Unionized Oligopolies - A survey

Anna K. Goeddeke

Frontier Economics

May 29, 2010

Abstract

Unionized Oligoplies are market structures with incomplete upstream labour markets interacting with incomplete downstream product markets. In this survey I give and overview of the recent development any main findings of this strand of literature.

1 Introduction

The interrelationship between product and labor markets has long been neglected in both the labor market literature as well as in industrial economics. Until the 1980s, the theoretic labor market literature either assumed that the product market is monopolistic or that it is perfectly competitive. Excellent surveys of this literature are Oswald (1985) and Ulph and Ulph (1990). The results of this literature were, however not entirely satisfactory. Ulph and Ulph conclude: "(...) imperfections in the labor markets go hand in hand with those in the product market (...). Some models exist along these lines (...)—but much still remains to be done." Since the end of the 1980s, a number of papers were published which take imperfections in the product market, more precisely oligopolies, into account. Thereby, they do not abstract from interesting interactions between firms and unions that affect the outcome of collective bargaining. This group of models are referred to as unionized oligopoly models. These models assume that in an labor market unions are active and possess market power. In a first stage, unions have to agree on wages with firms, which themselves compete which each other in an oligopolistic downstream product market in a second stage. In these unionized oligopoly models, unions have to take more effects into account than in the previous literature: If a union demands higher wages from a firm, it weakens the competitive position of that firm in the product market. As a consequence, the firm may lose market share and then reduce its employment. As long as the aim of unions is to maximize wage and employment, they have to pay attention to the trade–off between higher wages and a weakened competitive position during wage negotiations.

This survey summarizes the unionized oligopoly literature. I present the common features of these models. Afterwards, I discuss papers dealing with different topics such as innovations, international trade, and different types of negotiations. The assignment of the different papers to different topics is rather subjective. A large number of papers can be categorized to different topics. My objective is to group papers mostly related.

2 Building Blocks

Unionized oligopoly models have several features in common. To obtain a better understanding of this group of models, I sum up the main building blocks:

Oligopoly in the Product Market A common feature is the limited number of firms. Normally, 2 to n firms compete in different fashions. Usually, Cournot competition is assumed, but Bertrand or Conjectural Variation models can also be found. Some models work with general demand functions, but for simplicity linear demand functions are common. Products can be homogeneous or heterogeneous as well as substitutes or complements.

Level of Organization Unions as well as employers' associations organize themselves on different levels. This is reflected in the models. The level of organization of unions as well as employers associations' varies from national organization at the one end to firm specific (i.e., vertical coordination) at the other. While usually workers are assumed to be substitutable against each other, some articles also consider complementary workers in craft unions—such as pilots and flight attendants. Here, cooperation takes place on the professional line (i.e., horizontal cooperation). The level of organization is endogenized in some unionized oligopoly models.

Union Utility The early papers establish results with general union preferences increasing in wages and employment. Newer publications presume different and specific utility functions. One is the *wage bill maximization* (Dunlop 1944), $U = wn$, with w as the wage and n as the number of workers employed. The objection of the union is to maximize the total amount of wages received by its members. Sometimes *rent maximization* is assumed that is a utility of $U = (w - \overline{w})n$, where $\overline{w}$ is the reservation wage. Here, the union maximizes the mark–up on the reservation wage of its members. Another common utility function is the *Stone–Geary utility function* (Geary 1950, Stone 1954), $U = (w - \overline{w})^{\alpha} (n - \overline{n})^{(1-\alpha)}$, with $\overline{n}$ as the reservation employment and parameter α measures the relative importance of wages. With a Stone–Geary utility function, wage oriented as well as employment oriented unions can be modeled. Additionally, some unionized oligopoly papers use a *utilitarian utility function,* $U = lu(w) + (m - l)u(b)$, established by Dreze and Modigliani (1981), MacDonald and Solow (1981), and Oswald (1982). In this expression m represents the total number of union members and l the number of employed union members. The utility of a representative worker $u(\cdot)$ is strictly increasing with respect to wage w and unemployment benefit b. The utility function adds utility of employed as well as unemployed union members. For an overview of additional union utility functions, see Naylor (2003).

Bargaining One can distinguish both the scope of bargaining and the type of bargaining. The scopes of bargaining are usually either wages only or both wages and employment. When negotiations encompass only wages, this is referred to as *right–to–manage* (Nickell and Andrews 1983). Here, firms and unions bargain over wages, where as firms alone have the right to choose employment. In this case equilibrium solutions lie on the labor demand function. The second case, where unions and firms bargain over wages as well as employment, is called *efficient bargaining* (MacDonald and Solow 1981). The Pareto efficient equilibrium lies on the contract curve.

As type of negotiations, mostly the Nash–Bargaining Solution (Nash 1950) is used in the unionized oligopoly literature. The Nash–Bargaining Solution maximizes $B = (U - \overline{U})^{\beta} (\pi - \overline{\pi})^{1-\beta}$ with respect to the scope of bargaining. Here, β represents the relative negotiation strength

of the union, π is firm profit, and $\overline{U}$ and $\overline{\pi}$ are the outside options of union and firm during the negotiations. Some models insert strike payoffs as outside options, while others do not take any outside options into consideration. As a special case of the Nash–Bargaining solution, the *Monopoly Union model* (Dunlop 1944, Oswald 1982) is frequently applied. Unions can set wages (i.e., $\beta = 1$) and afterwards firms set employment. But sometimes also the approach of Rubinstein (1982) is applied instead of the Nash–Bargaining Solution.

Sequence of the Game Nearly uniformly, the papers assume that negotiations take place simultaneously for different firms and unions. Exceptions are Corneo (1995), De Fraja (1993a), and Bárcena-Ruiz and Campo Corredera (2003). These papers establish results when different sequences of bargaining take place. Nevertheless, apart from a few exceptions most papers assume that wage negotiations are long–run decisions and, thus, wages are established first, while competition in the product market takes place afterwards. With efficient bargaining it is mostly assumed that wages and employment are determined simultaneously—and very rarely also sequentially (e.g., Santoni (1996)).

3 The First Models and Results

As an introduction to the unionized oligopoly literature let us discuss four models representing the early literature, namely Davidson (1988), Dowrick (1989), Dowrick (1993), and Horn and Wolinsky (1988).

Davidson (1988) examines wage changes as a result of different levels of union organization in a Cournot duopoly. In his right–to–manage model the level of bargaining is always the firm level, while the level of union organization can be either firm specific or industry wide. In addition, the paper also takes strikes into consideration.

Davidson's main result is that wages are higher if unions are organized at an industry level than they are if unions are organized at the firm level. The reasons are twofold: First, there is an externality effect. When unions are firm–specific and one of the two is able to negotiate for higher wages, this results in a positive externality for the other union. The firm that has to pay higher wages, has a competitive disadvantage in the product market, and this is beneficial for the other firm. This other firm can produce more, earn a higher profit and the second union shares this higher rents. This positive externality is not internalized with firm–specific unions. However, once the unions coordinate their behavior and form an industry–wide union, this effect is internalized, and the union succeeds in securing a higher wage rate, as they do not have to he concerned about the competitive position of "their" firm. The second reason beside the internalization of a positive externality is union payoffs during strikes. Davidson assumes that threat points during negotiations are zero for firm–specific unions. In contrast, when an industry–wide union demands a wage increase in the first firm, it can go on strike in that firm. The second firm is a monopolist during the strike and needs more workers supplied by the union. Therefore, an industry union can extract rents from the second firm during the strike at the first firm. This strengthens the threat point for industry–unions does, ceteris paribus, also raise earnings in comparison to firm specific union wages. Notably, Davidson establishes his results with a general, concave utility function increasing in wages and employment.

He is also able to show that coordination of the two firm specific unions on industry level is a stable form of collusion. Neither union has an incentive to deviate, and this is different from collusion in the product market: Coordination between firms needs policy. When one firm restricts output, the other firm benefits due to higher prices, but the firm with the restricted output suffers. Each firm benefits from the agreement on the condition that the other firm

also reduces output. A deviation from the collusive outcome is always profit enhancing and, therefore, cartels may dissolve. In contrast, both unions benefit from coordination and deviating is not utility enhancing. All workers in the industry benefit when one firm union pair agrees on higher wages. One group of workers receiving directly higher wages, the other group of workers benefit indirectly since their firm becomes more competitive and employs more workers and this also increases the other unions' wage bill. No individual union has an incentive to cheat on the collusive agreement. However, coordination of the firms to form employers' association is not stable since the firm paying lower wages benefits and the other firm is indirectly harmed.

Dowrick (1989) extends the unionized oligopoly literature taking into consideration how different levels, different scopes of bargaining as well as different bargaining strengths influence wages and employment. Dowrick applies a model of parametric conjectural variation oligopoly to establish his results. The demand function is unspecified, n firms compete in the industry, and union utility is also unspecific. Unions are firm–specific and can be risk–friendly, risk–avers or risk–neutral. Most of the results are quite intuitive: an increase in union bargaining strength as well as in unions' threat points increase wage rates. This is independent of whether the scope of bargaining is wages only, or both wages and employment. In addition, equilibrium wages are decreasing in the unions' risk–aversion. Less obvious is the influence the level of organization has. The scope of bargaining has to be taken into account here: with right–to–manage negotiations, wages increase with an increase in the coordination between unions. This is the same result that Davidson (1988) has shown. However, enlarging the scope of bargaining to wages and employment complicates results. In contrast to right–to–manage models an increase in wages does not need to result in lower employment as firms and unions agree on employment separately. Therefore, higher wages in one union do not have a clear effect on the other union through employment in the product market. Thus, an increase in the level of coordination, which normally internalizes the external effect, does not simply lead to higher wages and lower employment. Effects of a shift in the level of organization are ambiguous with efficient bargaining.

Another intuitive result is that all factors that increase the total surplus to be split between union and firm (i.e., a higher demand or a lower number of firms), increase earnings of workers. The behavior of firms in the product market, (collusion or competition) is also analyzed. When firms collude, they benefit from higher profits, and unions participate when the scope of bargaining is both employment and wages. With right–to–manage negotiations, the wage rate follows an inverted U–shaped function of coordination of firms: wages are lowest without any coordination between firms, increase as expected with coordination, but decrease to the point where firms perfectly collude and produce the monopoly quantity together. As long as unions are firm specific and one union succeeds in securing an increase in the wage rate, this reduces the market share of its firm—and therefore employment—more the higher the level of collusion is. To refrain from the negative effect of lower employment, unions abstain from demanding higher wages with higher collusion in the product market. As a result, wages decrease when collusion becomes perfect.

The focus of Dowrick's second paper (Dowrick 1993) is a variation in the level of bargaining. The papers sheds light on the question of what happens if the level of bargaining is shifted from industry to firm–level. Dowrick examines this against the backdrop of an Australian debate that a decrease in wages can be implemented through a shift in bargaining level. The novelties of his paper are numerous: First, he is the first modeling horizontal union coordination on the professional line. Second, he distinguishes between the level of organization of firms and unions and the level of wage negotiations. The level of organization determines which external effects are internalized. The level of bargaining influences the costs during strikes. Thus, he can work out differences between a decentral organization and a decentral level of bargaining which drives some of his results. Third, Dowrick endogenizes strike payoffs, he takes into consideration the

profits of firms during strikes as well as strike utility of unions. Fourth, the model is highly general. For costs as well as demand the assumptions are not specific.

The main results of the paper are not always clear and unambiguous. Dowrick shows that wages are lower (a) if substitutable workers are organized in competing unions and (b) if complementary workers are organized in the same union. The reason is the internalization of external effects. Substitutable workers exert positive external effects on each other and, therefore, they should coordinate their behavior to increase wages. This is not optimal for complementary workers, however higher wages for one group negatively affects the other group since demand is reduced for the workers. Thus, complementary workers are better off splitting up when they want to increase wages.

The results for the level of firm coordination as well as the level of bargaining are ambiguous. Dowrick concludes that it is generally not true that a lower level of bargaining reduces earnings. In contrast, if the levels of organization of unions and firms is central, the pressure on wages can also be high even if negotiations are decentral.

Horn and Wolinsky (1988) differ from the previous models as they build a classical industrial economics model with two vertically connected markets. In the upstream market two firm specific suppliers sell an input to two firms in the downstream market. The upstream firms can be understood as two unions, each selling workers to one of the downstream firms. This way of building the model became standard for many following papers in the unionized oligopoly literature. It is assumed that unions maximize a specific utility function, more precisely they maximize the wage bill. Negotiations between firms and unions take place solely over the wage rates, and demand on the product market is linear. The novelty of this paper, despite its influence on the following literature, is that substitutable as well as complementary products are taken into consideration. In addition, a merger in the upstream as well as in the downstream market is modeled.

Horn and Wolinsky confirm some results of Dowrick and Davidson. When the upstream unions merge and products are substitutes, wages increase. However, results differ when products are complements. Then, with firm specific unions, an increase in wages in one of the firms decreases the demand for the product in the other firm and thus employment. This negative external effect is internalized when the unions merge and lower wages.

However, when the firms in the product market also merge, wages increase for substitutable goods. Wages increase since firms and unions do not have to consider their competitive position and can increase wages without losing market share (no business stealing effect). This leads to monopoly profits which are lower than the joint duopoly profits of the two firms. As a result, firms would not merge. The situation for complementary products is the opposite. A higher wage yields a negative external effect in a duopoly, and a merger for the firm would decrease earnings of workers, but increases firms' profits. Thus, firms have incentives to merge with complementary products.

The publication of Horn and Wolinsky was pathbreaking for the unionized oligopoly literature since an explicit assumption of a union utility function as well as demand function results in much more tractable models. Even if the models loose generality, this enables researchers to gain insights otherwise not possible.[1]

---

[1]Around the time of the publication of Horn and Wolinsky a strand of literature arises, focusing on the interaction between retailers and manufacturers, or more generally vertical connected markets. They sometimes focus on questions not relevant for unions as upstream suppliers (e.g., the vertical integration of upstream and downstream firm) but sometimes are very related to the unionized oligopoly literature. However, it is beyond the scope of this survey also to summarize these papers.

4 International Unionized Oligopolies

How globalization affects unions is an often discussed topic. It is sometimes claimed that national unions loose influence on firms exposed to international competition. Dreher and Gaston (2007) distinguish four channels through which union workers suffer. First, the economic rents employers and workers bargain over are reduced, since firms compete more fiercely with an increase in the number of competitors. Second, firms can relocate production—or threaten to relocate production—to low–wage countries. Hence, the bargaining position of the union is weakened. Third, Governments may adopt policies that weaken union bargaining strength. Fourth, social integration may adversely affect unionization; for example sometimes globalization is equated with "americanization". If indeed globalization leads to institutional convergence to the U.S. benchmark, then the less unionized and less regulated U.S. labor market servers as a benchmark for "successful" globalization to the disadvantage of unions.

Economists mostly welcome globalization—at least American economists, see Fuller and Geide-Stevenson (2003)—due to lower prices and, thereby, higher consumer rents. The impact on workers is less clear, however, on the one hand, they benefit from lower prices, on the other hand wages can decline and jobs become less secure.

The theoretical literature on international unionized oligopolies is numerous and can be distinguished according to the different core topics. A common feature is that most papers study two–country models. One group of papers emphasize the role of trade liberalization with either unions active in one or in both countries. Another group deals with foreign direct investments and the effect on wages and employment. They investigate whether it is beneficial for a firm to relocate production to a low–cost country and export the products to the former domestic country or whether it is always (international) welfare enhancing if foreign direct investments are attracted to create new jobs. Finally, some papers examine how different levels of organization of unions and different levels of bargaining in countries drive the effects of globalization.

4.1 Trade Liberalization

4.1.1 Unions in One Country

Brander and Spencer (1988) published one of the first and most cited paper considering the effects of trade policy interventions in a unionized oligopoly. They examine tariffs, subsidies, and import quotas. In their Cournot duopoly model, two firms are active in two different countries. The domestic country is unionized and can decide about policy interventions. Union and firm in the domestic country negotiate about wages applying a Nash–Bargaining Solution, while wages in the foreign country are exogenous. The timing of the game is as follows: First, the domestic country's Government chooses an optimal level of policy intervention in order to maximize domestic welfare. Second, firm and union bargain for wages. Finally, in the third stage, firms compete in the international product market. With policy interventions, the foreign firm has to pay tariffs or has to stick to quotas, and subsidies are only paid to the domestic firm.

As a first result, Brander and Spencer show that without any trade policy intervention, the presence of a union in the domestic country reduces domestic producer surplus and total industry output. Total producer surplus (domestic plus foreign) is larger with than without unions. The reasons are obvious: the union increases cost for the domestic firm. Hence, the competitive position of the domestic firm in the product market is weakened. The firm reduces output and thereby increases profits of the foreign firm. Industry production is lower with unions and this increases overall producer surplus.

In what follows, Brander and Spencer build on their previous models of tariff reduction (Brander and Spencer 1984) and subsidies (Brander and Spencer 1985) in imperfect product

markets. In these papers, the authors have shown that in non–unionized oligopolies strategic trade policy can increase domestic welfare through a profit–shifting effect. As long as a foreign firm earns rents in an imperfectly competitive market, at least in part from the domestic country, strategic trade policy can shift these profits to the domestic market. In Brander and Spencer (1988), they extend former findings to a unionized oligopoly. Brander and Spencer find that an increase in subsidies results in higher wages. This due to the fact that the increase in subsidies leads to a higher production of the domestic firm. Unions benefit from higher employment and thus earnings rise. In a unionized oligopoly, the optimal level of subsidies that a welfare maximizing Government chooses is higher than in a non–unionized oligopoly. Within unionized oligopolies, the positive effect of one unit of the subsidy is reduced since the union undercuts the objectives of the policy: the welfare enhancing output enlargement of the domestic firm is reduced because of the higher wages. Therefore, optimal subsides are higher with active unions in order to shift production.

The situation for tariffs is comparable. As a consequence of higher tariffs the domestic firm is protected and earns higher profits. The union appropriates a part of the rents through higher wages. Different to subsidies, with tariffs prices for consumers increase and this lowers consumer surplus. The total effect of a tariff is again reduced in a unionized compared to a non–unionized oligopoly: with tariffs, the competitive advantage of the domestic firm is only slightly enlarged because unions extract part of the rents. At the same time, prices increase more for consumers in a unionized oligopoly than in a standard oligopoly model. Consumers have to pay for both tariffs and the higher earnings of workers.

At last, Brander and Spencer also analyze import quotas. In contrast to a tariff, with import quotas the domestic firm does not have to fear higher imports when the union demands higher wages. Thus, imports stay constant, only wages increase. This results in even higher earnings for unions because higher wages do not incur much pressure on the competitive position of the firm when compared to tariffs. However, prices are even higher and consumer surplus is reduced. To sum up, the different policy options result in very different outcomes. Unions benefit from each form of protection; they can participate in higher rents of firms. Import quotas are most beneficial for unions, while consumers prefer subsidies due to lower prices. Both with tariffs and with import quotas prices increase.

An extension of Brander and Spencer is Mezzetti and Dinopoulos (1991). They apply the model of Brander and Spencer and focus on different bargaining strengths of unions. In addition, they enlarge the scope of bargaining to efficient bargaining and unions are either employment or wage oriented. Furthermore, the firm can credibly threat the union to relocate production to the foreign country. Mezzetti and Dinopoulos concentrate on tariffs as strategic trade policy instruments.

In the beginning, the paper analyzes what effect an increase in union power has in an international Cournot duopoly with one unionized country. When the union is employment oriented and its negotiation strength increases, employment and therefore output of the domestic firm increases. At the same time, wages increase as well as overall consumption. The foreign firm suffers and, thus, imports are lower. In summary, an increase in union power increases welfare in the domestic country with employment oriented unions. In contrast, with wage oriented unions, employment and output decrease with an increase in union power. The foreign firm benefits from a higher union strength, while consumption and welfare are lower at home. This is in line with the results of Brander and Spencer.

With tariffs, imports decrease as well as domestic consumption, but nevertheless wages increase. The effects on employment are ambiguous and depend on the curvature of the demand function and on whether the union focuses on wage or employment. Mezzetti and Dinopoulos show that under very special circumstances employment in the domestic country decreases with

an increase in tariffs. Nevertheless, tariffs are always in the interest of the union. For welfare, results are ambiguous. With a concave demand function and a low level of tariffs, domestic welfare is increasing in tariffs. The rents are transferred from the foreign firm to the firm and union in the domestic country. However, welfare can decrease with tariffs if the union is wage oriented and the demand function convex.

After the publications of Brander and Spencer and Mezzetti and Dinopoulos numerous papers were published which extend their discussions:

Campbell and Vousden (2000) focus on different policy instruments leading to more productive workers. They compare a tariff reduction and a reduction of union power due to labor market reforms. Undeniably, both instruments can lower wages. A reduction of union power is the direct way, but can be disadvantageous for politicians. An indirect and maybe politically less harmful way may be a reduction of tariffs. Do they both lead to more productive workers? Are the welfare implication of reduced union power and tariffs also equal? To answer this, Campbell and Vousden employ the models of Brander and Spencer and Mezzetti and Dinopoulos. In contrast to the previous papers, they assume that union and firm negotiate over wages as well as work–effort instead of employment. Campbell and Vousden examines whether labor market liberalization (i.e., a reduction in union bargaining power) yields the same results as trade liberalization (i.e., a tariff reduction). First, they find that with an employment oriented union, both policy instruments lead to a higher effort of workers. However, many effects differ: A labor market reform increases firm profits, enlarges domestic production and results in higher welfare. In contrast, lower tariffs decrease firm profits and domestic production and decrease welfare. To put it in a nutshell, it is economically preferred to lower unions bargaining strength directly, and the possibly politically easier way to use trade liberalization as a substitute for labor market reforms is disadvantageous.

Santoni (1996) extends the seminal papers of Brander and Spencer and Mezzetti and Dinopoulos to asymmetric firm sizes. He applies the sequential bargaining solution introduced by Manning (1987). Similar to efficient bargaining, unions and firms negotiate over wages and employment, albeit in two separate negotiation rounds. First, firms and unions agree on wages, then on employment. Santoni concentrates on the change of results due to different firm sizes. One result is that the domestic firm and union benefit from policy interventions, but whether they prefer subsidies or tariffs depends on the foreign firm size. With a large firm in the foreign country, unions and firms prefer tariffs, with a smaller firm in the foreign country unions and firms prefer subsidies.

Another related model is Bandyopadhyay and Bandyopadhyay (1999). They consider three countries where goods are produced in two countries, which export to a third country without production. The two production countries are similar apart from the fact that only one of them is unionized. Wages are determined endogenous. In the non–unionized exporting country wages are at the competitive level. Bandyopadhyay and Bandyopadhyay establish the surprising result that both exports as well as welfare are higher in the unionized country. This results from the optimal export subsidies the two Governments choose. With optimal subsidies, the unionized country enjoys a higher welfare ceteris paribus.

Bandyopadhyay and Bandyopadhyay extend their findings in a follow-up paper (Bandyopadhyay and Bandyopadhyay 2001). Here, they also consider efficient bargaining and find that welfare of the unionized country increases the more the more wage oriented its union is. This contrasts with Mezzetti and Dinopoulos, due to the strategic export policy of the two Governments. In addition, welfare also increases if the union is wage oriented and the unions' bargaining strength increases. Instead, a higher union strength leads to a welfare reduction with employment oriented unions. The market share of the unionized country can also be higher than the market share of the firm paying competitive wages if reservation wages in the unionized country

are lower than abroad.

Ma (2008) also extends the findings of Brander and Spencer (1988). In a similar framework he shows that an export subsidy is not necessarily the equilibrium outcome. One reason can be an opportunity cost for the Government in addition to the costs of the subsidy. For sufficiently high opportunity costs, subsidies lead to lower welfare. Other reasons are unions and firms lobbying the domestic Government. If the Government maximizes own utility—a weighed average of political contributions of firm and union and of welfare—Ma shows that also export taxes can be optimal. This result is established for Bertrand as well as for Cournot competition.

Bastos, Kreickemeier, and Wright (2007a) do not assume that all workers are unionized; but instead they examine open shop unions (i.e., not all workers are union members). Bastos et al. build a Cournot duopoly model with the two firms being located in two countries, product markets are separated and trade is possible, but a tariff must be paid. One of the two countries is unionized, and it is assumed that all workers receive the negotiated wage. However, not all workers are union members in the model, where union density is exogenously given. Thus, the unionized wage has aspects of a public good for the workers. In addition, union density has an impact on the firms' fallback position during a strike. Non–union members continue to work in case of a strike, and this weakens the position of the union. With an increase in international competition unionized firm's position is weakened during a strike because it induces a reaction from the rival firm and this dampens the position of the home firm. This weakened position of the home firms due to international competition boosts the union position. Thus, the firm will accept higher union demands with strong international competition. Hence, trade liberalization may in fact lead to higher wages, due to the threat of trade is necessary to make the firms "suffer" in the wage negotiations.

All the papers presented so far have in common that wages in one country are endogenously determined by union–firm–negotiations, but wages in the other country are exogenous. Beyond this, trade liberalization was mostly asymmetric: only the unionized country sets up trade barriers. A bridge to the papers where unions are active in both countries and trade barriers are symmetric are Fisher and Wright (1999) and Mauleon, Song, and Vanettelbosch (2006).

In Fisher and Wright (1999), two countries are unionized; a third country is not unionized and pays competitive wages, and all countries charge tariffs. As forms of trade liberalization, either one country can lower tariffs for one other country (unilateral tariff reduction), or two countries can agree on bilateral reduction of tariffs (free trade agreement). Finally, also free trade between all three countries is modeled (free trade). In the model, the union sets wages in the upstream market, firms choose in the downstream market quantities (and thereby employment) and demand for the final product is assumed to be linear. When in two of the three countries the unions set wages, only a free trade agreement between unionized countries increases welfare. An agreement with the non–unionized country or even free trade lowers welfare. Reasons are intuitively: if a unionized country lowers tariffs as well as the non–unionized country, incomes through tariffs are reduced. Additionally, imports increase more than export since the non–unionized firm has a strategic advantage through lower costs. The welfare of the unionized countries is thus reduced.

Concerning wage altering due to trade liberalization, Fisher and Wright show that union wages are higher after bilateral or multilateral trade liberalizations. The increased labor demand of the higher exports offsets the lower domestic market share of the unionized firm.

Mauleon, Song, and Vanettelbosch (2006) examine free trade agreements in a network formation game. International trade can occur between three countries. They examine which level of free trade a country should choose. The game is as follows: In the first stage, Governments decide on the trade agreements. In the second stage, unions in unionized countries set wages. In the non–unionized nations, firms choose wages. In the last stage, firms compete in the three

different markets in Cournot fashion. The model is asymmetric since countries can be unionized. The efficient result is always a free trade network. However, for this to be also a pairwise stable network either all countries or no country have to be unionized. Nevertheless, when only one or two of the three countries are unionized, the free–trade network is not pairwise stable. In addition, the authors show that when starting from the point of a no–trade agreement, mostly the profitable deviations do not lead to the free trade agreement. This is also true for cases in which, if it would be reached, a free trade agreement would be stable.

4.1.2 Unions in Both Countries

As described above, with unions active in only one country, results are ambiguous with respect to policy interventions. Nevertheless, most papers predict that some strategic trade policy is welfare enhancing. However, even trade liberalization can lead to higher wages for unionized workers. Let us now discuss the papers which assume that both countries under consideration are unionized. These papers differ since one group concludes that wages decrease and the other group that wages increase after trade liberalization. Otherwise, their results are just as diverse as with unions active only in one country.

Wages Decrease After Trade Liberalization Huizinga (1993) models two countries, with one firm and one union active in each of them. In the beginning, no trade takes place between the countries. The unions set wages to maximize their rents; then firms set quantities and thereby employment. Without trade liberalization, firms are monopolists in their markets. When trade liberalization is implemented, the markets are unified and demand is higher, but firms compete in a Cournot duopoly. Wages and prices are lower after the liberalization, employment increases as well as firm profits and union utility and thus welfare. These results are driven by the fact that the market is enlarged. Overall, trade liberalization is advantageous for the economy, but for an employed worker the situation is less clear, since wages decline. The positive effect on union utility is solely driven by higher employment. Very similar results are established in Sørensen (1993), who models wage bargaining between firm and union instead of wage setting and slightly change other assumptions of Huizinga. However, he mainly confirms the previous results.

Kikuchi and Amegashie (2003) focus on an asymmetric situation. Before liberalization, the markets of both countries are separated. By assumption one country has fewer firms than the other. In each country, one union sets industry wages while firms choose employment. Without international trade, wages in the two countries are independent from the number of firms. Nevertheless, product market prices in the small country are larger since there competition is less intense. When trade liberalization takes place, the two markets are integrated and all firms compete in one market. The wages in the small country are now lower than in the big country, since due to lower employment the small union is more sensible to competition disadvantages. Thus, the small union reduces wages more. This can result in the former high priced, small country becoming a net exporter after the liberalization. Whether this results depends on the difference in market size between th two countries.

Wages Increase After Trade Liberalization The papers discussed so far mostly show a decrease in wages after trade liberalization. This is independent from the type of liberalization, i.e., whether liberalization is modeled through a decrease in tariffs, an abolishment of tariffs or enlarged product markets. This contrasts with empirical study of Gaston and Trefler (1995) who find higher wages after liberalization. Theoretical explanations can be found in Bastos, Kreickemeier, and Wright (2007a) or the following papers: Naylor, for example, (Naylor 1998, Naylor 1999, and Naylor 2000), points out that a tariff reduction can lead to higher wages.

Naylor (1998), which is highly related to Huizinga (1993), examines two countries with one firm and one union active in each of them. Monopoly unions set wages to maximize their rents, and firms choose employment. Product markets are separated, and after liberalization consumers solely buy in their domestic market. Hence, the two firms can export the products to the other market, but they have to pay tariffs. Firms can decide whether they produce for their domestic market only or if they export as well. Hence, no trade, one–way trade, or two–way trade may result. For simplicity, Naylor (1998) only considers a situation where both firms choose to export (i.e., two way trade) to the other country, but trade patterns are endogenized in his following papers.

Under the condition that both firms export to the other market, a reduction of tariffs increases earnings of workers. The advantage to sell more in the foreign markets offsets the disadvantage of higher competition in the domestic market. Even if fewer workers are needed to satisfy domestic demand, more workers are needed to produce goods for export. The last effect is larger than the first so that employment and wages increase. Prices decrease, union rent and welfare increase. The implication on firm profits is less clear cut. When tariffs are very high and then marginally reduced, profits decrease: the higher cost due to higher wages offset the effect of lower tariffs. However, if the level of tariffs is low, a further reduction increases firm profits, as the cost increase is less severe and the tariff reduction dominates.

Naylor extends his own model in Naylor (1999), not solely focusing on two–way trade. Instead, he assumes that unions have a "high wage" or a "low wage" strategy. When a union chooses the high wage strategy, no trade occurs. With low wages, the probability that two–way trade takes place is high. However, Naylor (1999) shows that a critical level of tariffs exists. For higher tariffs unions choose the high wage strategy and induce no trade. Below this threshold, no equilibrium exists. For even lower tariffs, a second threshold exists below which unions demand low wages and two–way trade occurs.

Naylor (2000) differs in that the home country is unionized while abroad competitive wages are paid. In equilibrium, no trade, one–way trade and two–way trade can take place. With high tariffs, both firms do not want to trade. After a reduction in tariffs, one–way trade occurs since the non–unionized firm has lower wages to pay and so with equal tariffs, exports are profitable for the foreign firm but not for the home firm. When the tariff is so high that only one–way trade occurs, a reduction in tariffs leads unions to reduce labor demand due to an increase in international competition. A further reduction of tariffs leads to two–way trade. The union increases wage demand after a marginal further reduction of tariffs. However, the decision between "high–wage" and "low–wage" strategies does not solely depend on whether trade is one–way or two–way. Even if the strategy decision depends on the level of tariffs, the competition between the firms, the level of product differentiation, unions preferences and the level of the reservation wages also matter.

In a nutshell, Naylor shows that a marginal tariff reduction can increase wages when even before the reduction, trade was reciprocal. Then, the market expansion effect dominates the market discipline effect. Nevertheless, the absolute wages in case of autarky are higher than with reciprocal trade. This due to the fact that for a high level of tariffs, unions choose a high wage strategy and only induce one–way trade. Below a critical level of tariffs, unions switch to a low–wage strategy. Then, a further marginal reduction of tariffs can increase wages. The main difference between the papers of Naylor and Huizinga is that the latter only considers the extreme cases of autarky and free trade, whereas Naylor also examines a marginal reduction of tariffs, and this can increase low wages.

Piperakis, Hine, and Wright (2003) analyze the stability of Naylor's model. Even if the two markets have different sizes, Naylor's results can be confirmed. Only for very large market size differences, and for reciprocal trade, a reduction of tariffs leads to lower employment and lower

wages in the big country. Advantages to sell more products for the big firm are small when the other market is much smaller. The big country only suffers the increased competition, and hence welfare can also be reduced.

Another extension to Naylor's model is Munch and Skaksen (2002). They divide the trade costs in a fixed and a variable part. The fixed trade costs are set–up costs and have to be paid if the firms want to export. For each unit of the export good, also a variable tariff must be borne. They show that wages decrease with a decrease in fixed trade costs. The results of the variable costs are ambiguous, they can increase or decrease wages.

Gürtzgen (2002) also confirms Naylor's findings. She extends the model to Bertrand competition with heterogeneous products. Gürtzgen shows that wages, employment, and welfare increase with a marginal reduction in tariffs. Her results are not sensitive whether products being complements or substitutes.

Straume (2002) also re–establishes several of Naylor's findings allowing for both collusion between unions and firms. Collusion between firms is understood in the sense that both firms prefer autarky, that is being monopolists in separated markets and thus do not export. With union collusion, the two unions in the two countries maximize profits together. Straume finds that non–unionized firms prefer autarky to trade and thus this form of collusion occurs. However, with two non–collusive unions in the upstream market, firms benefit if the unions choose a low–wage strategy with free trade and thus prefer free trade and do not collude. Nevertheless, unions only choose the low wage strategy for transportation cost (or tariffs) lower than a certain threshold. In summary, Straume shows that the presence of unions can actually promote intra–industry trade (i.e., non collusion of firms) as an equilibrium outcome.

Finally, Bandyopadhyay, Bandyopadhyay, and Park (2000)'s model is related to Naylor as well as to Brander and Spencer (1988). They examine a two country model in which in one or in both countries unions are active and Bertrand competition takes place in the product market. They focus on optimal trade policies. Bandyopadhyay et al. show that export subsidies are welfare maximizing independent from whether unions are active in one or two countries. However, results are only applicable if products are not nearly perfect substitutes.

The recapitulation of the findings on trade liberalization in unionized oligopolies is challenging since the results are diverse. With one country being unionized, lots of articles—but there are exceptions—show that wages decrease with trade liberalization. Usual protectionism is welfare enhancing for the unionized country. The articles focusing on trade between two unionized countries find that comparing autarky with free trade again results in lower wages but welfare increase with free trade. Finally, starting from a two–way trade equilibrium a further reduction in trade barriers mostly increases wages.

4.2 Foreign Direct Investments

The papers discussed so far mainly dealt with trade liberalization. Another group of papers focuses on the influence that unions have on foreign direct investments (FDI) and vice versa. These models have in common that they examine whether it pays off for firms to escape union wages through shifting production to another country or at least to threaten to relocate production. The firms can blackmail unions to lower wages in these papers. If unions deny a wage reduction, firms move. Tariffs, quotas, and subsidies are only rarely taken into consideration within this strand of literature, however.

Seminal contributions in this field are the publications of Zhao (Zhao 1995 and Zhao 1998). In his first paper, Zhao (1995) builds a Cournot duopoly model with two firms being located in two different countries. In each of them, one union negotiates for wages and employment with the respective firm. Unions can be wage as well as employment oriented. The products firms sell

are homogeneous and sold in one international market. The game has two stages. In the first, firms choose independently whether they want to invest abroad. In the second, firms and unions negotiate for wages and employment. At the outset, Zhao calculates profits, wages, employment, union utility, and welfare without any FDI to have a reference point. When firms invest abroad, they have to pay union wages in the foreign country, too. However, the wage negotiation range changes with FDIs. It is assumed that after two FDIs have taken place in both countries, both firms and the union negotiate in one negotiation round in each country for an industry wage and firm specific employment. Additionally, firms' threat points differ: With an FDI, they can produce in the other country during strikes. However, unions threat points are zero after the FDI. Zhao shows that after two FDIs have taken place and a wage oriented union negotiates with the firms, wages decrease and employment increases. Firms can threaten to produce in the other country and, therefore, wages decrease. In addition, employment is larger due to a higher production. The situation differs with an employment oriented union. After the FDIs have taken place, wages as well as employment decrease. The reason is that due to the stronger position of the union before the FDI, wages and employment were very high and thus, with a weaker position of the union after the FDI, employment as well as wages are lower. Firms' profits are higher with FDIs in case of a wage oriented as well as an employment oriented union.

Taken the asymmetric case into consideration with only one FDI, Zhao shows that this is the preferred case for the firm investing abroad. Profits are even higher than with two FDIs. However, the non–FDI firm suffers. Thus, both firms have a dominant strategy to invest in the other country. In equilibrium two FDIs take place. For welfare and with wage oriented unions employment increases with two FDIs and this leads to a higher welfare. With employment oriented unions employment and also welfare decrease. A conclusive policy advice whether FDIs are welfare enhancing or not therefore depends on union preferences. Nevertheless, wages are always lower with FDIs.

Zhao (1998) applies the same model but focuses on different levels of union organization and levels of bargaining. With union organization and bargaining on industry–level as in his previous publication, Zhao finds that wages always decrease after FDI takes place. This is independent from unions being wage or employment oriented. The wage reduction is due to two effects. First, there is the threat–point effects which simply states that firms can produce abroad during a strike. This strengthens firms' position during negotiations, thereby reducing wages. Second, the two firms negotiate together with the union in one round and internalize the external effect of altered wages and quantities on each other which lowers wages (i.e., the collusive effect).

If the union organization is industry wide but wages are firm specific, the threat point for the union during a strike is increased since the union can extract rents from the non–striking firm. The threat point effect of the firms is unchanged, but the collusive effect does not appear anymore with both firms negotiating separately. Both effects together increase wages. Finally, if union organization is also shifted to firm–level, the union's threat point is reduced. The position for firms remains unchanged, and this reduces wages.

The idea to examine the effects of different union organization levels as well as different negotiation levels on FDIs is also a central point in Leahy and Montagna (2000), even though the framework is very different to Zhao. In Leahy and Montagna one multinational enterprise (MNE) can invest in the unionized domestic country. Even before the investment, n different firms are active in the market. Leahy and Montagna take decentral unions and thus firm specific wages into consideration as well as one central union with central or firm specific wages. Unions always set wages. The claim that international firms prefer a decentral wage negotiations is not supported by the findings of the authors. By assumption, the MNE is more productive than the other firms and thus the MNE benefits from industry wide wages. Hence, with a central union organization and bargaining, the union cannot extract as much rent from the more productive

MNE than the union would like to, since this would weaken the domestic firms even more. In addition, Leahy and Montagna show that national welfare decreases with an FDI in their model. The MNE extract profits from the national firms and these rents are transferred to the home country of the MNE. Welfare in the unionized country decreases and this effect becomes more severe the larger the competitive advantage of the MNE is.

In contrast to the right–to–manage model of Leahy and Montagna, Bughin and Vannini (2003) analyze efficient bargaining. In their duopoly model, an FDI can increase welfare when union bargaining strength is not too high. Additionally, the decision between FDI and exports is rather simple in Leahy and Montagna. Firms produce in the country with lower wages since no trade barriers are taken into consideration. With efficient bargaining, the decision becomes more complicated: wage as well as employment effects are noteworthy. Overall the authors conclude that with a right–to–manage model incentives for firms to undertake an FDI are higher compared to efficient bargaining.

Leahy and Montagna (2005) is different in the model set–up compared to the previous papers . They shed light on the question if wage dumping behavior of less developed countries (LDC) is welfare enhancing for these countries. Therefore, they model three countries: One is the export oriented LDC. Products are sold in a second, developed and importing nation. Goods are produced in the developed country. Additionally, the LDC can produce goods and export them if MNEs invest there. The MNE's domestic country is a third unregarded country. Unions are active in the developed as well as in the less developed country. The question under consideration is whether the LDC should always attract FDIs through a restriction in union power. The authors find that it is not always in the interest of the LDC to restrict union power in the LDC to maximize the level of FDI. This is due to the fact that workers in the LDC benefit from the FDI if they can extract at least a little bit of the surplus. This drives the result that union power should not be limited so much that wages MNEs pay are just equal to reservation wages. The optimal level of union power in the LDC depends on the competitive position of the LDC, i.e., the relative cost advantage to the highly developed country. Interestingly, conflicts occur not between but within countries. Consumers in highly developed countries prefer low social standards and therefore a low union power since prices decrease. Firms as well as workers in the developed countries oppose this social dumping.

4.2.1 Policy Implications

The papers discussed so far are very ambiguous in terms of policy recommendations. The profitability of FDI for national welfare is highly sensitive to the model set–up. Nevertheless, some articles focus on policy instruments to influence the FDI decision of firms.

Skaksen (2005) examines whether countries should subsidize FDIs, focusing on a Cournot duopoly with two firms active in two unionized countries. With FDI, the foreign firm relocates production to the domestic country and produces there. Skaksen assumes that after the FDI, both firms negotiate with one union. Thus, after the FDI wages increase when products are substitutes and decrease when products are complements. This is solely driven by the fact that after the FDI the unions do not compete anymore since both wages are set by one union. When products are complements, a subsidy for inward FDIs can be world welfare enhancing since inefficiencies in the labor markets are reduced.

A more sophisticated model of policy instruments is build by Rocha-Akis (2006). In her set–up the Government of the domestic country can choose an optimal labor tax, which is tantamount to choosing a transfer policy to unemployed since they are linked through the budget constraint. With the policy decision the Government has an impact on the location choice of a multinational firm. Rocha-Akis models a duopoly with homogeneous products sold in the home country. The

firm located in the domestic country is assumed to be immobile. The other firm is a mobile MNE and chooses between production in the domestic or in the foreign country. If the MNE chooses the latter, it exports the goods to the home country. The countries are also diverse in their institutional set–up. The home country is unionized and wages are negotiated between firms and unions. In the foreign country wages are exogenous. Additionally, in the home country the Government collects a labor tax. Rocha-Akis also assumes that the Government can attribute different weights to producer and consumer rents, or on labor income and unemployment benefits. If the Government values consumer and producer surplus more, it is business friendly, otherwise it is labor friendly.

When two conditions are fulfilled it is optimal for the domestic Government to induce a relocation of the MNE to the foreign country: the Government must be business friendly, i.e., putting emphasis on producer and consumer surplus. If in addition the relocation costs for the MNE are low (i.e., the sunk relocation costs as well as foreign labor costs are low and home union bargaining strength high), it is optimal to choose a low labor tax and, thus, a low level of redistribution. Thereby, the Government induces a location of the MNE in the foreign country and this is—maybe surprising at first glance—optimal for the domestic country's Government. When incentives to relocate are high for the MNE, than it is mostly better for the home firm and consumers if the Government does not try to stop the MNE to produce in the foreign country. The MNE exports from abroad, the home producer can compete with the MNE if taxes are not too high even if wage costs at home are higher. Through an increased output the domestic firm can benefit and this also leads to a higher consumer surplus. Exactly the opposite is true for a Government that places enough weight on workers' income. In this case, the Government should try to induce the MNE to produce in the home country.

With a Cournot duopoly model, Ma (2007) demonstrate that with lobbying taken into account, an economically disadvantageous FDI can occur. In each of two symmetric unionized countries one monopolist is active. Both countries try to attract an MNE but this MNE only invests in one of the two countries. The Government can subsidize the FDI with a lump sum subsidy or even tax it. The Government's decision is influenced by the political contributions of the domestic firm and union. With the additional assumption that the first country benefits more from FDI than the second, Ma establishes that an equilibrium can be found where FDI is taking place in the second country, if the political incentives in the second country dominate both the first country's economic advantage as well as the political incentives. Thus, too much lobbying can result in economically disadvantageous FDIs.

Haufler and Mittermaier (2008) also examine whether a country should attract FDI through a tax discount or even a subsidy. In their model, two countries (each with one active monopolist) compete to attract a third firm. The countries are heterogeneous, they have different market sizes, and only one country is unionized. Both Governments choose optimal policies in the first stage to maximize welfare. The authors find that in equilibrium the unionized country can attract the FDI by offering a tax discount or even paying a subsidy. The Government compensates the foreign firm more than the union wages harm the firm. Thus, also a smaller home market does not prevent the FDI in the unionized country with an optimal policy.

4.2.2 Number of FDIs

Mukherjee and Suetrong (2007) examine the impact of different union structures on FDIs. In their two–country model, only one country is unionized and the unionized firms can serve the other market through exports or an outward FDI. Additionally, the number of firms engaging in FDI is endogenous. Wages are set either by decentral unions, or in the central case, one industry union sets industry wages. Mukherjee and Suetrong find that wages are always lower

under decentralized wage setting than with central wage setting for a given number of FDIs. Nevertheless, they also show that incentives to realize an FDI are higher with centralized than with decentralized wage negotiations. Thus, wages and union utility under decentralized wage setting can be higher than with centralized wage setting when firms actively decide over FDIs.

Naylor and Santoni (2003) test whether autarky, one–sided FDIs or reciprocal FDIs are Nash equilibria. In their Cournot duopoly model, one firm and one union are active in each country. The unions are able to set wages, firms choose product market quantities and thereby employment, and product markets are separated. Firms can invest abroad if they are willing to pay fix costs, otherwise they can only sell in the domestic market. The authors show that incentives to undertake an FDI are the greater the weaker the union in that country is and the stronger the union's preferences for employment are.

The aim is then to test whether autarky, one–sided FDIs, or two–sided FDIs are equilibria. This depends on the level of fixed FDI costs. The authors find that a high substitutability of products and a weak firm strength result in a game that takes the form of a prisoners' dilemma for firms. With weak firms and high product substitutability, autarky becomes advantageous for firms. The easier it is to substitute products the more intense is the competition in the product market, which decreases profits and earnings. Weaker firm bargaining strength leads to higher wages—especially in the duopoly situation. Therefore, under these circumstances firms are more likely to prefer autarky. Nevertheless, even in this case, it is profitable for one of the firms to invest abroad under the condition that the other firm does not do the same. So, the firm which has taken the investment benefits from a new product market in the other country and does not suffer competition in the domestic market. However, this harms the other firm. Thus, the classical prisoners' dilemma logic applies. Each firm invests abroad, while highly substitutable products and weak firm strength lead to lower wages.

The sequential choice of two firms to undertake an outward FDI and its welfare and policy consequences are in the focus of Ishida and Matsushima (2008). In their Cournot duopoly model, two firms are located in one country. Both countries are unionized with firm specific unions and serve a home market as well as a separated foreign market. When a firm exports to the other country, transportation costs arise. The two firms can sequentially choose to relocate production. Producing in the foreign country incurs a fixed cost and exogenous labor costs. Following the first firm's decision whether or not to undertake an FDI, the second firm decides. Ishida and Matsushima show that the second FDI is always detrimental for home welfare. In most cases, the asymmetric situation with one FDI is preferable for social welfare. The reason is the wage restraint of the second union when the first firm undertakes an FDI. With one firm producing abroad, the competitive situation for the second, national firm is weakened. Thus, the second union lowers wages to help its firm to stay competitive in the foreign market. Since wages for the second firm have to be low for all workers, this firm can produce at low costs for the home market, too. The first union can therefore not increase the wages for the remaining workers in "its" firm as much as the union would like. Even if the firm generates high profits in the foreign country,the firm would reduce output if home wages would be high and this would lower employment and thus utility of the first union. Summing up, the first FDI leads to lower domestic wages and thus lower prices and higher welfare. Nevertheless, when the second firm also invests abroad, wages rise sharply in the home country, since both unions try to extract all the domestic rents from their firms. This reduces output in the home market and, therefore, prices increase and welfare decreases. Additionally, the authors show that the social disadvantage of two FDIs does not primarily result from lower union utility but instead from lower consumer surplus. Unions can under certain conditions benefit from the second FDI since this weakens competition between the unions.

Glass and Saggi (2005) also endogenously determine the equilibrium number of FDIs. In

their model, two firms are located in two different countries with distinct markets. Each firm can choose to serve the foreign market through an FDI or through exports. It is assumed that both firms need one intermediate good supplied by a local upstream supplier. This intermediate can be interpreted as a labor union, but nevertheless the model is more general and assumes that a profit maximizing firm produces this intermediate. The timing is different than in the previous models. First, downstream firms decide about an FDI or exports. In the second stage, the downstream firms choose quantities, in the third stage the upstream firms choose prices. Thus, the order is reversed. Relating to unions, the wage decision would be the short run decision while the product market quantity game is a long run decision. Glass and Saggi establish for two markets of similar sizes that two FDIs are the only equilibrium. This decreases global welfare since it eliminates the indirect competition between the two monopolistic input suppliers. This due to the fact that upstream prices are set after the downstream firms decide to produce in both countries and about the quantity they produce. Additionally, one outward FDI increases intermediate prices in both countries. It is obvious that the price of the intermediate good is higher in the FDI host country since demand increases and thus the monopolistic upstream supplier charges a higher price. This higher price of the intermediate in the host country has a positive external effect on the prices in the other country. Thus, this effect can offset the price decreasing demand reduction effect in the other country and increase the prices there, too. So, the authors interpret one FDI as a cost–raising strategy.

4.2.3 Miscellaneous

Bughin and Vannini (1995) is very different from the other papers due to the assumption. The paper sheds light on the impact of an inward FDI on union wages and firm profits. The improvement of their model is that the competitive wage in the domestic country is endogenous, and this drives lots of this results. It is assumed that two firms compete in a Cournot duopoly, a domestic and an international firm. The international firm has the option to produce in a second foreign country at an exogenous wage or to produce in the home country. With an inward FDI, again, two cases are distinguished. With full unionization, the MNE also has to pay union wages, with partial unionization, only the domestic competitor is unionized and the MNE pays a competitive wage. Notably, in the case of partial unionization the MNE influences the competitive wage in the domestic country with its labor demand and, therefore, also affects the union threat point during wage negotiations. By assumption unionization leads to unemployment since total labor supply is exogenous and constant.

In this setting, Bughin and Vannini show that FDI lowers the host country's welfare. Unions are indifferent between an MNE producing in the foreign market and exporting the goods to the home market or producing in the domestic country and being unionized. With a unionized MNE, unemployment is unaffected in the domestic country. Nevertheless, the worst situation for the union arises when the foreign firm produces in the domestic country, but pays competitive wages. This is due to the fact that, with an increased labor demand from the MNE, unemployment decreases and competitive wages will also decrease and thus the threat point of the unions during negotiations is lowered. For the MNE, incentives to produce in the domestic country are reduced when the domestic country is unionized and the MNE has to pay union wages. Therefore, partial unionization is in the interest of the MNE. Union power in the rival's firm creates unemployment, thus lowering the competitive wage for the MNE and creating a cost advantage.

The decision for the firms has been between FDIs or exports so far; it was assumed that an FDI is a substitute for exports. However, the empirical literature shows that firms sometimes choose an FDI in one country, but in addition, they also export to that country. The question, why FDI and export can be complements, is in the focus of Mukherjee (2008). In his model, a

multinational firm is located in its domestic country and needs labor as an input for production with labor costs being exogenous in the domestic country. The firm exports the goods to a foreign country, where the demand is located, and the foreign country's Government does not impose tariffs. Additionally, the firm can undertake an FDI in the foreign country, but then has to pay fixed costs of FDI and endogenously determined wages, set by a union. In the foreign country, also the second, local firm is active, which has to pay union wages and compete with the foreign firm in Cournot fashion. It is assumed that wages are firm specific and set by a monopolistic union. The timing of the game is rather uncommon. In the first stage, the multinational firm decides between FDI, export, or both. In the second stage, the MNE chooses its export level, before the host country union sets wages. Finally, both firms choose quantities produced in the foreign country. This timing is uncommon in several ways. The second decision and thus a rather long run decision is the level of exports. Mukherjee reasons this by the capacity choice of the MNE in its domestic plant. It builds production facilities in the home country, and this is a long–term decision. Nevertheless, this can be advantageous for the firm since this leads to a first–mover advantage. The firm can credibly threat to export a positive quantity. Afterwards the union sets the wages before the multinational firm chooses the production quantity in the foreign country. Thus, when wages are too high in the foreign country, the MNE firm will produce at home. With low wages, the union in the foreign country can attract FDI. Mukherjee shows that the MNE chooses different strategies dependent on the market size. The MNE undertakes only an FDI and does not export when the market size is small. Then, the union sets lower wages than in the domestic country to attract the MNE. In an intermediate range of market size the international firm partly chooses to undertake FDIs and exports. Thus, it is nicely established that firms can understand FDI and exports as complements. With the threat to supply the home market at least partly by exports the MNE "persuades" the union to lower the wages. Within a large market, union wages are higher in the host country than in the foreign country, and therefore the firm chooses only to export.

Another nice fingertip related to Naylor (2002b), Naylor (2002a), and the literature on FDIs is Ishida and Matsushima (2005). In their duopoly, two firms are at the outset located in one unionized country and compete in Cournot fashion. Additionally, they can export their homogeneous good to another foreign country's market and again compete there in Cournot fashion. However, transport costs arise for each unit exported. Wages are set by two firm specific unions in the home country, quantities are solely chosen by firms. If one of the firms has the option to invest abroad, the new plant in the foreign country is also unionized. The authors state that one would normally assume that the option to do an FDI increases the competitive position of the first firm since it can supply the foreign market cheaper and no transportation costs arise. The rival without this option suffers. Instead, they show that the profits of the rival can increase if transportation costs to the other market are sufficiently high. In order to help its firm to be more competitive in the foreign market the home union of the firm without the option to do an FDI will reduce wages so much that this offsets the negative effect of the lower transportation costs of the international firm. Thus, more intense competition can be advantageous for the rival without the option to do the FDI.

4.2.4 Trade Liberalization and FDI

In a combined model Lommerud, Meland, and Sørgard (2003) take trade liberalization as well as FDIs into account. In their two country model, one country is unionized, in the other country wages are exogenously given and at the competitive level. One firm is located in each country and in the unionized country one union is active. Markets are separated, but both firms can export if they pay tariffs. Only the firm in the unionized country can also invest in the non–

18

unionized country. Overall, this firm has three options. It can stay local, it can produce in both countries but then fix costs of the FDI arise. Finally, it can totally relocate production and cease production in the domestic country. It is assumed that total relocation is more expensive than partial relocation. The game has three stages. First, the firm in the unionized country decides whether to relocate or not. Wage setting takes place at the second stage. Finally, firms compete in Cournot fashion in the third stage. Like in the models of Naylor a marginal reduction of tariffs increases wages. Unions extract some of the rents the firms can generate due to a larger product market. The disadvantage of higher competition in the domestic market is offset. However, the incentives for FDIs are increased with higher wages in the unionized country. This is true for partial FDIs since wages increase as well as for a total relocation because an export to the unionized country after relocation becomes cheaper. Overall, employment as well as welfare decrease in the unionized country with a tariff reduction since the FDI level increases.

Related to this, Vandenbussche and Collie (2005) examine a model of the location choice of two "footloose" companies and the optimal tariffs a domestic country should choose to affect location choice. In their model the only association the firms have to the different countries is that shareholders of each firm belong to one of the two countries and therefore home (foreign) firm's profits increase welfare of the home (foreign) country. Additionally, the labor market in the home country is unionized and wages are set by a monopolistic union, wages in the foreign country are exogenous. The firms compete in the product market, and demand for the product only arises locally. Therefore, firms have to balance two effects: when they locate in the home country they have to pay union wages, however, when they choose the foreign country as the place of production, they have to pay tariffs for an export to the home country. The domestic Government chooses this tariff in order to maximize domestic welfare. The game has the well known order. First, the Government chooses the optimal tax; afterwards firms choose location, followed by the wage determination of the unions. Finally the firms compete in the product market. Like Lommerud, Meland, and Sørgard (2003) they show that trade liberalization can lead to outward FDIs and thus to a reduced welfare in the domestic country. Different from Lommerud, Meland, and Sørgard (2003), Vandenbussche and Collie allow the domestic Government to choose optimal tariffs. When the wage level in the foreign country is close to domestic level, the optimal tariff set by the domestic Government dissuades firms from moving abroad. Different from the previous literature, tariffs do not improve welfare through the common 'foreign rent–extracting' motive, instead, the tariff deters outward FDI and thus increases union rents. However, when the wage differences are sufficiently large and the wage in the non–unionized foreign country is lower than in the domestic country, the Government will optimally not collect a tax. It is then better for domestic welfare when the two firms produce abroad and export the good to the home market. Due to higher profits in the domestic firm, domestic welfare increases. Additionally, consumer surplus is higher since the quantity produced is high. Nevertheless, no production takes place in the home country and unions suffer. However, the first positive effects offset the last negative, so overall domestic welfare improves without a tariff. To sum up, Vandenbussche and Collie show that with totally footloose firms, a welfare maximizing Government is more inclined to set tariffs against foreign countries with similar wage levels. Instead with low–wage countries the Government prefers a free–trade agreement.

4.3 Differences in Labor Market Organization

The following papers focuses on equilibrium wages and employment when countries with different models of labor market organization compete. Capital flows (FDI) and strategic trade policy is usually left aside in these models.

Corneo (1995) examines wage and employment changes in a Cournot duopoly with asym-

metric union organization level as well as bargaining levels. In his model, n firms compete in one integrated product market. Firms are located in two different countries. In the first stage, unions and firms in each country negotiate for wages. In a second stage, firms choose quantities. Corneo varies the level of union organization, the level of bargaining, bargaining strengths of firms and unions, threat points of unions during strikes, and he analyzes simultaneous and sequential bargaining. As levels of organization and negotiation he assumes either a central union organization with an industry wage or decentral unions with firm specific wages. First, Corneo assumes that in both countries firm specific wage negotiations take place, while reservation wages and bargaining strengths differ between the countries. It is shown that wages increase with an increase in union power and reservation wages. Additionally, higher wages also benefit the other union which in turn will increase its wage. Secondly

Secondly, Corneo examines different organization levels. Wages are highest if a central union negotiates a central wage in both countries. Wages are lowest for decentral bargaining and union organization. The reasons are well known: a central union internalizes the externality one union's wage has on the other union's utility. With more decentral unions and bargaining, unions compete indirectly through the firms competing in the product market, and this leads to lower wages. When the situation is asymmetric and in one country wages are set on the industry level and in the other country on the firm level, then wages are high in the country with industry–wage setting than in the country with firm wages. This is independent of the number of firms active in each market. The asymmetric case is thus in the middle of the two symmetric cases. With sequential bargaining, wages are higher than with simultaneous negotiation since an "upswing" effect occurs: if one union negotiates a higher wage rate, this leads to a positive externality for the other union in the next round, and so on. Corneo also examines whether central wages are higher in the country with more firms or with less. One has to keep in mind here that the product market is totally liberalized. Thus, wages in the country with more firms are higher than in the country with fewer firms. For the union in the small country the threat of competition from other firms is more severe, therefore this union has a strong interest in lower wages. The union in the large country is, in contrast, less affected by actions of the competing union in the small country.

Summarizing the findings concerning international unionized oligopolies, it is noticeable that numerous papers introduce their findings with statements that they are "at odds with conventional wisdom", or results are "counter intuitive" (see for example Corneo (1995), Leahy and Montagna (2000), or Lommerud, Meland, and Sørgard (2003)). The effects of trade liberalization or FDIs are very nebulous. Once product market and labor market imperfections are taken into account, the effects of trade policies is unclear. Depending on the model specification, wages, employment, profits, union utility, and welfare can increase or decrease after trade liberalization. Noteworthy, unionized countries do not necessarily have a competitive disadvantage compared to non–unionized nations. Similarly, FDIs can be disadvantageous and do not always increase domestic welfare. They can decrease and increase wages as well as employment. A general and unambiguous policy advice is thus not available.

5   Innovations

The effect unions have on innovations is a controversial topic. The theoretical as well as the empirical literature is not conclusive on whether unions hinder or boost innovations. To review of the literature, I first summarize the findings on how unions affect innovations if product markets are competitive. Building on this literature, I present the seminal work of Dowrick and Spencer (1994) and of Ulph and Ulph (1988, 1989, 1994, 1998, and 2001), and finally discuss

other papers analyzing union effects in a unionized oligopoly.

5.1 Classical Papers on Unions and Innovations

One of the first attempts to examine the effect of union strength on investment was Grout (1984). He models a monopolistic firm which can invest in innovations. With unions, a hold–up problem can arise. After an investment, the firm earns higher profits and the union has the possibility to appropriate a share of this rent. The union demands higher wages and this reduces the investment rent for the firm, which in turn lowers investment incentives ex ante. If union and firm can sign binding contracts ex ante, however, the union will not appropriate gains from innovations ex post and the investment level of the firm is not reduced. Grout concludes that the investment level of firms is higher with binding contract than without.

In contrast, Freeman and Medoff (1984) do not conclude that unions always reduce innovation activity of firms. They find two antagonistic effects, a "labor–saving" and a "rent–seeking" effect (Freeman and Medoff 1984, p.162–180). The latter effect is well known from Grout the "labor–saving" effect is new. With greater union power and, therefore, higher wages, firms have more incentives to adopt a new technique using less labor and thus, union wages encourage labor saving innovations. Furthermore, Freeman and Medoff find that unions contribute to employee training and lower job turnover as well as establish more efficient governance structures and this brings about an innovation friendly climate in the firm.

Even the empirical literature is not decisive whether innovations are higher or lower with unions. For the United States, most studies find that unions hinder innovation, while for Europe, the situation is less clear cut. Some studies do not find any influence on innovations, while some also find positive effects. Excellent overviews over the empirical literature are provided by Keefe (1992), Menezes-Filho and van Reenen (2003), Menezes-Filho et al. (1998b), and Menezes-Filho et al. (1998a).

Nevertheless, imperfect product market competition has been neglected in these first theoretical papers. This is the focus of the following contributions.

5.2 Imperfect Competition in the Product Market

5.2.1 Dowrick and Spencer

Dowrick and Spencer (1994) ask whether unions are unions luddites in their paper's title.[2] In their paper, Dowrick and Spencer analyze the question which factors lead to unions becoming luddites, or stated differently, to unions opposing labor–saving innovations. The paper first assumes that wages are exogenous. Secondly wage setting is endogenized with a single union and multiple unions. Usually, union's utility has no specific functional form. It is only assumed that unions focus on wages or employment. Also the demand function is quite general, not even assumptions concerning the elasticity are made. On top of this, workers can be substitutes or complements in production, and union organization can be firm–, industry–, and sometimes craft–specific. In the first stage of the game, unions decide to oppose or support innovations. In the second stage, wage negotiations take place, and finally, in the third stage, each firm retains the right to choose employment quantity in the product market. For the simple reason that results are quite numerous, I have subjectively chosen to present some of them.

If wages are exogenous, unions sometimes facilitate labor–saving innovations. This at first glance

---

[2]Luddites, a group of early 19th century English workmen, destroyed labor saving machinery as a protest. Their principal objective was the introduction of new wide–framed looms. There looms could be operated by unskilled workers resulting in job losses for many former textile workers. Nowadays, luddite has become a synonym for anyone opposed to technological progress.

surprising result occurs if product market demand is elastic. The firm hires more workers and this increases union utility. Consequently, with an inelastic product market demand, unions are luddites. The paper concludes that all factors that lead to a reduction in labor demand elasticity increase the probability that unions oppose innovations.

With wages determined endogenously, and even with a lower employment, labor saving innovations can be in the interest of the union if wages increase. This result is derived on the assumption that the union is wage oriented and can appropriate enough of the firm's innovation rents through higher wages while general statements are difficult with a linear demand that decentral unions are more likely to support innovations, while industry unions tend to oppose them. An industry union is exposed to higher demand elasticity since it is concerned about the utility of all workers in the industry and thus lower employment harms an industry union more. At this point, Dowrick and Spencer point out a relation to the empirical findings of Calmfors and Driffill (1988), who found an inverted U–shaped relationship between union organization level and wage level. Wages are highest with an intermediate level of union organization and lowest with a very central or decentral unions. Similar effects are established for innovations by Dowrick and Spencer. Very decentral unions do not oppose labor saving innovations much, their luddite level is low. In contrast, with industry unions the aversion to innovations increases. Finally, Dowrick and Spencer speculate that central unions internalize the positive macroeconomic effects of innovations and thus do not hinder innovations. With this, also an inverted U–shaped relation between level of union organization and innovation is established.

Irrespectively, a causality between union bargaining strength and opposition to labor saving innovations cannot be found. The factors that determine whether unions are luddites are their preferences for wages and employment and the level of union organization.

5.2.2 Ulph and Ulph

Apart from the publication of Dowrick and Spencer, Ulph and Ulph have published several papers dealing with unionized oligopoly, especially on the strategic effects of innovations. They mostly assume that a new technology can be obtained by a patent race and only one of the competing firms is able to introduce the innovative technology. This adds a new aspect to the previous literature, since now it can be beneficial for a union if its firm wins the innovation even if this would lead to lower employment. The alternative that the competing firm wins the new technology and the demand for labor falls still more, is even worse for the union.

In their first paper Ulph and Ulph (1988) model a patent race in a duopoly and assume that it takes the form of an auction. Only the firm that bids most receives the patent and can use the new technology. They distinguish three cases of negotiations, which all have in common that bargaining takes place after the auction. In addition, in all cases the scope of bargaining covers at least wages and employment, in two cases also the timing of innovations is an extra dimension of bargaining. In the first case, *ex–post bargaining*, unions and firms negotiate about employment and wages after the patent auction. With *sequential post–auction bargaining* again wage and employment agreements are concluded after the auction, but now the firm that won the patent and its union negotiate in a separate negotiation round whether and when the firm introduces the new technology. This is because it can be beneficial for firm and union that the competitor does not win the auction. This again depends on the competitive threat, which is the difference between the profits the firm makes if it wins the race and those it makes if it looses. However, this does not imply that it is in the interest of both, union and firm, to introduce the new technology. It is not sufficient to claim that unions decrease firm profits after an innovation. One has to compare firm profits when the other firm would win instead. Even when the winning firm does not introduce the technology, it can be better off compared

to the case where the competitor introduces the innovation. With *simultaneous post–auction bargaining*, the innovation winning firm and union negotiate two sets of wages and employment. One is paid before the new technology is introduced, the other afterwards. Additionally, they agree on the date when the innovation is introduced.

The main finding is that an enlarged scope of negotiation, including the timing of innovations, is disadvantageous for unions. It never leads to a firm that would have lost the patent race winning it now, which would be in the interest of firm and union. Nevertheless, for some parameter constellations enlarging the scope of bargaining can lead to a firm that otherwise would innovate not doing so. This harms both firm and union. Another somewhat surprising result is that with *simultaneous post–auction bargaining* unions are willing to decrease wage claims after the innovation to introduce the new technology later. Thus, the union cannot appropriate nay rents after the introduction.

In a very similar model, Ulph and Ulph (1989) focus on union bargaining strength, and confirm their previous finding that negotiations over wages, employment, and the timing of the innovation are detrimental to union utility. However, sometimes an increased union strength can increase the probability of a firm to win a patent race it otherwise would have lost.

The publication Ulph and Ulph (1994), in contrast to their previous work, also analyze right–to–manage negotiations and show that the more the union cares for employment the less the union can influence the results of the patent race. In contrast, with efficient bargaining and increased union strength, sometimes a firm wins a patent race which it would have lost with a weaker union.

In Ulph and Ulph 1998 and Ulph and Ulph (2001) a similar question as Grout (1984) is discussed. Is it more efficient to introduce *ex–ante* or *ex–post* negotiations to implement the optimal level of R&D? In contrast to Grout's work, Ulph and Ulph state that *ex–post* negotiations can be advantageous. This rests on the effect that Ulph and Ulph consider a patent race between firms and include strategic product market effects. Considering a non–unionized imperfect product market with a patent tournament taking place, firms over–invest in R&D since firms are very keen to win the patent and prevent the competitor from introducing the new technology. Considering unionized markets and *ex–ante* negotiations, the results resemble the findings with a competitive labor market. Firms over–invest in technology. Thus, with *ex–post* negotiations, firms invest less since unions extract rents due to the hold–up problem and thus *ex–post* negotiations reduce the over investment. Ulph and Ulph (2001) also conclude that *ex–ante* negotiations are not always preferable to *ex–post* negotiations.

5.2.3 Other Publications

In their mainly empirical publication, Menezes-Filho, Ulph, and van Reenen (1998a) build a theoretical model to examine the influence of union bargaining strength on R&D activity. The model is highly related to Ulph and Ulph (1994). The authors show with efficient bargaining as well as with right–to–manage how union bargaining strength influences equilibrium outcomes. For right–to–manage investment incentives for firms can decrease in union power. The union extracts more rents and this reduces R&D incentives. Nevertheless, with efficient bargaining, an increase in union power can increase in employment if unions are relatively weak, especially for employment oriented unions. This again implies that the firm with a higher market share has higher incentives to invest in innovations.

Zikos (2007) also extends the papers of Ulph and Ulph to show that firms and a union prefer long–term wage contracts (i.e., the union sets wages before the firm chooses R&D level). In contrast to Ulph and Ulph, Zikos assumes that investments in innovations of the firms are not mutually exclusive as in the tournament models. Instead, firms' innovations have positive spill–

overs on competitors. The focus of the paper is on different wage contract lengths. The paper examines long–term wage contracts, where the union sets the wage in the first stage, then firms choose their R&D level, and in the last stage the firms compete in the product market. The standard *ex–post* wage setting is referred to as short term contracts, where first the firms decide over the investment before the union chooses wages. Zikos finds that a long–term contract induces lower wages than short term wages and therefore employment and investments are highest for long–term contracts. The union prefers the long–term contract even if wages are lower since it benefits from the higher employment level. Additionally, profits for firms are maximized with long–term contracts. Indeed, comparing the incentives of firms and union to choose a contract in an endogenous wage contract game, they will both agree on the long–term contract.

Banerjee and Lin (2003) is not a unionized oligopoly paper in the strict sense. However, it is very similar to Zikos (2007). Banerjee and Lin build a model of a vertical related industry, with one upstream firm setting a price for all firms in a downstream oligopoly and examine how innovations in the downstream industry are influenced by the upstream industry. They also analyze whether input price contract before or after the innovation are preferred by the upstream and downstream firms. It is shown that downstream and upstream firms' profits, level of innovations, consumer surplus and, thus, welfare are higher with "fixed–priced contract", that is input price contracts signed before the R&D investment stage.

Bárcena-Ruiz and Campo Corredera (2003) focus on simultaneous and sequential wage set-ting. In their model, two unions set wages for a downstream duopoly. Unions decide if they want to set wages simultaneous or sequentially. After this decision, firms invest in R&D, than unions set wages, and finally firm competition takes place. The authors find two distinct effects. The first is a strategic effect: with sequential wage setting the union with the first mover advantage sets a higher wage than the second union, and both set higher wages than with simultaneous wage setting, when neglecting R&D investment. The second effect is a productivity effect: the firm with the follower union invests more in R&D than the leader firm since wages are lower. Total investment is maximized with simultaneous wage setting. However, these two effects together lead to unions preferring to set wages simultaneously, in contrast to Corneo (1995) and De Fraja (1993a): when the market is small and the efficiency of the investment sufficiently great, the productivity effect dominates the strategic effect.

Tauman and Weiss (1987) point out that unionized firms can adopt a new technology while a non–unionized competitor abstain from doing so. In their model, two firms compete in Cournot fashion. One of the firms is unionized while wages of the other firm are exogenous at the competitive level. Both firms can adopt a new labor saving technology. They show that an equilibrium can occur in which only the unionized firm will adopt the technology. Under the assumption that reservation wages are equal and firms and unions act simultaneously (i.e., at the same point in time, firms decide about the technology adoption and the union sets wages), the equilibrium that only the unionized firm introduces the technology can occur. However, demand has to be high in this case. With a high demand, the unionized firm outbid the low cost firm in the competition for the new technology. Generally, with a high demand, both firms are willing to pay more for the new technology than with a low demand. However, with an increase in demand the unionized firm has the additional advantage from introducing the labor saving technology since the union demands a higher wage with a higher demand. When unions set wages after technology adoption, which seems to be the more realistic case, the reservation wages of the union members have to be higher than the reservation wages of the non–union members. Only then, a unionized firm will solely introduce the advanced technology. Otherwise, the union appropriate the profits of the new technology, the firm anticipates this and invests less. With higher opportunity costs of the unionized workers, however, their wages exceed the wages of the non–unionized workers even more (in relative terms), which makes the introduction of the labor saving innovation more

attractive. In summary, with wage and innovation negotiated simultaneously and with a high demand, or with sequential decisions, a high demand, and higher opportunity cost of unionized workers, an equilibrium can be established in which only the unionized firm introduces the labor saving technology.

5.2.4 Central vs. Decentral Wages

Several papers consider whether innovation activity is influenced by institutional settings, in particular the level of union organization and wage negotiations. This could perhaps explain the empirically differences in union influence on innovation across countries. While countries in which unions seem to hinder innovations are mostly organized decentral, with a more central organization unions appear to support innovations. The following publications give several hints why a central level of union organization can lead to higher investments in innovation, even if the union can extract a higher amount of the rents with a central organization.

Therefore, Calabuig and Gonzalez-Maestre (2002) extend the model of Tauman and Weiss (1987). In their duopoly model union organization can be central or decentral. However, wages are always firm specific. Both firms can buy a new technology so that both firms can introduce labor saving innovations. They find that in a market with low demand a firm with a central union is willing to pay a higher price for an innovation than a firm with a decentral union. In a large market, firms with a decentral union organization are willing to pay more. This is a consequence of the number of active firms after the innovation. In a small market, after the innovation of one firm the other firm has to leave the market because of cost disadvantages. With the purchase of the innovation the firm additionally buys a monopoly. Since wages in a monopoly are equal with either level of union organization, firms with central unions before the innovation are willing to pay more. Their wages have been higher before the innovation, so profits are lower and thus the profit differences are higher. This does not apply for a large market. Even after the innovation two firms stay active and the central union will extract more rents than two decentral unions. Thus, firms with central unions pay less for the innovation. In this paper, a first hint is given why more innovations can take place with central unions.

Manasakis and Petrakis (2005) apply a model with cooperative research to show that with central unions more investment in R&D can occur. In their model, each firm can choose to do research cooperatively or strategically, that is research within an R&D network or alone. However, strategic research does also lead to spill–overs to the other firm. Therefore, research is not a perfect private good. In their duopoly model with symmetric firms and homogenous goods, innovations are not labor– but cost–saving. Union organization as well as wage bargaining level is either on firm or on industry level. Among other results, they show that firms with an industry wage can have a higher incentive to invest in research.

First, when each firm does research strategically, investments are higher with a central union if spill–overs are low. Since a central union demands higher wages, firms invest more in research to generate the labor–saving process innovations. At the same time, low spill–overs reduce the free–riding effect of the other firm which also enlarges incentives to invest. With high spill–overs, incentives to free ride are higher. However, profits for firms with central unions are lower even if the level of R&D is higher.

A different result occurs with research networks. No free–riding exists anymore, all spill–overs are internalized. Then, the only factor that influences the profitability of the investment is the comparison between firm profits before and after investment. Profits are higher with decentral unions, since rent extraction of central unions is higher, and thus incentives to invest lower. However, welfare implications are quite ambiguous.

The third paper that establishes higher investments with central unions is Haucap and Wey

(2004). In their duopoly model with homogeneous goods unions set wages while firms choose employment. Three different union organization and wage setting levels are modeled. With central negotiations, union organization as well as wage bargaining is centralized. Under "co-ordination", organization is still central, nevertheless, negotiations are decentral. Finally, with decentral unions, union organization as well as bargaining is firm specific. Like in the papers of Ulph and Ulph a patent race is modeled and only one firm can innovate. The findings are that with a central organization and wages, highest incentives to innovate occur. A decentral union organization and wage bargaining also lead high incentives to innovate, however lower than in the central case. Lowest incentives occur under coordination. Reasons are obvious: with coordination the hold–up is most severe. After innovation, the low cost firm (i.e., the one with the labor saving innovations) must pay higher rents and the firm with a competitive disadvantage must pay less. In this case, the union can extract the highest rents, since the union is a price discriminating monopolist. With decentral unions and wage negotiations, also wages differ after innovations because of different costs. Nevertheless, the two unions now compete and do not internalize the positive externalities higher wages would have. Thus wages are lower compared to coordination and incentives to innovate for firms are higher. The highest incentives occur with a central wage and a central union. The union cannot price discriminate and has to set an average wage that extracts some of the rents of the productive firm, but does not harm the unproductive firm too much. This boosts incentives to innovate since the union can extract the least. Employment levels are also examined. Employment is highest with decentral wages and lowest with central ones. Hence, policy implications are not clear cut. If high innovations are preferred union organization and wages should be central. However, to enlarge employment a decentral structure is the best.

Similar to Haucap and Wey, Mukherjee and Pennings (2005) construct a duopoly model. At the outset, one of the firms has a competitive advantage. The productive firm can put a take–it–or–leave–it offer to the unproductive firm to buy a license and also introduce the advanced technology. With decentral wages and union organization, the license is always bought. Even when the more productive firm is very efficient and would be a monopolist due to cost advantages, it prefers to sell the license and induce duopoly competition. With central negotiations, this is not always the case. Sometimes the more productive firm will not sell the license and thus a monopoly occurs.

In the second step the authors endogenously determine whether the first firm should invest in the new technology. The possibility to license the technology to the other firm highly affects the decision. When the innovation leads to a very high or a very low technology improvement most innovations take place with a central organization. However, with medium improvements, incentives are highest with decentral negotiations. This relativizes the results of Haucap and Wey since centralization does not always lead to highest innovation incentives.

5.2.5 Extensions

Also very related is the paper of Mukherjee (2007). It does not directly deal with the decision of undertaking an innovation, but focuses on two firms in a duopoly in which one of the firms has a higher labor productivity than the other. Otherwise, the two firms do not differ. The firms negotiate with two firm specific unions for wages and set quantities in the product market in the second stage. With a wage bill maximizing union productivity adjusted wage bills are equal for both firms, that is, the less productive firm has to pay lower wages and this leads exactly to equal profits for firms. This result can also be established for the coordination case in Haucap and Wey (2004). The reason for this maybe surprising result is that objective functions for both wage bill maximizing unions are the same if one considers productivity adjusted wages as strategic

variables. This has considerable impact on innovation incentives for firms. If after a successful innovation a wage bill maximizing union can extract all the rents, this diminishes innovation incentives. However, these results do not hold for a rent maximizing union. In contrast to wage bill maximization, a rent maximizing union subtracts the reservation rate from its wage, so it only maximizes the surplus over the reservation wage times employment. With a positive reservation wage, being equal for workers in the productive firm as well as in the unproductive firm, this leads to asymmetric objective functions and in equilibrium, productivity adjusted wages are also asymmetric.

Manasakis and Zikos (2007) is related to Manasakis and Petrakis (2005) even though the focus is different. Manasakis and Zikos examine labor saving innovations with spill–overs and address the question under which circumstances firms and decentral unions prefer joint research. Additionally, the paper establishes conditions under which firms can convince unions by subsidizing them to agree on a research joint venture. Manasakis and Zikos find that profits are always higher with research joint ventures, but the unions can only partly benefit: their utility only increases if spill–overs are high. If firms try to convince unions to approve a research joint ventures with transfers in case of low spill–overs, this lowers the incentives to form a research joint venture for firms. For very low spill–overs, the amount of money the firm has to pay exceeds the benefits form the joint venture and thus the firm abstains from doing so.

Additionally, Mauleon, Sempere-Monerris, and Vannetelbosch (2008) extend the analysis of Manasakis and Petrakis (2005) and Manasakis and Zikos (2007), but focus on R&D networks between three firms. In a model with three firms, each firm can choose to undertake joint research with the other firms. Different from before, firms must cooperate to generate spill–overs to each other. The firms not participating in the same network cannot free ride on the findings of the other firms. Due to tacit knowledge, only a share of the research result is accessible for the other firm in the network, so spill–overs are imperfect. Four network settings are under consideration. Either there is no link (i.e., no cooperation), there is one link, two links, or a perfect network. The authors show that with unions setting wages, the preferred situation occurs that a full cooperation is the efficient and stable network. However, unions overall reduce the investment in R&D compared to firms setting wages.

Lingens (2006) also contributes to the discussion. He changes the patent race and applies a model by Reinganum (1983) and Tirole (1988), so that an additional "Arrow effect" arises. The presence of unions always reduces the firms' profits during the patent race. Therefore, firms have higher incentives to invest in innovations in order to shorten the time until the innovation is found. This new effect always occurs, with efficient bargaining as well as with right–to–manage. However, numerical simulations in this paper show that even with this effect, research investments decline under unionization compared to a competitive labor market.

Lommerud, Meland, and Straume (2006) examine whether unions are luddites with respect to international competition. They model two countries with separate markets when one market is unionized. Does this union oppose or advance labor saving innovations? They find that it is beneficial for the level of technology adoption that a union is wage oriented instead of being employment oriented. A union with a larger home market will also oppose innovations more often.

With respect to innovations, the conventional wisdom is not affirmed either: Calabuig and Gonzalez-Maestre (2002), Haucap and Wey (2004), Manasakis and Petrakis (2005), and also partly Mukherjee and Pennings (2005) show that unions can positively influence the level of innovations. This contributes to explain why empirical results are ambiguous. With imperfect competition in the product market, different institutional settings of union bargaining can lead to unions favoring innovations. In addition, Ulph and Ulph (1998) and Ulph and Ulph (2001) show that innovation levels without unions can be too high. Even if unions reduce innovations,

this can be efficient.

6   Mergers

The idea that unions affect the merger decision of firms is prevailing. Horn and Wolinsky (1988) already examine incentives for firms to merge in a unionized duopoly. They conclude that incentives are low since unions appropriate the merger rents. In their model, the two duopoly rents together are higher than the monopoly rent after the merger due to higher wages and therefore firms do not merge with substitutable goods.

Aside from that, four publications mainly focus on international mergers (see Straume (2003), Lommerud et al. (2005), Lommerud et al. (2006), and Lommerud et al. (2008)). Here, the key note is that firms can change the union organization they are confronted with as well as the product market situation by a merger. These papers are highly related to the FDI publications since firms can merge nationally or internationally. With international merger they induce competition between unions, with national mergers competition between unions is reduced.

Straume (2003) examines a merger of two firms in a three countries–three firm oligopoly. Product markets are separated, but nevertheless firms can export to the other countries when they pay tariffs. It is assumed that only the first country is unionized and in the two others wages are competitive. As the equilibrium market structure in the case of low and symmetric tariffs, the unionized firm will merge with one of the non–unionized ones. The merger is profitable for the unionized firm since they can threat the union to produce the goods in the non–unionized country and export them to the unionized country. Thus, the union lowers wages even if the competition in the product market is reduced with the merger. With a higher level of tariffs, the two non–unionized firms merge. A merger including the unionized firm would lead to higher wages. Due to high tariffs, product market competition is decreased and a production in the non–unionized country and an export is not profitable and therefore the union can set higher wages.

Lommerud, Straume, and Sørgard (2005) try to shed light on the question why the so–called merger paradox established by Salant, Switzer, and Reynolds (1983) does not arise within a unionized oligopoly. The merger paradox states that it does not pay to merge under Cournot competition except the merger leads to a monopoly. The merged firms reduce production, the outsiders increase production and thus, it is more profitable to be an outsider than an insider of a merger. Different to the previous paper Lommerud et al. model three firms competing in one market and all firms are unionized. The unions can focus on wages or on employment and set wages. As union organization, without a merger three unions are active and set three firm specific wages. After a merger, two new union organizations for the merged firms can occur. Either the two unions affected by the merger stay separate after the merger and the new firm can negotiate with two distinct plant specific unions. Or, the unions also merge and thus after the merger again the firm negotiates with one firm specific union. As results Lommerud et al. show that the profitability of a merger highly depends on the union organization after the merger. Firms always want to be an insider of the merger when unions do not also merge, that is they are plant specific afterwards. Then, the plant specific unions compete for the level of employment and wages for the merged firm are lower than for the outside firm. The only exceptions are unions with a high emphasis on employment. In this case, wages are low even before the merger and do not decrease much afterwards: the merger paradox would appear.

With a union merger simultaneous to the firm merger, competition in the product market as well as between the remaining two unions is reduced. Wages increase and the merger paradox appears. To sum it up, with unions not focused on employment and organized separately after

a merger, firms want to be an insider of a merger due to lower wages. Lommerud et al. conclude that this situation mainly occurs with international mergers since unions seldom work together internationally.

Lommerud et al. (2006) extend their previous model to a more sophisticated one. Here, four firms are located in two countries but compete in one product market. In each country, one industry union sets two firm specific wages. Again, they search for the equilibrium market structure. The model only allows for two firm mergers and rules out a merger to monopoly. Lommerud et al. show that two international mergers are the equilibrium since firms can induce competition between international unions. This is independent of merger specific efficiency gains. Even without these gains always two international mergers appear. An improvement of this publication is the examination of welfare effects. For international welfare, two mergers are optimal when products are sufficiently substitutable. With complementary products one or no merger is beneficial. Focusing on national welfare the situation is rather ambiguous. For consumers, merger leads to higher prices and wages can increase and decrease as a reaction to national and international mergers. To conclude to decide, whether mergers increase welfare, one has to take also into consideration how many of the consumers are located in each of the two countries and where the shareholders of the firms are located. With different parameter settings, it can be beneficial for a nation that no merger or a national merger in the other country takes place. Unambiguously, they can show that a national merger is only welfare enhancing for one country if the efficiency gains are high enough. Thus, the creation of "national champions" is mostly not welfare enhancing. Finally, Lommerud et al. also consider non–cooperative merger (i.e., acquisitions). Again, two international acquisitions are the equilibrium.

Lommerud, Meland, and Straume (2008) try to build a model that shows a scope for a "national champion" merger policy. As they state honestly: "The model assumptions are not necessarily chosen for their empirical relevance, but rather to give the national champion argument a fair chance". Two of the three firms of their model are located in the domestic unionized country. The other one is located elsewhere and pays competitive wages. Lommerud et al. assume that a cross–border merger is driven by the wish to keep wages low. Also, merger synergies are higher for a domestic merger than for international ones and finally they assume that the policy makers' put more emphasis on domestic wage levels than on domestic profits. As a merger policy, the welfare maximizing domestic Government can ban cross–mergers, however, they cannot force firms to merge. With these assumptions, Lommerud et al. try to show that a national merger is welfare enhancing. This is true when the firms can only choose between national and international merger. When the domestic firms also have the possibility to relocate production and the domestic Government cannot ban this, firms have high incentives to relocate with a national champion policy. Thus, the worst situation for domestic welfare of a total relocation of production occurs when firms have the possibility of a capital flight. Only very high non–labor synergies due to a domestic merger, a low degree of competition in the product market, and high fixed costs for a relocation of production can save the national champion argument.

Also Mukherjee and Zhao (2007) consider the choice of firms to merge internationally, to undertake a greenfield FDI (i.e., a relocation of production), or to export. In their duopoly, the home country is not unionized, wages are assumed to be zero, and the domestic firm is less productive than the firm in the host country. This more productive firm has to pay union wages. The product market is located in the host country, too. Thus, the domestic firm can supply the market choosing exports but paying tariffs, or chose a greenfield FDI. This can be beneficial since tariffs do not occur. However, the firm has to pay union wages in the host country. The third option is a merger with the host country firm. This leads to a monopoly and the firms can choose whether they want to produce in the less productive plant in the foreign country without labor costs but with tariffs or in the unionized, more productive host country.

Mukherjee and Zhao establish plenty of results: they find that when the host Government decides that the merged firm has to operate a plant in the host country, then the domestic firm will only merge with central unions but decentral wages. However, with decentral unions, the firm will choose a greenfield FDI. When the host countries' Government does not regulate the location of production, a merger is always preferred. In this case the location of production differs with respect to central or decentral unions.

Unlike Lommerud et al., Zhao (2001) focuses on vertical product market mergers instead of international questions. In his model, two monopolists are vertically connected and the downstream firm is unionized. For the upstream firm no labor costs are modeled. The union and the downstream firm negotiate for wages and employment. Usually, it is assumed that a merger between two vertically connected firms is welfare enhancing since the double mark–up problem is solved. Both firms produce more after the merger and thus profits increase, prices decrease, and welfare increases. In a unionized oligopoly additional effects arise. Zhao shows that after a merger wages increase for the downstream firm (except for a very convex demand), and also employment increases. The larger employment is in accordance with the literature on vertical mergers. Since the double mark up problem is solved, output and thus employment is large. Before the merger, the downstream firm would not take the impact of a strike on the upstream firm into consideration during the negotiations. Afterwards, this increases equilibrium wages since a strike would harm the firm in the upstream as well as the firm in the downstream market. With these effects taken into consideration, the author finds for a linear demand that the two vertically connected firms would not merge. The higher wages reduce the incentives to merge too much. Nevertheless, even with a union in the downstream market the welfare is higher with a vertical merger. Afterwards, Zhao also examines how the option to do an FDI of the downstream firm influences the merger decision. The downstream firm can than produce in two countries. However, the firm has always to pay union wages, but it benefits from the indirect competition between the unions and thus even after the merger the wages do not increase much. With an FDI, again, a merger would arise. Whether this is also beneficial for national welfare relies on union preferences for wages and employment. With wage oriented unions, welfare increases with an FDI and a vertical merger, the opposite is true for employment oriented unions. Finally, Zhao tests the stability of his model. Even with right–to–manage negotiations his results are stable with a unionized upstream market, or a unionized upstream as well as downstream market.

Mergers in a vertical connected industry are also the focus of Chang (2005). In his model two firms are active in an upstream market and two firms are active in a downstream market. Only the upstream firms need labor as an input and both are unionized. Each upstream firm has a vertical chain with a downstream firm, and the latter sells the goods in the product market competing in Cournot fashion. Prices between the upstream and the downstream firm are modeled in two ways. Either the upstream firm can charge a franchise fee that fully extracts the rents from the downstream firm, or the downstream firm can extract all the rents from the upstream firm. The author examines how a merger in the upstream market and a merger in the downstream market affect results. Without a merger, it does not matter whether the upstream or the downstream can extract all the rents, total profits are maximized. Mergers in the upstream market and in the downstream market both reduce union utility.

The focus of Mauleon and Vanettelbosch (2006) are the incentives for firms to merge if the union can strategically send delegations to wage negotiation. In their model, the surplus–maximizing unions can choose to delegate wage negotiations to wage–maximizing delegates (for example senior union members) instead of surplus–maximizing delegates. These wage–maximizing delegates have a very low probability to be laid off after a wage increase and thus they simply try to maximize wages and not surplus. In the product market duopoly, firms can choose to merge first. Afterward, unions choose the delegates to send to the wage bargaining.

Then, wage negotiations take place and finally firms choose employment. The authors assume that without the merger, two firms and two unions are active negotiating firm specific wages. With a merger of the firms also the unions merge. As possible equilibria, it can arise that both unions choose wage–maximizing or surplus–maximizing delegates. However, also the asymmetric case is possible.

It is shown that for unions in a duopoly it is beneficial to send wage–maximizing delegates if union power is not too high. Otherwise, for a bargaining strength higher than this threshold, unions would send surplus–maximizing delegates. In a monopoly, the same is true, however, the threshold is lower when the union sends surplus–maximizing delegates.

For the firms, incentives differ: For firms it nearly never pays to merge if they have to negotiate with wage–maximizing delegates. So, for the firms to merge, the union strength must be extremely low in a monopoly, otherwise the union always sends wage–maximizing delegates. For higher union bargaining strengths, the union would send also wage–maximizing delegates, but firms will not merge. However, since unions send surplus–maximizing delegate for a lower bargaining strength in a monopoly than in a duopoly, the firms can induce the union to send surplus–maximizing unions with a merger for a range of union strengths. That surplus–maximizing delegates take part in the negotiations outweighs the high bargaining strength of the union and thus firms have an incentives to merge when the merger has an impact on the delegation decision of the unions. To sum it up, Mauleon and Vanettelbosch conclude that the statement that an increase in union power decreases firms' incentives to merge is not true in general. Once the firms can influence strategically the delegation choice of unions, the opposite is true. Nevertheless, also in their model the situation arises that firms will merge if and only if unions are weak.

Brekke (2004) concentrate on a unionized oligopoly with hospitals as downstream firms. Related to Lommerud et al. (2005) he considers a merger with unions organized either on industry or hospital (i.e., plant) level, setting industry, firm, or plant specific wages. Different to the previous literature, he considers hospitals providing horizontally and vertically differentiated products. Therefore, he assumes that price and quality competition or solely quality competition occurs in the hospital market. At the outset, Brekke assumes quality as well as price competition. After the merger, prices increase to the benefit of the firms. Again, wage altering results differ due to the organization level of the unions. When wage setting as well as union organization is hospital (i.e., plant) specific, a merger reduces wages. Hospital specific unions compete since the "hospital–firm" can pit them against each other. Thus merger profitability increases due to lower wages. When unions are organized on industry level and negotiate firm specific wages before the merger, it is assumed that after the merger only one wage is negotiated and thus wages increase. This is equivalent to a merger between two hospitals which even before the merger paid industry wages. With increased wages, incentives to merge are reduced in both cases compared to a merger in a non–unionized hospital market. Additionally, the profits due to mergers decrease with quality competition compared to the previous case where price and quality competition has taken place. With quality competition, after a merger prices cannot increase, which was besides decreased wages a beneficial factor of mergers.

To conclude on the findings on mergers in unionized oligopoly: several papers show that those mergers that lead to more competition between unions reduce wages and mostly strengthen the incentives to merge. Nevertheless, when union organization is very central, unions can extract merger rents and this lowers the incentives. Sometimes, unionization hinders economically beneficial mergers, for example, a vertical merger that solves the double mark–up problem can be impeded by unions.

7 Negotiations

Questions concerning the way unions and firms negotiate are the focus of investigation in the following articles. The papers mainly try to shed light on the question which forms of negotiations firms and unions would choose and which scope of bargaining or timing arises endogenously.

7.1 Different Negotiation Strengths

Padilla, Bentolila, and Dolando (1996) focuses on the strategic interaction between unions as well as between firms. In their duopoly model, both firms are unionized and negotiate with firm specific unions. They do not assume that unions' negotiation strengths are equal. To establish their findings, Padilla et al. apply the distinction between "strategic substitutes" and "strategic complements" of Bulow, Geanakoplos, and Klemperer (1985). To give an example, in their duopoly, the production decisions of the firms are strategic complements if an increase in the production of one firm increases the marginal revenues of the others. Then, the other firm has an incentive to produce more, too. Contrarily, with strategic substitutes, an increase in one firm's production decreases the marginal revenues of the others. Thus, the rival will produce less. Padilla et al. show that for unions, wages are strategic complements. When one union can enforce higher earnings, the other union has an incentive to do the same. Nevertheless, for firms wages are strategic substitutes. An increase of wages of the first firm raises the incentives for the second to negotiate for even lower wages. This is due to the fact that with higher wages it is easier for the competing firm to increase its own market shares. These higher market shares are in addition more valuable since the price–cost margin also increases. Hence, whether the whole game is one of strategic substitutes or one of strategic complements depends on the relative bargaining power. When firms are relatively strong, the overall game will be one of strategic substitutes, otherwise, with strong unions it is one in complements.

With respect to the strategic effects, the paper shows that a higher productivity in one firm can lead to lower wages in that firm and not as expected, to higher earnings if in the game wages are strategic complements. However, if under this condition the bargaining strength of one union increases, this leads to lower wages in the other firm. Stated differently, only when unions bargaining power is higher than a certain threshold (i.e., the relative bargaining strength of unions is high), a decrease in product market competition increases wages since then wages are strategic complements.

Bughin (1996) focuses on the impact of heterogeneous bargaining strengths on efficient bargaining negotiations. In his theoretical as well as empirical oligopoly model, unions and firms negotiate over wages and employment. As long as union strengths and firms profits are positive, the union can always negotiate a rent higher than their marginal labor productivity since it skims–off rents. Thus, wages with efficient bargaining are to the right of the labor demand curve because more workers are employed. This influences firms' profits on the product market. Firm profits measured do not reflect the real oligopoly power of the firms compared to a non–unionized oligopoly. The unions have already extracted part of the rents and thus firms' oligopoly power seems to be lower that it really is. This effect increases with a higher union strength. Bughin proves his statements for various manufacturing sectors in Belgium. The union captures rents and thus firm oligopoly power seems lower than it is. Nevertheless, he shows for Belgium data that the relative bargaining power of firms is higher than the one of unions.

7.2 Efficient Bargaining vs. Right–to–Manage

The first paper dealing with the advantages and disadvantages of efficient bargaining and right–to–manage negotiations is Yang (1995). In his duopoly, two firms produce a homogenous good

and compete in Cournot fashion. He examines two levels of union organization, industry or firm unions, but wages are always firm specific. At the outset, he assumes that right–to–manage negotiations between two decentral unions and two firms take place. Yang considers a special case of a right–to–manage model, the monopoly union bargaining. Unions can set wages and firms choose employment unilaterally. Efficient bargaining is only adopted when the union as well as the firm prefers it and then the negotiations are modeled with a Nash–Bargaining solution with equal bargaining strengths of firm and union. After agreeing on the mode of bargaining, negotiations take place with efficient bargaining or unions choose wages with right–to–manage, respectively. In the last stage, firms with a wage setting union can choose employment.

Yang shows that firms and unions have a strict preference for the introduction of efficient bargaining. Firms benefit since they have a direct bearing on the wages with the introduction of efficient bargaining. The unions also benefit from efficient bargaining since employment is higher. Nevertheless, a prisoners' dilemma occurs. It is individually rational to choose efficient bargaining; however, for both firm–union pairs a higher utility level would arise within a monopoly union setting. With a price discriminating union results are ambiguous. The union prefers right–to–manage and since both have to agree, right–to–manage is the equilibrium. No union deviates because they internalize the prisoners' dilemma occurring otherwise.

Dobson (1997) examines the choice between right–to–manage negotiations and efficient bargaining— he names it participatory framework—in a duopoly with Bertrand competition in the product market. The two firms negotiate with two firm specific unions for wages or wages and employment. As a result he establishes that firms always prefer a right–to–manage framework. The situation for the unions is less clear cut and depends on the negotiation strengths and the competitiveness of the two heterogeneous products the firms produce. For a range of parameters with a high substitutability of products and a low union negotiation strength, also unions prefer right–to–manage negotiations. In this Bertrand model, prices are strategic complements and thus each firm–union pair has an incentive to negotiate high wages. With higher costs per firm, the competitive pressure is dampened and thus prices in equilibrium are higher. Additionally, when side payments are allowed, the range of parameter where unions and firms agree on right–to–manage negotiations is enlarged. To sum it up, choosing right–to–manage negotiations can be a strategic decision for higher wages compared to efficient bargaining. With these higher costs in the product market a higher level of surplus for all parties involved is created. Nevertheless, for welfare efficient bargaining is optimal.

Petrakis and Vlassis (2000) examine whether firms and unions prefer right–to–manage or efficient bargaining during negotiations. In their model they assume decentral firm specific negotiations between unions and firms. In the first stage of the game each firm–union pair agrees on the type of negotiation. In the second stage, negotiations take place, either about wages and employment or solely for wages. In the third stage, firms which agreed on right–to–manage negotiations choose quantities in a Stackelberg follower fashion. At the outset, right–to–manage negotiations between firms and unions take place. Only when for one firm–union pair both agree on efficient bargaining, they negotiate for wages and employment. With strong unions (e.g., in a duopoly and union strength higher than firm strength), firms never agree on efficient bargaining contracts since they fear high wages. With efficient bargaining in contrast to right–to–manage, the equilibrium wages lie to the right of the labor demand curve on the contract curve. This bargaining regime entails "over–manning", that is too many workers are employed compared to a right–to–manage equilibrium with the same wage. When unions are weak, at least some of the firms agree to switch to efficient bargaining. On the one hand, they suffer due to "over–manning", on the other hand they benefit from being a Stackelberg leader in the product market. But not all firms will switch to efficient bargaining and an equilibrium with all firm–union pairs conduct efficient bargaining is not stable. It would then again be beneficial for some pairs to switch back

to right–to–manage negotiations and not suffer due to "over–manning".

More generally, Petrakis and Vlassis conclude that within an n firm oligopoly the union power has to increase with the number of firms to establish an all–firm right–to–manage equilibrium. Stated differently, the more competitive the industry, the more probable is a mixed situation with some firms and unions negotiation about wages, and others negotiating over wages and employment.

Bughin (1995) does not examine whether firms and unions prefer right–to–manage or efficient bargaining. In contrast to the other publications, he criticizes both concepts due to their imperfections. He claims that right–to–manage leads to non Pareto–optimal solutions and efficient bargaining is first only found rarely in the real world and second, for given wages, firm do not use all their profit opportunities. Thus, it is not plausible that they do not cheat on previous agreements without any enforcement mechanism of the union to keep firms off from doing so. Therefore, the author wants to find another reason why firms and unions do agree on a solution off the labor demand curve. Bughin loosens the assumptions that firms behave as profit maximizers during the product market game. Instead, they maximize a linear combination of profits and union utility and address different weights to theses aims. The game is then as follows. First, wage negotiations take place, then, afterwards firms choose their weight on profits and union utility as profit maximizer. Stated differently, they commit themselves whether they behave union friendly or as profit maximizers during the competition in the product market. Finally, the two firms compete in Cournot fashion in the product market. Bughin shows that firms always set a positive weight on union utility and thus are not that focused on costs during the product market game. The level of employment can be higher and therefore a result off the labor demand curve is found. Nevertheless, the commitment of the firms to cooperate with the union is a prisoners' dilemma for firms. The firm with the higher production wins most, if the other still maximizes profits in the product market game. However, the dominant strategy is to commit to a labor friendly behavior. Thus, giving weight on union utility is a self enforcing mechanism and establishes a result off the labor demand curve. Here, a higher concentration in the upstream market—that is union–firm wage negotiation and no competitive labor market— leads to a more intense competition in the product market which is in contrast to the standard industrial organization literature.

7.3   Firms Prefer to Be Unionized

Vannini and Bughin (2000) show that firms sometimes prefer to pay higher union wages instead of competitive wages. They first calculate Cournot equilibrium quantities for exogenous wages. Profits are squared quantities since they apply a Cournot model. Then, Vannini and Bughin calculate quantities for the two firms when they negotiate wages with two firm specific unions or with one central union. With efficient bargaining, they show that quantities agreed on are higher than the oligopoly quantities with exogenous costs. This is a well known fact with efficient bargaining and the quantity agreed on is independent of union strength. The firm and union maximize this cake they negotiate about and divide the cake through the agreement on wages. However, since profits are squared quantities, firms' gross profits are higher with efficient bargaining. But unions skim–off some of the rents through higher wages and the level depends on union strength. Thus, the cake division as well as net profits of firms depend on union strength. Vannini and Bughin show that with a low union strength and efficient bargaining the effect of a higher employment and thus profits offsets the rent sharing with the union. This is even more the case with central unions when products are sufficiently distinct since quantities are even higher. So, firms prefer to be unionized here!

7.4 Timing

Dobson (1994) and De Fraja (1993a) shed light on the question which consequences sequential negotiations—instead of the usually assumed simultaneous negotiations—between firms and unions entail.

De Fraja (1993a) applies a duopoly model with conjectural variation to examine staggered vs. synchronized wage setting. He shows wage altering when two decentral unions do not negotiate with the two firms simultaneously. Instead, in every other period one firm–union pair negotiates about wages. The wages for the other pair are fixed during that time. Nevertheless, both firms can choose employment in each period. As a central result he states that wages are higher with sequential negotiations. Unions maximize not only their one–period utility but the present value of their future utility. Thus, they internalize the positive impact higher wages in this period have on the wage negotiations of the other union in the next period. Also the union in the second period takes the influence on the wages of the other union in the third period into account etc. Overall, this leads to a situation where every union pushes each other up and wages are higher and employment is lower. Additionally, De Fraja examines how a longer period of fixed wages matters. This unambiguously reduces the equilibrium wages. The increased utility from the external effect in the future becomes more distant and thus with discounting future utility this leads to lower earnings. When the negotiation period goes to infinity, results approximate the results with simultaneous negotiations.

In line with that, Dobson (1994) also tries to find out whether unions prefer simultaneously or sequentially negotiations. He builds a duopoly model with one central union. This union can choose to negotiate simultaneous or sequential with the firms. In his model "sequential negotiations" are a two–stage game. In the first stage, the first firm and the union negotiate together. In the second stage, the union takes the wage negotiation with the first firm into account as a threat point during negotiations with the second firm. Instead, with simultaneous negotiations, the threat point during the negotiations is always zero. Thus, utility of the union is lower with simultaneous negotiations. The advantage of sequential negotiations increases the more asymmetric the firms are. With asymmetric firms, it is in the interest of the union to negotiate first with the weaker firm (i.e., the firm with the lower negotiation strength). These wages are threat points in the negotiations with the stronger firm. Similar results arise when firms differ due to costs. Union utility is higher when the union targets the firm with the higher profits since then the threat point is higher.

Related is also Bárcena-Ruiz and Campo Corredera (2000) who examine long–term and short–term wage contracts. In their two period duopoly model, firms and unions can negotiate a long–term contract with duration of both periods in the beginning of the first period. In addition they can also agree on a short–term contract for one period and renegotiate in the beginning of the second period. Firms compete in Cournot fashion in each period. The firms and unions maximize the discounted profits or utility of two periods, respectively. Since the demand function is stationary and independent across the periods, results for a long–term contract are equivalent to results for a short–term contract, when both firm–union pairs choose the same contract length. Nevertheless, in the asymmetric, sequential case—one firm–union pair negotiate long–term contracts, the other one short–term—leads to different findings. Wages in the long–term firm are higher than in the short–term for both periods and thus employment and profits are lower. Compared to the symmetric case, profits of the short–term firm exceed profits in the symmetric case and lowest profits occur for the long–term firm. Union utility is highest with a long–term contract, followed by the asymmetric utility for the short–term. Nevertheless, the symmetric case always leads to lowest union utility. When solving for the equilibrium length structures the authors show that when firms can choose the type of contract, two short–term

contracts are the equilibrium. Even if profits are highest for a firm if it chooses a short–term and the competitor a long–term contract, this is not an equilibrium since the second firm can generate higher profits also negotiating short–term contracts. If unions can decide, two equilibria exist, that is one union chooses a short–term and the other a long–term contract. However, since the asymmetric equilibrium results for both unions in higher utility than the symmetric one also the union with the short–term contract does not have an incentive to deviate.

7.5 Level of Negotiations

Grandner (2001) focuses on different negotiation levels in vertically connected markets. In his oligopoly m firms compete in an upstream market, n firms in a downstream market and all firms are unionized. He examines three cases. First, with completely decentralized bargaining, each firm negotiates with a decentral union. Second, industry specific centralized bargaining encompasses a case where two industry unions bargain over one wage for the upstream market and one for the downstream market. Third, with completely centralized bargaining, one central industry union negotiates one wage for the upstream as well as the downstream market. He extracts two effects that unions on different levels can internalize. The competition externality is the often discussed external effect on other unions in the same industry level due to higher wages. The second effect is the integration externality. This are the negative externalities a higher wage has on the wages in the other market (i.e., upstream or downstream) due to a lower employment. The internalization of this negative externality decreases wages. Thus, Grandner can rank the different negotiation regimes due to wage levels. Wages on industry level, that is one wage for the upstream market as well as one wage for the downstream market lead to the highest wages since only the competition externality is internalized. With very central negotiations the negative externality is also internalized which leads to lowest wages. Intermediate levels of wages occur with decentral wage negotiations since no externality is internalized.

Gürtzgen (2003) also examines different levels of wage negotiations, however, in her model all unions are active within one industry. The focus of her paper is to limit the conclusion of Calmfors and Driffill (1988) that very central as well as very decentral unions are favorable due to lower wages. Instead she wants to rehabilitate intermediate levels of union organization. Therefore, Gürtzgen extends the model of Dowrick (1993) in assuming that unions cannot only coordinate their behavior on the vertical line, but also on the horizontal line. In other words she models union coordination on the professional line (i.e., complementary craft union workers of different firms coordinating their behavior) as well as coordination in an industry (i.e., substitutable workers of different crafts but one firm or industry working together).

She concludes that wages are not necessarily highest for intermediate union organization. When former decentral unions merge, and afterwards complementary workers are organized within one union, this leads to lower wages. Thus, with goods sold on the product market, vertical coordination can lead to lower wages. The two groups of workers take into consideration that a higher wages for one group has a negative external effect on the other workers and thus wage demand is lower when they are organized in one union.

Very general results are established by Dhillon and Petrakis (2002). They provide sufficient conditions under which a central wage is independent of a number of market characteristics and institutions of bargaining. At least, the n identical firms in the market have to be endowed with a log–linear labor technology and negotiate with a single industry union. In addition, the utility function of the union has to be log–linear in aggregate employment and in a function of the wage rate. With some other assumptions on the output and profit functions of the firms they show that wages are independent of the number of firms, a vector of parameters characterizing product market features and sometimes also the same results occur for efficient

bargaining and right–to–manage negotiations. This result breaks down for decentral negotiations. Nevertheless, the findings have some implications for employment policy. Even if many market characteristics do not have any impact on wages, they have an effect on industry employment. Thus, to induce a higher aggregate employment one has to encourage the entry of new firms with central negotiations.

Bárcena-Ruiz (2003) combines the last papers examining four different wage bargaining structures: central simultaneous, central sequential, decentral simultaneous, and decentral sequential negotiations. In this framework he examines the politically preferred bargaining structure of these four. In addition, he considers foreign and domestic shareholders for the two domestic unionized firms. The Government trying to maximize welfare does not take the interests of the foreign shareholders into account. Bárcena-Ruiz finds that decentral wages maximize welfare when the share of domestic shareholders is large. Otherwise, with lots of foreign shareholders the Government prefers central negotiations since this increases union utility more. Within a decentral system he shows that simultaneous negotiations are preferred for a high share of domestic firm owners and sequential within a central system.

8 Minimum Wages

A binding minimum wage for an industry or even for a whole country is common in a large number of countries. Undeniable, this institutional setting has an impact on union–firm negotiations in the same industry or nation. This impact is central in a number of publications of Petrakis and Vlassis.

In their first paper Petrakis and Vlassis (1999) build a duopoly model. Both firms have a distinct productivity and are unionized with two decentral unions. In a first round, firms and unions bargain the level of an industry minimum wage. Afterwards, firms and unions agree in decentral negotiations on the level of normal wages. These wages have to be equal or exceed the minimum wages. In the third stage, Cournot competition takes place in the product market. Petrakis and Vlassis find a critical minimum wage which is only binding for the unproductive firm, but not for the productive. The productive firm gains from an introduction of minimum wages exceeding this threshold since it raises the cost of its rival: With a decentralized wage setting regime, efficient firms pay higher wages than their inefficient rivals. Thus, the efficient firms' relative advantage in productivity is partially appropriated through higher wages. A sector minimum wage exceeding the wage a decentral union and inefficient firm would agree on raises the costs of this less productive firm. This is known as a "Raising Rivals' Costs" effect (see Salop and Scheffman (1983) and Salop and Scheffman (1987)). Efficient firms thus have a strategic incentive to opt for a high enough minimum wage and reduce their relative wage–cost disadvantage. They steal market share from their inefficient competitor and increase own profits. Clearly, this is in the interest of the union of the efficient firm, because minimum wages raise wages and employment. Even unions of inefficient firms can benefit from such an arrangement, provided that the minimum wage does not drastically reduce employment.

Accordingly, Petrakis and Vlassis built three models extending the idea of raising rivals' cost in a more sophisticated way (see, Petrakis and Vlassis (2003), Petrakis and Vlassis (2004b), and Petrakis and Vlassis (2005)). Due to their resemblance, I focus on the publication in 2004 which emphasizes the endogenous establishment of minimum wages. In a first, institutional stage, an "intercountry authority" (e.g., the EU) decides in favor or against the establishment of a minimum wage. For simplicity, the authors assume that the "intercountry authority" always decide in favor. At the same stage, unions and firms have to agree on the level of the minimum wage via majority voting. Afterwards, decentral firm–union pairs agree on the normal wages

exceeding the minimum wage. Finally, firms set output. Firms are located in three countries, two countries are unionized and by assumption the firms located in one of these two countries are more productive than in the other. The unionized firms also compete with firms of a small third country with exogenous wages and without minimum wages. Petrakis and Vlassis establish a range of minimum wages which are only binding for the unproductive firms. Thus, the efficient firms benefit through a higher market share, even if this increases also their wages. The unproductive firms unambiguously suffer from the minimum wages. Unions of the productive firms earn higher wages and more workers are employed, thus, they favor the introduction of a minimum wage. In contrast, unions of the unproductive firms also benefit due to the binding higher minimum wages, but they suffer because of lower employment. Which of these effects offsets the other depends on the level of minimum wages. If the minimum wage is the lowest in the range of binding wages, Petrakis and Vlassis find that overall also the unions of the unproductive firms gain. When the firms and unions agree on minimum wages, the productive firm as well as both unions will agree on the introduction of minimum wages.

The impact of minimum wages on the determination of wage–bargaining structures is the focus of Petrakis and Vlassis (2004a). The paper endogenously establishes the equilibrium wage–bargaining structures, a "winning coalition" of firms and unions agree on in a duopoly with asymmetric firms. When the productivity difference of the two firms is high enough, a "winning" coalition of the two firms and two unions accept a minimum wage and the efficient firm pays wages exceeding this minimum. For lower levels of productivity heterogeneity, both firms pay the minimum industry wage. Finally, when the firms are nearly symmetric in productivity, firms and unions aim are so diverse that they cannot agree on a minimum wage and thus in both firms unions set decentral wages and firms choose employment. In this case, firms do not have any direct bearing on the wage level.

Related to the findings of Petrakis and Vlassis, Haucap, Pauly, and Wey (2001) examine the impact of a generally binding standard wage on an oligopoly. Incumbent firms compete in Cournot fashion with potential entrants. The incumbents are assumed to be equally efficient and be at least as efficient as the entrant firms. Two benchmark wage setting cases are assumed, either one strong employers' associations sets one generally binding standard wage, or one strong labor union determines an industry wage. Since market entry and exit are considered, incumbent firms try to set wages high enough to deter entry; competition in the product market is reduced as well as employment. However, it is not in the interest of a strong union to hinder entrance and thus the strong union will set a wage lower than the entry deterrence wage and is thus an "efficiency enhancing countervailing power".

Bastos, Monteiro, and Straume (2008) partly deal with minimum wages but focus on industries with heterogeneous firms. Two firms compete in an industry; both are unionized and have a heterogeneous productivity. Different than before, one central union sets one "industrial minimum wage" binding for both firms in a first stage. Afterwards, in a second stage, firm specific "fair wages" are determined. By assumption, these wages are given by the weighted average of the minimum wage and the firm's revenue per worker. Again, firms choose quantities and thus employment in the product market. The main finding is that the level of a minimum wage is negatively correlated with heterogeneity in that industry. In contrast, the wage cushion (i.e., the level the actual wage paid exceeds the minimum wage) is positively correlated with heterogeneity. Stated differently, with a higher heterogeneity minimum wages are lower since the union tries to preclude job losses in the less productive firm. Additionally, with heterogeneous firms, the average wage cushion is higher since the lower minimum wages leave room to extract rents in the more productive firm with higher firms' revenue per worker. However, with an increase in firm heterogeneity the first effect of lower minimum wages dominates the effect of higher average wage cushion and thus on average workers in a more heterogeneous industry get lower wages.

9 Incomplete Information—Strikes

Incomplete information in a unionized oligopoly receives little attention. An exception are Mauleon and Vannetelbosch, who, in a sequence of papers, focus on the impact of incomplete information between unions and firms on the emergence and duration of strikes and thus equilibrium wages. In addition, Pal and Saha (2006) deals with incomplete information and the entry decision of firms. However, I present this paper together with other papers concerning entry in section 10.2.

In the articles of Mauleon and Vannetelbosch, the level of impatience of firms and union is unknown and therefore is modeled as the discount factor of unions and firms. Negotiations are assumed to be like in the Rubinstein (1982) model of offers and counteroffers. Negotiation strengths of firms and unions depends on their impatience. As long as both parties have not agreed to accept an offer, workers are on strike. Since each party only knows its own impatience and not the impatience of the other negotiation party, the strike, or more precisely each bargaining round, reveals information over the other parties' impatience. Thus, a strike can be a rational strategy to gain information: the incompleteness of information is reduced in each round and finally an agreement is reached. As a basis for the publication of Mauleon and Vannetelbosch serves Cheung and Davidson (1991) who first model strikes, or ongoing bargaining as a way of information transfer. In their model, firms do not know the preferences of the unions during wage negotiations. Thus, with each negotiation round, unions reveal some parts of their payoff function. The main finding of Cheung and Davidson is that with central unions, strikes are more likely than with decentral unions. The idea is simply to understand with a two period model. The firm makes an offer to the union, and if the union accepts the offer, this wage is paid in both periods and no strike occurs. However, if the union rejects the offer, the firm can make another offer in the next period and there is no production in the first period. The authors show that it can be beneficial for a union to reject a first period offer that is higher than its default utility level, which is unknown to the firm. The union therewith sends a signal to the firm to be strong. However, the firm will increase the offer to balance the cost of a strike in the next period and the costs of higher wages. With central negotiations, the firm does not only learn something during the own negotiations with the union, but also during the negotiations with the union and the other firm. Thus, the union has an incentive to reject more offers to pretend to be strong when it negotiates with two firms. However, the model of Cheung and Davidson is not a unionized oligopoly model since products are sold on different markets.

Vannetelbosch (1997) extends the paper of Cheung and Davidson to a unionized oligopoly. Additionally, he assumes that not only firms can make wage offers, but also unions. Information asymmetries encompass the impatience of the other party and therefore its bargaining strength. It is assumed that a more impatient party is weaker and a strike harms this party more. The longer the unions and firms negotiate, the more they know about the impatience of the other party, they "learn" during negotiations. Vannetelbosch compares a central wage negotiated on industry level as well as decentral, firm specific wages. The level of information incompleteness and number of firms in the industry causes that decentral wages can be higher than central wages. But in addition, inefficiencies (i.e., the strike activity) is higher with industry bargaining.

In the following papers Mauleon and Vannetelbosch extend this basic model. In Mauleon and Vannetelbosch (1999), they examine whether the adoption of profit sharing schemes, which aligns the interests of workers and firms, leads to less strikes. They conclude that with firm specific negotiations and more than two firms in the industry, the strike activity is lower with profit–sharing. Nevertheless, with central negotiations the opposite in true.

The stability of their previous models is tested in Mauleon and Vannetelbosch (2003b). They show that differentiated products or competition in Cournot and Bertrand fashion does not have

any impact on the outcomes with industry wages. With decentral negotiations and with more differentiated products, the wage level increases as well as the number of strikes. Additionally, fewer strikes appear with Bertrand than with Cournot competition.

Finally, they shed light on the question whether an international Unionized oligopoly is influenced through information asymmetries. In Mauleon and Vannetelbosch (2005) a two–country model with separated product markets is investigated. At the outset reciprocal trade takes place and they examine a further market integration. When tariffs are high, a further integration lowers wages. However, when tariffs are rather low, a further integration increases wages, very similar to the findings of Naylor (1998). Mauleon and Vannetelbosch show that this result is independent of complete as well as incomplete information. Comparing the situation with two separated markets and one fully integrated one, they find with incomplete information, contrarily to complete information, wages in a fully integrated market need not be lower than with a separate market. Also the maximum real delay time in reaching an agreement is ambiguous. Intuitively, one would assume that with a higher market integration strikes harm firms and unions more due to the higher competition. However, since open markets raise the potential payoffs for the union and the firm and expanding the payoff set, this increases the scope for delay and thus also longer strikes can appear.

10   Differences in the Product Market

In this section, models are presented that examine the effects of variations in the product market competition on unions, firms, and welfare. They examine the impact of intense competition, the choice of strategic variables, vertically or horizontally differentiated products as well as mixed oligopolies.

10.1   Intensity of Competition in the Product Market

In an early model Dobson and Waterson (1997) examine the influence of the number of firms in the downstream market, on upstream and downstream prices. An upstream supplier (here again, not explicitly named as a union) negotiates with several oligopolistic downstream firms for "wages". The downstream firms compete in Bertrand fashion and their products can be anything between being independent or perfect substitutes. They find two opposed effects. First, a reduction in the number of downstream firms, or equivalent a decrease in downstream competition improves the relative bargaining power. This is due to the fact that firms have a disagreement payoff of zero since they cannot operate without the input good but the "union" can generate positive utility in the other firms. If the number of firms decreases, the "union" suffers, and its disagreement payoff decreases. This puts downward pressure on "wages". Nevertheless, the second is a positive selling power effect, that is, fewer firms can charge higher prices. When the second effect is sufficiently high, it increases "wages" and with higher input prices and less competition in the downstream market this leads to distinctly higher product prices and lower welfare.

Naylor (2002b) establishes in his model for a bilateral duopoly (i.e., two firms in the downstream market negotiating with two unions in the upstream market) that industry profits can increase with an increased number of firms in the product market. In a standard Cournot model, the profits decrease after an entry since individual firms decrease output; nevertheless, overall output is increased. With an endogenous determination of costs, a second effect has to be considered. With decentral unions, after the entry, wages can decrease so much that this effect offsets the product market effects. For this, the union bargaining strength must be sufficiently high. Then, increased competition in the product market raises labor demand elasticity. This leads,

with high wages at the outset to a large reduction of wages. To conclude, the decline in upstream market costs can offset the increased competition in the downstream market and industry profits increase.

Naylor (2002a) extends his paper with the claim that even individual firm profits can increase with competition increased in the downstream market. With powerful unions placing sufficient weight on wages relative to employment, an increase in the number of firms can raise profits of each firm. However, assuming that firms are active in the upstream market instead of unions, which maximize profits and therefore equally weight quantities and price–mark up, then individual profits always decrease.

Also Bastos, Kreickemeier, and Wright (2007b) examine the changes in product market competition. Under the assumption that union density is not 100 percent, they establish that an increase in product market competition can raise wages. Again, Bastos et al. assume that all workers receive union wages, but only union members lay down tools during a dispute, non–unionized workers continue to work. The reasons for higher wages are straightforward: When product market competition is increased, firms' payoffs during a strike are affected. The higher union density is, the more the firm has to reduce production and thus the more the rivals will expand output during strikes. This weakened position of the firm is in the interest of unions and it can skim off a larger share of firm profits through higher wages. However, for this effect to offset the normally lower wages through a more intense product market competition, union strength has to be sufficiently low. Nevertheless, Bastos et al. find this effect of a higher wage through a reduction in strike payoffs for a rather broad class of model specifications.

Symeonidis (2008) extends the literature to two part tariffs and shows that less competition in the product market can lead to higher consumer rents and welfare. At the outset of his model he examines a duopoly with two decentral unions negotiating for a one–part tariff. He introduces a collusion parameter, which allows him to represent firms perfectly colluding to firms competing in Cournot fashion. During wage negotiations no coordination of firms is assumed. In this setting, he can reestablish the result that less competitive behavior in the product market leads to lower wages. A marginal increase in one of the wage rates harms that firm more the less the competition in the product market is and thus unions negotiate a higher wage in a Cournot duopoly than for collusive firms. Consumer surplus can be higher when the firms perfectly collude compared to Cournot duopoly outcomes when unions have a significant market power and the products are near substitutes. In this case, collusion leads to a sharp decrease in wages and therefore costs for firms and thus firms increase production. The wage reduction leads to a quantity increase that offsets the collusive quantity reduction. This result holds also true for welfare if products are close substitutes and upstream agents have bargaining power.

Furthermore, Symeonidis extends his model to two–part tariffs. Workers receive the standard fixed wages but in addition the union receives a lump–sum payment independent of the number of workers which can be understood as a non–monetary benefit such as an improvement in working conditions. Again, the wage rate decreases with more collusion in the product market, nevertheless the lump–sum part increases. Thus, since a high wage has a negative employment effect, it has a negative feedback on unions and firms. It is therefore more optimal to reduce the wage and share rents through a high lump sum. Union utility decreases with an increase in collusion, and also firm profits decrease with more collusion since unions extract the rents through the lump sum. For consumers and welfare a higher level of collusion is beneficial. This is on the contrary to a duopoly model with exogenous costs. There, unions and firms benefit from a decrease in competition and consumers as well as welfare suffers. Symeonidis establishes the opposite in his model with two–part tariffs and endogenous costs.

10.2 Entry

Mukherjee, Broll, and Mukherjee (2008) focus on the incentives of a monopolist to license proprietary technology causing entry. Normally, it is assumed that a monopolist increases competition in the product market and thus weakens its own position if the firm would license its products. However, with unions in the upstream market influencing the costs, more competition can lead to lower wages in the upstream market. Indeed, it can be profit enhancing for a monopolist to license the product to a second firm. With a proper combination of up–front fixed–fee and output royalty the firm can increase profits with licensing. This result is stable for different union organization and negotiation levels. The highest profits occur with a central union setting central wages for both firms, but also with a central union and decentral wage setting. Qualitative results also hold for decentral unions. Additionally, the model is robust concerning price and quantity competition in the product market.

The repercussions of a limited number of qualified workers in an industry with entry are in the focus of Majumdar and Saha (1998). All workers are employed by a monopolist and receive union wages. The authors examine market entry of a competitor who also needs workers as an input. It is assumed that the entrant firm is not unionized and competes with the former monopolist in Cournot fashion. Due to the labor shortage, the entrant needs to attract workers from the incumbent with higher wages, that is they have to match the union wage paid by the incumbent firm and compensate the workers for the switching costs occurring with a change of the employer. Additionally, it is assumed that the incumbent cannot lay–off workers after the market entry of its competitor since all jobs are protected by law. Majumdar and Saha find that union wages decrease—compared to the monopoly case—but wages for workers in the new firm exceed the former monopoly union wage because the entrant has to attract the new workers. The higher competition in the product market thus reduces union wages.

When union power increases, this raises wages for the incumbent, and counterintuitively also the output of the incumbent. This is due to the fact that because of job security, the incumbent's quantity is not directly influenced by its own wage cost. Instead, an increase in union wages for the incumbent leads to an entrant who has to pay higher wages to attract new workers. Since production of the entrant directly depends on its own wages, the entrant will reduce output and thus this has a positive influence on incumbents quantities and increase industry output as well.

With the focus on entry with information asymmetries, Pal and Saha (2006) assume that a potential entrant in the product market is uninformed about the market demand, more precisely about the intersection of a linear demand function which can take two values: high or low. The entrant can use the wage rate chosen by the union as a signal to deduct market demand. Consequently, the union can strategically set the wage to deter or to accommodate entry. Unions mostly are ambivalent about entry. Entry results in more competition in the product market which lowers the rents firms earn and thus the union can extract. Nevertheless, with more competition, production increases and thus the number of potential union members. The authors distinguish two cases: in the first case, the union is averse to entry, in the second case the union favors entry. Irrespective of her preferences, the union always has to keep in mind that wage choice has two effects working in opposed directions. Setting a low wage signals low demand to the potential entrant and this deters entry. Nevertheless, with low wages, costs for the entrant are lower and thus makes entry more preferable and the product market more competitive. So, when the unions want to strategically influence the entry decision, it has to keep in mind, that through the signaling effect it sends information to the entrant but also lower wages influence product market competition. In general, Pal and Saha conclude that wages tend to be lower when union objective is entry deterrence and that higher wages occur when the union wants accommodation. Finally, the paper emphasizes that unions do have a severe influence on the

product market decision, especially when the information effect dominates the competition effect and thus union behavior should not be viewed as merely redistributive.

10.3 Bertrand vs. Cournot competition

In the standard oligopoly literature it is claimed that Bertrand competition results in lower profits for firms compared to Cournot competition with products being imperfect substitutes (see for example Singh and Vives (1984)). López and Naylor (2004) shed light on the question whether this result can be confirmed in a duopoly with endogenous costs. With a strong, wage oriented union Bertrand competition can be in the interest of a firm. Profits under Bertrand as well as Cournot competition decrease with a unit increase of wages. But the reason why firms sometime prefer Bertrand is that for any given level of wages, Cournot equilibrium profits decrease more steeply in wages than do Bertrand equilibrium profits. Nevertheless, the authors show that relative union strength has to be higher than 0.91 to find the higher profits with Bertrand competition, which never could be estimated in empirical studies.

Correa López (2007) examines the incentives of firms to choose prices or quantities as strategic variables. To do this, she extends Singh and Vives (1984) to a duopoly with an upstream market. The key note of Singh and Vives was that firms prefer to choose Cournot instead of Bertrand competition with substitutable products. However, under consideration of an upstream market with a decentral union structure, Correa López finds that for a range of labor and product market characteristics—distribution of bargaining power and unions relative preferences over wages—firms prefer Bertrand competition. Nevertheless, with central negotiations the standard prediction holds. In a simpler but similar paper, also Manasakis and Vlassis (2006) established some of the results of Correa López (2007).

10.4 Mixed Oligopoly

In the literature on mixed oligopolies, profit–maximizing firms compete with firms aiming on the maximization of something different from profits. Mostly, it is assumed that some competitors are public firms, maximizing for example welfare or consumer surplus. Since it is a prevalent finding in many countries that especially public firms are unionized, also some publication focus on the influence of unions on mixed oligopolies.

De Fraja (1993b) examines a mixed duopoly with two firms, both unionized, competing in one market. The public firm focuses on welfare maximization, the private maximizes profits. Both firms and the two decentral unions negotiate for wages; output is set by the firms. With one public and one private enterprise he shows that the public firm pays a higher wage rate than the private rival. The explanation for this is as follows: For a given wage, a small increase in the wage changes the payoff of the public firm (i.e., welfare) in the following way: First, it decreases own profits and consumer rents through higher prices. Second, the other firm's profits increase as well as union utility. The latter effect (i.e., increased profits of the competitor and the higher union utility) at least partly offset the negative effects of an increase in wages. A private firm only consider the negative effect of higher wages on own profits and thus, no positive effects arise. Thus, the private firm negotiates lower wages since higher wages harm the profits of the private firm more than the welfare objective of the public. Nevertheless, after a privatization of the public firm, wages of the former public firm can increase or decrease, but wages of the private one always increase after a privatization since competition is reduced. The not privatized public firm produced more than two Cournot oligopolists and thus competition was more intense before the liberalization and thus prices are higher afterwards.

Also Ishida and Matsushima (2006) build a unionized mixed duopoly, but they focus on

wage regulation of public workers. This reflects the situation of some countries, (i.e., Japan and US) were public workers are tightly regulated in their rights to negotiate wages. The welfare effect of this regulation is central in the paper. In the model, one private firm maximizes profits choosing quantities in the product markets and wages are endogenously set by a decentral union. The public firm maximizes welfare. However, wage setting is assumed to be either by another firm specific union or, if wages are regulated, they are a weighted average of wages in the other firm and an exogenous average wage for the entire private sector. By assumption, the wage for the entire private sector is always lower than the wage the private union sets. Thus, with regulated wages, the wage the public firm has to pay is always lower than wages in the private one. Which of these two wage setting regimes is welfare enhancing is ambiguous. Unexceptional, the regime is preferred which leads to lower wages. However, three effects, one direct and two indirect effects, have an impact on wage levels: First, with wages being regulated, an exogenous gap is on public wages. Thus, if costs are lower, the public firm competes more fiercely in the product market. Second, the regulated wage gives a cost advantage to the public firm and thus leads private unions to lower wages, to keep the private firm competitive. Again, this intensifies product market competition. Additionally, the private union knows that wages for public workers are directly linked with the wages the private union sets and thus the union can strategically influence public wages. Hence, labor market competition is less intense with wage regulation. Overall welfare effects are not obvious. Whether the more intense product market competition or the lower labor market competition predominates crucially depends on the degree of product differentiation. Unambiguously, the model shows that the private union suffers from wage regulation, and the public union can benefit. Without a regulation, the public union is more aggressive than the private one and sets higher wages since the output of the public firm is also higher. This can lead to an inefficient low level of employment. Without the right to set wages, the workers in the public firm can benefit since they do not demand inappropriately high wages.

Although it is not a mixed oligopoly model, Haskel and Szymanski (1992) is very related to the competition between pubic and private firm. Haskel and Szymanski focus on the privatization of a public unionized firm to a unionized oligopoly. The objective of the public firm is to maximize a weighted combination of the interest of consumers and producers (i.e., unions and firms). The objective of the private firms after the privatization is to maximize profits. Also different are the budget constraint for the public and private firms. While the private firms are constraint by the threat of bankruptcy, the budget constrained for the public firm is looser; it can make a loss in equilibrium. The authors find that the objective to maximize welfare is better achieved with private firms than with a welfare maximizing monopolist. With public ownership, output and wages are relatively high. Unions can extract a high wage since the objective of a public firm during the negotiations with the union is a weighted sum of consumer surplus and firm as well as union profits and this increases wages. However, these high wages lead to losses in the public sector. With private firms and the threat of bankruptcy wages are lower and with some competition in the product market, the private ownership leads to higher welfare. Nevertheless, this result is driven by higher firm rents. Employment and wages are lower, and even prices are higher in a private sector. Thus, unions, workers, and consumers suffer after the privatization.

Grönblom and Willner (2008) analyze privatization and liberalization and also find that they do not always increase welfare when firms are unionized. At the outset, one unionized welfare maximizing firm sets the output. After liberalization and privatization, a Cournot oligopoly with profit maximizing unionized firms arises. The welfare implications for liberalization and privatization with decentral wage negotiations are, that welfare only increases if the output increases. This is not necessarily the case, since the welfare maximizing monopolist has an incentive to set a higher quantity than a profit maximizing monopolist. Thus, generally speaking

the liberalization and privatization only increases welfare for a high number of firms or weak workers. When the authors allow for market entry with fixed costs in the liberalized market, in most cases liberalization reduce welfare unless the market is extremely fragmented or the employees very weak. With central negotiations, that is wage negotiations between one central union and one employers' association, liberalization always reduces welfare since output never increases.

In a nutshell, the publications of unionized mixed oligopolies show that liberalization of the industry not always lead to lower prices and higher welfare. Instead, since unions are active and try to extract rents, after liberalization prices increase, thus consumer rents and in some models also welfare are lower.

10.5 Horizontal and Vertical Differentiation

In his paper Grandner (2007) examines the location of two firms on a Hotelling line. He extends the model of Economides (1986) in which two firms with a general cost function choose location on a Hotelling line. Economides (1986) derived regions in his paper, where pure strategy price equilibria exist, of which some are maximum differentiation, while some other equilibria are not maximum differentiation. However, minimum differentiation is never an equilibrium. Grandner assumes in a second stage that two firm specific unions negotiate with firms over wages. Hence, wages are endogenous. Finally, in the third stage, firms choose prices simultaneously. With endogenous labor costs and a union not being a wage setter or having a negotiation strength of zero, he shows that the optimal location is always nearer to the extreme points, that is products are more differentiated compared to exogenous costs in Economides (1986).

Bacchiega (2008) focuses on vertical instead of horizontal differentiation. In his model two firms compete in an industry and can produce a low or a high quality good. For the production of a high quality product, one unit of a high skilled worker is needed. The production of low quality goods only needs unskilled workers and it is assumed that low skilled workers are not organized, thus they only receive their reservation wage. Instead, the high skilled workers are organized in a union and can extra rents due to their negotiation power. The author shows that in equilibrium one firm produces only the high quality good while the other produces the low quality good and both earn positive profits. Unsurprisingly, the profit of the high quality firm is lower with more competition in the product market. The low quality generates high profits if union strength is high, that is if its competitor has to pay higher wages. It can be shown that for a relative union bargaining strength lower than firm strength the high quality firm generates higher profits, while for a union bargaining strength higher, the low quality firm receives higher profits. From a welfare point of view, welfare decreases with an increase in union strength. Thus, if a social planer would aim to maximize social rents, it would try to minimize the weight attributed to union strength. However, there is a long–term trade–off to the incentives to invest in skills. If skilled workers only receive the reservation payoff, no one would invest in training and thus in the long run this would lead to a disadvantageous result due to a lack of skilled worker in the industry.

In a discussion paper Bacchiega (2004) extends his findings to trade liberalization. He assumes that in the domestic country two firms are active, equal to his previous model. In addition, he examines also a second country. In this only the low quality product is produced by low skilled worker within a competitive industry. Free trade between the countries leads to a market expansion effect and to a competitive effect. The first is positive for firms. Additionally, competition is increased and this harms especially the low quality firm in the home country, but also the high quality firm since the competition for the low quality becomes more intense. Therefore, the domestic low quality firm looses from the liberalization, the high cost firm benefits if the market

expansion effect is high enough. The same is true for the skilled worker as well as home welfare. To sum it up, Bacchiega finds that with a small market size in the foreign country all domestic agents loose with trade liberalization. With market size increasing, first, the welfare maximizing Government is willing to accept trade since consumers gain, but unions and firms suffer. Finally, with a further increase in size, a high quality firm and than the union agree to liberalization. Since the low cost producer always suffers, it never benefits from liberalization.

11 Incentive Contracts

In most unionized oligopoly papers, firms and unions negotiate over a fixed remuneration scheme. Bensaïd and Gary-Bobo (1991) extend the literature by examining profit–sharing schemes. In their model, profit sharing does not induce any differences in the workers' behavior, and only strategic inter–firm effects are taken into consideration. Firms offer unions a take–it–or–leave–it contract. This remuneration scheme has a fixed and a variable part and both are chosen by the firms. Decentral unions can than accept or refuse the offer. If they refuse it, workers receive the reservation wage of the industry. Bensaïd and Gary-Bobo find that firms and unions agree on profit sharing schemes. In equilibrium, the offer includes a fixed wage lower than the reservation wage, leading to lower marginal costs for firms. If only one firm–union pair agrees on profit–sharing this leads to a competitive advantage for this firm in the product market. For the other firms, the best reaction to a profit–sharing strategy of their competitor is to also introduce profit sharing. Thus, in equilibrium all firm adopt profit sharing remuneration schemes. Nevertheless, this is a prisoners' dilemma for firms. It would be in the interest of the industry to pay the fixed reservation wage, but all firms have an individual advantage to shift to profit sharing since production is higher. The overall intensified competition in the product market is to the disadvantage of all firms. For workers and welfare the situation is the other way around. Workers accept lower fixed wages and benefit through the sharing parameter. Also welfare is higher since prices are lower.

In this line, also Sørensen (1992) builds a duopoly model in which the unions and the firms can negotiate for a profit sharing scheme. In his paper, no take–it–or–leave–it contract is modeled; instead the fixed as well as the variable part of the remuneration are scopes of bargaining. He finds profit sharing profitable for firms as long as the union is not too powerful. Again, unions always benefit from the introduction of profit sharing schemes and also welfare is always higher with profit sharing.

Not only workers can receive a variable remuneration contract, it is also common for managers. As agents of the owners of the firm, they take part in the wage negotiations with unions. Hence, it can be profit enhancing for the owners to create an incentive contract for managers paying more attention to sales or profits. Therefore, Szymanski (1994) extends the model of strategic delegation of Fershtman and Judd (1987) and Vickers (1985) to a model with endogenous cost. In the seminal paper of Fershtman and Judd, owners of a company choose incentive contracts for the managers. The aim of the owners is to maximize profits, while managers instead maximize their own incomes. Owners can set a remuneration contract for managers to let them pay more attention to sales or profits. In equilibrium, Fershtman and Judd as well as Vickers show that it is optimal for owners to set a higher weight on sales than on profits. Nevertheless, these models disregard that managers also have an influence on costs. This is explicitly modeled in Szymanski (1994). He assumes that managers in the duopoly negotiate with two firm–specific unions for wages. The game therefore is as follows. In the first stage, owners of the firm choose incentive contracts for the managers. In the second, the managers negotiate with unions for wages. Finally, the two managers choose output in the product market. It is "trivial to show", as Szymanski

states, that owners will set more weight on profits than on sales when costs are a decreasing linear function of the weight the manager sets on profits. Indeed, it can happen that the weight the managers set on cost control exceeds the one of a profit maximizer. The focus of the paper is to examine an increase in union bargaining strength. This increased union power raises wages and prices, reduces output and also the rent a union can extract is increased. Surprisingly, the author shows that an increase in union power can lead to higher profits of owners. As long as unions only care about wages the output reduction effect of their wage demand is high. Thus, owners benefit from the reduced output since it leads to a more collusive quantity in the product market and this can increase profits.

Related to the previous paper, also Chatterjee and Saha (2005) examine incentive contracts for managers in a unionized oligopoly. The owners of a firm can set incentive remuneration schemes for managers to place more value on profits or sales. The managers than negotiate with unions for wages and during these negotiations managers as well as unions maximize their utility. The owners choose the manager contract to maximize their own profits.

In the literature on management incentive contracts in non–unionized Cournot oligopolies, a strict preference of owners for sales–emphasized contracts is predominant. However, Chatterjee and Saha show that in a unionized oligopoly two strategies can be profit enhancing for owners. They have to balance the advantages of profit orientation to reduce wages, and of sales orientation to gain in output competition. Thus, when they give less weight to sales (in the extreme case also a negative one) this is on the one hand negative since it weakens the position in the product market. On the other hand, wages the firm has to pay to workers are also reduced since managers are interested in higher profits and strongly negotiate for lower wages. For the owners the strategy is profit increasing as long as the wage saving effect predominates the output shrinking effect. If the manager contracts emphasis sales more, output in the product market is increased, however, union wages and thus costs also increase.

Which of these strategies is in the interest of the owners depends on union strength. For strong unions an emphasis on profit–sharing is welfare enhancing, but for weak union the managerial economics literature in non–unionized oligopolies is confirmed that manager–contracts should focus on sales.

Aidt and Sena (2005) do not assume like all other unionized oligopoly models, that the only aim of unions is to extract rents. Building on Freeman and Medoff (1984), they assume that unions also create rents by training the worker leading to a higher productivity or adopt a higher efficiency in the firms' organization. This is adopted in their model: unions can choose whether they invest resources in rent creation or in rent extraction. With rent extraction, the negotiation strength of the unions increases, with rent creation, workers become more productive. The game is as follows. In the first stage, unions decide to invest in rent creation or extraction. Afterwards, firms and unions negotiate over wages, and finally firms set quantities. As union structure, decentral firm specific unions are modeled. Another assumption driving the results is that demand elasticity is constant. Without this assumption, for example with a linear demand, results would chance. However, with constant demand elasticity, unions have to balance two effects: When the union invests in rent creation, thus increasing productivity of workers, and with a constant wage, more workers are employed. However, with this happening, the union lacks resources to invest in rent extraction, which reduces wages. When the union invests in rent extraction, nevertheless, this reduces employment without any investments in productivity. Thus, in equilibrium the union invests some of her rents in rent creation and some in rent extraction.

Additionally, Aidt and Sena examine the impact of an increase in the product market competition on the distribution of union resources in extraction and creation. They claim that unions increase the share of resources devoted to rent creation with more product market competition.

The workers benefit by a higher job security and thus accept lower wages. The authors argue here, that unions maximize the cake they and the firms create instead of maximizing the rents they extract. Also an increased labor market liberalization in modeled through a decrease of the exogenously assumed part of union strength. With a reduction of this part, unions will invest more in rent extraction than in creation to reach their former negotiation strength. This is disadvantageous for the firms since the cake is reduced.

12   General Equilibrium

Two papers extend the previous industry models to country models. They assume that each country consists of different industries and in each industry some firms compete and thus have market power. They also examine market power in the upstream market (i.e., unionized industries). Dube and Reddy (2006) examine trade liberalization and find that an increase in international competition reduces wages and a race–to–the–bottom occurs. Due to the lower costs for firms, it can therefore happen that firm profits increase after the liberalization.

More generally, Correa López (2006) examines union influence on a general equilibrium unionized oligopoly model. In her article with multiple results she shows that lots of results depend on the ability of firms to increase prices after a wage increase. This also drives employment altering. If firms can increase prices, employment is higher and also the level of wages highly depends on product market characteristics.

13   Conclusion

To put it in a nutshell, the findings of the unionized oligopoly literature are diverse and often unexpected, especially for orthodox economists: tariffs, quotas, and export subsidies can enhance domestic welfare[3], and, in addition, lower tariffs can lead to higher wages. Sometimes unionized countries have a strategic competitive advantage compared to countries with competitive labor markets. The often appreciated inward FDIs can harm domestic welfare, in contrast outward FDIs can, unexpectedly, increase domestic wages. Furthermore, increased union strength can lead to higher profits for firm owners, and even welfare is sometimes positively correlated with union strength. The positive effects of trade liberalization and privatization can be offset with unions so that a country may suffer lower welfare after liberalization and privatization. The impact of unions on innovations is not unambiguous in the unionized oligopoly literature, it is shown that monopolists can have an incentive to license a superior technology to another firm and, thus, induce competition within a unionized oligopolies. Finally, the incentives to invest in education can also be higher with unions than without.

References

Aidt, T. S. and V. Sena (2005). Unions: Rent creators or extractors? *Scandinavian Journal of Economics 107*(1), 103–121.

Bacchiega, E. (2004). Vertical differentiation, wage bargaining and intra-industry trade liberalization. SSRN discussion paper.

Bacchiega, E. (2008). Wage bargaining and vertical differentiation. *International Review of Economics 54*(1), 35–52.

---

[3]This was also established for non-unionized oligopolies.

Bandyopadhyay, S. and S. C. Bandyopadhyay (1999). Unionization and international market share rivalry: A paradox. *Review of International Economics 7*(1), 153–161.

Bandyopadhyay, S. and S. C. Bandyopadhyay (2001). Efficient bargaining, welfare, and strategic export policy. *Journal of International Trade & Economic Development 10*(2), 133–149.

Bandyopadhyay, S., S. C. Bandyopadhyay, and E.-S. Park (2000). Unionized Bertrand duopoly and strategic export policy. *Review of International Economics 8*(1), 164–174.

Banerjee, S. and P. Lin (2003). Downstream R&D, raising rivals' costs, and input price contracts. *International Journal of Industrial Organization 21*(1), 79–96.

Bastos, P., U. Kreickemeier, and P. Wright (2007a). Open shop unions and international trade liberalisation. University of Nottingham: Research Paper Series: Globalisation and Labour Markets 2007/30.

Bastos, P., U. Kreickemeier, and P. Wright (2007b). Open shop unions and product market competition. SSRN Discussion Paper.

Bastos, P., N. P. Monteiro, and O. R. Straume (2008). Firm heterogeneity and wages in unionised labour markets: Theory and evidence. NIPE Working Paper 14.

Bensaïd, B. and R. J. Gary-Bobo (1991). Negotiation of profit-sharing contracts in industry. *European Economic Review 35*(5), 1069–1085.

Brander, J. A. and B. J. Spencer (1984). Tariff protection and imperfect competition. In H. Kierzkowski (Ed.), *Monopolistic competition and international trade*, pp. 194–206. Oxford: Oxford University Press.

Brander, J. A. and B. J. Spencer (1985). Export subsidies and international market share rivalry. *Journal of International Economics 18*(1-2), 83–100.

Brander, J. A. and B. J. Spencer (1988). Unionized oligopoly and international trade policy. *Journal of International Economics 24*(3-4), 217–234.

Brekke, K. R. (2004). Competition or coordination in hospital markets with unionised labour. *International Journal of Health Care Finance and Economics 4*(1), 65–89.

Bughin, J. (1995). Bargaining over employment as a firm strategic choice. *Review of Industrial Organization 10*, 723–735.

Bughin, J. (1996). Trade unions and firms' product market power. *The Journal of Industrial Economics 44*(3), 289–307.

Bughin, J. and S. Vannini (1995). Stretegic direct investment under unionized oligopoly. *International Journal of Industrial Organization 13*(1), 127–145.

Bughin, J. and S. Vannini (2003). Unions and the welfare impact of foreign direct investment— A wisdom extension. *Labour 17*(2), 158–198.

Bulow, J. I., J. D. Geanakoplos, and P. D. Klemperer (1985). Multimarket oligopoly: Strategic substitutes and complements. *Journal of Political Economy 93*(3), 488–511.

Bárcena-Ruiz, J. C. (2003). Politically preferred wage bargaining structures. *European Journal of Political Economy 19*(2), 341–353.

Bárcena-Ruiz, J. C. and M. L. Campo Corredera (2000). Short-term or long-term labor contracts. *Labour Economics 7*(3), 249–260.

Bárcena-Ruiz, J. C. and M. L. Campo Corredera (2003). Timing of wage setting when firms invest in R&D. Working Paper Biltoki DT2003.14.

Calabuig, V. and M. Gonzalez-Maestre (2002). Union structure and incentives for innovation. *European Journal of Political Economy 18*(1), 177–192.

Calmfors, L. and J. Driffill (1988). Bargaining structure, corporatism and macroeconomic performance. *Economic Policy 3*(1), 13–61.

Campbell, N. and N. Vousden (2000). Import competition and worker productivity in unionized firms. *Review of International Economics 8*(2), 193–207.

Chang, S.-H. (2005). Upstream mergers, downstream mergers, and unionized oligopoly. *The American Economist 49*(2), 67–74.

Chatterjee, I. and B. C. Saha (2005). Wage bargaining and managerial incentives. SSRN Discussion paper.

Cheung, F. K. and C. Davidson (1991). Bargaining structure and strike activity. *Canadian Journal of Economics 24*(2), 345–371.

Corneo, G. (1995). National wage bargaining in an internationally integrated product market. *European Journal of Political Economy 11*(3), 503–520.

Correa López, M. (2006). A model of unionized oligopoly in general equilibrium. The University of Manchester Economics Discussion Paper EDP-0605.

Correa López, M. (2007). Price and quantity competition in a differentiated duopoly with upstream suppliers. *Journal of Economics & Management Strategy 16*(2), 469–505.

Davidson, C. (1988). Multiunit bargaining in oligopolistic industries. *Journal of Labor Economics 6*(3), 397–422.

De Fraja, G. (1993a). Staggered vs. synchronised wage setting in oligopoly. *European Economic Review 37*(8), 1507–1522.

De Fraja, G. (1993b). Unions and wages in public and private firms: A game-theoretic analysis. *Oxford Economic Papers 45*, 457–469.

Dhillon, A. and E. Petrakis (2002). A generalised wage rigidity result. *International Journal of Industrial Organization 20*(3), 285–311.

Dobson, P. W. (1994). Multifirm unions and the incentive to adopt pattern bargaining in oligopoly. *European Economic Review 38*(1), 87–100.

Dobson, P. W. (1997). Union-firm interaction and the right to manage. *Bulletin of Economic Research 49*(3), 213–229.

Dobson, P. W. and M. Waterson (1997). Countervailing power and consumer prices. *The Economic Journal 107*, 418–430.

Dowrick, S. (1989). Union-oligopoly bargaining. *The Economic Journal 99*(398), 1123–1142.

Dowrick, S. (1993). Enterprise bargaining, union structure and wages. *The Economic Record 69*(207), 393–404.

Dowrick, S. and B. J. Spencer (1994). Union attitudes to labor-saving innovation: When are unions luddites? *Journal of Labor Economics 12*(2), 316–344.

Dreher, A. and N. Gaston (2007). Has globalisation really had no effect on unions? *Kyklos 60*(2), 165–186.

Dreze, J. H. and F. Modigliani (1981). The trade-off between real wages and employment in an open economy (Belgium). *European Economic Review 15*(1), 1–40.

Dube, A. and S. Reddy (2006). Threat effects and trade: Wage discipline through product market competition. SSRN Discussion paper.

Dunlop, J. T. (1944). *Wage determination under trade unions*. Basingstoke: Macmillian.

Economides, N. (1986). Minimal and maximal product differentiation in Hotelling's duopoly. *Economics Letters 21*, 67–71.

Fershtman, C. and K. L. Judd (1987). Equilibrium incentives in oligopoly. *American Economic Review 77*(5), 927–940.

Fisher, T. C. G. and D. J. Wright (1999). Unionized oligopoly and trade liberalization. *Canadian Journal of Economics 32*(3), 799–816.

Freeman, R. and J. Medoff (1984). *What Do Unions Do?* New York: Basic Books.

Fuller, D. and D. Geide-Stevenson (2003). Consensus among economists: Revisited. *Journal of Economic Education 34*(4), 369–387.

Gaston, N. and D. Trefler (1995). Union wage sensitivity to trade and protection: Theory and evidence. *Journal of International Economics 39*(1-2), 1–25.

Geary, R. C. (1950). A note on "A constant-utility index of the cost of living". *Review of Economic Studies 18*(1), 65–66.

Glass, A. J. and J. Saggi (2005). Exporting versus direct investment under local sourcing. *Review of World Economics 141*(4), 627–647.

Grandner, T. (2001). Unions in oligopolistic, vertically connected industries. *European Economic Review 45*(9), 1723–1740.

Grandner, T. (2007). Product differentiation in a linear city and wage bargaining. Working Paper No. 109, Vienna University Working Paper Series.

Grout, P. A. (1984). Investment and wages in the absence of binding contracts: A Nash Bargaining approach. *Econometrica 52*(2), 449–460.

Grönblom, S. and J. Willner (2008). Privatization and liberalization: Costs and benefits in the presence of wage-bargaining. *Annals of Public and Cooperative Economics 79*(1), 133–160.

Gürtzgen, N. (2002). Trade liberalization and union wages in a differentiated Bertrand duopoly. *Open Economies Review 13*(2), 133–151.

Gürtzgen, N. (2003). Revisting the impact of union structures on wages: Integrating different dimensions of centralisation. *Labour 17*(4), 519–542.

Haskel, J. and S. Szymanski (1992). A bargaining theory of privatisation. *Annals of Public and Cooperative Economics 63*(2), 207–227.

Haucap, J., U. Pauly, and C. Wey (2001). Collective wage setting when wages are generally binding: An antitrust perspective. *International Review of Law and Economics 21*(2), 287–307.

Haucap, J. and C. Wey (2004). Unionisation structures and innovation incentives. *The Economic Journal 114*(494), 149–165.

Haufler, A. and F. Mittermaier (2008). Unionisation triggers tax incentives to attract foreign direct investment. CESifo Working Paper No. 2312.

Horn, H. and A. Wolinsky (1988). Bilateral monopolies and incentives for merger. *RAND Journal of Economics 19*(3), 408–419.

Huizinga, H. (1993). International market integration and union wage bargaining. *Scandinavian Journal of Economics 95*(2), 249–255.

Ishida, J. and N. Matsushima (2005). FDI may help rival firms. *Economics Bulletin 6*(22), 1–8.

Ishida, J. and N. Matsushima (2006). Should civil servants be resticted in wage bargaining? A mixed-duopoly approach. Kobe University Discussion Paper.

Ishida, J. and N. Matsushima (2008). Outward foreign direct investment in unionized oligopoly: Welfare and policy implications. OSSIPP Discussion Paper DP-2008-E-005.

Keefe, J. H. (1992). Do unions hinder technological change? In L. Mishel and P. B. Voos (Eds.), *Unions and Economic Competitiveness.* Armonk, New York: M.E. Sharpe, Inc.

Kikuchi, T. and J. A. Amegashie (2003). Trade liberalisation and labor unions. *Open Economies Review 14*(1), 5–9.

Leahy, D. and C. Montagna (2000). Unionisation and foreign direct investment: Challenging conventional wisdom. *The Economic Journal 110*(462), C80–C92.

Leahy, D. and C. Montagna (2005). Union legislation and export platform FDI. *Journal of International Trade & Economic Development 14*, 437–452.

Lingens, J. (2006). Union wage bargaining and the incentive to innovate. Discussion Paper University of Regensburg.

Lommerud, K. E., F. Meland, and L. Sørgard (2003). Unionised oligopoly, trade liberalisation, and location choice. *The Economic Journal 113*, 782–800.

Lommerud, K. E., F. Meland, and O. R. Straume (2006). Globalisation and union opposition to technological change. *Journal of International Economics 68*, 1–23.

Lommerud, K. E., F. Meland, and O. R. Straume (2008). Mergers and capital flight in unionised oligopolies: Is there scope for a 'national champion' policy? NIPE Working Paper 10.

Lommerud, K. E., O. R. Straume, and L. Sørgard (2005). Downstream merger with upstream market power. *European Economic Review 49*(3), 717–743.

Lommerud, K. E., O. R. Straume, and L. Sørgard (2006). National versus international mergers in unionised oligopoly. *The RAND Journal 37*(1), 212–233.

López, M. C. and R. A. Naylor (2004). The Cournot-Bertrand profit differential: A reversal result in a differentiated duopoly with wage bargaining. *European Economic Review 48*(3), 681–696.

Ma, J. (2007). Double-edged incentive competition for foreign direct investment. Peking University Guanghua School of Management Working Paper.

Ma, J. (2008). Is an export subsidy a robust trade policy recommendation towards a unionized duopoly? *Economics and Politics 20*(2), 141–155.

MacDonald, I. M. and R. M. Solow (1981). Wage bargaining and employment. *American Economic Review 71*(5), 896–909.

Majumdar, S. and B. C. Saha (1998). Job security, wage bargaining and duopoly outcomes. *The Journal of International Trade & Economic Developement 7*(4), 389–403.

Manasakis, C. and E. Petrakis (2005). Union structure and firms' incentives for cooperative R&D investments. Discussion paper University of Crete, Department of Economics 0705.

Manasakis, C. and M. Vlassis (2006). Equilibrium mode of competition in unionized oligopoly. BE.NE.TeC Working paper 2006-03.

Manasakis, C. and V. Zikos (2007). Unions' and firms' attitudes towards research joint ventures: When will the incentives be aligned. *Labour 21*(1), 135–156.

Manning, A. (1987). An integration of trade union models in a sequential bargaining framework. *Economic Journal 97*(385), 121–140.

Mauleon, A., J. Sempere-Monerris, and V. J. Vannetelbosch (2008). Networks of knowledge among unionized firms. *Canadian Journal of Economics 41*(3), 971–997.

Mauleon, A., H. Song, and V. Vanettelbosch (2006). Networks of free trade agreements among heterogeneous countries. Unpublished.

Mauleon, A. and V. Vanettelbosch (2006). Strategic union delegation and incentives for merger. *Applied Economics Letters 13*(1), 1–5.

Mauleon, A. and V. J. Vannetelbosch (1999). Profit sharing and strike activity in Cournot oligopoly. *Journal of Economics 69*(1), 19–40.

Mauleon, A. and V. J. Vannetelbosch (2003a). Efficiency wages and union-firm bargaining with private information. *Spanish Economic Review 5*(4), 307–316.

Mauleon, A. and V. J. Vannetelbosch (2003b). Market competition and strike activity. *International Journal of Industrial Organization 21*(5), 737–759.

Mauleon, A. and V. J. Vannetelbosch (2005). Market integration and strike activity. Working Paper 2005025, Université catholique de Louvain, Département des Sciences Economiques.

Menezes-Filho, N., D. Ulph, and J. van Reenen (1998a). The determination of R&D: Empirical evidence on the role of unions. *European Economic Review 42*(3-5), 919–930.

Menezes-Filho, N., D. Ulph, and J. van Reenen (1998b). R&D and unionism: Comparative evidence from British companies and establishments. *Industrial And Labor Relations Review 52*(1), 45–63.

Menezes-Filho, N. and J. van Reenen (2003). Unions and innovations: A survey of the theory and empirical evidence. In J. T. Addison and C. Schnabel (Eds.), *International Handbook of Trade Unions*, pp. 293–335. Cheltenham, UK Northampton, MA, USA: Edward Elgar.

Mezzetti, C. and E. Dinopoulos (1991). Domestic unionization and import competition. *Journal of International Economics 31*(1-2), 79–100.

Mukherjee, A. (2007). Irrelevance of productivity difference: A case with labor union. *Economic Bulletin 10*(17), 1–8.

Mukherjee, A. (2008). Unionised labour market and strategic production decision of a multinational. *The Economic Journal 118*(532), 1621–1639.

Mukherjee, A., U. Broll, and S. Mukherjee (2008). Unionized labor market and licensing by a monopolist. *Journal of Economics 93*(1), 59–79.

Mukherjee, A. and E. Pennings (2005). Unionization structure, licensing and innovation. SSRN Discussion paper.

Mukherjee, A. and K. Suetrong (2007). Unionisation structure and strategic foreign direct investment. SSRN Discussion paper.

Mukherjee, A. and L. Zhao (2007). Unionization structure and the incentives for foreign direct investment. Discussion Paper Series, No. 202, RIEB, Kobe University.

Munch, J. R. and J. R. Skaksen (2002). Product market integration and wages in unionized countries. *Scandinavian Journal of Economics 104*(2), 289–299.

Nash, J. (1950). The bargaining problem. *Econometrica 28*(2), 155–162.

Naylor, R. (2002a). The effects of entry in bilateral oligopoly. Warwick Economics Research Papers No. 638.

Naylor, R. A. (1998). International trade and economic integration when labour markets are generally unionised. *European Economic Review 42*(7), 1251–1267.

Naylor, R. A. (1999). Union wage strategies and international trade. *The Economic Journal 109*(452), 102–125.

Naylor, R. A. (2000). Trade and wages when the trade regime is determined endogenously. *Review of International Economics 8*(3), 556–565.

Naylor, R. A. (2002b). Industry profits and competition under bilateral oligopoly. *Economic Letters 77*(2), 169–175.

Naylor, R. A. (2003). Economic models of union behaviour. In J. T. Addison and C. Schnabel (Eds.), *International Handbook of Trade Unions*, Chapter 3, pp. 44–85. Cheltenham, UK Northampton, MA, USA: Edward Elgar.

Naylor, R. A. and M. Santoni (2003). Foreign direct investment and wage bargaining. *Journal of International Trade & Economic Development 12*(1), 1–18.

Nickell, S. J. and M. Andrews (1983). Unions, real wages and the employment in Britain 1951-1979. *Oxford Economic Papers 35*, 183–206. Supplement.

Oswald, A. J. (1982). The microeconomic theory of the trade union. *Economic Journal 92*(367), 576–596.

Oswald, A. J. (1985). The economic theory of trade unions: An introductory survey. *Scandinavian Journal of Economics 87*(2), 160–193.

Padilla, A. J., S. Bentolila, and J. J. Dolando (1996). Wage bargaining in industries with market power. *Journal of Economics & Management Strategy 5*(4), 535–564.

Pal, R. and B. C. Saha (2006). Wage commitment, signalling, and entry deterrence or accommodation. *Labour 20*(4), 625–650.

Petrakis, E. and M. Vlassis (1999). The strategic role of minimum sectoral wages in oligopoly: A case for the Spanish labour market. *Investigaciones Economicas XXIII*(3), 331–350.

Petrakis, E. and M. Vlassis (2000). Endogenous scope of bargaining in an union-oligopoly model: When will firms and unions bargain over employment? *Labour Economics 7*(3), 261–281.

Petrakis, E. and M. Vlassis (2003). Minimum wages in national and internationally integrated economies. *Journal of Political Modeling 25*(3), 257–265.

Petrakis, E. and M. Vlassis (2004a). Endogenous wage bargaining institutions in oligopolistic sectors. *Economic Theory 24*(1), 55–73.

Petrakis, E. and M. Vlassis (2004b). The political economy of the minimum-wage institution in an internationally integrated market. *Review of International Economics 12*(1), 27–40.

Petrakis, E. and M. Vlassis (2005). The endogenous national minimum wage institution. *Journal of Macroeconomics 27*(4), 747–762.

Piperakis, A. S., R. C. Hine, and P. W. Wright (2003). Market size and economic integration when labor markets are unionized. *Review of International Economics 11*(3), 483–494.

Reinganum, J. F. (1983). Uncertain innovation and the persistence of monopoly. *American Economic Review 73*(4), 741–748.

Rocha-Akis, S. (2006). Labour tax policies and strategic offshoring under unionised oligopoly. Vienna University, Department of Economics Working Paper Series, No.99.

Rubinstein, A. (1982). Perfect equilibrium in a bargaining model. *Econometrica 50*(1), 97–109.

Salant, S. W., S. Switzer, and R. J. Reynolds (1983). Losses from horizontal merger: The effects of an exogenous change in industry structure on Cournot-Nash equilibrium. *The Quarterly Journal of Economics 98*(2), 185–199.

Salop, S. and D. Scheffman (1983). Raising rivals' costs. *American Economic Review, Papers and Proceedings 73*, 267–271.

Salop, S. and D. Scheffman (1987). Cost-raising strategies. *Journal of Industrial Economics 36*, 19–34.

Santoni, M. (1996). Union-oligopoly sequential bargaining: Trade and industrial policies. *Oxford Economic Papers 48*(4), 640–663.

Singh, N. and X. Vives (1984). Price and quantity competition in a differentiated duopoly. *RAND Journal of Economics 15*, 546–554.

Skaksen, M. R. (2005). Should governments subsidise inward foreign direct investment? *Scandinavian Journal of Economics 107*(1), 123–140.

Sørensen, J. R. (1992). Profit-sharing in a unionized Cournot duopoly. *Journal of Economics 55*(2), 151–167.

Sørensen, J. R. (1993). Integration of product markets when labour markets are unionised. *Recherches Economiques de Louvain 59*(4), 485–502.

Stone, R. (1954). Linear expenditure systems and demand analysis: An application to the pattern of British demand. *The Economic Journal 64*, 511–527.

Straume, O. R. (2002). Union collusion and intra-industry trade. *International Journal of Industrial Organization 20*, 631–652.

Straume, O. R. (2003). International mergers and trade liberalisation: Implications for unionised labour. *International Journal of Industrial Organization 21*(5), 717–735.

Symeonidis, G. (2008). Downstream competition, bargaining, and welfare. *Journal of Economics & Management Strategy 17*(1), 247–270.

Szymanski, S. (1994). Strategic delegation with endogenous costs—A duopoly with wage bargaining. *International Journal of Industrial Organization 12*(1), 105–116.

Tauman, Y. and Y. Weiss (1987). Labor unions and the adoption of new technology. *Journal of Labor Economics 5*(4), 477–501.

Tirole, J. (1988). *The theory of Industrial organization*. Cambridge, Mass. and London: MIT Press.

Ulph, A. (1989). The incentives to make commitments in wage bargains. *Review of Economic Studies 56*(187), 449–466.

Ulph, A. and D. Ulph (1988). Bargaining structures and delay in innovations. *Scandinavian Journal of Economics 90*(4), 475–491.

Ulph, A. and D. Ulph (1989). Labor markets and innovations. *Journal of the Japanese and International Economies 3*(4), 403–423.

Ulph, A. and D. Ulph (1990). Union bargaining: A survey of recent work. In D. Sapsford and Z. Tzannatos (Eds.), *Current Issues in Labour Economics*, pp. 86–125. Basingstoke: Macmillan.

Ulph, A. and D. Ulph (1994). Labor markets and innovations—ex post bargaining. *European Economic Review 38*(1), 195–210.

Ulph, A. and D. Ulph (1998). Labour markets, bargaining, and innovation. *European Economic Review 42*(3-5), 931–939.

Ulph, A. and D. Ulph (2001). Strategic innovation with complete and incomplete labour market contracts. *Scandinavian Journal of Economics 103*(2), 265–282.

Vandenbussche, H. and D. Collie (2005). Can import tariffs deter outward FDI? *Open Economies Review 16*(4), 341–362.

Vannetelbosch, V. J. (1997). Wage bargaining with incomplete information in an unionized Cournot oligopoly. *European Journal of Political Economy 13*(2), 353–374.

Vannini, S. and J. Bughin (2000). To be (unionized) or not to be? A case for cost-raising strategies under Cournot oligopoly. *European Economic Review 44*(9), 1763–1781.

Vickers, J. (1985). Delegation and the theory of the firm. *Economic Journal 95*, 138–147. Supplement.

Yang, B. Z. (1995). Unionized oligopoly, labor-management cooperation, and international competitiveness. *Journal of Economics 62*(1), 33–53.

Zhao, L. (1995). Cross-hauling direct foreign investment and unionized oligopoly. *European Economic Review 39*(6), 1237–1253.

Zhao, L. (1998). The impact of foreign direct investment on wages and employment. *Oxford Economic Papers 50*(2), 284–301.

Zhao, L. (2001). Unionization, vertical markets, and the outsourcing of multinationals. *Journal of Internatioal Economics 55*(1), 187–202.

Zikos, V. (2007). The temporal dimension of wage contracts in oligopoly with spillovers. Department of Economics Discussion Paper Series, Loughborough University, 2007-04.