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Wage Bargaining, Job Loss Fears and Offshoring

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Abstract

In this paper I present a simple theoretical model where firms and trade unions negotiate over wages. Firms have the possibility to offshore parts of their production and trade union members have a disutility from individual job loss fears. I show that higher job loss fears result in lower wages. As a Nash bargaining result, firms can use potential but non realized offshoring as a threat to enforce lower wages. Using a large German household survey, I can show evidence that increasing potential offshoring lowers wages through high job loss fears.

Keywords: Offshoring, wage bargaining, job loss fears
JEL classification: F16; J50

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1 Introduction

It is a common phenomenon that during wage negotiations firms use the threat of shifting domestic jobs abroad in order to lower the result of the wage bargaining.[1] If wages are the result of collective bargaining between firms and trade unions, it is often argued that offshoring strengthens the bargaining power of firms, which results in lower wages (see, e.g. Eckel and Egger, 2009). In this paper I argue that workers perceive job loss fears which lowers their individual utility. Offshoring affects these fears and workers are willing to accept a lower outcome during wage negotiations. Specifically, it is the threat of potential offshoring which increases fear, and not necessarily actual offshoring.

In their recent article Geishecker, Riedl and Frijters (2012) find that international outsourcing or offshoring towards low-wage countries increases job loss fears of German workers. These fears could have effects on wages when they are determined by negotiations between firms and workers individually or collectively. For example, Manski (2004) mentions the importance of the perception of job insecurity as a determinant for wages and employment. These concerns are mostly reasonable and justified and are indicative of real future job loss. Clark (2001), Stephens, Jr. (2004) and Dickerson and Green (2012) show that individual perceptions of job loss probabilities can be robust and valid predictors for actual job loss probabilities.

In the previous literature regarding the impact of offshoring on wages, these perceptions are not considered. So far, a lot of research has been done regarding the effect of offshoring on wages, both theoretically and empirically. It is known that mostly high-skilled workers benefit from offshoring, whereas low-skilled workers usually have to accept lower wages. Recent literature, however, changed the perspective from a skill to a task oriented view of wage effects from offshoring. Workers who perform tasks which are more interactive and non-routine are more protected from offshoring, irrespective of the skill level. Nevertheless, this is the first study to incorporate individual perceptions like job loss fears into the effect of offshoring on wages.

I extend the model of Skaksen (2004), where wages are determined via wage bargaining between firms and trade unions and introduce individual perceived fear of job loss as an additional term into the worker's utility function. Firms have the possibility to chose between in-house production or purchasing intermediate goods, used

[1] There is much evidence regarding those threats during wage negotiations reported in the media, e.g., in March 2013 during wage negotiations of the German trade union *IG Metall* and the employers' association: http://www.focus.de/finanzen/news/wirtschaftsticker/roundup-tarifverhandlungen-fuer-740-000-metall-beschaeftigte-vertagt_aid_945640.html.

in the production process, from abroad. During wage negotiations, firms can use the possibility to offshore as a threat to increase worker's job loss fears. I use a Nash wage bargaining model with a right-to-manage setting and find that with increasing job loss fears, workers are willing to accept lower wages.

In the empirical application I test these theoretical implications, namely whether a general increase of job loss fears lowers wages and whether increasing potential offshoring lowers wages through different levels of job loss fears. In order to show this, I use large German household panel data combined with industry level offshoring measures. Since I argue that potential but not realised offshoring affects the wage bargaining outcome, world-wide export supply of intermediate goods is used to approximate potential offshoring. The empirical results confirm the theoretical implications.

This paper is structured in the following way. In the next section I briefly discuss the existing literature on offshoring and wages, wage bargaining and perceived job insecurity. In Section 3 I present a right-to-manage wage bargaining model and show how individual job loss fears impacts the Nash bargaining solution. The empirical analysis is carried out in Section 4. I describe the data used and explain the empirical model. After that I interpret the estimation results. Section 5 concludes.

2 Literature

When looking at the theoretical literature, the impact of offshoring on wages is not clear cut.[2] In previous studies authors like Feenstra and Hanson (1996), Arndt (1997, 1999) and Kohler (2004) apply general equilibrium models with competitive labour markets and come to different conclusions. Depending on the assumptions and framework of their models, relative wages of low- to high-skilled workers may rise or fall.

A large body of literature models the effect of offshoring on wages where wages are determined on imperfect labour markets via collective bargaining. In Skaksen (2004) wages are negotiated between firms and trade unions in a right-to-manage model. After wage bargaining the firm can decide whether to outsource one activity of its production process or not. The author finds that the threat of potential outsourcing lowers wages, whereas actual outsourcing results in higher wages. Ranjan (2013) comes to similar results. He applies a Pissarides search model to look at unemployment and finds that decreasing offshoring costs lowers unemployment first but increases unemployment when offshoring costs are sufficiently low. Gaston (2002) uses

[2]For an extensive view over the previous literature on the effects of offshoring on wages, both theoretically and empirically, see, e.g. Harrison, McLaren and McMillan (2011).

an efficient wage bargaining model where both wages and employment are negotiated and firms use offshoring as a threat to lower wages. His model also predicts higher wages and lower employment if offshoring takes place. However, contrary findings are in Koskela and Stenbacka (2009) where the firm decides to offshore before wage negotiations. They find that increasing offshoring rises the wage elasticity of labour demand which results in lower wages and unemployment. Additionally, Eckel and Egger (2009), Egger and Kreickemeier (2009) and König and Koskela (2011) also focus on the bargaining power of trade unions and find that the effect of offshoring on wages can be positive or negative, depending on the power of the unions. However, the better fall back option for firms to shift production to foreign countries lowers the bargaining power of unions and therefore also the wages of the union members.

Although all articles mentioned above name the threat of potential offshoring as a form of pressure during wage negotiations, none of the models take that explicitly into account. In this paper, the effect of this threat is considered in more detail. Trade union members experience direct utility losses in the form of job loss fears through the threat of potential offshoring. This way I can show that by increasing fears the Nash solution of the collective bargaining results in lower wages. Therefore I claim that job loss fears are an additional channel to explain labour market effects of offshoring.

The existing empirical literature mainly examines the impact of actual offshoring on wages for different skill groups or different tasks. Studies of, e.g., Geishecker and Görg (2008), Geishecker, Görg and Munch (2010) and Hummels, Jørgensen, Munch and Xiang (2011) find a negative wage effect for low-skilled workers and a positive effect for high-skilled workers, indicating that mostly low-skilled labour is threatened by offshoring. Initiated by the theoretical work of Grossman and Rossi-Hansberg (2008), there is a growing amount of literature that examines the impact of offshoring on the wages of workers performing different tasks. Baumgarten, Geishecker and Görg (2013) and Ebenstein et al. (forthcoming) find that the focus on offshoring tasks is more important than that on skill levels. Their results show distinctive negative wage effects for workers performing routine and non-interactive tasks, irrespective of the skill level. In addition to skill and task related effects on wages, this paper emphasizes the role of individual perceptions, in this case job loss fears, in connection with the effect of the threat of potential offshoring on wages.

As mentioned above, the existing theoretical literature often explains the wage reducing effect of offshoring as a consequence of lower bargaining power of trade unions. In Brock and Dobbelaere (2006), Dumont, Rayp and Willemé (2006) and Dumont,

Rayp and Willemé (2012) the authors empirically assess the effect of international trade on the bargaining power of trade unions. While Dumont et al. (2006) and Dumont et al. (2012) find a negative influence of internationalization on the bargaining power of unions, Brock and Dobbelaere (2006) only find small and no significant effects for the Belgian manufacturing industry.[3]

Of the papers that investigate the effect of individual perceptions like job loss fears on wages, Blanchflower (1991) studies the effect of fear of unemployment on wages of British workers in the 1980s. He argues that when the wage rate is the result of bargaining between firms and trade unions, wages are lower if workers have to fear unemployment. His empirical results show that if workers expect redundancy or plant closure within the next year, wages are around 8 percent lower. Campbell, Carruth, Dickerson and Green (2007) find that past unemployment and unemployment of near family members and friends are linked with higher fears of unemployment. They also find that higher fears of unemployment lead to lower wage growth for men.

Goerke and Pannenberg (2012) state that individual perceptions and attitudes play an important role in wage negotiations. They theoretically and empirically look at risk aversion and collective bargaining for Germany and find that increasing risk aversion leads to lower wages.

Investigating how FDI and offshoring affect individual job loss fears, Scheve and Slaughter (2004) use industry FDI and Geishecker et al. (2012) take industry FDI and offshoring measures and link them with individual data on perceived job security. Scheve and Slaughter (2004) find that increasing FDI leads to increasing job insecurity of British workers. FDI increases the elasticity of labour demand and thus wage and employment volatility. Consequently, individual job insecurity rises. Related to the effects of FDI, Geishecker et al. (2012) find that offshoring toward low-wage countries increases individual job loss fears of German workers.

Besides the importance of subjective measures in collective bargaining, the perception of job security is also an important determinant for individual well-being and overall utility (see, e.g. Frey and Stutzer, 2002). Thus, the aim of this paper is to theoretically and empirically assess the effect of job loss fears on wages in the presence of collective bargaining, when firms have the possibility to offshore parts of their production abroad.

[3]Dreher and Gaston (2007) also empirically assess the bargaining power of 17 OECD countries. They use union membership as a measure for bargaining power and find no direct link between globalization and bargaining power.

3 Wage bargaining with job loss fears

The model presented in this paper builds on a general equilibrium model, where wages are determined by Nash wage bargaining with optional offshoring. In a right-to-manage setting the trade union is first negotiating with the firms over wages. In a second step firms can decide over the amount of labour demand and have the possibility to offshore parts of their production to maximize their profits.

A very similar framework can be found in Skaksen (2004). This paper, however, differs in two aspects. First, firms can use the possibility to shift production abroad as a threat in order to enforce lower domestic wages. I introduce the fear of job loss as a channel through which this threat is affecting worker's utility. Thus, job loss fears are modelled as an additional component in the utility function of the union members. Second, union members are heterogeneous in their individual perception of job loss fears and it is the median member of the trade union who determines the wage bargaining outcome.[4] As a consequence, the Nash wage bargaining solution shows, that with an increasing threat of potential offshoring, and therefore higher job loss fears, the trade union accepts lower wages.

3.1 Firms

The representative firm is producing one homogeneous good according to a Cobb-Douglas production function with decreasing returns to scale:

$$Q = N^{\alpha} H^{\beta}, \qquad \alpha + \beta < 1, \tag{1}$$

where Q is the quantity of the produced good, N is the labour input for the in house activity which cannot be offshored and H is the intermediate input which can either be produced in house or be purchased abroad (offshoring). Depending on whether the firm does offshoring or not, labour demand can be either $L = H$ or $L = N + H$. In order to prevent workers to switch between the two production factors, wages have to be equal for both factors.

According to the right-to-manage model, after the wage of in-house production is negotiated, the firm sets the amount of in-house labour demand and can decide whether to offshore the production of the intermediate good or not. Offshoring takes place if the cost of in-house labour exceeds the cost of offshoring. The firm's decision is based

[4] For an extensive description of right-to-manage and the median voter model, see, e.g. Booth (1994).

on maximizing the following profit function:

$$\Pi = Q - wL - cZ, \tag{2}$$

where the price of the produced good is set to one, w is the wage rate for in house labour L, c is the cost for offshoring including trade costs and Z is the quantity of the intermediate input in case of offshoring.

3.2 Labour market

All domestic workers are organized in one trade union and are collectively negotiating about the wage rate through Nash wage bargaining. In these wage bargaining solutions wages are usually higher than in a competitive labour market and labour demand is lower than the total endowment of union members, i.e. each member is faced with a probability of not getting employed. Beside this objective probability of job loss, I now introduce subjective individual job loss fears in the worker's utility function.

According to authors like Schmidt (1999), Green, Felstead and Burchell (2000), Manski and Straub (2000) and Nickell, Jones and Quintini (2002) job loss fear is decomposed into two components: the perceived probability of job loss and the subjective cost of job loss. Here, the subjective probability of job loss is a consequence of the uncertainty about the exact costs of offshoring. Workers observe offshoring activities in their domestic markets or outside their own country, while firms put pressure onto their workers during wage negotiations with the possibility to offshore parts of the production abroad. Workers sense this threat of potential offshoring and develop an own individual and subjective probability of getting displaced. This subjective probability is multiplied with the cost of job loss, which can be both actual monetary losses and non-pecuniary utility losses (see, e.g. Green et al., 2000). As a result, this gives the expected subjective loss of utility in case of unemployment. Hence, the utility of each employed worker i is a function of the utility of the wage w minus the job loss fear components $p_i \times [U(w) - U(\overline{w})]$:

$$U_i^w = U(w) - p_i \left[U(w) - U(\overline{w})\right], \tag{3}$$

with the subjective individual probability of job loss p_i and $\overline{w}$ as the reservation wage. The probability p_i has the functional form of a Pareto distribution:

$$p_i(w, k) = 1 - \left(\frac{\overline{w}}{w}\right)^k, \tag{4}$$

where $w > \overline{w}$ and $k > 0$. Workers differ in their perception of job loss fears, or more precisely, in their perceived probability of job loss, which is a function of the wage w and a perception parameter k. This parameter k is generally increasing with lower offshoring costs, i.e. $\partial k/\partial c < 0$. As already mentioned above, workers do not know the exact amount of offshoring costs. Instead, they perceive the threat of potential offshoring through their environment, such that decreasing offshoring costs intensify this threat, which in turn results in higher k. Inserting $U(w) = w$, $U(\overline{w}) = \overline{w}$ and p_i from Equation 4 the utility function of Equation 3 becomes:

$$U_i^w = \overline{w} + \overline{w}^k w^{1-k} - \overline{w}^{k+1} w^{-k}, \tag{5}$$

and the first and second derivative with respect to w are

$$\frac{\partial U_i^w}{\partial w} = (1-k)\overline{w}^k w^{-k} + k\overline{w}^{k+1} w^{-k-1} \tag{6}$$

$$\frac{\partial^2 U_i^w}{\partial w^2} = -k(1-k)\overline{w}^k w^{-k-1} - k(1+k)\overline{w}^{k+1} w^{-k-2}. \tag{7}$$

Figure 1 shows the graph of the utility function for $k = 0$, $k = 1$ and $k = 2$, representing three different threat scenarios for one worker. From this graph it can be seen that the utility function has different properties regarding the value of the individual perception parameter k:

- $\mathbf{k = 0}$: In the absence of job loss fears the utility function is constantly increasing in w: $U_i'(w) > 0$ and $U_i''(w) = 0$.
- $\mathbf{0 < k \leq 1}$: The utility function is increasing in w with a decreasing marginal utility: $U_i'(w) > 0$ and $U_i''(w) < 0$.
- $\mathbf{k > 1}$: The utility function is initially increasing in w with a decreasing marginal utility until the function reaches its maximum value at $w = \frac{k\overline{w}}{k-1}$. After $w = \frac{(1+k)\overline{w}}{k-1}$ the second derivative is changing its sign from being negative to positive.

In this bargaining environment, where all union members are heterogeneous regarding the perception parameter k, it is the median member of the trade union who decides if the bargained wage rate is accepted or not. Accordingly, it is the individual parameter k of the median member of the union which is crucial for determining the Nash bargaining solution.

In case of a successful negotiation, the expected outcome of the median member

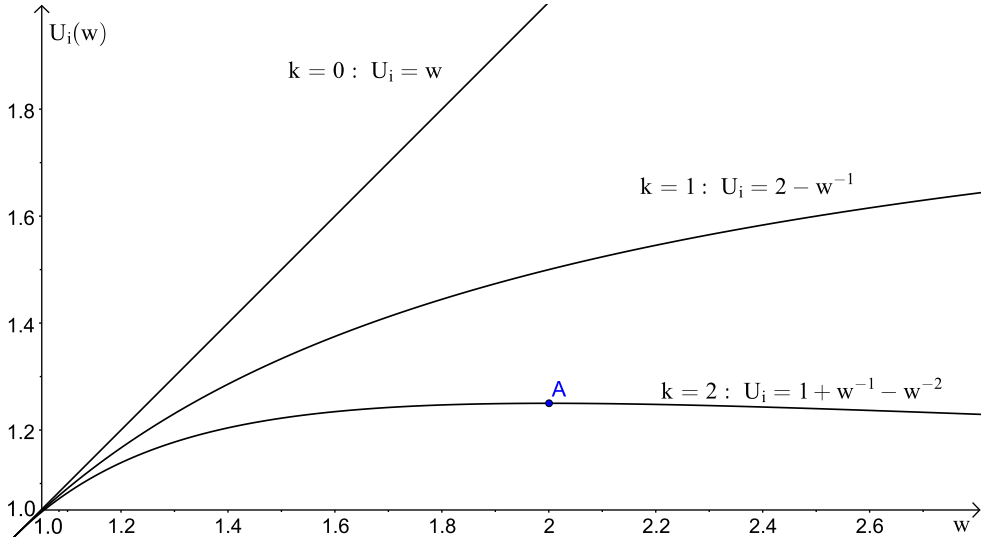

Figure 1: Utility function for different k. A: maximum utility for $k = 2$.

is the following:

$$U_m = \frac{L}{M} U_m^w + \left(1 - \frac{L}{M}\right) U_m^{\overline{w}}, \tag{8}$$

where the subscript m stands for the median member and U_m^w is the utility of the employed median member derived from Equation 3. L/M is the actual probability of getting employed after the wage is set. It is the fraction of labour demand L over the total number of union members, M. $U_m^{\overline{w}}$ is the utility of the median member in case of unemployment and is set to $U_m^{\overline{w}} = \overline{w}$.

To get the Nash wage bargaining solution, the Nash product NP has to be maximized with subject to the wage rate w, see e.g. Binmore, Rubinstein and Wolinsky (1986):

$$\max_w : NP = \left(U_m - U_m^{\overline{w}}\right)^{\gamma} \left(\Pi - \overline{\Pi}\right)^{1-\gamma}, \tag{9}$$

where U_m is derived from Equation 8 and $U_m^{\overline{w}} = \overline{w}$ is the utility of the median worker in case of a conflict. Π is derived from Equation 2 and the profit for the firm in case of a conflict is $\overline{\Pi} = 0$. In case of a conflict, all workers are unemployed. The bargaining power of the trade union and the firm is represented by the exponent γ and $1 - \gamma$, respectively.

3.3 Nash wage bargaining

The right-to-manage model consists of two stages. In the first stage the wage is negotiated between the trade union and the firms and in the second stage the firms determine employment and offshoring, taking into account the negotiated wage from the first stage. To solve this sequential game backwards, I first derive the demand of in house labour, given the wage rate w and offshoring costs c. Unlike the union members, firms do have exact information about the costs of offshoring. After that, the optimal wage bargaining solution is obtained by maximizing the Nash product with subject to w, knowing the profit maximizing labour demand of the firms.

3.4 Stage 2

To get the optimal domestic labour demand, the profit function of the firm from Equation 2 is maximized with subject to L. In-house employment differs if the firm does offshoring or not:

$$L = \begin{cases} N + H = (A_1 + A_2) w^{\frac{-1}{1-\alpha-\beta}}, & \text{if } w \leq c \\ N = A_1 w^{\frac{\beta-1}{1-\alpha-\beta}} c^{\frac{-\beta}{1-\alpha-\beta}}, & \text{if } w > c, \end{cases} \tag{10}$$

where $A_1 = \alpha^{\frac{1-\beta}{1-\alpha-\beta}} \beta^{\frac{\beta}{1-\alpha-\beta}}$, and $A_2 = \alpha^{\frac{\alpha}{1-\alpha-\beta}} \beta^{\frac{1-\alpha}{1-\alpha-\beta}}$. In the first case wages are below offshoring costs and the firm produces the intermediate input at home ($L = N + H$). Unsurprisingly, labour demand is decreasing in w. In the second case wages are higher than offshoring costs and the firm employs domestic workers only in the first activity ($L = N$). Labour demand is decreasing in w and c.
Accordingly, the profit maximizing demand for purchasing the intermediate input abroad is:

$$Z = \begin{cases} 0, & \text{if } w \leq c \\ H = A_2 w^{\frac{-\alpha}{1-\alpha-\beta}} c^{\frac{\alpha-1}{1-\alpha-\beta}}, & \text{if } w > c. \end{cases} \tag{11}$$

If the cost of offshoring is above domestic wages the firm does not offshore and the demand of the abroad produced intermediate input is zero. In the second case the firm does offshoring due to lower offshoring costs and demand Z is positive and decreasing in w and c.

3.4.1 Stage 1

In the first stage the wage is negotiated between the firm and the trade union, both taking the level of employment from the second stage into account. The Nash bargaining solution is obtained by the wage $\hat{w}$, which maximizes the Nash product from Equation 9. As already mentioned above, the fear of job loss is depending on the individual perception parameter k, which is increasing with the threat of potential offshoring when offshoring costs are decreasing. Trade union members have no full information on c. They can only perceive the threat of potential offshoring and can make predictions of c via offshoring activities in other countries or industries.

The first order condition for maximizing the Nash product from Equation 9 with subject to w is:

$$\frac{\partial NP}{\partial w} = \gamma \frac{\partial U_m(w)/\partial w}{U_m(w) - U(\overline{w})} - \gamma \frac{\partial L(w)/\partial w}{L(w)} + (1-\gamma)\frac{\partial \pi(w)/\partial w}{\pi(w)} = 0 \tag{12}$$

Inserting the profit function of the firm π from Equation 2 and labour demand $L(w)$ from Equation 10, the first order condition becomes:

$$\frac{\partial NP}{\partial w} = \gamma \frac{1 - k + k\overline{w}w_{-1}}{w - \overline{w}} + \frac{(1-\gamma)(-\alpha-\beta)-\gamma}{(1-\alpha-\beta)w} = 0 \tag{13}$$

Solving Equation 13 for $\hat{w}$ yields:

$$\hat{w} = \overline{w}\left(1 + \frac{\gamma(1-\alpha-\beta)}{\alpha+\beta+k\gamma(1-\alpha-\beta)}\right). \tag{14}$$

The wage $\hat{w}$ of the Nash bargaining solution is a function of the reservation wage $\overline{w}$, the parameters α and β from the production function, the bargaining power of the trade union γ, and the median member's perception parameter k. The firm threatens the union members with the possibility of offshoring, and as a result, the fear of losing employment lowers the optimal wage rate through the parameter k. The higher the median union member perceives the threat of potential offshoring, the lower the Nash bargaining solution:

$$\frac{\partial \hat{w}}{\partial k} = -\overline{w}\gamma^2 \frac{(\alpha+\beta-1)^2}{[\alpha+\beta+k\gamma(1-\alpha-\beta)]^2} < 0. \tag{15}$$

However, there are two solutions from maximizing the Nash product, differentiated

by the median member's perception of the threat of potential offshoring:

$$\hat{w} = \begin{cases} \hat{w}_1 = \overline{w}\left(1 + \frac{\gamma(1-\alpha-\beta)}{\alpha+\beta+k\gamma(1-\alpha-\beta)}\right), & \text{if } k \leq z \\ \hat{w}_2 = \overline{w}\left(1 + \frac{\gamma(1-\alpha-\beta)}{\alpha}\right), & \text{if } k > z. \end{cases} \tag{16}$$

In the first scenario, union members are concerned about their future employment and are willing to accept lower wages in order to prevent the firm from offshoring and to keep employment for both production factors in house. The willingness of the trade union members to agree to a wage cut is, however, limited. In a second scenario the threat of potential offshoring is so strong, i.e. k is greater than the threshold variable z, that the trade union accepts offshoring and only negotiates over the wage for employment in the first factor, which cannot be offshored. In this case, the expected utility of the median member must be higher than in the first scenario. However, since offshoring is happening now, domestic employment is lower (see Equation 10).

As already mentioned above, Skaksen (2004) uses a similar framework regarding the firms' decision for offshoring and the determination of wages via Nash bargaining. He describes three different outcomes for the Nash wage bargaining, depending on the costs of offshoring. In one scenario offshoring costs are so high that the firm will never do offshoring and the wage bargaining solution is as if offshoring is not possible. In the other scenario offshoring costs are so low that union members accept offshoring and negotiate only over the wage for the remaining in-house production. However, in the most interesting scenario the bargaining outcome has no analytical result. Skaksen argues that there exists an interval in which the costs of offshoring are sufficiently low to threaten domestic employment while high enough so that the workers are willing to accept wage cuts to prevent the firm from offshoring. As the only possible solution Skaksen proposes the wage that is exactly equal to the costs of offshoring so that the firm just decides to produce at home. In the model described above it is now possible to find an analytical result for this scenario because there exists a k which reproduces the result of Skaksen (2004). To show this, the Nash bargaining solution from Equation 14 has to be equal to the cost of offshoring:

$$\overline{w}\left(1 + \frac{\gamma(1-\alpha-\beta)}{\alpha+\beta+k\gamma(1-\alpha-\beta)}\right) = c \tag{17}$$

Solving this equation for the fear perception parameter k, gives:

$$k = \frac{1}{\gamma}\left(\frac{\alpha+\beta}{\alpha+\beta-1} + \frac{\gamma}{\frac{c}{\overline{w}}-1}\right) \tag{18}$$

Thus, if the fear perception parameter k of the median trade union member equals exactly Equation 18, $\hat{w} = c$ is a Nash bargaining solution in the presence of job loss fears. Accordingly, the solution of Skaksen (2004) is a special case of the Nash bargaining model presented in this paper. The Nash bargaining result of Equation 14 is in fact much more general and allows wage rates which are even below the costs of offshoring, depending how strong the fear of job loss is.

4 Empirical analysis

A large part of the German wages are negotiated industry-wide between employers and trade unions. This wage applies, however, often only as a base trade. In addition to this industry-wide wage floor, many non-tariff payments are individually negotiated between the company and its employees, and hence leads to different individual wages.

One advantage of the the median voter concept in the collective bargaining model is that the same results can be drawn for individual wage bargaining. In the collective wage bargaining model, it is the utility function of the median voter which is crucial for the wage of all union members. To change the setting to an individual wage bargaining model, the utility function of the median member has to be replace with the utility function and fear level of the respective individual. The result of decreasing wages with increasing fears will still be the same.

In this section two implications of the theoretical model are empirically evaluated with combined micro and industry data for the German manufacturing sector. The first implication to check is, whether increasing job loss fear results in lower wages. The second, whether the threat of potential offshoring lower wages through different levels of job loss fear.

4.1 Data

For this analysis I use micro data at the individual level from the German Socio-Economic Panel (SOEP), a large longitudinal survey of private households, for the years 1995 to 2008.[5] The focus is on male and female full-time workers of the manufacturing sector (NACE 15-36) at the age of 18 to 65 years. The dependent variable is the natural logarithm of real hourly wages, constructed from the Cross-National

[5]For more details on the German SOEP, see e.g. Wagner, Frick and Schupp (2007). The data used in this paper was extracted using the Add-On package PanelWhiz for Stata. PanelWhiz (http://www.PanelWhiz.eu) was written by Dr. John P. Haisken-DeNew (john@PanelWhiz.eu). See Haisken-DeNew and Hahn (2010) for details. The PanelWhiz generated DO file to retrieve the data used here is available from the author upon request. Any data or computational errors in this paper are my own.

Equivalent File (CNEF) of the SOEP. Hourly wages are yearly total wages and salaries from main job (reported the previous year) with 13th and 14th month salary, profit sharing and vacation and Christmas bonus, divided by the total amount of working hours per year.

The variable measuring perceived job loss fear is yearly obtained from the SOEP by asking the respondents how concerned they are about their job security. The respondents can answer in three categories: *not concerned at all; somewhat concerned; very concerned*. Accordingly, the variable is coded in ordinal scale of three categories.

In the theoretical model it is potential and not realised offshoring that is threatening the workers' jobs. However, potential offshoring cannot be observed and is therefore approximated by world-wide export supply of intermediate goods. World-wide export supply has been used only for instrumenting actual offshoring in the empirical literature like e.g., in Baumgarten et al. (2013), and is now used as a proxy for potential offshoring for the first time. It is measured at the 2 digit industry level and is obtained from the UN Comtrade database. To prevent problems of endogeneity, world-wide export supply includes all countries reported except Germany.

As a short robustness check, actual offshoring is also used in this analysis. Actual offshoring is measured as an extended version of the narrow concept of Feenstra and Hanson (1999), which means that it only captures intermediate inputs denoted to the corresponding industry of itself.[6] For constructing actual offshoring, import data from Eurostat COMEXT are combined with input-output tables from the German Federal Statistical Office.

To capture additional industry-specific characteristics that might affect wages, industry productions values from the Federal Statistical Office of Germany and industry specific R&D expenditures from the OECD ANBERD database are also used.

4.2 Empirical model and identification

The empirical model applied here is a standard wage regression with common individual demographic covariates, like in Mincer (1974), Brown and Medoff (1989), Schmidt and Zimmermann (1991), extended with variables for individual job loss fears, potential offshoring and several other covariates capturing industry specific characteristics:

[6]For a more detailed description of this offshoring measure, see Appendix of Geishecker et al. (2012).

$$\begin{aligned} \ln W_{ijt} = \alpha + \gamma \text{FEAR}_{it-1} + \delta \ln \text{OFF}_{jt+1} + \eta \text{FEAR}_{it-1} \times ln\text{OFF}_{jt+1} \\ + \beta \text{X}_{it} + \tau \text{IND}_{jt} + \theta_t + \lambda_j + \mu_i + \epsilon_{ijt} \end{aligned} \tag{19}$$

The dependent variable is the log of hourly wages W for individual i in industry j at time t. The variable FEAR stands for the level of individually perceived fear of job loss. It is measured in three categories and is recoded into three dummy variables indicating low, medium and high fears. In the theoretical model individual job loss fear is a function of the current wage. Including job loss fear in time t into the empirical model would lead to simultaneity problems. For that reason, FEAR goes into the model with a one period lag, assuming that past fears may explain current wages but current wages cannot influence past individual fears.

OFF is potential offshoring for industry j and is measured as world-wide export supply of intermediate goods excluding Germany. If supply of intermediate goods of the rest of the world increases, it indicates that costs of offshoring decreases so that it is more attractive for domestic firms to purchase intermediate goods from abroad. Domestic workers see future world-wide trade in intermediate goods as an indicator for potential offshoring for their domestic firms and therefore as a threat for their jobs.[7] Potential offshoring is split into high- and low-wage countries, where high-wage countries are defined as "advanced economies" from the IMF *International Financial Statistics*.[8] The reason behind is that worker may see only export of intermediate goods from low-wage countries as a threat for their jobs.

Additionally, there could also be a simultaneity problem with future world-wide export supply of intermediate goods and wages. This problem can be avoided by using individual wage data and arguing that aggregate industry export supply is unlikely to be determined by individual wages (see, e.g., Ebenstein et al., 2011 and Baumgarten et al., 2013). Furthermore, Germany is excluded as export supplier and partner country in the export supply data. Hence, the most likely occurring case that German wages may determine export activities towards Germany can be excluded.

X is a vector of individual demographic variables including dummy variables for four different age intervals, dummies for low, medium and high levels of education[9],

[7] I assume that on average, workers can make perfect predictions of future world-wide trade in intermediate goods.

[8] high-wage countries are: EU-15, USA, Canada, New Zealand, Australia, Japan, Norway, Switzerland and Iceland.

[9] Accoring to the OECD International Standard Classification of Education (ISCED), workers are split into low, medium and high-skilled.

and dummy variables for being married and for having children. Furthermore, there are variables on work related individual characteristics like tenure, work experience, occupation and firm size. IND denotes Industry production values and research and development intensities and are accounting for industry specific wage effects. For detailed descriptive statistics on all variables used in this analysis, see Table 1.

In order to control for as much observed and unobserved heterogeneity as possible,

Table 1: Descriptive statistics

Variable	Notes	Mean	SD
Real hourly wage	in Euro	16.67	8.75
D: JobLossFear: low	0/1	0.33	0.47
D: JobLossFear: medium	0/1	0.50	0.50
D: JobLossFear: high	0/1	0.18	0.38
D: Age: 18 - 24	0/1	0.03	0.16
D: Age: 25 - 39	0/1	0.40	0.49
D: Age: 40 - 54	0/1	0.46	0.50
D: Age: 55 - 65	0/1	0.12	0.32
Tenure	in years	12.68	9.58
Work Experience: full-time	in years	19.30	10.12
Work Experience: part-time	in years	0.55	2.09
D: Education: low	0/1	0.15	0.35
D: Education: medium	0/1	0.66	0.47
D: Education: high	0/1	0.19	0.39
D: Occupation: missing	0/1	0.00	0.03
D: Occupation: clerk	0/1	0.08	0.27
D: Occupation: service	0/1	0.01	0.08
D: Occupation: craft	0/1	0.33	0.47
D: Occupation: skilled	0/1	0.18	0.39
D: Occupation: unskilled	0/1	0.05	0.22
D: Married	0/1	0.72	0.45
D: Children	0/1	0.46	0.50
D: Firm Size < 20	0/1	0.14	0.35
D: Firm Size 20 - 199	0/1	0.24	0.43
D: Firm Size 200 - 1999	0/1	0.09	0.29
D: Firm Size > 1999	0/1	0.02	0.15
D: Firm Size missing	0/1	0.00	0.05
D: Public Firm	0/1	0.01	0.09
Industry Producation Value	in Billion Euro	104.53	62.65
actual: $\text{OFF}^{highwage}$	in percentage points	4.94	4.41
actual: $\text{OFF}^{lowwage}$	in percentage points	1.79	1.77
$\text{OFF}^{highwage}$	in Billion US-Dollar	242.56	208.49
$\text{OFF}^{lowwage}$	in Billion US-Dollar	126.05	121.99
R&D / Y	in percentage points	2.23	2.40
Observations		16507	

the model also controls for time fixed effects θ_t, industry fixed effects λ_j and individual fixed effects μ_i. Additionally, regional dummies at the federal state level and industry

specific time trends are also included and ϵ_{ijt} is the residual error term. This model is estimated with OLS with clustered standard errors at the combined industry federal state mode applying the sandwich formula of White (1980) and Arellano (1987).

In this empirical analysis I want to test two predictions of the theoretical model. First, whether an increase in job loss fear lowers wages. Second, whether there is an effect of potential offshoring on wages through the different levels of job loss fears. To test the first prediction, two dummy variables indicating medium and high level of fear capture the effect of individuals who change from no fear to medium or high fear. To test the second prediction the empirical model controls for potential industry offshoring and individual job loss fears separately and multiplied together as an interaction term. The coefficient of potential offshoring plus the coefficient of the interaction term gives the effect of changes of potential industry offshoring on wages for different levels of job loss fears as elasticity:

$$\frac{\partial \ln W_{ijt}}{\partial \ln \mathrm{OFF}_{jt+1}} = \delta + \eta \times \mathrm{FEAR}_{jt-1} \tag{20}$$

4.3 Estimation results

Table 2 shows the results of the fixed effects OLS regressions for different specifications. They all include individual, workplace and industry characteristics, where almost all coefficients have the expected sign. Wages significantly increase by age and tenure, however, probably due to high multicollinearity with age and tenure, years of work experience have no more additional significant effects on wages. As expected, workers with higher education levels receive significant higher wages. Ceteris paribus, workers get around 7.7 or even 15.7 percent higher wages when changing from low to medium or from low- to high-skilled level, respectively. Being married has a small positive impact on wages, whereas having children has no effect at all. Workers employed in bigger firms with more than 2000 employees also receive higher wages of around 4.7 percent. Interestingly, industry specific characteristics like industry production value and R&D intensity have no significant effect. With industry specific time trends and industry fixed effects, those covariates do not have any more explanatory power.

The first specification reported in the first column of Table 2 also shows the effect of medium and high job loss fears on wages. Perceiving no fear of job loss is represented by the reference category. According to the estimation results, changing from low to medium job loss fear does not have any effect on wages. However, workers who change to high job loss fear experience a wage cut by around 1.6 percent on

Table 2: Fixed effects OLS wage regressions

Dependent variable: log of hourly wages				
	(1)	(2)	(3)	(4)
D: Age: 25 - 39	0.0671***	0.0672***	0.0664***	0.0686***
	(0.021)	(0.021)	(0.021)	(0.021)
D: Age: 40 - 54	0.0529**	0.0530**	0.0525**	0.0545**
	(0.023)	(0.023)	(0.023)	(0.023)
D: Age: 55 - 65	0.0744***	0.0746***	0.0739***	0.0757***
	(0.026)	(0.026)	(0.026)	(0.026)
Tenure	0.0036**	0.0036**	0.0035**	0.0035**
	(0.002)	(0.002)	(0.002)	(0.002)
Work Experience: full-time	-0.0235	-0.0234	-0.0235	-0.0233
	(0.019)	(0.019)	(0.019)	(0.019)
Work Experience: full-time^2	-0.0003***	-0.0003***	-0.0003***	-0.0003***
	(0.000)	(0.000)	(0.000)	(0.000)
Work Experience: part-time	-0.0254	-0.0255	-0.0255	-0.0255
	(0.018)	(0.018)	(0.018)	(0.018)
Work Experience: part-time^2	0.0005	0.0004	0.0005	0.0004
	(0.001)	(0.001)	(0.001)	(0.001)
D: Education: medium	0.0742***	0.0744***	0.0742***	0.0740***
	(0.017)	(0.017)	(0.017)	(0.017)
D: Education: high	0.1463***	0.1475***	0.1473***	0.1475***
	(0.049)	(0.049)	(0.049)	(0.049)
D: Married	0.0212*	0.0210*	0.0213*	0.0207*
	(0.012)	(0.012)	(0.012)	(0.012)
D: Children	-0.0017	-0.0017	-0.0018	-0.0022
	(0.011)	(0.011)	(0.011)	(0.011)
D: Firm Size 20 - 199	0.0032	0.0031	0.0031	0.0029
	(0.006)	(0.006)	(0.006)	(0.006)
D: Firm Size 200 - 1999	0.0118	0.0120	0.0120	0.0118
	(0.009)	(0.009)	(0.009)	(0.009)
D: Firm Size > 1999	0.0458***	0.0465***	0.0462***	0.0456***
	(0.015)	(0.015)	(0.015)	(0.015)
D: Firm Size missing	0.0138	0.0141	0.0138	0.0139
	(0.048)	(0.048)	(0.048)	(0.048)
D: Public Firm	0.0023	0.0027	0.0024	0.0018
	(0.024)	(0.024)	(0.024)	(0.024)
Industry Production Value	-0.0004	-0.0005	-0.0005	-0.0006
	(0.000)	(0.000)	(0.000)	(0.000)
R& D / Y	-0.0088	-0.0084	-.01188*	-0.0089
	(0.006)	(0.006)	(0.007)	(0.006)
D: Fear: medium	0.0002	0.0003	0.0003	0.0321
	(0.006)	(0.006)	(0.006)	(0.022)
D: Fear: high	-0.0158**	-0.0158**	-0.0158**	0.0342
	(0.007)	(0.007)	(0.007)	(0.031)
actual: OFF^{highwage}			-0.0035	
			(0.003)	
actual: OFF^{lowwage}			0.0006	
			(0.006)	
$\ln\text{OFF}^{highwage}_{t+1}$		0.0793*		0.0780
		(0.047)		(0.048)
$\ln\text{OFF}^{lowwage}_{t+1}$		-0.0692*		-0.0604
		(0.040)		(0.041)
$\text{Fear}^{high} \times \ln\text{OFF}^{highwage}_{t+1}$				0.0128
				(0.013)
$\text{Fear}^{med} \times \ln\text{OFF}^{highwage}_{t+1}$				0.0019
				(0.011)
$\text{Fear}^{high} \times \ln\text{OFF}^{lowwage}_{t+1}$				-0.0255*
				(0.014)
$\text{Fear}^{med} \times \ln\text{OFF}^{lowwage}_{t+1}$				-0.0093
				(0.011)
Constant	3.2162***	2.9585***	3.2800***	2.9729***
	(0.259)	(0.251)	(0.260)	(0.363)
Observations	16,507	16,507	16,507	16,507
R-squared	0.865	0.865	0.865	0.865
Number of individuals	3,636	3,636	3,636	3,636

Reference category: low job loss fear, age 18-25 low education, firm size < 20
Standard errors in brackets. ***, **, * significant at 1, 5, 10 %.

average, ceteris paribus. This change in fear of job loss corresponds to a change of the perception parameter k from the theoretical model, where increasing k, ceteris paribus, lowers the optimal Nash wage bargaining solution. This first specification only shows the stand-alone effect of job loss fears on wages. In the following, I also include potential offshoring individually and interacted with job loss fear to capture the effect of potential offshoring through different levels of job loss fears.

The second column of Table 2 adds potential offshoring, separated into high- and low-wage exporting countries. The results show that potential offshoring has contrary effects on wages, depending on the wage level of the country which supplies the intermediate goods. Increasing export supply of intermediate goods from high-wage countries does have a positive effect, where an one percent increase leads to 0.08 percent higher wages, ceteris paribus. However, a one percent increase of export supply of intermediate goods from low-wage countries, i.e. a one percent increase of potential offshoring for domestic firms, lowers wages of domestic workers by 0.07 percent.

Regarding those findings it is important to note that export supply of intermediate goods from high-wage countries does not necessarily means a threat of potential offshoring for domestic jobs. Rather, this effect is similar to empirically observable employment and wage effects of offshoring to high-wage countries, where wages may rise due to increasing labour demand and/or productivity gains, like, e.g. in Ebenstein et al. (forthcoming) and Sethupathy (2013).

Export supply of intermediate goods from low-wage countries, however, can be seen as a threat for domestic jobs. According to the theoretical model, this threat results in lower wages, where the magnitude depends on the level of individually perceived fear of job loss.

To compare the effect of the threat of potential offshoring with the effect of actual offshoring on wages, column 3 of Table 2 shows the otherwise same specification now with actual offshoring. The small and also insignificant estimates indicate no effect of within industry changes of actual offshoring, which confirms the findings of empirical studies of e.g., Ebenstein et al. (forthcoming) or Baumgarten et al. (2013). In contrast, within industry changes of potential offshoring are sufficient enough to show their impact on wages.

To test if an increasing threat of potential offshoring does lower wages differently, regarding the level of perceived fear of job loss, the third specification additionally contains estimates of potential offshoring interacted with dummy variables for medium and high levels of job loss fear. The third column of Table 2 shows a significant negative effect of the interaction term of potential offshoring and high level of job loss fears. For workers who are in the highest fear category, increasing potential offshoring does have a stronger negative impact on wages than workers who are in the medium or low fear category.

To quantify the magnitude and statistical significance of potential offshoring on wages, the parameter estimates of potential offshoring and the interaction terms are

derived from Equation 20. Table 3 shows the marginal effects of potential offshoring on wages by fear level, as well as standard errors and the test for statistical significance.

Table 3: Marginal effects of potential offshoring by fear level

	Fear: low	Fear: medium	Fear: high
$\ln OFF_{t+1}^{highwage}$	0.0780	0.0798*	0.0907*
	(0.048)	(0.048)	(0.048)
$\ln OFF_{t+1}^{lowwage}$	-0.0604	-0.0700*	-0.0858**
	(0.041)	(0.041)	(0.041)

standard errors in brackets. ***, **, * significant at 1, 5, 10 %.

Initially, it is striking that the opposing effects established above of export supply of intermediate goods for low- and high-wage countries gain with increasing fears. Even though the effects are only weakly statistical significant, export supply of high-wage countries raises hourly wages by 0.08 and 0.09 percent for worker with medium and high fear levels, respectively. This result seems to be slightly counterintuitive at first sight. For workers who conceive stronger fears, it would be reasonable to be more reserved in demanding higher wages in order to stay employed. One possible reason for this is that workers with a higher fear level may claim a higher wage premium than workers with less fear when there is no increasing threat of potential offshoring.

The effects reported in Table 3 match the predicted results of the theoretical model regarding the wage effect of potential offshoring for domestic workers with different fear levels. Increasing potential offshoring lowers the wages for all fear levels differently. For workers with low fears, a one percent increase of potential offshoring lowers hourly wages by 0.06 percent, for workers with medium fears by 0.07 percent and for the workers with high fears the wage loss is strongest with almost 0.09 percent. Only the effect for workers with a high fear level is statistical significant at the 5 percent level, though.

Table 4 shows that the percentage changes of the variable for potential offshoring are partly large and volatile. Depending on the industry, the average rate of change for the period 1995 to 2008 is between 0.2 and 15.6 percent. Considering now the sector of motor vehicles (NACE code 34), in which the average yearly change rate is about 13 percent, according to the regression results for the wage of German workers in this industry the following can be stated:

- Ceteris paribus, the yearly average increase in potential offshoring of 13 percent

Table 4: Average yearly wage effect of potential offshoring by fear level

NACE Code	Industry description	yearly average change of potential offshoring	Effect by fear level low	med	high
15	Food products, beverages, tobacco	7.58	-0.46	-0.53	-0.65
17	Textiles	2.81	-0.17	-0.20	-0.24
18	Wearing apparel; dressing of fur	4.66	-0.28	-0.33	-0.40
19	Tanning and dressing of leather	0.18	-0.01	-0.01	-0.02
20	Wood and cork, except furniture	4.09	-0.25	-0.29	-0.35
21	Pulp, paper and paper products	5.98	-0.36	-0.42	-0.51
22	Publishing, printing	15.59	-0.94	-1.09	-1.34
23	Coke, refined petroleum products	14.28	-0.86	-1.00	-1.22
24	Chemicals and chemical products	8.90	-0.54	-0.62	-0.76
25	Rubber and plastic products	10.57	-0.64	-0.74	-0.91
26	Other mineral products	10.06	-0.61	-0.70	-0.86
27	Basic metals	9.77	-0.59	-0.68	-0.84
28	Fabricated metal products	11.88	-0.72	-0.83	-1.02
29	Machinery and equipment	13.08	-0.79	-0.92	-1.12
30	Office machinery & computers	6.97	-0.42	-0.49	-0.60
31	Electrical machinery & apparatus	10.53	-0.64	-0.74	-0.90
32	Radio, TV and communication	9.14	-0.55	-0.64	-0.78
33	Medical, precision and optical instr.	10.30	-0.62	-0.72	-0.88
34	Motor vehicles and trailers	13.24	-0.80	-0.93	-1.14
35	Other transport equipment	11.86	-0.72	-0.83	-1.02
36	Furniture	7.11	-0.43	-0.50	-0.61

Note: Author's calculation. All numbers in percentage points. Average change of potential offshoring was calculated using the geometric mean.

causes wage cuts of about 1.1 percent ($13.24 \times -0.0858 \approx -1.14$) for workers with a high level of fear. Whereas workers with medium or low fears are less affected with a 0.93 and 0.8 percent wage cut, respectively.

- The biggest increase of potential offshoring in the motor vehicles sector was in 2004. Ceteris paribus, this increase affected a cut in wages of workers with strong fears of almost 2.9 percent. For workers with little or no fears wages decreases by 2.3 and 2.0 percent, respectively.
- A worker who was employed in the motor vehicles sector for the entire period capturing this analysis and constantly perceived a high level of job loss fear had to accept a wage cut of 16 percent due to changes of potential offshoring from 1995 to 2008. Whereas a worker with constantly no fear of job loss but otherwise completely identical, only had to face a wage cut of 11.2 percent, ceteris paribus.

5 Conclusion

In this paper I theoretically and empirically show that the increasing opportunities for firms to offshore results in lower wages if workers fear for their jobs.

In the theoretical model firms can chose either to produce the intermediate good in house or purchase it from abroad. Workers are organized in one trade union and differ in their individual perception regarding their job security. Therefore, I introduce job loss fear as an additional term of the worker's utility function. Firms and the trade union are negotiating over wages via Nash wage bargaining. Firms can use the opportunity of relocating parts of the production abroad as a threat to induce workers' fears. The Nash wage bargaining solution shows that rising fears, induced by potential offshoring, leads to lower wages.

For the empirical analysis I use a large German household panel dataset combined with industry-level data. Since it is potential and not realised offshoring which is threatening workers' jobs, world-wide export supply of intermediate goods is used as a proxy for measuring potential offshoring. I find that in general increasing fears of job loss leads to lower wages. Workers who become more anxious, and therefore switch from low to a high level of fear, are paid with 1.6 percent lower wages on average. Moreover, increasing potential offshoring to low-wage countries has a negative impact on wages, where workers with different levels of job loss fear are also affected differently. For instance, in the sector of motor vehicles the cumulative change of potential offshoring from 1995 to 2008 led to declining wages of about 11.2 and 16 percent for workers perceiving a low and a high level of job loss fears, respectively.

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