

DOES INTERNATIONAL OUTSOURCING REALLY LOWER WORKERS' INCOME?***

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Abstract:

We analyze the impact of international outsourcing on income, if the domestic labor market is imperfect, i.e. there is a bilateral bargaining between a firm and a labor union. In our analysis we distinguish between the cases where the parties negotiate over the wage only and where they negotiate over both wage and profit sharing. We find in the first case that outsourcing has an ambiguous effect on the workers' income, while it increases the workers' income in the second case. For the optimal amount of international outsourcing, we find that, depending on the wage effect of outsourcing, in a pure wage bargaining system it can be higher or lower than the level where domestic and foreign marginal labor costs are the same. In contrast, in a wage and profit share bargaining system, the amount of outsourcing lies below this level.

JEL classification: E23, E24, J23, J33, J82

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I. Introduction

Over the last years, as a result of the growing globalization, international outsourcing, which is defined as the acquisition of production parts from an independent foreign supplier, has become an important managerial tool in reorganizing a firm's production process.¹ Attended with this fact, many people fear the wide consequences for the domestic labor market, especially for ordinary workers. Due to the possibility of substitution, such consequences may be the loss of employment or a wage reduction.² In this situation, the labor market structure and the existence of a labor union with the power to avoid a wage decrease and/or to bargain with the firm over employment guarantees, play an important role.

This paper presents a theoretical framework to analyze the effects of committed international outsourcing on workers' income, if workers are represented by a labor union.³ Thus, we assume an imperfect domestic labor market, i.e. a firm and a labor union negotiate over workers' remuneration, while we distinguish between two kinds of negotiation. In the first case, we follow the classical bargaining approach where the wage alone is determined, while in the second case we assume an alternative approach where the firm and the labor union bargain over both the wage and a profit share.

Due to the actuality and importance of this topic, there is a growing amount of literature relating to the effects of outsourcing or globalization on wages. From a theoretical point of view, Danthine and Hunt (1994) show that the globalization intensifies the product market competition. As a consequence, lower profits occur, which results in wage moderation in unionized sectors. A similar finding is presented by Glass and Saggi (2001). Opposed to that, Naylor (1998, 1999) finds that domestic unionized workers may benefit from globalization in terms of higher wages and employment, since total production expands if new markets can be served by the firm. Lommerud et al. (2009) show that higher market integration favours outsourcing to low cost countries and increases the domestic wage due to less elastic labor demand. The reason is that the used inputs are complements and thus, for a given amount of outsourcing, the resulting loss of the labor union due to a higher wage decreases. However, there are also studies, such as Skaksen and Sorensen (2001) or Koskela and

¹ Empirical studies like Hummels et al. (1998, 2001) or Yeats (2001) show the increase of imported intermediate goods over the last 30 years.

² For an overview concerning the debate on employment effects due to outsourcing see Freeman (1995) and Bhagwati et al. (2004).

³ In the committed case, outsourcing takes place before wage bargaining. Thus, the external procurement is seen as a long-term contract or investment that fixes the amount of outsourcing. An overview about the relationship between outsourcing and wage bargaining is presented by Perry (1997).

Stenbacka (2009), which show that the domestic wage effect of foreign direct investments or outsourcing is a priori ambiguous. In Skaksen and Sorensen (2001), the degree of substitution between the activities in the home country and abroad is decisive for the wage effect. If the activities are good substitutes, a lower wage results and the domestic workforce loses, while a higher wage results from complementary activities and thus, the domestic workforce gains. In Koskela and Stenbacka (2009), the wage effect of outsourcing depends on the labor union's relative bargaining power, where it lowers (increases) the wage if the labor union is sufficiently strong (weak).

Empirical studies also analyze the wage effect of international outsourcing. In their study, Feenstra and Hanson (1999) show the wage reducing effect for low-skilled workers in the United States over the period 1979-1990. Senses (2010), also using U.S. data, provides empirical evidence of an increasing wage elasticity and thus for a wage moderating effect of outsourcing.⁴ Focusing on German data, Geishecker and Görg (2008) identify winners and losers from international outsourcing depending on the skills of the workers. Although the German labor market is characterized by relatively rigid wages, there may be a wage-moderating effect of outsourcing, if it improves the outside option of the firm. The authors find that this is true for low-skilled workers, who receive a lower wage with higher outsourcing, while the high-skilled wage increases.

The mentioned theoretical studies focus on pure wage effects of outsourcing, by assuming that only the wage is determined by bargaining between the firm and the labor union. However, additional components such as bonus payments or profit sharing can be the result of such bargaining as well.⁵ The idea behind the incorporation of profit sharing in a compensation scheme is to stimulate the workers' motivation and identification with the firm and thus to increase their productivity.⁶ In this paper, we extend the literature by implementing profit sharing as a part of the compensation scheme.⁷ The distinction between the case in which the union and the firm negotiate over the wage only, and the case in which both the wage and a profit share are determined simultaneously, allows to discern between a wage and income effect. Thus,

⁴ Similar findings are shown in earlier studies by Slaughter (2001) and Hasan et al. (2007).

⁵ Empirical studies as Pendleton et al. (2001) show that profit sharing is an often used compensation scheme in many OECD countries. For further evidence regarding the incidence of profit sharing see also Estrin et al. (1997) and Conyon and Freeman (2004).

⁶ However, empirical studies show that the productivity effect is ambiguous. For an increasing effect on productivity see Cable and Fitzroy (1980), while Jones and Pliskin (1991) and Kruse (1992) demonstrate a negative productivity effect of profit sharing.

⁷ There are some studies that analyze the implementation of profit sharing in collective bargaining, e.g. Holmlund (1990) and Jerger and Michaelis (1999). Concerning the efficiency property, Pohjola (1987) and Anderson and Devereux (1989) show that also without an employment determination the outcome of a collective bargaining is efficient by introducing bargaining over wages and profit sharing. However, all studies abstract from outsourcing.

our central research question is: Is the fear of income loss for unionized workers justified?

In our analysis we find that in the case in which the firm and the labor union bargain over the wage only, outsourcing has an ambiguous effect on wage and thus on the workers' income. In contrast, if the labor union and the firm bargain simultaneously over the wage and a profit share, outsourcing will increase the workers' income, if the marginal costs of outsourcing are lower than the domestic outside option.

Knowing the income and wage effects, based on comparative statics, we analyze the optimal amount of outsourcing under the different remuneration schemes. Here, we find that depending on the wage effect, the outsourcing demand under a pure wage bargaining system can become higher or lower than the outsourcing level where domestic and foreign marginal labor costs are the same, while under a simultaneous wage and profit share bargaining system the amount of outsourcing is lower than the level where domestic and foreign marginal labor costs are the same.

We proceed as follows. Section II presents the basic framework. Section III investigates the model in terms of labor demand, the structure of the bargaining process and the optimal amount of strategic outsourcing. A conclusion and a brief discussion of extensions are presented in Section IV.

II. Basic Framework

We assume that in our economy a representative firm produces the final good by using two input goods. The combination of these inputs for producing the final good is represented by the Cobb-Douglas production function

$$F = X^\alpha \cdot Y^\beta \quad \text{with } 0 < \alpha + \beta < 1, \quad (1)$$

where X and Y characterize the amount of two inputs. Furthermore, we assume that the X -input production must take place in-house, whereas the Y -input can be produced in-house or can be outsourced. For simplicity, we model a linear technology in every input production, where for one unit of the input good, one unit of labor respectively outsourced input is needed. Thus, the production functions for the input goods are

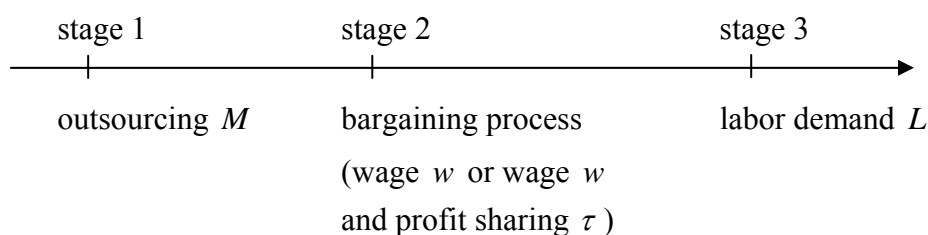
$$\begin{aligned} X &= L^X \\ Y &= L^Y + M, \end{aligned}$$

where L^X or L^Y presents employment in the specific input production and M the used amount of outsourcing.

We further assume that labor in both input productions is homogenous and that the overall workforce $L = L^X + L^Y$ is represented by a labor union. This assumption ensures that no wage discrimination between the input productions can be realized by the firm.

The structure of actions can be interpreted as sequential decisions on three stages. Due to the investment of the external procurement, on the first stage, the representative firm commits to the amount of outsourcing. After the firm has decided about outsourcing, the firm and the labor union bargain over i) the wage level or ii) the base wage and profit sharing. Since the firm has the right-to-manage, it determines employment according to its labor demand after knowing the bargaining results. The timing sequence of the decisions is summarized in Figure 1.

Figure 1: *time sequence of decisions*



The decisions at each stage are analyzed by using backward induction.

It should be pointed out that our assumption of committed outsourcing implies that the firm undertakes irreversible investments and that the outsourced inputs are specifically designed for the final good producer. Of course, if the outsourced inputs are standard components, this assumption can be reversed by assuming that the outsourcing decision takes place after the domestic wage determination.⁸ According to Figure 1 we also neglect the possibility of *ex post* renegotiations of the outsourcing contract. One may assume that the special requirements can be easily stipulated in an *ex ante* contract. However, problems often arise with regard to the verification of the agreement by a third party and if the economic environment is too complex and unpredictable. In that case, it can be impossible to design a contract that accounts for all outcomes and thus the contract becomes incomplete, which creates the so-called “hold-up”-problem.⁹ If not

⁸ See Skaksen (2004) and Braun and Scheffel (2007) for this strand of the literature, i.e. the case of flexible outsourcing.

⁹ A survey concerning outsourcing and incomplete contracts is presented by Spencer (2005). The “hold-up”-problem describes the opportunistic behavior by the input producer, if special investments are needed.

all properties can be clearly verified *ex ante*, the final producer evaluates the match of the external procured inputs with the requirements after the outsourcing decision has taken place and additional costs for monitoring or quality control arise. In case of a mismatch between the needs and the effective quality, negotiations concerning the price between the outsourcing partners may be resumed. For our time sequences this means that, after domestic wage formation, additional negotiations between the parties or additional monitoring costs of outsourcing may be introduced. However, for keeping the analysis simple, we neglect the “hold-up”-problem in the relationship between the parties. Therefore, we abstract from costs for supervising the quality of the intermediate good or *ex post* renegotiations.

III. Solving the Model

In the next parts we solve the model according to the presented timing structure. We first derive at the third stage the labor demand in both input productions for given outsourcing. After that, at the second stage, we focus on the bargaining process by distinguishing the two mentioned approaches. While in the first approach the firm and the labor union bargain over the wage only, in the second approach both parties negotiate the wage and a profit share. Finally, at the first stage, we solve for the optimal amount of strategic outsourcing.

III.1. 3rd stage: Domestic Labor Demand

The firm decides on domestic labor to maximize the profit function

$$\max_{L^X; L^Y} \pi = (L^X)^\alpha \cdot (L^Y + M)^\beta - w \cdot (L^X + L^Y) - f(M), \quad (2)$$

taking M , the amount of outsourcing, as given. For the cost of outsourcing, $f(M)$, we assume that there are additional costs associated with outsourcing other than the price of the intermediate goods. Such costs could be costs for transport, which exponentially increase with higher outsourcing. To allow for an exponential cost increase, we model a quadratic cost function, i.e. $f(M) = \frac{1}{2}cM^2$, with $c > 0$, $f'(M) > 0$ and $f''(M) > 0$.

Solving problem (2) leads to the standard result that employment is set where marginal productivity equals the wage rate. From the first-order conditions we obtain as the labor demand for given outsourcing in the different input productions¹⁰

$$L^X = w^{-\frac{1}{1-\alpha-\beta}} \cdot \alpha^{\frac{1-\beta}{1-\alpha-\beta}} \cdot \beta^{\frac{\beta}{1-\alpha-\beta}}, \quad (3a)$$

$$L^Y = w^{-\frac{1}{1-\alpha-\beta}} \cdot \alpha^{\frac{\alpha}{1-\alpha-\beta}} \cdot \beta^{\frac{1-\alpha}{1-\alpha-\beta}} - M. \quad (3b)$$

Thus, the overall domestic labor demand is

$$L = L^X + L^Y = (\alpha + \beta) \cdot w^{-\frac{1}{1-\alpha-\beta}} \cdot \alpha^{\frac{\alpha}{1-\alpha-\beta}} \cdot \beta^{\frac{\beta}{1-\alpha-\beta}} - M. \quad (4)$$

Equation (4) shows that domestic labor demand is a negative function of both the wage and the amount of outsourcing, where the substitutability of low-skilled labor and international outsourcing is consistent with empirical evidence, e.g. presented by Görg and Hanley (2005).

The labor demand reaction to wage changes can be expressed by the wage elasticity of labor demand, which can be written as

$$\eta = -\frac{\partial L}{\partial w} \frac{w}{L} = \frac{1}{1-\alpha-\beta} \left(1 + \frac{M}{L} \right) > 1. \quad (5)$$

According to equation (5), the wage elasticity depends on the wage level and the amount of outsourcing. These effects can be determined by the first derivatives $\eta_w = \frac{1}{1-\alpha-\beta} \cdot \frac{\eta}{w} \cdot \frac{M}{L} > 0$ and $\eta_M = \frac{\eta}{L} > 0$.¹¹ Therefore, with a higher domestic wage or higher outsourcing, domestic labor demand becomes more elastic. In the absence of outsourcing, the wage elasticity $\eta|_{M=0} = \frac{1}{1-\alpha-\beta}$ is constant and smaller than in the presence of outsourcing, which is in line with empirical evidence as shown by Senses (2010).

¹⁰ Notice, that also in the presence of a bargained profit share, where the profit of the firm is $(1-\tau) \cdot \pi$, we obtain the same labor demand reactions, since profit sharing works as a profit tax. Due to the neutrality of this kind of tax, also in the case of a bargained profit share the domestic labor demand does not depend on profit sharing.

¹¹ For notational convenience we use in the next calculations the subscript as a characterization of the first derivative, i.e. $\eta_w = \partial \eta / \partial w$.

III.2. 2nd stage: Bargaining Process

At this stage, the firm and a labor union bargain over i) the wage level or ii) the wage and profit sharing. We distinguish between these scenarios since both are possible in observed bargaining rounds. However, in our framework the determination of the bargaining regime is exogenous, which is driven by the fact that sometimes the bargained variables are given by politics or law.¹²

The outcome of the bargaining process is assumed to be determined by the Nash-Bargaining-Solution, where the Nash-Product is defined as

$$\Omega = (U - U_0)^\gamma \cdot (\pi - \pi_0)^{1-\gamma}.$$

In the above notation U_0 and π_0 are the disagreement payoffs for the union and the firm. In case of disagreement there is no production, implying that every union member gets the exogenous outside option, i.e. $U_0 = N \cdot b$, where b captures the available minimum income for the labor union members N . On the other side, the firm loses its investment in outsourcing, i.e. $\pi_0 = -f(M)$, which means that the firm has an incentive to reach an agreement.

III.2.1 Bargaining over Wages only

Assuming that only the wage will be determined, we can write the bargaining problem as

$$\max_w \Omega = (U - U_0)^\gamma \cdot (\pi - \pi_0)^{1-\gamma}.$$

To describe the preferences of the labor union, we model a utilitarian union utility function $U = u(w) \cdot L + u(b) \cdot (N - L)$ in case of an agreement, where the individual utility $u(\cdot)$ is linear in income, i.e. $u(w) = w$ and $u(b) = b$. Combining this with the union's outside option U_0 , we can express the union rent as $\bar{U} = U - U_0 = (w - b) \cdot L$. The bargaining rent of the firm, $\bar{\pi} = \pi - \pi_0$, can also be expressed explicitly. Since the profit in case of an agreement is $\pi = F - w \cdot L - f(M)$ and the disagreement profit is $\pi_0 = -f(M)$, we obtain a rent of $\bar{\pi} = F - w \cdot L$.

¹² While in most European countries as Germany or Finland the wage is the central determinant in a bargaining between the union and the firm, in France there exists an obligatory profit share system for firms with more than 50 workers. However, in the bargaining round the firm and the labor union determine the details such as the calculation formula or the duration. Moreover, in Section IV we briefly discuss the endogenous choice of the regime by the bargaining parties.

Maximizing the Nash-Product concerning the wage, the first-order condition is $\Omega_w = 0 = \gamma \cdot \frac{\bar{U}_w}{\bar{U}} + (1-\gamma) \cdot \frac{\bar{\pi}_w}{\bar{\pi}}$, where

$$\frac{\bar{U}_w}{\bar{U}} = \frac{L_w}{L} + \frac{1}{w-b} = \frac{1}{w} \cdot \left(-\eta + \frac{w}{w-b} \right), \quad (6a)$$

and

$$\frac{\bar{\pi}_w}{\bar{\pi}} = -\frac{1}{w} \frac{\alpha + \beta}{(1-\alpha-\beta) + M/L}. \quad (6b)$$

Using these expressions as well as the wage elasticity of labor demand, as the solution of the first-order condition we obtain

$$w = A(w, M, \gamma) \cdot b, \quad (7)$$

which is the standard result that the wage consists of the outside option and a mark-up. In our model the mark-up $A = \frac{\gamma \cdot \eta \cdot [\eta \cdot (1-\alpha-\beta) - (\alpha+\beta)] + (1-\gamma) \cdot (\alpha+\beta)}{(\eta-1) \cdot \gamma \cdot [\eta \cdot (1-\alpha-\beta) - (\alpha+\beta)] + (1-\gamma) \cdot (\alpha+\beta)} > 1$ depends on the relative bargaining power of the labor union γ , the amount of outsourcing M and the wage w . Therefore, equation (7) is an implicit formulation.

Knowing the negotiated wage we can distinguish the extreme cases of a monopoly labor union, which sets the wage unilaterally, and the absence of a labor union, where the firm sets the wage independently. The case of a monopoly labor union is characterized by $\gamma = 1$, where the wage becomes $w|_{\gamma=1} = \frac{\eta}{(\eta-1)} \cdot b$, while in the absence of a labor union, i.e. $\gamma = 0$, the wage is $w|_{\gamma=0} = b$.¹³

To answer our research question and thus to characterize the income effect of outsourcing, we now turn to a detailed analysis. After the implicit differentiation of (7) with respect to outsourcing and substituting $b = w/A$, we can characterize the impact of international outsourcing on the bargained wage as

$$\frac{dw}{dM} = \frac{\frac{A_M w}{A}}{1 - \frac{A_w w}{A}}, \quad (8)$$

¹³ Since $\eta > 1$, it is obvious that the relative bargaining power of the labor union will have a positive effect on the mark-up in the general case of $0 < \gamma < 1$, i.e. $A_\gamma > 0$.

where $1 - \frac{A_w w}{A} > 0$ (see Appendix A).

The outsourcing effect on the mark-up, $A_M w/A$, is a priori ambiguous and depends on the relationship between the relative bargaining power of the labor union and the outsourcing-labor ratio.¹⁴ For the impact of outsourcing on the mark-up we find

$$A_M \left\{ \begin{array}{l} > \\ = \\ < \end{array} \right\} 0. \quad (9)$$

Thus, outsourcing has a priori an ambiguous effect on the domestic wage.

For a better understanding we can also identify the wage effect of outsourcing in the extreme cases. In the case of unilateral wage setting by the firm, the wage will be at the lowest possible level, which is the constant and exogenous alternative income. Thus, outsourcing has no wage effect, i.e. $\left. \frac{dw}{dM} \right|_{\gamma=0} = 0$. On the other hand, in the case of a

monopoly labor union we obtain $A_M|_{\gamma=1} < 0$, which yields $\left. \frac{dw}{dM} \right|_{\gamma=1} < 0$.

Concerning the more general case, in which both parties are endowed with a positive bargaining power, i.e. $0 < \gamma < 1$, we can summarize as

Proposition 1: *If the firm and the labor union bargain over the wage only, outsourcing has an ambiguous effect on the workers' income.*

To explain this ambiguous effect we can identify two opposite mechanisms. First, with higher outsourcing the labor demand (5) becomes more elastic. Due to a more elastic labor demand, a higher wage increases the union's utility loss of less employment. Consequently, this mechanism induces wage restraint and makes the labor union less aggressive, which results in a lower wage mark-up. Second, as outsourcing and domestic labor are substitutes, with higher outsourcing the firm's profit is less affected by domestic labor costs. Thus, outsourcing moderates the profit-reducing effect

¹⁴ A similar result is obtained by Koskela and Stenbacka (2009). However, they use a model where only our Y -production characterizes the production technology and focus on the unemployment effects of outsourcing in a general equilibrium model, while we concentrate on the comparison of different bargaining regimes concerning the income effects of outsourcing in a partial analysis. Thus, we show whether this unclear result in the classical approach also holds for a more realistic description of the production technology with more than one production chain. Additionally, we can answer if this unclear result depends on the bargaining regime. For that reason, the detailed presentation of a known result is used for a better understanding and a complete analysis.

π_w/π of a wage increase, which promotes a higher wage mark-up. In line with this explanation, one may also argue that higher outsourcing increases the firms' costs in case of disagreement and thus the firm has a stronger incentive to reach an agreement. Since now the firm faces a weaker bargaining position, the labor union is able to achieve a higher wage mark-up. As one can see from the mark-up equation above, the interplay of the relative bargaining power, the production technology and the reaction of the labor demand elasticity determine, which of the two opposing effects dominate.

The effect of outsourcing on the domestic wage is also analyzed in Lommerud et al. (2009). They find an unambiguous wage increasing effect of outsourcing, since the labor demand becomes less elastic, which is driven by the assumption of complementary inputs. Additionally, they see the fixed costs of outsourcing as sunk costs and thus there will be no negative impact for the firm in the bargaining. However, in our model we follow a different assumption concerning the production technology and the investment costs. Thus, the different assumptions between the two analyses, yielding different effects on the labor demand elasticity and the firm's outside option, explain the possible bargaining outcome differences.

As mentioned in the introduction, the workers also fear the substitution of domestic jobs by outsourcing and thus the loss of employment. Knowing the wage effect, the overall impact of outsourcing on domestic labor demand can be derived. Using equation (4) we can determine employment effect as

$$\frac{dL}{dM} = -1 - \frac{1}{1-\alpha-\beta} \frac{L+M}{w} \cdot \frac{dw}{dM}. \quad (10)$$

Equation (10) shows the two working channels of outsourcing on the domestic labor demand. The first one is the substitution of employment in the Y -sector and the second one is the wage effect due to the reaction of domestic labor costs. While the substitution effect decreases labor demand, the a priori unclear wage effect can reinforce or offset this effect or does not affect the labor demand. Thus, we can determine an unambiguous employment effect if outsourcing has a wage increasing effect only, since in that case both the substitution effect and wage effect lead to less employment. Therefore, in this case outsourcing increases the domestic income, but fewer employees will receive a higher wage. If outsourcing does not affect the negotiated wage level, the labor demand reducing substitution effect is still working and fewer workers receive the same income. Also in the case of a wage moderating effect there is the negative substitution effect. However, now the positive employment effect,

which results from the lower labor costs, can offset the substitution effect. Thus, there could be higher or lower workforce with lower income due to higher outsourcing.

III.2.2 Simultaneous Bargaining over Wage and Profit Sharing

As mentioned in the introduction, there are several studies concerning the simultaneous negotiation about the wage and profit sharing. However, these studies abstract from strategic outsourcing.

Before we formally analyze this bargaining regime in the presence of outsourcing, we have to modify the objective functions of the labor union and the firm. Since we assume that the individual utility is linear in income, the overall remuneration of an employed worker can be written as $\omega = w + \tau \cdot \frac{\pi}{L}$, where τ characterizes the share of profit, which is distributed to the workforce.¹⁵ On the other hand, the income of an unemployed worker is still characterized by the exogenous minimum income b . Following the assumption of a utilitarian union utility, we can write the union rent in a bargaining regime with profit sharing as $\bar{U} = w \cdot L + \tau \cdot \pi$. Of course, the profit of the firm's owner will change, too. In case of agreement he now earns $(1 - \tau) \cdot \pi$. Since the value of disagreement is the same as in section III.2.1, the rent is now represented by $\bar{\pi} = (1 - \tau) \cdot \pi + f(M)$.

Due to the simultaneous negotiation of the wage and the profit share, in this setting, the Nash-Product has to be maximized concerning both parameters, i.e. $\max_{w, \tau} \Omega = \bar{U}^\gamma \cdot \bar{\pi}^{1-\gamma}$. As the first-order conditions, we obtain

$$\Omega_w = 0 = \gamma \cdot \frac{\bar{U}_w}{\bar{U}} + (1 - \gamma) \cdot \frac{\bar{\pi}_w}{\bar{\pi}} \text{ and} \quad (11a)$$

$$\Omega_\tau = 0 = \gamma \cdot \frac{\bar{U}_\tau}{\bar{U}} + (1 - \gamma) \cdot \frac{\bar{\pi}_\tau}{\bar{\pi}}. \quad (11b)$$

Using $\bar{U}_\tau = \pi$ and $\bar{\pi}_\tau = -\pi$, (11b) can be rewritten to $\frac{\gamma}{\bar{U}} = \frac{1-\gamma}{\bar{\pi}}$. Inserting this expression in (11a) yields $0 = \bar{U}_w + \bar{\pi}_w$, where $\bar{U}_w = L_w \cdot (w - b) + (1 - \tau) \cdot L$ and $\bar{\pi}_w = -(1 - \tau) \cdot L$. Implementing these results, we obtain a negotiated base wage of

$$w = b, \quad (12)$$

¹⁵ The idea behind this is that the worker are assumed as a team, where the whole team gets the profit share $\tau \cdot \pi$, which is then distributed equally among the members.

so that the wage is equal to the exogenous outside option, which corresponds to the well known results of Weitzman (1987).

Comparing the negotiated wages (7) and (12) shows that the wage stipulated in a simultaneous wage and profit share bargaining is smaller than (equal to) the wage in the case without any profit share negotiations, if the labor union has a positive (zero) relative bargaining power. The intuition is relatively simple, since the parties actually bargain over the distribution of the rent realized by the production. If there is no labor union, the whole rent will be earned by the firm. Since the rent is influenced by employment and the highest rent is realized with the highest employment level, the firm reduces the wage to the lowest possible level, which is the outside option b . If there is bargaining, due to a higher wage, the rent decreases. However, now the union realizes a part of it. In the presence of simultaneous wage and a profit share bargaining, a similar mechanism leads to the derived result (12). Both parties maximize the rent and fix the wage on the lowest level, i.e. the outside option, while the distribution of the created rent between the parties will be determined by the negotiated profit share level.

Inserting (12) in the rewritten first-order condition concerning the profit share, $\frac{\gamma}{\bar{U}} = \frac{1-\gamma}{\bar{\pi}}$, and using the labor demand (3a) and (3b), we obtain for the bargained profit share

$$\tau = \gamma \cdot \frac{b^{-\frac{\alpha+\beta}{1-\alpha-\beta}} \cdot \alpha^{\frac{\alpha}{1-\alpha-\beta}} \cdot \beta^{\frac{\beta}{1-\alpha-\beta}} (1-\alpha-\beta) + bM}{b^{-\frac{\alpha+\beta}{1-\alpha-\beta}} \cdot \alpha^{\frac{\alpha}{1-\alpha-\beta}} \cdot \beta^{\frac{\beta}{1-\alpha-\beta}} (1-\alpha-\beta) + bM - f(M)}. \quad (13)$$

From (13) we deduce that in the absence of outsourcing the profit share corresponds to the relative bargaining power of the labor union, i.e. $\tau|_{M=0} = \gamma$ ¹⁶, while in the presence of outsourcing the negotiated profit share is higher than the relative bargaining power of the labor union, i.e. $\tau|_{M>0} > \gamma$.

As mentioned above, the profit share determines how the created rent is distributed between the two parties. Thus, one would expect that the share of the rent for every party equals its relative bargaining power. However, as shown in equation (13), this does not hold in our framework. The economic intuition for this result is the following: Since the amount of outsourcing is determined before bargaining takes place, the firm has an incentive to reach an agreement and to avoid the negative profit, being the costs associated with the outsourcing commitment, in case of a disagreement.

¹⁶ For this standard result see also Holmlund (1990).

Therefore, the firm faces a weaker position than in the case of an outside option with zero profits, where only the relative bargaining power is decisive for the distribution. In what follows, the firm receives a lower share of the rent than its relative bargaining power predicts.

Since in the former analysis the wage equals the income, the wage effect and the income effect of outsourcing are the same. However, in the case of a simultaneous bargaining over the wage and profit sharing we have two income components. Thus, in contrast to the former analysis, we now discern between a wage and an income effect.

As equation (12) shows, the wage is the constant exogenous outside option and not affected by outsourcing so that, in the alternative bargaining approach, there is no wage effect of outsourcing. However, outsourcing affects the profit in the absence of an agreement. This provides an incentive for the firm to reach an agreement and affect the workers' profit income via the negotiated profit share. To determine this effect, we have to show the effect of outsourcing on the negotiated profit share. Here we find that (see Appendix B)

$$\frac{\partial \tau}{\partial M} = \gamma \frac{cM \cdot \left[V + \frac{1}{2}bM \right]}{(V + bM - f(M))^2} > 0, \quad (14)$$

where $V = b \frac{\alpha+\beta}{1-\alpha-\beta} \cdot \alpha \frac{\alpha}{1-\alpha-\beta} \cdot \beta \frac{\beta}{1-\alpha-\beta} \cdot (1-\alpha-\beta) > 0$, so that the bargained profit share depends positively on the amount of outsourcing.

However, our research question focuses on the income effect of outsourcing, which corresponds to the impact on the workers' profit income. Under this type of compensation scheme, the income of an employed individual is $\omega = b + \tau \cdot \frac{\pi^*}{L}$, where the income effect of outsourcing can be formalized by

$$\frac{\partial \omega}{\partial M} = \frac{\partial \tau}{\partial M} \cdot \frac{\pi^*}{L} + \frac{\tau}{L^2} \left[\frac{\partial \pi^*}{\partial M} \cdot L - \frac{\partial L}{\partial M} \cdot \pi \right], \quad (15)$$

where $\frac{\partial L}{\partial M} < 0$ and $\frac{\partial \tau}{\partial M} > 0$. To determine the outsourcing effect on profit we need the indirect profit function π^* . Using the derived results, we obtain $\pi^* = (1-\alpha-\beta) \cdot \alpha \frac{\alpha}{1-\alpha-\beta} \cdot \beta \frac{\beta}{1-\alpha-\beta} \cdot b \frac{\alpha+\beta}{1-\alpha-\beta} + b \cdot M - f(M)$ and thus $\frac{\partial \pi^*}{\partial M} = b - \frac{\partial f(M)}{\partial M}$.

As this formulation shows, under the assumption that the marginal costs of outsourcing,

$\frac{\partial f(M)}{\partial M}$, are lower than the domestic marginal costs of labor, b , we have $\frac{\partial \pi^*}{\partial M} > 0$ and

thus an unambiguous income effect of outsourcing. We can summarize our finding as

Proposition 2: *If the labor union and the firm bargain simultaneously over the wage and the profit share, outsourcing increases the workers' income, if the marginal costs of outsourcing are lower than the domestic outside option.*

As one can see from (15) outsourcing affects workers' income in two ways. The first part shows the share-increasing effect, since every worker gets a higher share of the per capita profit. This effect results from the fact that higher outsourcing increases the loss of the firm if there is no agreement, which makes the firm less aggressive and increases the negotiated profit share. The second mechanism is shown by the expression in brackets. On the one side, due to the substitution of domestic labor by outsourcing in the Y -activity, higher outsourcing increases the profit, if the marginal costs of outsourcing are lower than the domestic marginal costs of labor. On the other side, due to the decreased employment the per capita profit increases. Since the profit share, the overall and the per capita profit will be positively affected by the external procurement, an employed worker will unambiguously benefit from higher outsourcing.

Similar to the above section we also determine the employment effect. Since the wage equals the constant outside option, in the case of a simultaneous bargaining of a wage and a profit share only the negative substitution effect affects the domestic employment level, i.e. $\frac{dL}{dM} = -1 < 0$. Thus, in that case we find lower employment with higher income.

III.3 1st stage: Optimal Strategic Outsourcing

So far we have restricted ourselves to a short-run analysis, where the amount of outsourcing is given, since the firm has committed itself. We now relax this point of view by exploring the initial stage of the outsourcing decision and focusing on a long-run perspective, where the firm determines its investments into outsourced production.

III.3.1 Optimal Outsourcing if Parties Bargain over Wages only

Assuming a rational firm, there is a perfect forecast and thus, on this stage, the firm maximizes its profit subject to domestic labor demand (4) and wage formation (7). Under the domestic labor demand, the indirect profit function is described by

$\pi^* = (1 - \alpha - \beta) \cdot \alpha^{\frac{\alpha}{1-\alpha-\beta}} \cdot \beta^{\frac{\beta}{1-\alpha-\beta}} \cdot w^{\frac{\alpha+\beta}{1-\alpha-\beta}} + w \cdot M - f(M)$. Thus, the firm's optimizing problem is characterized by

$$\max_M \pi^* \quad \text{s.t.} \quad w = A(w, M, \gamma) \cdot b. \quad (16)$$

Differentiating the indirect profit function yields the first-order condition

$$\frac{\partial \pi^*}{\partial M} = w - cM - \frac{dw}{dM} \cdot L^Y = 0. \quad (17)$$

As equation (17) points out, the level of outsourcing depends on the employment used in activity Y and on the wage effect of outsourcing. As one can see under $L^Y > 0$ and $dw/dM < 0$ it follows that $cM > w$, which means that the amount of outsourcing lies above the outsourcing level where domestic and foreign marginal costs are equal. Thus, we can conclude that under $L^Y > 0$ and in the presence of a wage moderation effect of outsourcing, the firm can reap an additional benefit with higher outsourcing.¹⁷ In contrast, in the case of a wage increasing effect and $L^Y > 0$, no additional benefit can be realized by the external procurement and the amount of outsourcing lies below the outsourcing level where domestic and foreign marginal costs are equal. We summarize our finding as

Proposition 3: *If the parties bargain over the wage only, strategic outsourcing will be higher (lower) than the level where domestic and foreign marginal labor costs are the same, if outsourcing decreases (increases) the domestic wage.*

This result can be explained as follows. On the one hand, higher outsourcing increases total production costs, but on the other hand, it may also lead to a wage moderating effect and becomes a strategic instrument for the firm as it reduces the wage bill. As equation (17) shows, the optimal amount of outsourcing is given when both effects are equalized. In contrast, if outsourcing leads to a wage increase, it increases total production costs only. Thus, the amount of outsourcing is lower than the level where domestic and foreign marginal labor costs are the same. However, if there is no employment in activity Y , $L^Y = 0$, or no wage moderating effect, $dw/dM = 0$, we

¹⁷ For a graphical argumentation see Koskela and Schöb (2010).

obtain the well known result that the firm chooses an amount of outsourcing where the marginal costs are the same.

III.3.2 Optimal Outsourcing if Parties Bargain over Wage and Profit Sharing

Since in this scenario the wage is set to the constant outside option, the indirect profit is given by $\pi^* = (1 - \alpha - \beta) \cdot \alpha^{\frac{\alpha}{1-\alpha-\beta}} \cdot \beta^{\frac{\beta}{1-\alpha-\beta}} \cdot b^{\frac{\alpha+\beta}{1-\alpha-\beta}} + b \cdot M - f(M)$.

Thus, the firm's problem is characterized by¹⁸

$$\max_M (1 - \tau) \cdot \pi^* \quad \text{s.t.} \quad \tau = \gamma \cdot \Phi. \quad (18)$$

Taking into account the formerly derived results, the first-order condition is

$$\frac{\partial [(1 - \tau) \pi^*]}{\partial M} = (1 - \tau) \cdot (b - cM) - \frac{\partial \tau}{\partial M} \cdot \pi^* = 0. \quad (19)$$

Since $\frac{\partial \tau}{\partial M} \cdot \pi^* > 0$ and $0 < \tau < 1$, we see from (19) that $b > cM$. Under the assumption of a wage moderating effect of outsourcing, this lies in contrast to the case where the parties bargain over the wage only. So the firm now chooses an amount of outsourcing lower than the level at which the marginal cost of outsourcing equals the domestic marginal cost. Comparing the optimal amount of outsourcing under the different bargaining approaches and the reasonable assumption that $b < w$, we can conclude from the conditions $b > cM$ respectively $cM > w$, that the bargained profit share approach leads to a lower investment in the outsourced production.

From (19) we can also determine the impact of labor market imperfections. As can be seen from (13) and (14), the labor union's bargaining power affects the optimal profit share and the impact of outsourcing on the profit share. For a given amount of outsourcing a stronger labor union reaps a higher share of the profit, which is shown in equation (13). Since outsourcing increases the profit, this provides an incentive to reduce outsourcing. This effect will be reinforced, if the firm takes into account the impact of outsourcing on the profit share, because with lower outsourcing the firm faces a stronger bargaining position, which increases the firm owner's earned profit. Thus, both effects have the same direction and the firm owner faces a higher incentive to

¹⁸ According to (13), the profit share mark-up is $\Phi = \frac{\pi^* + bM}{\pi^* + bM - f(M)}$.

reduce its outsourcing activities in the presence of a strong labor union in order to reap a higher share of the profit.¹⁹

Proposition 4: *If the parties bargain over the wage and profit sharing, strategic outsourcing will be lower than the level where domestic and foreign marginal labor costs are the same and the amount of outsourcing decreases with the labor union's bargaining power.*

Our analysis shows that the bargaining structure can be crucial for outsourcing demand, as the different regimes induce different effects on the firm's cost parameters. In the case of a bargained profit share, the wage is the exogenous alternative income and is not affected by outsourcing. Thus, the relevant cost parameter for determining the amount of outsourcing is the profit share. Since higher outsourcing decreases the share of profit the firm owner earns, due to a higher loss in case of a disagreement, this provides - independent of the power of the union - an incentive for less outsourcing. However, this incentive will be reinforced by a stronger labor union, since the profit share also reflects the bargaining power, meaning that a higher union bargaining power decreases the firm's profit share. As a consequence, the firm will react with less outsourcing the stronger the labor union becomes. In contrast, if the parties bargain over the wage only, the wage is the cost parameter. With that structure, the firm may only realize higher profits by higher outsourcing, if outsourcing has a wage-moderating effect. Thus, wage-moderation increases the incentive for higher outsourcing in order to reduce the labor costs.

Following this argument, it is easy to see that the different bargaining structures may lead to different amounts of outsourcing for a given union's bargaining power. Thus, bargaining over both the wage and profit sharing leads to less outsourcing than in the classical wage bargaining approach, if outsourcing has a wage moderation effect.

IV. Conclusions and Discussion

The main goal of this paper was to show the effect of outsourcing on workers' income in an imperfect domestic labor market which was modeled by a bargaining round between a firm and a labor union. In our analysis we distinguished between two

¹⁹ Also Lommerud et al. (2009) have found a negative relationship of union's bargaining power and the amount of outsourcing. However, as mentioned earlier, their analysis differs with respect to their assumptions concerning the production technology and they model only the classical wage bargaining. Nevertheless, the argument for explaining the result is the same.

bargaining approaches, one where the firm and the union negotiate over the wage only, and a second, as discussed in the political debate, where the parties bargain over both the wage and a profit share.

For the first case, we found that outsourcing has an ambiguous effect on the workers' income, while in the second case, outsourcing to low cost countries will unambiguously increase the workers' income. Thus, the bargaining regime may be crucial for the income effect. While under a pure wage bargaining the fear of losing income entailed by higher outsourcing can be justified under certain circumstances, in a wage and profit share bargaining the fear of losing income is unjustified.

Concerning the amount of strategic outsourcing we find different results as well, since outsourcing has different effects on the firm's cost parameters. If the parties bargain over the wage only, the wage is the cost parameter. Since the impact of outsourcing on the wage is a priori ambiguous, the result for the optimal amount of outsourcing is also a priori unclear. Here we find that in case of wage-moderation (increase) outsourcing becomes higher (lower) than the level where domestic and foreign marginal labor costs are the same. If the wage and a profit share are determined in the bargaining, the wage equals the exogenous alternative income, meaning that only the profit share characterizes the firm's cost parameter. If the inputs are outsourced to a low-cost country, meaning that the domestic outside option is bigger than the marginal costs of outsourcing, the resulting amount of outsourcing is lower than the outsourcing level where domestic and foreign marginal labor costs are the same. Furthermore, in our model we find that - as the profit share increases with the power of the labor union and the level of outsourcing - a stronger labor union reinforces the incentive for less outsourcing.

Based on this knowledge, we are able to compare the optimal amount of outsourcing and the employment level under the different bargaining regimes. Here we find that for an equally strong labor union, under the assumption of a wage-moderating effect in the classical approach, the firm's optimal investment in outsourced products is lower, while the employment level is higher, in the case of a simultaneously negotiated wage and profit share. Thus, in order to reduce the fear of substitution and less income of domestic employment, the union has an incentive to adopt profit sharing as a part of the bargaining round and compensation package.

It would have been interesting to analyze the endogenous choice of the regime by the bargaining parties in our model by comparing the profit the firms' owner receives and the union utility under the different approaches on an initial stage prior to our stage 1. However, despite the fact that we formalize a relatively simple framework, we are not able to explicitly solve the model for the amount of outsourcing and, due to the

complexity of the model on this stage, a comparison of the parties' outcomes cannot be realized.

Another research question could be the implementation of different labor types by assuming that the X -input production uses high-skilled labor, while in the Y -input production low-skilled labor is used. An analysis with this framework under the classical bargaining approach is done by Koskela and Stenbacka (2010). They find that if the labor union represents both types of labor, the high-skilled wage increases, while the low-skilled wage decreases with higher outsourcing. However, this increasing wage dispersion effect of outsourcing can be reduced by a stronger union preference for wage solidarity. Of course, also in the case of a bargained wage and profit share one could distinguish between different types of labor. In the case where the high-skills participate on the firm performance via profit sharing, one would expect that the wage for the high-skilled worker equals their outside-option and is unaffected by outsourcing, while the wage for the low-skilled worker, due to the substitutability of the inputs, is negatively correlated with outsourcing. However, to be more precise, this question should be analyzed explicitly. Thus, the analysis of income and employment effects for different types of labor if there is bargaining over wage and profit sharing is an interesting topic for further research.

Appendix A: Derivation of the Wage Effects

As the mark-up we have $A = \frac{\gamma \cdot \eta [\eta(1 - \alpha - \beta) - (\alpha + \beta)] + (1 - \gamma)(\alpha + \beta)}{(\eta - 1)\gamma \cdot [\eta(1 - \alpha - \beta) - (\alpha + \beta)] + (1 - \gamma)(\alpha + \beta)} = \frac{T}{Z}$,

which depends on the wage and the amount of outsourcing. The wage impact is shown by $A_w = \frac{T_w \cdot Z - T \cdot Z_w}{Z^2}$, where $T_w = \gamma \cdot \eta_w \cdot ((1 - \alpha - \beta) + M/L) - \gamma \cdot \eta \frac{M}{L^2} L_w$ and

$Z_w = T_w + \gamma \cdot \frac{M}{L^2} L_w$. Using this, we obtain

$$A_w = \frac{\gamma}{Z^2} \left[-\eta_w \cdot \gamma \cdot \left((1 - \alpha - \beta) + \frac{M}{L} \right)^2 - \frac{M}{L} \frac{\eta}{w} (1 - \gamma)(\alpha + \beta) \right]. \quad (A1)$$

Since $\eta_w = \frac{1}{1 - \alpha - \beta} \frac{\eta}{w} \frac{M}{L} > 0$, we have $A_w < 0$ and thus $1 - \frac{A_w w}{A} > 0$.

The impact of outsourcing can be analyzed in a similar way. Here we have $A_M = \frac{T_M \cdot Z - T \cdot Z_M}{Z^2}$, where $T_M = \gamma \cdot \eta_M \cdot \left((1 - \alpha - \beta) + \frac{M}{L} \right) + \gamma \cdot \eta \frac{L - M \cdot L_M}{L^2}$ and

$Z_M = T_M - \gamma \cdot \frac{L - M \cdot L_M}{L^2}$. Using these expressions we find that

$$A_M = \frac{\gamma}{Z^2} \frac{\eta}{L} \left[-\gamma [\eta \cdot (1 - \alpha - \beta) - (\alpha + \beta)]^2 + (1 - \gamma)(\alpha + \beta)(1 - \alpha - \beta) \right]. \quad (\text{A2})$$

From (A2) we obtain

$$A_M \begin{cases} < \\ = \\ > \end{cases} 0, \quad (\text{A3})$$

yielding equation (9).

Appendix B: Relationship between Profit Sharing and Outsourcing

Equation (13) can be reformulated to $\tau = \gamma \cdot \frac{V + bM}{V + bM - f(M)}$, where

$V = b^{\frac{\alpha+\beta}{1-\alpha-\beta}} \cdot \alpha^{\frac{\alpha}{1-\alpha-\beta}} \cdot \beta^{\frac{\beta}{1-\alpha-\beta}} \cdot (1 - \alpha - \beta)$. Thus, the effect of outsourcing on bargained profit sharing is $\frac{\partial \tau}{\partial M} = \gamma \cdot \frac{-f(M) \cdot b + f'(M) \cdot V + f'(M) \cdot bM}{(V + bM - f(M))^2}$. Using $f(M) = \frac{1}{2}cM^2$,

we can write the effect of outsourcing on the profit share as

$$\frac{\partial \tau}{\partial M} = \gamma \cdot \frac{cM \cdot \left[V + \frac{1}{2}bM \right]}{(V + bM - f(M))^2}, \quad (\text{B1})$$

which equals equation (14).

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