in world capital markets by lowering domestic investment. The crucial assumption is that international capital mobility is not costless for firms. Larger amounts of capital can be moved only at higher costs. In particular, the typical firm i faces quadratic costs while buying or selling capital, which are of the form ⁵:

$$C = \lambda(K_i - K_{0i})^2/2$$

These costs might arise from a variety of reasons. They may reflect the costs of (i) marketing overseas, (ii) negotiating a foreign deal, (iii) transportation and installation (iv) tariffs and other non-tariff barriers, (v) adapting capital to foreign

⁴This assumption is not crucial to the model, and can easily be relaxed. Analytically, this would mean that the domestic supply curve of capital is upward sloping. The consequence of cheaper capital mobility would still be to rotate the domestic capital supply curve closer to the international supply curve.

⁵This formulation of costs yields similar first order conditions for the firms optimization as those derived in Rodrik (1998). Rodrik, however, does not explicitly model firm level mobility costs, but assumes that the countries capital supply curve is upward rising because of the presense of capital mobility costs.

standards and conditions. Eaton and Kotum (2001) find cost barriers in capital equipment trade to be quantitatively important. A quadratic form is chosen because many of these costs can be expected to be larger dependent on the size of the transaction. The significance of these costs is captured by the parameter λ . The exact value that this parameter takes depends partially on the state of world capital markets, and partially on government policies aimed at controlling capital flows. These mobility costs introduce an element of rigidity in domestic capital usage. The higher these costs are, the harder it is to alter domestic investment, and consequently the smaller are the linkages between domestic and world capital markets. λ can thus also be taken as a measure of the extent of capital mobility. The case of λ being infinitely high approximates a situation of no capital mobility. As it becomes prohibitively expensive to move capital, capital employment must equal domestic capital endowment. The rate of return on capital then becomes delinked with the international rate, and is determined domestically. If λ is close to zero, capital is costlessly mobile. Domestic capital owners then face competition from world capital markets, and being small, cannot obtain a rate of return higher than the international rental rate.

(ii) *Monopoly Labor Union* : The second point of departure is through the assumption that sector 1 is unionized. Each firm operating here is supplied labor through a monopoly union that utilizes its position to set wages higher than their competitive level.. Though the union specifies the wage rate that must be paid to workers in this sector, it cannot dictate the number of workers the firm wants to employ at that wage. The union thus operates under a “right to manage” system. This process is inefficient, as pointed out by McDonald and Solow (1981) and Hall and Lillen (1979) because the monopoly union could do better by negotiating over

both wages and employment. However it may be argued that in most cases, union contracts take the form assumed here.⁶ We assume that the union acts as a Nash player, and does not internalize the impact its wage demands will have on the wage in the other sector, w_2 .

The representative union’s objectives are described by the following function:

$$U = (w - w_2)L^\gamma$$

The belief that the union values both the wage gap and total employment are conventional in the theory of trade unions’ behavior (see for e.g., Farber). Additional flexibility is derived by the use of the parameter γ , where γ measures the relative importance the union places of employment vis-a-vis the wage gap. In theory this can take any strictly positive value. When it is equal to one, the function describes the case of the “rent maximizing” union. However in the model, to ensure stability we assume that $\gamma > \max(\alpha, (1 - \alpha))$. The union maximizes its objective function subject to the labor demand curve facing it. This leads to a wage demand w such that:

$$w(1 - 1/\gamma\epsilon) = w_2 \tag{2.1}$$

where ϵ denotes the total elasticity of labor demand facing the union, and is defined to be positive. This is similar to the optimization condition for a mo-

⁶Layard, Nickell and Jackman (1991) state that “employment is almost never bargained as such” in most union contracts. In the US, contracts also include a “management rights” clause which gives companies the right to make adjustments to their labor force. Striking to prevent layoffs is also not legally acceptable. Similarly Farber notes that “the more common situation (for a union) is either of no control over employment, or the negotiation of work rules that attempt to control the capital-labor or labor-output ratio.”

nopolist, modified to take account of the additional weight the union places on employment. The union is thus able to generate an inter-industry wage differential because of its monopoly power.

We assume that there are \bar{L} number of identical workers in the economy, each ex-ante endowed with one unit of labor, which they supply inelastically in the market. Workers are assumed to be perfectly immobile across national borders. Each worker is assumed to hold only one job, and there is no job-sharing. The number of workers employed in any sector is thus equal to the labor demanded in that sector. Workers have a choice at the beginning of each period regarding which sector they seek employment in. All workers seeking employment in the unionized sector need to become members of the monopoly union.⁷ The choice of deciding which sector to seek employment in is therefore equivalent to deciding whether or not to join the union.

Joining the union makes workers eligible for a higher paying union job. At the same time, however, firms in this sector are under no compulsion to employ all union members. In fact, since union wages are always at least as much as w_2 there will always be a queue of workers waiting to enter this sector and $L \leq M$ (where M represents union membership). Consequently some union workers find themselves unemployed. Thus unionization generates unemployment in the model. This unemployment is involuntary from the workers point of view, though the risk of this happening is fully anticipated. The typical union member thus has to

⁷Though the assumption of compulsory union membership is strong, some justification may be obtained by assuming that union dues are negligible (Blanchflower and Bryson (2002)). From the workers point of view therefore, joining the union is costless, but doing so increases unions bargaining power, and so potentially benefits them. There is then little incentive for them to stay out of the union. The union too has no incentive to restrict membership.

weigh the benefit of higher wages against the possibility of unemployment. The probability of unemployment in sector 1 is represented by π , where $\pi = L/M$.

The unemployed portion of the work force in sector 1 are forced to seek employment in sector 2. However ex-post mobility is costly. Union workers who become unemployed and have to shift sectors face a loss of $(1 - \beta)$ portion of their labor endowment, where $\beta \in [0, 1]$. β may represent time spent looking for an alternate job offer, or some portion of labor endowment lost in the process of changing sectors. The labor supply to sector 2 is all the residual labor left over from sector 1. Thus $L_2 = \bar{L} - M + \beta(M - L)$ or

$$L_2 = \bar{L} - L \left(\beta + \frac{1 - \beta}{\pi} \right)$$

Wages in sector 2 are competitively set to absorb all workers seeking employment in that sector. Suppressing β , thus $w_2 = w_2(L, \pi)$. We measure the responsiveness of sector 2 wage to employment in the unionized sector as η , where $\eta = (\partial w_2 / \partial L) / (w_2 / L)$ is the elasticity of the w_2 to employment in the unionized sector. In this analysis, we assume that $\eta < 1$.

The size of the interindustry differential endogenously determines union membership, and unemployment probability π . Assuming risk neutrality, a worker is indifferent between the two sectors when his expected wage from either decision is equal. To keep the analysis simple we assume that seniority is not an issue in wage negotiations, or in determining layoffs. All union members receive the same wages and face the same probability of being laid off. We also rule out the possibility of internal transfers within the union, like union-administered unemployment schemes. Since all workers and unions are identical, the condition

determining union membership can be represented at the sectoral level as:

$$\pi w + (1 - \pi)\beta w_2 = w_2 \quad (2.2)$$

Note that even though the ex-ante supply of labor in the economy is fixed, because of unemployment, the ex-post labor supply in the economy is variable. The larger the wage gap generated by the union, the larger is the portion of labor endowment which is wasted. This captures the distortionary effect the unionization has on labor markets.

The final link in the chain is to figure the labor demand by firms in each sector. We assume that all firms are small, and act as price takers in both the goods and input markets. Since all firms are identical, the market clearing wages in sector 2 and the return to Land are represented by the first order conditions:

$$w_2 = G_L(L_2, \bar{T}) \quad (2.3)$$

$$r_T = [G(L_2, \bar{T}) - G_L(L_2, \bar{T})L_2]/\bar{T}$$

The assumption of a fixed supply of the specific factor in sector 2 means that labor faces diminishing returns in that sector. Since this sectoral wage rate represents the opportunity wage of labor, outside wages are declining in L_2 . This means that η is positive.

In sector 1 capital owners are also the owners of firms. The economy starts off being endowed with K_0 amount of capital, all of which is divided equally among the identical domestic firms. The actual domestic investment of the typical i th firm, K_i , can however differ from its endowment, K_{0i} . Any additional (extra) capital must be bought (sold) from abroad. During the period, firms observe

union wage demand (w), international rental rates (r^*), marginal mobility cost (λ) and product price (p). The profit maximizing problem of the typical firm ‘i’ in sector 1 can be represented as follows:

$$\max_{L_i, K_i} pF(L_i, K_i) - w_i L_i - r^*(K_i - K_{0i}) - \lambda(K_i - K_{0i})^2/2$$

Since all firms are identical and their number is normalized to one, the first order conditions can be represented in terms of industry wide capital and labor employment as follows:

$$pF_L(L, K) = w \tag{2.4}$$

$$pF_K(L, K) = r^* + \lambda(K - K_0) \tag{2.5}$$

Where $L = \sum_i L_i$ is the industry level employment in sector Y, and $K = \sum_i K_i$ is the industry employment of capital. Applying Euler’s condition the profits that firms make can be estimated as:

$$R = r^* K_0 - \lambda/2 * (K^2 - K_0^2) \tag{2.6}$$

Suppressing r^* and K_0 , which are assumed exogenous in the model, $K = K(w, p, \lambda)$, and $L = L(w, p, \lambda)$. From condition 2.5, note that in a firm which buys foreign capital, domestic units of capital earn rental rates higher than their opportunity cost (r^*) and earn positive rents. On the other hand, if the firm sells capital abroad, the effective return on the marginal capital unit, after accounting for mobility costs, is lower than the international rental rate. Domestic units of capital are “stuck” at home, and earn lower rental rates than r^* . Thus in the presence of capital mobility costs, domestic firms face an upward sloping supply curve for capital, even when the international supply curve is horizontal. The

slope of this supply curve depends on the value that λ takes. Lower mobility costs collapse the domestic capital supply curve towards the world capital supply curve. Consequently domestic rental rates become less responsive to the efficient capital stock, and become more closely fixed to the international rental rate. The responsiveness of domestic rate of return to changes in domestic investment are captured by θ , where

$$\theta = \frac{\partial r / \partial K}{r / K} = \frac{\lambda K}{r * + \lambda(K - K_0)}$$

θ is the inverse of the elasticity of the domestic capital supply curve . It can range from 0 (when λ is zero), to being infinity high (when λ is close to infinity) when capital is immobile. This means that $\theta = \theta(\lambda, K(w, p, \lambda))$.

Lemma 1 *When capital is mobile, higher union wages lower domestic investment by firms. The responsiveness of capital to wages is higher (i) The higher the share of labor in total costs and, (ii) The more elastic the domestic capital supply curve.*

Totally differentiating equations 2.4 and 2.5, and solving yields the following (where the hats denote rates of change):

$$\frac{\widehat{K}}{\widehat{w}} = -\left(\frac{1 - \alpha}{\alpha\theta}\right) \quad (2.7)$$

This means that union wages and domestic investment move in opposite directions. As the union increases its wage (product prices being fixed) domestic rates of return on capital are compressed. The higher the share of labor in total costs (or the smaller α is), the larger this compression is and consequently, the greater the incentive for capital to escape abroad. Note that $\partial(-\widehat{K}/\widehat{w})/\partial\alpha = -1/\alpha^2\theta \leq 0$.

The amount of capital that can escape, however, depends on how high mobility costs are. At one extreme if these are infinitely high, no capital can leave the domestic economy. At the other extreme, when mobility costs tend to zero, the supply of capital becomes perfectly elastic at the prevailing international rate and domestic rental rates cannot be compressed beyond this. Remembering that θ measures the inverse of the elasticity of the domestic capital supply curve, this is captured by the observation that $\partial(-\widehat{K}/\widehat{w})/\partial\theta = -(1-\alpha)/\alpha\theta^2 \leq 0$.

Lemma 2 *The elasticity of demand for labor in the unionized sector is dependent on the degree of mobility of the factor specific to that sector.*

Raising wages in the unionized sector reduces employment there on two counts. Firstly it promotes a substitution of labor by capital, holding domestic rental rates fixed. Given our assumption of a Cobb-Douglas production function, this effect is constant and depends on the share of labor in total costs. However as rental rates fall, capital investment also declines and the labor demand curve shifts inwards, reducing employment further. The total change in labor demand due to a change in union wage is the sum of this substitution and scale effects. The decline in firms' investment depends on θ , and thus on capital mobility costs. Totally differentiating equations 2.4 and 2.5, and solving yields the following:

$$\epsilon = -\frac{\widehat{L}}{\widehat{w}} = \frac{1}{\alpha} + \frac{(1-\alpha)}{\alpha\theta} \quad (2.8)$$

Thus $\epsilon = \epsilon(\theta) = \epsilon(\lambda, K(w, p, \lambda))$

2.2.1 Equilibrium

The model operates over two periods. In the first period, agents observe product prices and marginal capital mobility costs. The union in sector 1 then announces

its wage demand. This wage cannot then be renegotiated. Simultaneously workers decide which sector to seek employment in. Subsequently in the second stage, firms in sector 1 take their production and employment decisions. Any unemployed labor from sector 1 migrates to sector 2. The latter sector absorbs the surplus labor and wages there are competitively determined. All factor payments are made at the end of the second stage. Both the union and the workers know the firms' production function, there is no uncertainty, and there are no asymmetric information problems. The discount rate is normalized to zero.

Equilibrium in the model implies solving conditions 2.3, 2.4, 2.5, 2.6, 2.1 and 2.2 which define the whole system. Equilibrium means determining labor allocation between the two sectors, and hence a set of union and non-union wages, such that both the union's maximizing condition and the workers' membership conditions are satisfied.

Union wage demand schedule: The union's wage demand condition relates union mark-up with the elasticity of labor demand. However both outside wages and labor demand elasticity are endogenously determined, and ultimately depend on union wage and unemployment probability. The union's optimizing condition 2.1 implies that $w = w(\pi, p, \lambda)$. Holding product prices and mobility costs fixed, this condition implies a Union Wage Demand Schedule (VV) relating different levels of π with the wage demand they would evoke from the union. Totally differentiating this condition, and using 2.7 and 2.8 yields:

$$dw/d\pi = -\frac{(1-\beta)\eta}{(1-\beta+\beta\pi)\left[1+\epsilon\eta+\frac{1}{(\gamma\epsilon-1)}\frac{(1-\alpha)^2(1-\theta)}{\alpha\theta(\theta+1-\alpha)}\right]} \leq 0 \quad (2.9)$$

Holding union wage fixed, an increase in π means that less labor is destroyed because of unemployment. An increase in labor supply tends to push wages in sector 2 down. For the union to be in equilibrium again, its own wage demand

must also fall. How much it falls depends on how responsive w_2 is to changes in employment, and the markup unions can charge which depends on its own sectoral labor demand elasticity. This is measured by the term $\epsilon\eta$. However as union wages fall, a secondary effect also arises because some investment in the economy rises, and this pushes firms to a less elastic portion of their (shifted) labor demand curve. This is reflected in the remaining terms in the denominator in the above expression. Thus *ceteris paribus*, the union becomes less aggressive in its wage demand, the less unemployment there is in its own sector.⁸

Workers membership schedule: The membership constraint relates union wage gap with the probability of unemployment in the unionized sector. This condition yields a membership schedule showing different combinations of union wages and unemployment probability in sector 1 which satisfy the typical worker's membership constraint. The relationship between w and M implied by this membership constraint (MM) is:

$$dw/d\pi = -\frac{(1-\beta)(1+\eta)}{(1-\beta+\beta\pi)(1+\epsilon\eta)} \leq 0 \quad (2.10)$$

The relationship between w and π implied by the membership constraint is negative. As wages rise in the unionized sector, employment falls even as joining the union becomes more attractive. This means that the probability of getting employment in sector 1 must fall for all union members.

The equilibrium union sector wage, employment and wages in the outside

⁸Note that the slope of the schedule depends on how responsive w_2 is to changes in its labor supply. A special case in this model would be where the non-unionized sector can absorb any amount of labor at constant wages ($\eta_L = 0$). This breaks down the relationship between π and outside wages, and thus union wage. In this case the wage demand schedule becomes horizontal.

sector are determined where the wage demand schedule and the membership schedule intersect with each other. (Figure 1).

2.3 Effects of enhanced Capital Mobility

An important feature of the current phase of globalization has been closer integration of domestic capital markets with world markets. This has been aided by declines in transportation costs, improvements in communication technologies and political decisions by governments to attract new investments. These include the opening of industries previously closed to FDI, the streamlining or abolition of approval procedures and the provision of incentives. Bilateral investment treaties aiming at the promotion and protection of such investment have also been concluded between many countries (Epstein, 2000). These developments have increased the ability of firms to shift production internationally. The model captures these increases in capital mobility as a decline in the firm's costs of moving capital, or a fall in the value of the parameter λ .

The direct effects of this change can be estimated by differentiating equations 2.4 and 2.5 and solving. This shows that holding union wages constant, cheaper mobility prompts larger transactions in capital by firms in sector 1. This changes the domestic investment level of firms and thus shifts the labor demand curve, either to the left if firms are net sellers of capital in international markets or to the right if they are net purchasers.

$$\hat{K} = -\left(\frac{1-\alpha}{\alpha\theta}\right)\hat{w} - \frac{(K-K_0)}{K}\hat{\lambda} \quad (2.11)$$

At the same time, as noted earlier the elasticity of labor demand in sector 1 depends on mobility costs, and will be affected by changes in it.

Proposition 1 *Cheaper capital mobility makes the original sectoral labor demand curve more elastic at every point. When investment is allowed to change also, labor demand elasticity is higher at the same wage along the shifted labor demand curve.*

The proof of the proposition is presented in the appendix 1 of the thesis. A graphical representation is provided in figure 2. The intuition for this result is that as the union raises wages, firms respond by either selling more capital in international markets or lowering their intended purchases. Firms can substitute labor by capital more easily, the more easily they can adjust their domestic capital stock without requiring large changes in the rate of return on it. The cheaper capital mobility is, the less steeply upward sloping is the domestic capital supply curve, and the more substitutable labor therefore is with capital. This supports Rodrik's assertion that capital mobility increases labor demand elasticities⁹ The strength of the elasticity effect is directly related to the proportion of domestic capital endowment to total investment. Thus the same percentage fall in the marginal mobility cost will cause a larger percentage change in the elasticity in capital exporting countries, than in capital importing ones.

Effect on the union's wage demand schedule: The union is impacted by an increase in the degree of capital mobility in two ways: firstly because this changes the domestic investment level of domestic firms and thus labor demand. Secondly, because the shifted demand curve that it now faces is more elastic. This

⁹Note however that our choice of a Cobb-Douglas plays an important role in generating this strong effect on elasticity. Other production functions can yield different results, because changes in the capital intensity of production may mask the effects of increasing capital mobility on labor demand elasticity.

reduces its ability to charge a mark-up over wages in sector 2. The total impact on the union wage demand schedule (VV) can be gauged by totally differentiating equation 2.1, using 2.11 and ???. This is done in the appendix. To examine how the wage demand schedule is shifted, note that

$$\left. \frac{\widehat{w}}{\widehat{\lambda}} \right|_{\pi=\bar{\pi}} = \frac{\left(\frac{1}{\gamma\epsilon-1}\right)\frac{(1-\alpha)}{(1+\theta-\alpha)}\frac{K_0}{K} - \eta\frac{(K-K_0)}{K}}{1 + \epsilon\eta + \frac{1}{(\gamma\epsilon-1)}\frac{(1-\alpha)^2(1-\theta)}{\alpha\theta(\theta+1-\alpha)}}$$

The sign of the expression above depends on the sign of the numerator since under model assumptions the denominator is always positive. The first term in the numerator measures the elasticity effect induced by better capital mobility, i.e., the effect of increased labor demand elasticity on union wage demand. *Ceterus paribus*, this tends to make the union tone down its wage demand. Industries where most of the capital is domestic are those where the elasticity effect is felt most strongly. On the other hand the effect is weaker the higher the weight the union places on employment, because then the union induced distortion is small to start off with. The initial degree of integration of the economy with world markets, as measured by θ , has a non-linear impact on the strength of the elasticity effect. The effect is insignificant when capital is completely immobile, and again as the economy approaches full capital mobility ($\theta \rightarrow 0$). The strongest disciplining effects on unions are felt when the economy is relatively, but not completely closed to international capital markets.

The second term measures the spillover “scale effect” resulting from changes in domestic investment by firms, induced by cheaper access to international capital markets. This affects employment in the unionized sector, thus the outside wage and the union wage. The direction in which the scale effect pulls wages depends on whether investment rises or falls. Its strength however depends on how significant

international capital transactions are at prevailing international prices, and on the responsiveness of outside wages to changing employment in the unionized sector. The scale effect is small if unionized sector employment changes have no significant impact on outside wages (η is close to 0), or when domestic rates of return on capital are close to international rates.

If the unionized sector is a seller of capital, both the scale and elasticity effects resulting from greater capital mobility work in the same direction, to pull union wages down (holding π fixed) the net result is that wages in the unionized sector must decline along with mobility costs. Thus the VV schedule shifts down as λ falls. For a country which purchases capital from abroad, however, though the elasticity effect hurts the union's monopoly power, expanding employment in the unionized sector raises the base outside wage. The wage in the unionized sector may rise or fall depending on whether the rise in w_2 is enough to overcome the fall in the union mark-up or not.

Effect on workers membership constraint: A change in the degree of capital mobility also impacts workers' perceptions of the probability of unemployment, and consequently shifts the membership schedule. Totally differentiating the membership constraint yields (MM), and using 2.11 and ?? yields the following condition (see appendix):

$$\left. \frac{\widehat{\pi}}{\widehat{\lambda}} \right|_{w=\bar{w}} = \frac{-\eta(1-\beta+\beta\pi)\left(\frac{K-K_0}{K}\right)}{(1-\beta)(1+\eta)} \quad (2.12)$$

It can be seen that the membership schedule shifts right or left as λ declines, depending on whether a country was buying or selling capital from world markets at the original equilibrium. For a seller of capital declining domestic investment reduces employment in the unionized sector. The earlier union wage is now

sustainable only if employment probability rises enough to restore the equality in expected wages. Thus the membership schedule shifts to the left. The exact opposite holds when the country is a net capital buyer. The more the sector interacts with world capital markets, the larger is the impact on capital flows and greater the shift in the membership schedule.

Since a decline in marginal mobility costs affects the decisions of both the union and workers, it will have an impact on wages in both sectors and on the distribution of labor between them. Adjustment in the unionized sector can proceed along two fronts. Either the union can choose to adjust wages and accept higher unemployment probabilities for its members, or lower wages in order to keep more of its members employed.

Proposition 2 *In a country which sells capital in international markets, greater capital mobility forces the union to reduce its wage demand. The effect on members probability of employment depends on how integrated the country is with the world capital market. In a country where firms buy capital from abroad, union wage may rise if i) the country transacts a lot in international markets, ii) outside wage is very responsive to employment changes in the unionized sector, or (iii) if the union is very employment oriented. If union wages rise, the effect on members employment probability is unclear. However if wages fall, employment probability must increase.*

A graphical representation of this proposition is presented in figures 2 and 3. The mathematical solution is presented below. From appendix 2 it can be seen that:

$$\frac{\hat{w}}{\hat{\lambda}} = \frac{\frac{1}{(\gamma\epsilon-1)} \frac{(1-\alpha)(1+\eta)}{(1+\theta-\alpha)} \frac{K_0}{K} - \eta \left(\frac{K-K_0}{K} \right)}{\left(1 + \epsilon\eta + \frac{(1+\eta)}{(\gamma\epsilon-1)} \frac{(1-\alpha)^2}{\alpha(\theta+1-\alpha)} \frac{(1-\theta)}{\theta} \right)} \quad (2.13)$$

Under the assumptions of the model, the denominator is always positive. Thus the sign of the above expression depends on the sign of the numerator. An economic meaning can be assigned to this expression as follows: The first term measures the change in the mark-up that unions can obtain over wages in sector 2, and is related to the labor demand elasticity they face. As noted earlier, greater capital mobility increases this elasticity and this elasticity effects always tends to make the union tone down its wage demand. The second term in the numerator measures the increase in w_2 resulting from the fact that increased investment in the unionized sector increases labor demand there at the prevailing union wage. A secondary effect on w_2 arises because a fall in union-non-union wage gap reduces unemployment in sector 1, and increases labor supply. Union wages rise only if the base wage rises faster than the decline in the mark-up.

If outside wages are unaffected by changes in the unionized sector, our general equilibrium model collapses effectively into a partial equilibrium model. This model implies neglecting scale effects so that capital mobility affects the union only negatively through the elasticity effect. The inevitable result is that union wages must decline. However when scale effects are also considered, the picture may be different depending on which direction the scale effects work in. In an economy where the unionized sector is losing capital, sectoral wages are pulled down by the combined effects of a declining union-maintained wage gap, and falling outside wages induced by larger capital outflows (Figure 3). For a capital importing country however, the situation is different. Though the position of the union here too is undercut by the increased labor demand elasticity, union wages receive some support because the inflow of capital raises employment and pulls the outside wage up. The final result depends on which one of the two effects

dominates (Figure 4). Economies where capital imports were large, where unions were very employment oriented, or where mobility was high, are those where wages may rise in response to greater capital mobility.

Solving for π we get the following condition,

$$\frac{\widehat{\pi}}{\widehat{\lambda}} = - \frac{(1 - \beta + \beta\pi) \left[\frac{(1+\epsilon\eta)}{(\gamma\epsilon-1)} \frac{(1-\alpha)}{(\theta+1-\alpha)} \frac{K_0}{K} - \frac{\eta}{(\gamma\epsilon-1)} \frac{(1-\alpha)^2}{\alpha(\theta+1-\alpha)} \frac{(1-\theta)}{\theta} \left(\frac{K-K_0}{K} \right) \right]}{(1 - \beta) \left(1 + \epsilon\eta + \frac{(1+\eta)}{(\gamma\epsilon-1)} \frac{(1-\alpha)^2}{\alpha(\theta+1-\alpha)} \frac{(1-\theta)}{\theta} \right)}$$

The change in employment probability depends on the elasticity effects, the scale effects and the effect of changing labor supply in the economy all mixed together. For a country where the unionized sector attracts capital, the numerator is positive. For a country which is losing capital, a sufficient condition to ensure that employment probability rises when λ falls is that $\theta < 1$. For such economies, initially the union is able to use its monopoly power to prevent its wages from adjusting proportionately, and employment probability may therefore even rise. However as the economy becomes integrated with the world capital market and θ falls, the distortion reducing effect of capital mobility outweighs the scale effects. Union wages adjust more than proportionately, and employment probability increases. When domestic firms buy capital from abroad to invest domestically, however, $\theta > 1$ ensures that elasticity effects dominate over scale effects so that the union adjusts wages more than proportionately and employment probability rises.

Proposition 3 *When the unionized sector buys capital from abroad, greater capital mobility raises wages in the non-unionized sector. Even in an economy which sells capital to world markets, workers may gain from integration when capital outflows are small enough.*

Differentiating 2.3 gives us that $\widehat{w}_2 = \eta \left(\widehat{L} - \frac{(1-\beta+\beta\pi)}{(1-\beta)} \widehat{\pi} \right)$. Solving for this utilizing earlier results yields that

$$\frac{\widehat{w}_2}{\widehat{\lambda}} = \frac{-\eta \left[\left(1 + \frac{1}{\alpha(\gamma\epsilon-1)} \frac{(1-\alpha)^2}{(\theta+1-\alpha)} \frac{(1-\theta)}{\theta} \right) \left(\frac{K-K_0}{K} \right) + \left(\frac{\epsilon-1}{(\gamma\epsilon-1)} \frac{(1-\alpha)}{(\theta+1-\alpha)} \frac{K_0}{K} \right) \right]}{\left(1 + \epsilon\eta + \frac{(1+\eta)}{(\gamma\epsilon-1)} \frac{(1-\alpha)^2}{\alpha(\theta+1-\alpha)} \frac{(1-\theta)}{\theta} \right)}$$

For a capital importing economy, cheaper access to world capital markets boosts domestic investment and labor demand, and has a positive impact on labor incomes in general. An additional bonus is that it reduces union monopoly power, and promotes greater investment at home. For both of these reasons, workers in sector 2 gain from capital mobility. In an economy which loses capital, however, larger capital outflows reduce employment in the unionized sector and tend to pull all wages down. This effect is however countered by the collapse of union wages, which generates new employment in the unionized sector. If the difference between domestic and international rates of return on capital is small, or if the union distortion was very large to start off with, it is possible that outside wages may even rise. However when capital outflows are significant, it is unlikely that labor would benefit from increasing capital mobility.

Any increase in the outside wage rate will compress returns to the other specific factor, land. The domestic owners of this factor therefore are hurt by enhanced capital mobility when the economy is a net importer of capital. They may benefit though, when the country exports a substantial amount of capital to foreign markets, and employment declines force wage in sector 2 down.

Another interesting aspect is to examine the impact of mobility on union generated inter-industry wage differentials. Using our results it can be shown

that :

$$\frac{\widehat{w} - \widehat{w}_2}{\widehat{\lambda}} = \frac{(1 + \epsilon\eta)\frac{K_0}{K} - (\epsilon - 1/\alpha)(1 - \theta)\eta\left(\frac{K - K_0}{K}\right)}{\left(1 + \epsilon\eta + \frac{(1+\eta)}{(\gamma\epsilon-1)}\frac{(1-\alpha)^2}{\alpha(\theta+1-\alpha)}\frac{(1-\theta)}{\theta}\right)}$$

The first term in the numerator measures the elasticity effect which always acts to reduce the differential as capital becomes more mobile. The second term measures the effect of investment changes. Their direction depends on the degree of integration with world capital markets, and the direction of its transactions with the home economy. If we were to abstract away from scale effects by assuming that η is zero, note that interindustry wage differentials always fall when factor markets become more integrated. The speed with which they fall depends on the ratio of domestic endowment to investment.

2.4 Price Changes in an Integrated Economy

The other major component of globalization has been through product market integration. Tariff and non-tariff barriers to trade have been falling in the case of most countries, and the volume of trade has grown at a very rapid pace. We assume that the union is located in the import competing sector and its domestic price incorporates some trade distortion, such as an import tariff. Liberalization involves the removal of this distortion, the effect of which is felt through a lower product price for sector 1. Since the economy is assumed small in international markets, international product and factor prices remain unaffected by this policy change.

As before we differentiate sector 1 firms' profit maximizing first order conditions. This shows that if the union were to keep its wage fixed, a reduction in price would domestic firms to their investment by selling some capital abroad.

The amount of capital that is sold abroad depends on how large the price change was, and also on how easily capital investment can change in response to a change in its domestic rate of return (as captured by the term $1/\theta$).

$$\widehat{K} = -\left(\frac{1-\alpha}{\alpha\theta}\right)\widehat{\omega} + \frac{1}{\theta}\widehat{p} \quad (2.14)$$

where ω refers to the real wage in the unionized sector ($\omega = w/p$). For this entire section, real wage refers to wage measured in terms of product 1's prices, and price refers to the unionized sector product price, p .

However union wages cannot remain unaffected by this change for two reasons. Firstly, because as investment in sector 1 goes down, so does employment. This drives more workers to sector 2, and wages there fall in response. This decline tends to drag union wages down too. As before, this is the scale effect of the price change. However union mark-ups depend on labor demand elasticities, which in our general equilibrium framework, are endogenous.

Proposition 4 *In the unionized sector, a price change causes an inward shift of the sectoral labor demand curve when capital is mobile. At the same real union wage, labor demand elasticity is lower at a lower price along this shifted demand curve when $\theta > 1$, and higher when $\theta < 1$.*

Recalling our expression for labor demand elasticity, and totally differentiating the expression yields

$$\left.\frac{\widehat{\epsilon}}{\widehat{p}}\right|_{\omega=\bar{\omega}} = -\frac{(1-\alpha)(1-\theta)}{(1-\alpha+\theta)\theta} \text{ which is } \leq 0 \text{ as } \theta \leq 1$$

From lemma 2 we know that $\epsilon = \epsilon(\lambda, K(w, p, \lambda))$. Thus prices do not directly affect the responsiveness of labor demand to real wages, but affect it indirectly

through their effect on firms' efficient capital stock. Note that since the international rental rate for capital is constant, a domestic price decline makes international markets more attractive for home country firms¹⁰. Thus even when the union keeps its real wages fixed, domestic firms would like to reduce domestic investment by selling capital abroad. How much capital they can sell abroad depends on how fast mobility costs increase. When it is relatively costly to move capital across the border ($\theta > 1$), not much capital can escape. It is now difficult for firms to substitute labor by more capital, and thus the new labor demand curve is less elastic. However when the economy is better integrated with world capital markets, and θ is below unity, domestic rate of return on capital are more closely linked to the international rental rate. Adjustment in such markets occurs mostly through capital movements. When price falls, the equilibrium capital-labor ratio declines too. Firms find it easier to substitute labor with capital at the new equilibrium, and labor demand elasticity thus goes up. Thus in contrast to Rodrik we show that there is no direct correlation between trade openness and labor demand elasticity. This result may partially explain why the empirical findings that the linkage between greater trade openness and elasticity is weak (Slaughter, 1997; Krishna et. al., 2001; Fajnzylber and Maloney, 2000). Note that as the economy becomes more integrated with the world capital market, the elasticity effect becomes smaller.

Union Wage Demand Schedule: Liberalization impacts the union because of both, its effect on employment in the unionized sector, and on the elasticity of demand it faces. Totally differentiating equation 2.1 expressed in terms of real wages, using 2.14 and ?? we get that (appendix 3):

¹⁰This is true if capital owners spend their incomes domestically.

$$\left. \frac{\widehat{\omega}}{\widehat{p}} \right|_{\pi=\pi} = \frac{\frac{1}{(\gamma\epsilon-1)} \frac{(1-\alpha)(1-\theta)}{(\theta+1-\alpha)\theta} - 1 + \frac{\eta}{\theta}}{1 + \epsilon\eta + \frac{1}{(\gamma\epsilon-1)} \frac{(1-\alpha)^2(1-\theta)}{\alpha\theta(\theta+1-\alpha)}}$$

The sign of the expression above depends on the sign of the numerator. As before, the first term there measures the elasticity effect. Its direction depends on how demand elasticity changes when price falls, which in turn depends on the value θ takes. The elasticity effect is negative when the economy is not well integrated in world capital markets, and positive when it is. The last two terms measure the scale effect that occurs because of the effect on wages in the second sector. How fast real wages fall in sector 2 depends on the amount of labor released by the unionized sector ($1/\theta$), and the responsiveness of outside wages to this ($1/\eta$). Note that when $\theta > 1$, this term is negative and thus the wage demand schedule shifts up. This means that at the prevailing membership level, the union will adjust its wage demand less than proportionately to the price change. However if $\theta < 1$, the direction of the shift is a priori indeterminate and depends on that value η takes.

Workers' Membership Schedule: A change in prices will also impact workers' perceptions of the probability of unemployment, and the penalty if they are unemployed. This is reflected in a shift in the workers membership schedule. Totally differentiating the membership constraint (2.2), using 2.14 and ?? yields the following condition (see appendix):

$$\left. \frac{\widehat{\pi}}{\widehat{p}} \right|_{\omega=\bar{\omega}} = \frac{(1-\beta+\beta\pi)}{(1-\beta)(1+\eta)} > 0$$

Holding union real wages constant, a decline in unionized sector price makes wages in sector 2 more attractive. Therefore at the prevailing union real wage,

workers will want to join the union only if they are compensated for this by an increase in employment probability. A graphical representation is presented in figure 4.

Proposition 5 *Wage falls in the unionized sector when its product price declines. However the percentage decline in union wages is less than the percentage decline in prices when $\theta > 1$. Union members also gain from a decrease in unemployment probability. When $\theta < 1$, the same holds only when wage in the other sector is unresponsive enough.*

Solving the equations showing the effects on the wage demand and membership schedules, the following solution for union wages can be derived:

$$\frac{\widehat{\omega}}{\widehat{p}} = \frac{\frac{\eta}{\theta} - 1 + \frac{(1+\eta)}{(\gamma\epsilon-1)} \frac{(1-\alpha)}{(\theta+1-\alpha)} \frac{(1-\theta)}{\theta}}{\left(1 + \epsilon\eta + \frac{(1+\eta)}{(\gamma\epsilon-1)} \frac{(1-\alpha)^2}{\alpha(\theta+1-\alpha)} \frac{(1-\theta)}{\theta}\right)} \quad (2.15)$$

The sign of the above depends on the sign of the numerator. Clearly this is negative when $\theta > 1$. In this case the union is able to prevent its wages falling as fast as its product price because of two reasons. Firstly because liberalization leads to smaller investment declines, since capital cannot move abroad as easily. Secondly because as employment falls, labor demand elasticity rises and this allows unions to raise their mark-up. The result is that union real wages rise in terms of its product price, but fall in terms of the other price (see figure 5). However when the economy is better integrated and if wage in sector 2 falls rapidly when that sector is forced to absorb labor displaced from the unionized sector, then union wages may decline in terms of both prices. This may happen if $\theta \leq \eta \leq 1$. Thus union determined wages are more vulnerable to price changes in industries where capital is very footloose.

The other change happens in terms of the probability that a union member finds a job in the unionized sector. The mathematical solution to the change in employment probability is as follows:

$$\frac{\widehat{\pi}}{\widehat{p}} = \frac{\frac{1}{\theta} \left(\frac{(1+\eta)}{(\gamma\epsilon-1)} \frac{(1-\alpha)}{(\theta+1-\alpha)} (1-\theta) + \eta - \theta \right)}{\left(1 + \epsilon\eta + \frac{(1+\eta)}{(\gamma\epsilon-1)} \frac{(1-\alpha)^2}{\alpha(\theta+1-\alpha)} \frac{(1-\theta)}{\theta} \right)}$$

Clearly when θ is greater than one, employment probability rises when union product price falls. This result is mainly because even as employment falls in the unionized sector, the queue of workers wanting to join the union falls even faster. In more integrated economies where θ is less than one, we cannot make a prediction about π in general. However in the special case where $\theta \leq \eta \leq 1$, employment probability falls even as union real wages fall. Thus in such industries, liberalization proves doubly costly for the union.

Proposition 6 *Wage in the non-unionized sector decline in terms of its own price. This decline is higher (i) the higher the share of labor in total costs in the unionized sector, and (ii) the lower θ is. The effect is ambiguous in terms of the unionized sector's product price,*

The impact on the real outside wage can be estimated as follows:

$$\frac{\widehat{w}_2 - \widehat{p}}{\widehat{p}} = \frac{\frac{\eta}{\theta} - 1 - \frac{(1+\eta)}{(\gamma\epsilon-1)} \frac{(1-\alpha)^2}{\alpha(\theta+1-\alpha)} \frac{(1-\theta)}{\theta}}{\left(1 + \epsilon\eta + \frac{(1+\eta)}{(\gamma\epsilon-1)} \frac{(1-\alpha)^2}{\alpha(\theta+1-\alpha)} \frac{(1-\theta)}{\theta} \right)} \quad (2.16)$$

Wages in sector 2 fall due to trade liberalization which affects the unionized sector because it is forced to accept displaced labor from that sector. Thus how fast outside wages fall depend on how much this displacement is, which in turn depends on two factors mentioned above. Note that though the union wage falls slower than its product price for all θ greater than unity, the same result may

not hold for outside wages. The union is able to do this only at the cost of employment. Workers thus move to sector 2 and drive down wages there. The union is thus able to transfer more of the pressure of liberalization to wages in the non-unionized sector of the economy when it confronts lower levels of capital mobility itself.

Note that in the special case where capital mobility is completely restricted (θ is infinitely high), wages in both the sectors fall in terms of p , but rise in terms of sector 2's price. In this case, the model displays the neoclassical ambiguity characteristic of such models. At the other extreme, with full capital mobility, domestic rental rates are fixed to international rates and cannot vary. Wages thus have to shoulder the entire burden of adjusting to price declines, and have to change more than proportionately with prices. Thus capital mobility hurts all wages unambiguously in this situation.

Corollary 1 *Greater capital mobility magnifies the impact of a change in the unionized sector's price on wages. When capital is immobile, all wages respond less than proportionately to a fall in price. When capital is freely mobile, however, wages fall faster than prices.*

Taking the limit of expression 2.15 as $\theta \rightarrow \infty$, it is easy to see that,

$$-1 \leq \hat{\omega}/\hat{p} = \frac{\hat{w}_2 - \hat{p}}{\hat{p}} = -\frac{1}{(1 + \eta/\alpha)} < 0$$

Applying the limit $\theta \rightarrow 0$ to the solution for wages implies that

$$\hat{\omega}/\hat{p} = \frac{\hat{w}_2 - \hat{p}}{\hat{p}} = \frac{\alpha}{1 - \alpha} > 0$$

It is also instructive to see that both wages move together in both of these extremes. This implies that the difference between the rates of change in both the wages is due to the elasticity effect. An important question in this respect may be how the inter-industry wage differential responds to changes in capital mobility. From 2.15 and 2.16, the effect on the wage gap can be expressed as:

$$\frac{\hat{\omega} - (\hat{w}_2 - \hat{p})}{\hat{p}} = \frac{\frac{(\alpha\epsilon-1)(1+\eta)}{(\gamma\epsilon-1)\alpha} \frac{(1-\theta)}{(\theta+1-\alpha)}}{\left(1 + \epsilon\eta + \frac{(1+\eta)}{(\gamma\epsilon-1)\alpha} \frac{(1-\alpha)^2}{(\theta+1-\alpha)} \frac{(1-\theta)}{\theta}\right)} \leq 0 \text{ as } 1 \leq \theta$$

Corollary 2 *Union induced inter-industry wage gap rises as union product price falls if $\theta > 1$, and declines if $\theta < 1$*

Thus the union can successfully raise the wage gap, even as demand for its product falls, so long as it is relatively hard for capital to move out of the sector. However when capital is mobile enough, and $\theta < 1$, falling product prices increase the employment cost of keeping union wages high, and this forces the union to bring wages in its sector closer to the outside wage.

2.5 Conclusions and further research

This chapter examined how wages respond to globalization in a unionized economy. The major results in this paper are driven by a special general equilibrium spillover between the two sectors of the economy, where the union bases its wage demand on wages in the non-unionized sector. The union's wage demand depend upon the labor demand elasticity it faces. In this set-up I show that greater capital market integration may raise sectoral labor demand elasticity. However, I show that this does not necessarily translate into a fall in the wage either in the non-unionized sector or even in the unionized sector wage. This depends on

whether capital mobility promotes domestic investment or not, and on how large the union distortion is. It may also benefit union workers in some instances by increasing their chances of finding union jobs. When the unionized industry loses capital to markets abroad, integration negatively affects the union both by increasing labor demand elasticity and by reducing union employment. This forces a decline in union wages. Though such mobility hurts unions, it also provides a cushion to the general wage level through generating additional employment in the economy. Workers may gain from enhanced capital mobility when the jobs lost due to capital outflows are small compared to the new employment opportunities created by the collapse of union wages. When the industry is the recipient of capital inflows, greater integration promotes larger capital inflows, raises employment, and tends to pull up the non-union wage in the economy. We show that if capital inflows are large enough, even union wages might rise. Thus even while confirming Rodrik's proposition regarding elasticity, we show that there is no a priori reason to assume that capital mobility is always detrimental to worker interests.

Closer product market competition is modeled in the paper as a decline in the price of the union sector product. Contrary to Rodrik (1998), I show that price changes do not have a direct impact on labor demand elasticity, but affect it indirectly by changing domestic investment levels. At a fixed product wage, elasticity may go up or down depending on the extent of capital market integration. I show that when domestic firms are not well integrated with world capital markets, union wages fall less than price and the effect on real wages is ambiguous. At the same time union members benefit from increased decreased unemployment. Better integration with world capital markets cuts into the abil-

ity of the union to protect itself from product price declines. I show that workers are affected more by liberalization when capital can escape abroad more easily. Interestingly when capital is freely mobile, the neo-classical ambiguity disappears and all wages fall in terms of both good prices.

Many important avenues of research remain. In this model, I assume that both unions and workers have perfect information regarding the conditions facing the firm. In reality however, such information is not likely to be available to them, especially as far as the firms' outside options are concerned. Firms might be able to pressurize unions by misrepresenting their returns from relocating. Seniority is important in many unions when deciding who gets laid off. Thus unemployment probability might differ across members. The solution in this case might be better modeled as a political process as in Grossman (1984). This model also assumes mobility costs to be exogenous to the model, and identical whether capital comes into or flows out of the economy. A more probable situation might be that costs differ in both these situations. To the extent that these costs are partially determined by government policies, they might also be determined through a political economy process in which workers and firms lobby the government for protection. Mobility costs might then be endogenized by relating them to the economy's endowment relative to the rest of the world. Another avenue for research would be to model such a process explicitly.

Chapter 3

An Empirical Study of the effects of Integration on Union Wage Premiums

3.1 Introduction

Though it is a common belief that globalization has had a profound effect on employment, incomes and labor market institutions in the participating countries, the exact nature and extent of this change is poorly understood. One particular concern, especially in the industrialized countries, has been the effect of internationalization on workers compensations and employment prospects. Indeed the fear that workers, especially unskilled workers, have been badly hurt by globalization has become a strong argument against further integration. Attention has also become focused in particular on the effects this can have on labor market institutions which impact wage determination. Labor markets are often characterized by non competitive wage setting, where wages are determined through such institutions. Studies in the US, for example, point towards large and persistent inter-industry differentials in wages earned by seemingly equivalent workers. While there is no consensus over what these differentials represent, at least in

some industries like automobiles and steel, they might reflect rent seeking by organized labor unions.

It could be argued that integration may have larger effects on wages and employment in unionized markets than in competitive markets. The previous chapter presented a theoretical analysis examining this issue. In this chapter we empirically explore how important the threat effect unions face from outward foreign direct investment by their industry is in explaining differences in union wage premiums across industries and over time. We also examine the nature of union wage response to tariff protection, and whether this response is affected by the size of the threat effect they face. We do this by combining worker level data for the US obtained from the Current Population Surveys for the years 1990-1996, with industry level data on openness and other industry characteristics. Our study is different from previous literature in some important respects. Firstly, in terms of how we define and estimate the industry union wage premium. These are estimated as the wage differential that union members obtain over similar non-members in the same industry. Secondly, we use the share of industry capital invested in the US to the total worldwide industry capital stock, as the measure of the threat unions face from outward foreign direct investment. To the extent that FDI is the link connecting home and foreign labor markets, this may arguably be a better measure than looking at employment shares. Thirdly, we check for whether union response to changes in trade policy measures (tariffs) differs systematically with the level of the threat effect they face.

In line with theory, after controlling for industry and time fixed-effects, we find evidence of a threat effect operating on unions. Unions were able to charge higher premiums in industries that were mostly domestically invested than in industries

that had significant amount of capital invested abroad. We also find evidence that union response to tariff changes vary with the level of the threat effect. Tariffs (lagged one year) were negatively related with union premiums for more domestically invested industries, but positively related with them for industries that were heavily invested abroad. This suggests that unions use protection to raise employment for their members in less mobile industries, and to raise premiums in more mobile industries.

The remainder of this chapter is organized into four sections. Section 3.2 presents a review of earlier work. Section 3.3 describes the data, and lays out the statistical model we use. Section 3.4 presents the results and Section 3.5 provides a brief conclusion.

3.2 Literature Review

Theory suggests that the wage and employment response to labor market pressures can differ under collective bargaining compared with the competitive wage determination case. This is because unlike in the latter case, unions can choose which of their two objectives to adjust, generating employment for its members or maintaining a wage premium over their competitive level. In response to market pressures, they can therefore adjust their wage demands either less than proportionately at the cost of reducing employment, or more than proportionately to preserve union jobs. The exact choice they make has been the subject of some theoretical research.

The belief that unions face a threat from the growing internationalization of production is well established in the literature.¹ The pressure that this generates

¹See for example, Mezetti and Dinopoulos (1991), Zhao (1995), Rodrik (1999), Reddy

should lead them to reduce union wage premiums. Increasing import competition is another channel through which unions may face pressure. Brander and Spencer (1988) and Mezzetti and Dinopoulos (1991) model union-firm interaction in a Nash bargaining framework, and show that tariff protection allow unions to collect part of the increased firm level rents for its members in the form of higher wages. The relationship between tariffs and union wages in their models is thus positive. Other models, however, predict a more complex relationship. Grossman (1984) models a union where members are subject to seniority layoffs. He shows that declines in the product price (for example, due to increased import competition) generate a conflict between the interests of the marginal member who wants to lower wages to maintain his probability of getting employment, and the new median voter in a shrunken union, whose seniority and preferred wage are higher. He shows the outcome of a vote depends on the elasticity of labor demand facing the union. Unions facing an elastic labor demand are more likely to vote for wage increases, but if labor demand is inelastic, union wages fall with declining prices. Tariffs and union wages may therefore be either positively or negatively related with each other. A similar result is also derived by Lawrence and Lawrence (1985) in a different context. They show that declining industries may be characterized by perverse union wage responses to price declines, as the union tries to extract maximum rents at the cost of firm profitability. Unions can do this since firm capacity is largely fixed in the short run.

In the previous chapter, we set up a theoretical model that combined some of the essence of the Grossman (1984) and Lawrence and Lawrence (1985) models in a general equilibrium framework. The model predicted that the easier it is for an

(2000)

industry to shift production abroad and out of the reach of local unions, the higher is the price, in terms of employment, to the union of raising wages. Thus unions in more mobile industries should charge lower premiums over the competitive wage rate. This is the "threat effect" posed by the internationalization of production. Another prediction of the model was that union premiums would rise as tariff protection is lowered in industries that are not very mobile internationally, but that they would fall in the case of more mobile industries. Analogous to the Lawrence and Lawrence model (1985), unions opt to raise premium in the first case, in a bid to extract maximum rents from firms that are "stuck" at home and face limited ability to reduce employment. Allowing firms to be mobile internationally, however, changes union incentives. Now the unions fear losing too many jobs if they keep wages as high as before and companies shift production abroad. They therefore bear a greater part of the burden of greater import competition, and reduce wages faster than competitive wages are changing.

Empirical evidence regarding the effect of import competition on union rents is mixed. Lawrence and Lawrence (1985) use aggregate US industry level data for the period 1980-84, and show that import penetration has a negative effect on wages, but found the response of union and non-union wages to be similar, possibly implying little change in union premiums. Other indirect evidence comes from literature that examines the impact of openness on inter-industry wage differentials for union and non-union workers. Freeman and Katz (1991) use worker level data between 1974-1984, and find that import shares have a significant negative effect on inter-industry wage differentials for union members, but not on industry differentials calculated from the pool of non-union members. A similar result is reported by Gaston and Trefler (1995), who look at differentials for a cross-section

of industries in 1984. They find that while inter-industry wages differentials for union members are significantly and negatively related to industry tariffs and import penetration levels, non-union wage differentials are not. Their study is also significant because apart from the usual trade openness variables, they also introduce variables related to a firm's ability to send production abroad. They do not, however, find these to be statistically significant in their sample. These studies do not explicitly look at union premiums, but are suggestive of a negative relationship between union premiums and openness. In contrast, Pizer (2000) also examines inter-industry wage differentials in union and non-union samples for a later period, 1984 to 1991. He surprisingly reports that for union members, mean industry differentials are positively related to import penetration, while the relationship is statistically insignificant for non-union members. Further, for union members, the relationship is strongest when capacity utilization is low in the industry. This result suggests a relationship between openness and premiums that is opposite to the one suggested by similar earlier studies.

Other evidence comes from studies that estimate wage equations for the pool of union and non-union workers. MacPherson and Stewart (1990) pool worker level data from the Current Population Survey (CPS) for the years 1975-1981, and estimated separate union and non-union wage equations. They report that increasing import penetration by 10 percent lowered the average union non-union wage differential in their sample by around 2 percent. However, a different result is reported by Shippen and Lynch (2002). They conduct a similar exercise for a later time period from 1987-1994, and find that the effect of import penetration on both union and non-union wages over the entire period was zero. In their sample, import penetration did negatively affect union wages in the early part of

their time period, however by the mid 90s, this effect vanished.

Cebula and Nair-Reichart (2000) focus explicitly on union premiums (rather than wages) in their study of workers' wages from 1975-1984. Their finding is that union rents are sensitive to import competition, and that this responsiveness is not different for different levels of industry unionization. They do not however focus on the threat effect of firm mobility. Choi (2001) extends their study for the period 1983-1996, and also looks for the "threat effect" posed by foreign direct investment abroad. In his sample, however, import penetration has no significant impact on union wage premiums. He however documents that the stock of outward foreign direct investment, measured as the employment share of majority owned foreign affiliates in US industry employment, has a dampening effect on union premiums. On the whole, empirical evidence is mixed, and seems to suggest that union response to import competition and foreign direct investment may have been different in the early 80s compared to the 90s.

Of these studies, the Cebula-Nair Reichart (2000) study, and the Choi (2001) study most directly focus on our variable of interest, the union non-union wage premium. However our study is different from these papers in some important respects.

(1) We use a different measure of union wage premium. We define the premium as the extra wage a worker earns because of his union affiliation over an equivalent worker in the same industry. The previous studies estimate union rents as the premium over some estimated average wage. We think that this is a better measure of union rents, since the persistence of inter-industry wage differences and the lack of equilibrating labor movements suggests that worker may have some affinity to their industry, and mobility between industries may be limited.

It is also more likely that unions consider non-union wages in their own industry as a base in setting their own wages.

(2) We use the share of industry capital invested in the US to the total industry capital stock worldwide as a measure of the threat that unions face from outward FDI. A high value of the FDI variable suggests greater domestic orientation of the industry, and lower threat to domestic unions from FDI. The use of this measure is suggested by our theoretical model. The chosen FDI variable may take a high value either because high barriers to mobility make it difficult for firms to shift capacities abroad to take advantage of better conditions there. These barriers could be in the form of high costs of shutting down domestic capacity in the case of declining industries, or high fixed costs of starting operations in foreign locations. In either case, domestic unions face less threat of their jobs being exported abroad. Alternatively a high value of the FDI variable might reflect the relatively attractiveness of the US as a production center compared to locations abroad. In this case, relatively more capital will be invested at home than is invested abroad by domestic firms.² Using capital shares rather than employment shares at home and abroad might be a better (albeit imperfect) measure of the threat effect, since the threat to domestic employment from foreign workers must be intermediated by domestic industries making capital investments abroad.

(3) We also include trade policy variables like tariffs, along with trade volume based openness indicators. We also check for whether the impact of tariff changes

²Note that our measure also incorporates inward foreign direct investment, since the more net investment there is domestically, the lower the value our FDI variable takes, reflecting a lower threat effect.

on union premiums, is different across industries where unions face different levels of threat effects.

(4) There may be simultaneity issues with our openness indicators, the FDI variable, tariffs and union premiums. Higher union premiums may force more capital out, and raise the FDI variable. Similarly if import competition from abroad forces union premiums down, this may lead to increased lobbying by unions for protection. To the extent that causality runs from openness to premiums however, this cannot occur when we test the relationship with lagged openness variables. In our study therefore we test the relationship between current union premiums, and lagged openness indicators. This approach may also be justified on the ground that it might take some time for changes in labor market conditions to get reflected in union negotiated wages.

3.3 Specification and Data

Analyzing the impact of globalization indices on union premiums requires us to match worker level data with industry level characteristics. This is done by merging four data sets together: (1) The Merged Outgoing Rotation Group (MORG) of the current population extracted by the NBER, (2) the NBER Manufacturing Productivity Database, (3) US Trade by 1987 SIC Category, 1989-2001, provided by the NBER, and (4) US Direct Investment Abroad provided by the Bureau of Economic Analysis. The time period of the study, 1990-96 is dictated in part by the availability of data. This period is also interesting because this was when the Uruguay Round of GATT was passed, and import competition was increasing in virtually every manufacturing industry.

Though most data is available at a very disaggregated level, the publicly avail-

able foreign direct investment data is provided for only 32 broad classifications. Of these, two categories (electrical machinery and electric components and accessories) are not separated in the CPS data, and are merged together in our data set. This requires us to aggregate all data into 31 industry groups. This is done with the help of the concordances provided in the data sets themselves. Due care has been taken to ensure consistency at every step. Details of SIC industry codes included under each classification are given in Table 3.

Estimation is done in two stages. In the first stage we estimate our variable of interest, the industry union/non-union premium. Estimating this differential has been a source of debate in the literature because of fears that union status may be correlated with unobserved worker characteristics.³ However since our primary concern is in explaining changes in the union premium over time, following Blanchflower and Bryson (2002) we do not control for this potential endogeneity under the assumption that any resulting bias in our estimates remains constant over time. OLS is used to estimate the following log wage equation using data from the NBER MORG data set from 1990 to 1996.

$$\ln(w_{it}) = \alpha_t + \beta_t X_{ijt} + \delta_{jt} D_j + \gamma_{jt} (D_j * U_{ijt}) + \varepsilon_{it}$$

Where w_{it} is real hourly wage of worker "i" employed in industry "j" in time t, defined as the usual weekly earnings divided by usual weekly hours. X_{ijt} is a

³The direction of the relationship is however unclear. One possibility is that workers with lower underlying earning capacity have more to gain from union membership than higher quality workers. Union premiums estimated on the basis of observed characteristics will be underestimates of the real premium in this case. Alternatively there is also the possibility that the queuing that occurs because of positive union premiums, allows employers to choose the best workers among those the available pool of applicants, in which case estimated union premiums are overestimates.

vector of worker, location and demographic characteristics, including schooling, labor force experience⁴ and its square, full time or part time status, gender, race, marital status, geographic location dummies and veteran status. D_j is a vector of industry dummies and U_{ijt} is a dummy indicating the i th workers union membership. ϵ_{ijt} is a well-behaved random error term. The excluded industry group is non-union members in the textile products and apparel industry. The sample of workers included in the study includes workers between the ages of 16-76 who (1) were employed in the private sector, (2) were employed in the manufacturing sector except the petroleum industry⁵, (3) worked for more than an hour a week, and (4) earned more than \$1 and less than \$250 an hour.

A major shortcoming in the data is that it only reports wages, and not other non-wage benefits. This may bias our results, if for example, union members regularly receive more of their total compensation in the form of non-wage benefits than non-union members. In this case, our union premium would be underestimated. However our results may still be useful if we can assume that the composition of total compensation remains unchanged over time for both union and non-union members.

We interpret α_i as the premium enjoyed by a union member over a non-union worker in the same industry, which is not explained by observed worker characteristics.⁶ In the second step, we regress these estimated premiums on industry-level

⁴Labor force experience is defined as age minus years of schooling minus 6

⁵BEA data on outward FDI does not distinguish between the petroleum refining industry and petroleum mining industry. Since the study is limited to just the manufacturing sector, we drop all workers from this industry from our sample.

⁶This approach is similar to that used by Cebula and Nair-Reichert (2000) and Choi (2001) to calculate union rents. However they interpret their coefficients on the interaction term

variables including the capital-labor ratio, average establishment size, industry profitability,⁷ unionization levels, a measure of technological change and industry openness indices like tariff protection levels, import penetration, export intensity and foreign direct investment. The model we estimate is given below:

$$\gamma_{jt} = \mu_j + \eta_1(K/Lratio)_t + \eta_2(Size)_t + \eta_3(profitability)_{t-1} + \eta_4(technology\ proxy)_t + \eta_5(tariffs)_{t-1} + \eta_6(import\ penetration)_{t-1} + \eta_7(expor\ tintensity)_{t-1} + \eta_8(FDI)_{t-1} + \lambda_t + \omega_{jt}$$

The use of some of these variables is suggested by our monopoly-union model. Others are controls suggested by rent-sharing models and have been employed in previous studies. These include a measure of industry profitability, and the average establishment size.⁸ Technology might also be important in explaining union premiums. It could be that industries that employ new technology and highly skilled labor may be able to pay unions higher premiums than more mature industries (Pizer 2000). To check for this, we include a measure of technological change, where technological change in an industry is proxied by the share of

differently. They consider it to be the wage differential a union member in an industry receives in comparison to a worker in the excluded industry.

⁷We follow Pizer (2000) in constructing profitability as (sales + change in inventories + investment - payroll - energy cost - cost of raw materials - 0.18*capital)/ (sales + change in inventories + investment). An alternative measure of industry rents is also included based on the method employed by Leamer et al. (2000) where rents are the constructed as the residuals obtained by running the regression below for the cross-section of industries in every time period. This yields results that are similar to those obtained using the first method, and are not reported in this paper.

⁸This is obtained by dividing the total employment obtained from the NBER manufacturing productivity database by the total number of establishments in each industry obtained from the Economic Census.

scientists and engineers employed in that industry.⁹ This is calculated using information from MORG data on worker occupation.

Trade policy is measured by the average industry tariff level. These are calculated from the NBER trade data. We also include import penetration and export intensity indices as proxies for industry openness to trade to make them comparable to earlier studies. The use of both tariffs and import penetration in the same regression has been justified by Gaston and Trefler (1994). We include both on the grounds that not all changes in import penetration may result only from changes in the tariff levels. For example if productivity rises faster in foreign exporting firms than in domestic import competing firms, or if foreign wages go down, import penetration may rise even if domestic tariff levels remain fixed. Similarly outward foreign direct investment by domestic industries to take advantage of cost conditions abroad and subsequent import to meet domestic demand, may also lead to changes in trade intensities without any change in the tariff level. We interpret the coefficient on import penetration as reflecting the threat that unions face from increasing displacement of domestic production by imports.

The variable we choose for measuring the threat effect to domestic workers is the share of industry capital invested in the US to the total industry capital invested either at home or abroad in majority-owned foreign affiliates (MOFA).¹⁰ This measure is suggested by our theoretical model. The higher the capacity an industry has established abroad, the larger is its ability to threaten domestic

⁹This measure has also been used in previous studies such as Choi (2001).

¹⁰MOFA are defined by the BEA as those foreign affiliates where the US parent holds at least a 50% stake.

unions with shifting employment abroad. This should make the union tone down its wage demands, and have a negative effect on union premiums. As noted before, this variable may take a high value either because high barriers to mobility make it difficult for firms to establish facilities abroad to take advantage of better conditions there. Alternatively it might reflect the relative attractiveness of the US as a production center compared to locations abroad, in which case the US may also attract larger inward foreign direct investment. These will raise the value the FDI variable by raising domestic capital. Domestic unions then face a lower threat effect, and this should enable them to raise premiums.

Our theoretical model predicts different effects of changes in tariffs on short run union premiums depending on the degree of mobility available to firms in an industry and the consequent threat to the union. This, however, is not directly observable. As an approximation, we label industry-years in the top 45 percentile of the FDI variable as ones where unions face a low threat from outward FDI. Industry-years in the bottom 45 percentile of the FDI variable are classified as ones where unions faced a high threat from the possibility of industries shifting employment abroad. To check if union responses to trade policy changes are indeed different, we interact a dummy for an industries mobility in the last year with lagged tariffs.

One difficulty in estimating the postulated relationship, stems from the possible simultaneity between trade policy and union premiums. It is possible that declining wage premiums in the face of labor demand shocks lead unions to lobby for, and obtain higher protection. Cebula and Nair-Reichert (2000) use a 2SLS technique to solve this problem. Pizer (2000) suggests using lagged trade policy to avoid the simultaneity issue. We employ his methodology, with the added

justification that it might take some time for the effects of international competition to get fully reflected in union premiums since the negotiation process are typically long and happen periodically.

Since the dependent variables are first-stage estimates, the residuals in this regression may be heteroskedastic. Robust standard errors are therefore used for making inferences. Year effects are included since union premiums may be correlated with macroeconomic fluctuations not otherwise captured. Industry fixed effects are included to take account of permanent but unobserved industry characteristics that are correlated with both union premiums and trade policy, such as political clout. Finally we test for the validity of including these industry effects by estimating the same regression using the random effects model, and comparing the two with a Hausman test.

3.4 Findings

In general, manufacturing industries in the US became more open between 1990 and 1996. This is true whether openness is measured in terms of falling tariffs, increasing import penetration or export intensity.¹¹ The international orientation of most industries also went up, with the share of domestically invested capital in total industry capital falling on the average, after initially rising between 1991 and 1994 (Figure 6). The industries that witnessed the largest declines in this share were the Beverage industry, Farm and garden machinery, Electrical

¹¹Import penetration went down over the sample period for only two industries: Motor Vehicles and Equipment, and Farm and Garden Machinery. Export intensity decreased for three industries: Agricultural Chemicals, Tobacco Manufactures, and the Lumber, Wood, Furnitures and Fixtures industry.

and Electronic components and accessories industry, and the Motor Vehicles and Equipment industry. The FDI variable went up only for a handful of industries with the largest increase being in the Household appliances, and Office and computing machines industry. There is significant variation in the FDI variable, both across industries and over time.

The average estimated union premiums also showed significant variation over this period, with a positive trend between 1991 to 94, followed by a decline (Figure 7). One issue with our first stage estimates is that not all the coefficients are measured with the same degree of precision. A bigger concern is that some of our estimates of union premium turn out to be negative, implying union members earn less wages than their non-union members counterparts in the same industry. Most of these negative coefficients are not statistically different from zero, but for three industries the average union premium is estimated to be negative and significant for some years. These are the Drugs, Office and Computing Machines and the Household audio and video and communication equipment industries. One possible explanation for this is that union premiums in these industries may be small, and a larger part of the compensation for union workers may be in terms of non-wage benefits that are however not captured in our data.

Some results from our first stage regressions are tabulated in Table 2. These show industries with the highest and lowest average union premiums in our sample. As the table indicates, industries that had high union premiums tended to be ones that had larger plants (in terms of employment), were less exposed to trade, more heavily invested in the home market, and were also technologically more mature. They also tended to have, on the average, lower levels of tariff protection than industries with low union rents.

Estimated union premiums also show variation within industries over time. In slightly more than half of the industries, average union premiums in the last three years of the sample were higher than the average in the first three years. Premiums went up in some important industries like the Motor Vehicles and Equipment industry, Ferrous Metals and metal products industry, Paper and allied products, and the Construction and mining machinery industry. Union premiums declined in other industries like printing and publishing, and the Lumber, Wood Furniture and Fixtures industry. Indication that a threat effect may be in operation comes from the Lumber, Wood Furniture and Fixtures industry where union premiums declined as industries shifted more of their capital abroad. However the opposite seems to be true of the Motor Vehicles and Equipment industry, which despite witnessing the largest percentage decline in the share of domestic capital could also increase union premiums significantly.

As a first step we try to verify the implications of Gaston and Treffer's (1995) findings by regressing the estimated union premiums on a mix of industry characteristics and openness indicators without removing industry or time fixed effects. These specifications do not include all of their variables, but we replicate some of their key results. These results are presented in the first column of table 4. Import penetration, for example, has a negative effect on union premium (though this is significant only at the 15% level in our sample), while export intensity is positively associated. The positive coefficient on lagged profits also seems to suggest some sort of rent-sharing. We also replicate their most interesting result, the negative coefficient on lagged tariffs, which seems to imply that higher protection is associated with lower union premiums. The threat effect also appears to be important, as shown by the positive and significant coefficient in front of

the lagged FDI threat variable.

A problem with the Gaston and Trefler paper is that, being a purely cross-sectional study, they could not correct for industry or time fixed effects. A hausman test on our sample strongly suggests the inclusion of these. Once we do this, the results change significantly (column 2).¹² The coefficient on tariffs, despite remaining negative, becomes much less significant. Other openness indicators also do not appear to have much explanatory power. Industry characteristics like the capital to labor ratio, plant size, lagged unionization indicator and the technological change indicator alone retain their significance in explaining union wage premiums.

However these results are biased if we do not account for the possibility that union wage premiums responding in systematically different ways to tariff changes depending on the level of the threat effect. To check for this prediction, we divide industry-years into "high threat" and "low threat" group, depending on the value that our threat indicator took in the preceding year. Industry-years in the top 45th percentile of the FDI threat indicator are classified as facing a low threat from FDI, while those in the bottom 45th percentile are classified as facing a high threat. Some of the industries that were in the high threat category over the entire time period of our study were Tobacco manufacturing, Motor Vehicles and Equipment industry, the Office & Computing, and the Soaps, Cleaners and Toilet Goods industries. Industries like Printing and Publishing, Ferrous metals,

¹²Industry fixed effects are controlled for at the two-digit SIC level. Given the degree of aggregation in our data, this seems most appropriate. Similar results are obtained if industry effects are introduced for each industry classification in our sample, but given our small number of observations and the large number of coefficients to be estimated, all coefficients are measured with less precision.

Fabricated metal products and the Agricultural Chemicals industries faced the least threat from outward foreign direct investment. We interact the dummy for the threat category in the preceding year with the lagged tariff, and rerun the regression. The results are presented in column 3 of table 4. Since our regressand is estimated, we also run the regression weighting observations by the standard error of union premium estimates from the first stage regressions (column 5).

The addition of the interaction terms improves the fit of the regression and the R square. However even under the new specification, we do not find any significant effect of trade volumes on union premium. This suggests that while trade flows might influence the level of both union and non-union wages, the effect is similar for both. This finding is consistent with the results obtained in some earlier studies looking at union behavior over the same time period (Choi, 2001, Shippen and Lynch 2002).

At the same time, the FDI variable itself continues to be positively and significantly related to union premiums: unions in industries with lower levels of investment abroad were able to raise wages higher than unions in industries with more foreign investment. The size of the threat effect is quite large: holding everything else the same, unions in the Ferrous Metal Industry (with the least outward FDI) could charge a 8%-13% higher premium for their members than the premium for union members in the Soaps, Cleaners and Toilet Goods industry (the most heavily internationally invested industry in the sample), just on account of their industry having less outward FDI. However the effect is small in comparison to other industry characteristics like the capital-labor ratio and technological change in the industry.

The results also support our supposition that the level of threat from FDI

has a significant impact on union response. We find that the coefficient on the interaction terms between the threat dummies and tariffs have different signs for the high threat and the low threat groups, and are significant. This coefficient is positive for industries facing a high threat from outward FDI, suggesting that tariff reductions lead to declines in union wage premiums. This could happen as unions reduce wages to maintain employment, and bear part of the burden of liberalization. The response is exactly opposite for industries where outward FDI is small. Here the coefficient on the interaction term is negative, implying that tariff reductions in the past year cause current union premiums to go up. This is consistent with the "slow game" interpretation of Lawrence and Lawrence (1985) and our theoretical model, where unions raise premiums in the face of declining prices, even at the cost of employment, to take advantage of industries that are stuck at home. These results may also be consistent with the positive effect of import penetration on mean union industry differentials noticed by Pizer (2000). He reports that this effect is limited to industry-years where there was low capacity utilization, and does not appear when the sample consists of high utilization industry-years. To the extent that low capacity utilization may reflect industry capacity "stuck" at home, his results may support our findings.

It might be that our results about the effects of trade policy arise from our choice of industry classification. One possibility is that our results are driven by a few industries that dominate the high or low threat classification, and the regression is capturing some industry characteristic responses. To check this we choose an alternative division, dividing each industry into high or low threat categories based on their ranking in the first year of our sample. If industry specific effects alone are driving our results, this classification should yield the

same, or even stronger results, than our base case. This regression however does not yield any statistically significant coefficients for the interaction terms, suggesting that this is not the case (column 6, table 4). Another possibility is that the base classification might be dividing industries on the basis of time, and capturing some time-specific effects of trade policy. We therefore choose an alternative methodology, classifying industries in the lowest 45% percentile of the FDI variable in each year as high threat industries, and those in the highest 45% in each year as low threat industries. This categorization produces results that are qualitatively and numerically similar to our earlier results, though the coefficients on the interactions terms do not turn out to be statistically significant (column 7, Table 4). This is understandable since the threat from outward FDI should not be dependent on relative industry positions, but on the threat faced by each industry. However this also confirms our belief that the results are not driven by purely time-specific effects.

For industry controls other than the openness indicators, the findings of our study are consistent with other studies. Across all specifications, the capital to labor ratio has a positive and significant coefficient, implying higher union premiums in more capital intensive industries. In most regressions, the coefficient on average plant employment is negative and significant. The extent of unionization also appears to positively affect union premiums, though the coefficient is not always statistically significant. Previous studies have also found a similar union-threat effect (Choi 2001). Interestingly lagged industry profitability does not seem to have any significant effect on industry union premiums. This result is similar to the findings in Pizer (2000) and Choi (2001).

One industry characteristic that is an economically large and statistically sig-

nificant factor explaining union premiums is our proxy for technological change. Industries that employ a larger share of scientists and engineers, are also industries where union premiums tend to be small. This suggests that unions are most effective in raising wages in more mature industries. However care must be taken in interpreting this coefficient because this measure could also be proxying for the industry share of skilled workers. In this case be capturing the effect that union premiums are lower in more skilled labor-intensive industries.

Our results suggest that while the capital-labor ratio and the technological change proxy have the largest effect on union premiums, trade policy and outward FDI also have a significant impact on these. Of the openness indices, while the threat from outward FDI affects union premiums in all industries, trade policy changes seem to have the most impact only on industries that are very heavily invested abroad, or very less so.

3.5 Conclusions

In this paper I use worker level data from the CPS-MORG samples to estimate union wage premiums for 31 industries for the period 1990-1996. I combine these with industry level data obtained from the NBER trade database, the NBER productivity database and BEA data on US outward foreign direct investment to check for the effect of a range of openness indices on the estimated premiums.

I show that after removing industry and time fixed effects, there is evidence of a relatively strong “threat effect” from outward FDI on union premiums. The more heavily an industry was invested abroad, all else remaining the same, the smaller was the union wage premium in that industry. This shows that the growing internationalization of production does indeed reduce the ability of local

unions to maintain bargained wages.

I also find strong evidence to suggest that unions may respond in different ways to trade policy changes depending on the level of the threat effect they face from outward foreign direct investment. In more domestically invested industries, tariff reductions lead to higher union premiums for members over similar non-members, thereby increasing labor market distortions. However, in industries that are heavily invested abroad, unions respond to tariff reductions by lowering their wage premiums, presumably to protect employment. To the extent that most industries in our sample are moving towards greater investment abroad, this highlights one channel through which international integration can make bargained wages more vulnerable to trade liberalization.

Chapter 4

Appendices

Appendix 1: Proof of Proposition 1

Proof. Consider the partial effect of a change in λ on ϵ .

$$\frac{\partial \epsilon}{\partial \lambda} = \frac{(1-\alpha)K}{\alpha\theta^2[r^*+\lambda(K-K_0)]} \left[\theta \frac{(K-K_0)}{K} - 1 \right] = -\frac{(1-\alpha)}{\alpha\theta^2} \cdot \frac{r^*K}{r^2} < 0$$

or that holding all else constant, a reduction in capital mobility costs makes employment more responsive to wages.

Considering the total effects and utilizing condition ??, it may be shown that

$$\left. \frac{\widehat{\epsilon}}{\widehat{\lambda}} \right|_{w=\bar{w}} = \frac{-(1-\alpha)}{(1+\theta-\alpha)} \frac{K_0}{K} < 0$$

Thus when we also consider changes in the efficient capital stock, holding union wage fixed, the shifted labor demand curve is more elastic ■

Appendix 2: Effects of a decline in λ

Totally differentiating sector 1 firms' first order conditions yields the following:

$$\widehat{K} = -\left(\frac{1-\alpha}{\alpha\theta}\right)\widehat{w} - \frac{(K-K_0)}{K}\widehat{\lambda}$$

$$\widehat{L} = -\left(\frac{1-\alpha+\theta}{\alpha\theta}\right)\widehat{w} - \frac{(K-K_0)}{K}\widehat{\lambda}$$

The total impact on the union wage demand schedule (VV) can then be gauged by totally differentiating equation 2.1, using these two conditions above. This yields the following:

$$A\widehat{w} + B\widehat{\pi} = C\widehat{\lambda} \quad (4.1)$$

where

$$A = 1 + \epsilon\eta + \frac{1}{(\gamma\epsilon - 1)} \frac{(1 - \alpha)^2(1 - \theta)}{\alpha\theta(\theta + 1 - \alpha)} > 0$$

$$B = \frac{(1 - \beta)\eta}{(1 - \beta + \beta\pi)} > 0$$

$$C = \left(\frac{1}{\gamma\epsilon - 1}\right) \frac{(1 - \alpha)}{(1 + \theta - \alpha)} \frac{K_0}{K} - \eta \frac{(K - K_0)}{K}$$

Similarly totally differentiating the membership constraint yields (MM), yields the following condition:

$$D\widehat{w} + E\widehat{\pi} = F\widehat{\lambda} \quad (4.2)$$

where,

$$D = (1 - \beta + \beta\pi)(1 + \epsilon\eta) > 0$$

$$E = (1 - \beta)(1 + \eta) < 0$$

$$F = -\eta((1 - \beta + \beta\pi)\left(\frac{K - K_0}{K}\right)) \leq 0 \text{ as } K \leq K_0$$

Comparative statics are conducted using Cramer's Rule.

Appendix 3: Effects of a decline in price

Totally differentiating sector 1 firms' first order conditions yields the following:

$$\widehat{K} = -\left(\frac{1 - \alpha}{\alpha\theta}\right)\widehat{\omega} + \frac{1}{\theta}\widehat{p}$$

$$\widehat{L} = -\left(\frac{1 - \alpha + \theta}{\alpha\theta}\right)\widehat{\omega} + \frac{1}{\theta}\widehat{p}$$

The total impact on the union wage demand schedule (VV) can be gauged by expressing 2.1 in terms of real wages (ω), and totally differentiating equation using the above. This yields

$$A\widehat{\omega} + B\widehat{M} = G\widehat{p}$$

where A, B are the same as defined in the section on capital mobility, and

$$G = \frac{1}{(\gamma\epsilon - 1)} \frac{(1 - \alpha)(1 - \theta)}{(\theta + 1 - \alpha)\theta} - 1 + \frac{\eta}{\theta}$$

Similarly totally differentiating the membership constraint (2.2), yields the following condition:

$$D\widehat{\omega} + E\widehat{M} = H\widehat{p}$$

where terms D and E are as defined in the previous section, and

$$H = -\left[1 + \frac{(1 - \eta_L R)}{\theta}\right] < 0$$

Comparative statics are again conducted using Cramer's Rule

Chapter 5

Tables and Figures

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BIBLIOGRAPHY

- [1] Aitken, B. J., Harrison, A.E. and Lipsey, R.E., 1996. "Wages and foreign Ownership," *Journal of International Economics*, 40, 345-71
- [2] Bandyopadhyay, S. and S. Bandyopadhyay, 2001. "Efficient Bargining, Welfare, and Strategic Export Policy," *Journal of International Trade and Economic Development* 10(2): 133-49
- [3] Bhagwati, Jagdish, "But Mr. Clinton, Globalization has a Human Face," Policy Paper.
- [4] Blanchflower D. G. and A. Bryson, 2002. "Changes over Time in Union Relative Wage Effects in the UK and the US Revisited," NBER Working Paper 9395
- [5] Bosworth, B and G. Perry, 1994. "Productivity and Real Wages. Is There a Puzzle?" *Brookings Papers on Economic Activity* 1: 317-44. Brookings Institution, Washington
- [6] Brander, J and B. Spencer, 1988. "Unionized Oligopoly and International Trade Policy," *Journal of International Economics*, 24: 217-234
- [7] Brecher, R., and N.V. Long, 1989. "Trade Unions in an Open Economy: A General Equilibrium Analysis," *The Economic Record*, September, 234-239

- [8] Calvo, G., 1978. "Urban Unemployment and Wage Determination in LDCs: Trade Unions in the Harris-Todaro Model," *International Economic Review* 19(1): 65-81
- [9] Card, David, 1998. "Falling Union Membership and Rising Wage Inequality: What's the Connection?" NBER Working Paper 6520
- [10] Cebula, R. and U. Nair-Reichert, 2000. "Union Rent Seeking and Import Competition in US Manufacturing," *Journal of Labor Research* 21(3): 478-487.
- [11] Choi, M., 2001. "Threat Effect of Foreign Direct Investment on Labor Union Wage Premium," PERI Working Paper 27, University of Massachusetts Amherst.
- [12] Currie, J and A. Harrison, 1997. "Sharing the Costs: The Impact of Trade Reform on Capital and Labor in Morocco," *Journal of Labor Economics*, 15 (3) 2: 44-71
- [13] Davies, S.W. and Lyons, B. R., 1991. "Characterising Relative Performance: The Productivity Advantage of Foreign owned firms in the UK," *Oxford Economic Papers* 43: 584-95
- [14] Driffield, N.L., 1999. "Indirect Employment Effects of Foreign Direct Investment into the UK," *Bulletin of Economic Research*, 51: 207-21.
- [15] Epstein, G., 2000. "Threat Effects and the Impact of Capital Mobility on Wages and Public Finances: Developing a Research Agenda," Mimeo, The Political Economy Research Institute, University of Massachusetts, Amherst

- [16] Fajnzylber, P. and W. Maloney, 2000. "Labor Demand and Trade Reform in Latin America," World Bank Working Paper 2491, World Bank, Washington.
- [17] Freeman, R. B, 1993. "How much Has De-Unionization Contributed to the Rise in Male Earnings Inequality?" in S. Danziger and P. Gottschalk eds. "Uneven Tides: Rising Inequality in America", Russel Sage Foundation, New York
- [18] Freeman, R.B. and L.F. Katz, 1991. "Industrial Wage and Employment Determination in an Open Economy," in John Abowd and Richard Freeman, eds. Immigration, Trade and the Labor Market, NBER: 235-259.
- [19] Gaston, N. and D. Trefler, 1994. "Protection, Trade and Wages: Evidence from US Manufacturing," Industrial and Labor Relations Review 47 (4): 574-593.
- [20] Gaston, N. and D. Trefler, 1995. "Union Wage Sensitivity to Trade and Protection: Theory and Evidence," Journal of International Economics, 39: 1-25.
- [21] Gottschalk, P and R. Moffitt, 1994. "The Growth of earnings Instability in the US Labor Market," Brookings Papers on Economic Activity 2: 217-54. Brookings Institution, Washington.
- [22] Grossman, G., 1984. "International Competition and the Unionized Sector," Canadian Journal of Economics, 17(3): 541-556.
- [23] Hall, R.E., and Lilien D.M., 1979. "Efficient Wage Bargains under Uncertain Supply and Demand," American Economic Review 69: 868-879

- [24] Harrison, A. and A. Revenga, 1995. "The Effects of Trade Policy Reform: What do we really know?" NBER Working Paper 5225.
- [25] Kahn, L.M., 2000. "Wage Inequality, Collective Bargaining and Relative Employment from 1985 To 1994: Evidence from Fifteen OECD Countries," *Review of Economics and Statistics* 82(4): 564-579
- [26] Kletzer, L.G., 1998. "International Trade and Job Displacement in US Manufacturing: 1979-91," in Susan Collins eds., *Imports, Exports and the American Worker*, Brookings Institution Press: 423-456.
- [27] Krishna, P., D. Mitra and S. Chinoy, 2001. "Trade Liberalization and Labor Demand Elasticities: Evidence from Turkey," *Journal of International Economics* 55(2): 391-409.
- [28] Krugman, Paul R., 1995. "Growing World Trade: Causes and Consequences," *Brookings Papers on Economic Activity*, 327-377. Brookings Institution, Washington, DC.
- [29] Lawrence, C. and R.Z. Lawrence, 1985. "Manufacturing Wage Dispersion: An End Game Interpretation," *Brookings Papers on Economic Activity* 1: 47-106.
- [30] Lawrence, R. Z. and Matthew Slaughter, 1993. "International Trade and American Wages in the 1980s: Giant Sucking Sound or small Hiccup?" in Martin Neil Baily and Clifford Winston (eds.) *Brookings Papers on Economic Activity: Microeconomics* 2: 161-211. Brookings Institution, Washington, DC.

- [31] Leamer, Edward E., 1996. "In Search of Stolper-Samuelson Effects on US Wages," NBER Working Paper 5427
- [32] McDonald, I and R. Solow, 1981. "Wage Bargaining and Employment," *The American Economic Review* 71 (5): 896-908
- [33] Macpherson, D.A. and J.B. Stewart, 1990. "The Effect of International Competition on Union and Nonunion Wages," *Industrial and Labor Relations Review* 43(4): 434-446.
- [34] Mezzetti, C. and E. Dinopoulos, 1991. "Domestic Unionization and Import Competition," *Journal of International Economics* 31: 71-100.
- [35] Mishel, L. and J. Bernstein, 1994. "The State of Working America: 1994-95". Economic Policy Institute, Washington, DC.
- [36] Neven, D. and C. Wyplosz, 1996. "Relative Prices, Trade and Restructuring in European Industry," Centre for Economic Policy Research Working Paper 1451.
- [37] Panagariya, Arvind, 1999. "Trade Openness: Consequences for the Elasticity of Demand for Labor and Wage Outcomes," Mimeo. University of Maryland.
- [38] Pizer, S.D., 2000. "Does International Competition undermine wage Differentials and increase inequality?" *Journal of International Economics* 52: 259-282.
- [39] Reddy, S., 2000. "Liberalization, Distribution and Political Economy: The Bargaining Channel and its Implications." Mimeo, Harvard university, Department of Economics.

- [40] Reddy, S., 2000. "Capital Mobility, Trade Liberalization and Relocation Threats: The Bargaining Channel and The Distribution of Income." Mimeo, Harvard university, Department of Economics.
- [41] Revenga, Ana, 1992. "Exporting Jobs? The Impact of Import Competition on Employment and Wages in U.S. Manufacturing," *Quarterly Journal of Economics* 107(1): 255-284
- [42] Revenga, Ana, 1997. "Employment and Wage Effects of Trade Liberalization: The Case of Mexican Manufacturing," *Journal of Labor Economics*, 15(3) 2: 20-43.
- [43] Rodrik, D., 1998. "Has International Integration gone too far?" Institute for International Economics, Washington, DC.
- [44] Rodrik, D., 1999. "Globalization and Labor or if globalization is a bowl of cherries, why are there so many glum faces around the table?" in Richard E. Bladwin et al eds., *Market Integration, Regionalism and the Global Economy*. Cambridge University Press and the Centre for Economic Policy Research, Cambridge.
- [45] Sachs, J. and H. Shatz, 1994. "Trade and Jobs in US Manufacturing," *Brookings Papers on Economic Activity* 1994 (1): 1-69.
- [46] Shippen, B.S. and A.K. Lynch, 2002. "How International Trade Affects Union Wages: New Evidence," *Journal of Labor Research* 23(1): 131-144.
- [47] Slaughter, M., 1997. "International Trade and Labor-demand Elasticities," NBER Working Paper 6262.

- [48] Slaughter, M. and P. Swagel, 1997. "The Effects of Globalization on Wages in the Advanced Economies," IMF Working Paper WP/97/43, Washington, DC.
- [49] Sturgeon, T and R. Florida, 2000. "Globalization and Jobs in the Automotive Industry," Industrial Performance Centre Globalization Working Paper 01-003. MIT.
- [50] Zhao, Laixun, 1995. "Cross-hauling Direct Foreign Investment and Unionized Oligopoly," *European Economic Review*: 1237-1253.