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ABSTRACT

Can Deunionization Lead to International Outsourcing?*

We analyze unionized firms' incentives to outsource intermediate goods production to foreign (low-cost) subcontractors. Such outsourcing leads to increased wages for the remaining in-house production. We find that stronger unions, which imply higher domestic wages, reduce incentives for international outsourcing. Though somewhat surprising, this result provides a theoretical conciliation of the empirically observed trends of deunionization and increased international outsourcing in many countries. We further show that globalization- interpreted as either market integration or increased product market competition -will increase incentives for international outsourcing.

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1 Introduction

Many fear the consequences of globalization for ‘ordinary workers’ in the developed world. Will their jobs disappear to countries where labor costs are only a fraction of what they are in Western Europe and the US? Perhaps the rich world is left with ‘the new enterprise’ where highly skilled workers perform a firm’s core activities – and where everything that can be outsourced to low-income countries, is in fact outsourced. What will then happen to the less skilled?

An interesting question concerns the role of trade unions in such a situation. Are they the cause behind job losses in rich countries? Could it be that weaker unions would lead to more flexible wage setting, so that job losses could have been prevented – albeit at the price of higher wage dispersion among skilled and unskilled workers?

The role of trade unionism has evolved dramatically differently in different countries over the recent years.¹ The perhaps most drastic example of deunionization is the UK, where the percentage of workers covered by collective bargaining has fallen sharply over the last 15 years. The US always had weaker unions than Europe, but also there union coverage has been falling, albeit from a level that was low to begin with. In Continental Europe and Scandinavia union coverage is almost unchanged. Many of these countries are characterized by more centralized bargaining systems than in the UK and the US, and union membership rates remain at a high level. There are also a couple of countries, notably France and Portugal, where membership rates have fallen to quite low levels, but where union coverage – the percentage of the workforce that is covered by collective agreements – is still very high.

If trade unions and a lack of downwards wage-flexibility were important factors behind firms’ rush to outsource tasks to low-income countries, one would expect that outsourcing was more prevalent in countries with strong unions than in countries with weak unions. The facts do not seem to support this notion. Although it is not easy to find good data on country-wide outsourcing, one possible measure that may capture international outsourcing activities is the share of parts and components (input factors) in total imports. In Figure 1, we use data on this share found in Yeats (2001), and plot them against bargaining coverage levels – which is arguably the most relevant measure of the degree of unionization in a country – from OECD (1997), augmented by data from Dell’Aringa et

¹Some core facts are documented in OECD (1997) and EEAG (2004).

al. (2004) for the case of Ireland.

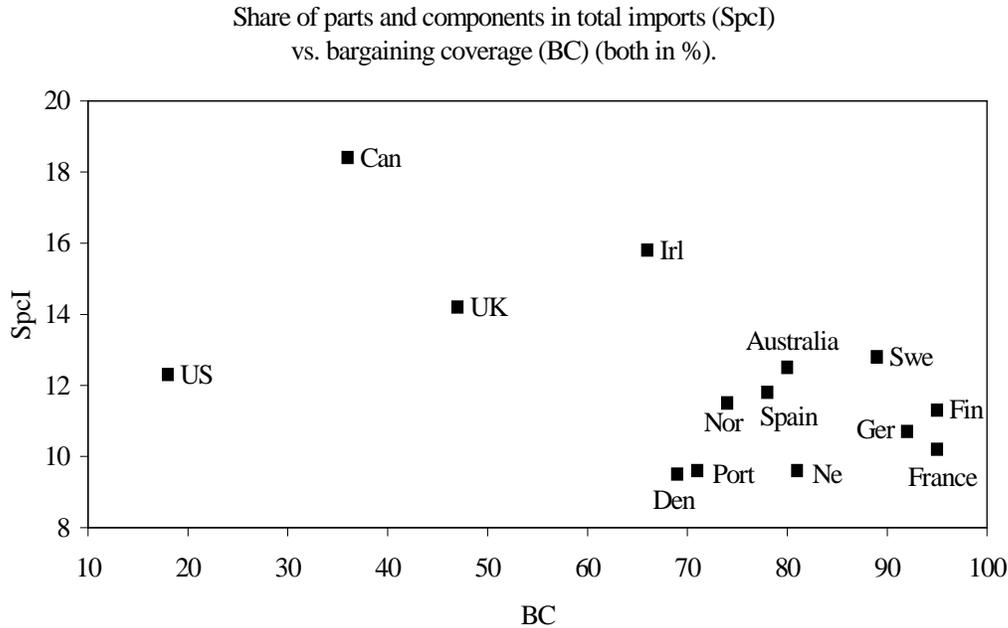


Figure 1

It is not advisable to draw any strong conclusions from such a picture, although it suggests that parts and components constitute a relatively low share of total imports for countries with high bargaining coverage rates. This is the opposite of what one would expect if trade unionism drove outsourcing. The US is an outlier in this figure, maybe because of the much larger possibility of US firms to outsource domestically due to the presence of many potential domestic subcontractors.² One could alternatively see Canada as the outlier (perhaps because Canadian production is so interrelated with what goes on in the US); then the impression becomes that outsourcing is rather independent of the strength of unions.³

This paper presents a theoretical model of deunionization and outsourcing decisions. The main result of the analysis is that deunionization can in fact trigger outsourcing. The

²Of course, this effect must also dominate the similar effect that makes *final good* imports low, due to the presence of many final goods manufacturers in a large country.

³It has been suggested to us that since, following Machin (2000), deunionization could be a result of increased importance of new industries, we could circumvent this potential problem by using coverage and imports related to manufactures only. The limited data we found (not reported) does still not seem to run contrary to our main result.

main building block behind this argument is that as more and more tasks are outsourced, the incentives for the remaining workforce to show wage restraint are weakened. Deunionization reduces the wage hike following outsourcing – and makes outsourcing more attractive. This suggests that union bashing is *not* an effective way to preserve jobs and income opportunities for less skilled workers in rich countries.

There is a quite substantial existing literature that studies theoretically the effect of globalization (most often taken to mean trade liberalization) on outcomes for unionized workers. Both Staiger (1988) and Naylor (1998, 1999) present models where unionized labor in fact might benefit from globalization. For example, Naylor presents a rather rosy picture: Unionized workers gain both in terms of higher wages and in terms of more jobs. Trade liberalization means more competition in the market, which lowers firms' profits but also expands total production. Firms lose market shares at home, but they gain shares abroad, and total production goes up. This leads to higher labor demand – which unions manage to translate both to higher wages and more jobs. Lommerud, Meland and Sørgard (2003) warn that the picture becomes more complex if domestic firms can move production out of the country, and there is then a tendency that unionized workers can suffer from globalization. In fact, it is exactly the possibility that unionized wages go up following trade liberalization that makes 'offshoring' of final goods production more attractive.⁴

International outsourcing of intermediate input production is barely mentioned in the literature on trade unions and globalization. One exception is Skaksen and Sørensen (2001).⁵ They find that outward FDI can lead the bargained wage to go up, provided that there is a sufficient degree of complementarity between the activities in the home country and the activities in the host country. This superficially resembles results as those of Staiger and Naylor, that unions can benefit from harder international competition. However, the basis for the Skaksen-Sørensen outsourcing result is quite different. They take as their starting point the well-known article by Horn and Wolinsky (1988), who pointed out that unions could benefit (lose) from more fragmented (integrated) production if tasks were compliments (substitutes). Outsourcing typically means to move out some tasks that are complimentary to tasks that will stay in the firm, and the Skaksen-Sørensen result then follows as a variant of the Horn-Wolinsky finding.

⁴In a related setting of unionized international oligopoly, Lommerud, Straume and Sørgard (2006) show that cross-border merger is another channel through which globalization might hurt unionized workers.

⁵See also Zhao (2001).

In the present paper, we take the analysis a step further by developing a theoretical model equipped to answer how deunionization will affect outsourcing decisions. We find, perhaps surprisingly, that outsourcing incentives are inversely correlated with trade union strength, implying that strong unions can in effect deter outsourcing. Although consistent with the stylized facts, this result may appear quite counterintuitive, since another implication of stronger unions is higher in-house production costs. Establishing a theoretical relationship between deunionization and international outsourcing is the main contribution of the paper; however, we also use the model to study the interrelation of deunionization and outsourcing with technology level and globalization.

Outsourcing, internationally and domestically, is a topical issue in the recent economics literature. In the theory of the multinational firm there is a tradition where the international firm is assumed to be organized as it is because it has carefully considered the costs and benefits of the various alternatives (see, e.g., Markusen, 1995). Grossman and Helpman have recently written a much noted string of papers (2002, 2003 and 2005) that can be seen as studying outsourcing in such a perspective: These models open up for many complications as search processes and contract incompleteness, but in the end the organizational structure of a firm is determined by the relevant costs and benefits of the various alternatives.⁶ There also exists a vein of literature that consider outsourcing decisions as strategic:⁷ The outsourcing decision itself influences the price structure that a firm faces. The theory of outsourcing with trade unions can be seen as an example of a strategic outsourcing theory: Outsourcing influences the wage rate the firm has to pay, and this in turn influences the outsourcing decision.

The present model sees production as a series of interrelated tasks, which in principle all can be outsourced to a foreign economy. In line with the tradition in international economics⁸, we choose to work with a model of monopolistic competition. Although we perform our analysis in a partial equilibrium setting, we think it is an advantage to work within the same framework as most recent studies of outsourcing – for example Grossman and Helpman’s mentioned series of papers. This should make it easier at some point to

⁶From the vast recent literature on outsourcing, we mention Feenstra and Hanson (1999), Glass and Saggi (2001), Kohler (2004), Antràs and Helpman (2004), Görg, Hijzen and Hine (2005), and Thesmar and Thoenig (2007).

⁷See, for example, Lyons and Sekkat (1991), Chen, Ishikawa and Yu (2004), Shy and Stenbacka (2003) and Choi and Davidson (2004).

⁸See, for example, the well-known textbook by Dixit and Norman (1980).

integrate the insights from the standard theory on outsourcing on the one side and the theory on trade unions and outsourcing and other forms of competitive pressures from abroad on the other.⁹ We underline that our central results can be reproduced in a model of international Cournot oligopoly with linear demand – a framework often favored by the literature on trade unions and globalization.

The remainder of this paper is organized as follows: Section 2 presents the model framework, while Section 3 studies wage bargaining and employment decisions within this format. Section 4 studies a firm’s outsourcing decision, and the impact of deunionization on this decision. Section 5 analyzes how globalization will affect outsourcing. In Section 6 we extend the model in several different directions, to see how our main results might change under alternative assumptions. Section 7 offers some concluding remarks.

2 Model

We apply a modified version of a partial outsourcing model by Shy and Stenbacka (2005), where we include labor market imperfections in the form of union-firm bargaining and cast the analysis in a setting of monopolistic competition. Consider an industry consisting of a large (and fixed) number of monopolistically competitive firms, indexed by i , each producing their own variety of a differentiated final good. Each firm produces the final good by using a continuum of inputs indexed by $j \in [0, 1]$. One unit of the final good requires γ_i^{-1} units of each input for firm i .¹⁰ Each input can either be produced domestically at the firm’s plant or outsourced to a foreign supplier.¹¹ In the case of in-house production, firm i can produce one unit of any input j by using one unit of labor at a wage rate w_i . Alternatively, the input can be acquired from a foreign supplier at an exogenous per-unit price c , which is assumed to be equal for all inputs (and all firms).¹²

⁹Blanchard and Giavazzi (2003) develop a model that combines monopolistic competition in the product market and bargaining in the labor market, and our model shares many traits with that work, but their focus is neither on firm structure nor on open economy issues.

¹⁰In Section 6.4 we extend the analysis to show how our results might change if we allow the inputs to be substitutable in production.

¹¹At this point it seems arbitrary to assume that outsourcing is by assumption international, but we will argue below that this is the natural way to proceed given how the model is constructed.

¹²Introducing cost heterogeneity by letting c_j denote the per-unit price of input j would not affect the qualitative nature of any of our results. However, the clarity of presentation is greatly enhanced by assuming that $c_j = c$ for all $j \in [0, 1]$.

There are fixed costs associated with the outsourcing of each link in the production chain.¹³ We assume that these costs vary with different inputs, where $g(j)$ is the cost of outsourcing input j . If we order the inputs on $[0, 1]$ according to $g(j) < g(l)$ for $j < l$, the cost of outsourcing k inputs is given by

$$G(k) = \int_0^k g(j) dj. \quad (1)$$

We assume that G is twice differentiable with $G'(k) > 0$, $G''(k) > 0$, $G'(0) = 0$ and $G'(1) \rightarrow \infty$. The last assumption essentially means that it is not economical to outsource all production, even though it would be technically possible.¹⁴

The going wage rate for in-house production is determined in bargaining between each firm and its corresponding trade union, representing all workers in the firm.¹⁵ The trade unions maximize total union rents, implying that the objective function of the trade union belonging to firm i is given by

$$U_i = (w_i - \bar{w}) n_i, \quad (2)$$

where \bar{w} is an exogenous reservation wage,¹⁶ and n_i is total domestic employment by firm i .

The producer of variety i faces the following demand for the final good:

$$y_i = \Gamma p_i^{-\sigma}, \quad \Gamma > 0, \sigma > 1, \quad (3)$$

where p_i is the price of variety i .¹⁷ If firm i has already outsourced the production of k_i inputs, its operating profits are given by¹⁸

$$\pi_i = [p_i - \gamma_i^{-1} (k_i c + (1 - k_i) w_i)] y_i. \quad (4)$$

¹³These costs will typically include costly search for (and evaluation of) potential sub-contractors, costs of managing and supervising the contract, and coordination costs of linking different production processes. The firms may also have to pay severance packages for laid-off workers.

¹⁴This assumption is further discussed in the concluding section.

¹⁵The implicit assumption is that workers are homogeneous: they are all ‘ordinary’, unionized workers. The empirical paper by Geishecker and Görg (2004) warns us that this is not necessarily the case, so that international outsourcing can have winners and losers. In Section 6.6 we include a brief discussion of the implications of enriching the model on this count.

¹⁶The reservation wage has several possible interpretations. For example, it can be thought of as the wage level in a perfectly competitive ‘buffer’ sector of the economy.

¹⁷A demand function of this type can be derived from individual utility maximization with CES utility functions, where σ is the elasticity of substitution between the different varieties.

¹⁸Here we treat the outsourcing cost $G(k_i)$ as sunk.

In line with the assumption of monopolistic competition, prices set by the other firms do not have a direct impact on the price-setting of an individual firm. In this respect, the actions of other firms are ignored. Each firm does, however, consider how its outsourcing decision affects the outcome of wage bargaining with its trade union. We propose the following sequence of events:

Stage 1: Each firm decides on the organization of production by choosing the number of inputs to be outsourced.

Stage 2: Each firm and its corresponding trade union bargain over the wage level that applies for in-house production.

Stage 3: Employment and prices for the final good varieties are set by each firm.

In a sense, the model is ‘long-term’: Workers, if equipped with sufficient bargaining power, can rationally set their wage level as they want it to be. It can seem that some globalization sceptics focus on the very short-term where nominal wage rigidities block workers from changing their wage given that international competition has become harsher, but here there are no such nominal rigidities. On the other hand, the model does not allow a trade union to promise moderate wages for a very long time to deter outsourcing. We think it is natural to view organizational structure as a long-term commitment that precedes wage bargaining. This assumption is commonplace but not ubiquitous in the literature on trade unionism under globalization.¹⁹

3 Wage bargaining and employment

Consider a given firm in the industry.²⁰ For given levels of outsourcing (k) and wages (w), profit maximizing price setting is derived from (3) and (4), yielding the optimal price

$$p(w, k) = (1 + \mu) \omega \gamma^{-1}, \quad (5)$$

where $\omega := kc + (1 - k)w$. Marginal production costs are $\omega \gamma^{-1}$, and $\mu := \frac{1}{\sigma - 1}$ is the mark-up of the price over marginal production costs. Since this mark-up is decreasing in σ , we can think of σ as a measure of the degree of product market competition.

¹⁹In Section 6.3 we show how our main results might change if we reversed the order of decisions, with outsourcing taking place subsequent to wage bargaining.

²⁰For notational convenience, we drop the firm indices i .

From (5) and (3) we derive the firm's labor demand:

$$n(w, k) = (1 - k) \gamma^{-1} y(w, k) = (1 - k) \gamma^{\sigma-1} \Gamma (1 + \mu)^{-\sigma} \omega^{-\sigma}. \quad (6)$$

Note that better technology (higher γ) increases the demand for labor, due to two opposing forces. On the one hand, better technology reduces the marginal cost of production, $\omega \gamma^{-1}$, which increases labor demand. On the other hand, superior technology also implies that a given quantity of the final good can be produced using fewer workers, which has the opposite labor demand effect. The first effect dominates when demand is elastic, i.e., $\sigma > 1$.²¹ The wage elasticity of labor demand is given by

$$\varepsilon := - \frac{\partial n(w, k)}{\partial w} \frac{w}{n(w, k)} = \lambda \sigma, \quad (7)$$

where $\lambda := \frac{(1-k)w}{\omega} \in [0, 1]$ is unionized (domestic) labor's share of total production costs. Note that increased international outsourcing reduces domestic labor's cost share, i.e., $\partial \lambda / \partial k < 0$, which leads to a corresponding reduction in labor demand elasticity.

We apply the Nash bargaining solution to determine the outcome of the wage bargaining between the firms and their corresponding trade unions. Assuming zero disagreement payoffs, the Nash maximand for wage bargaining is given by

$$\Omega = \alpha \ln U + (1 - \alpha) \ln \pi, \quad (8)$$

where $\alpha \in (0, 1)$ denotes the relative bargaining strength of the union. The equilibrium wage for a given level of outsourcing $k \in (0, 1)$, is given by

$$w(k) = \bar{w} + \alpha \mu \left[\bar{w} + \frac{k}{1-k} c \right]. \quad (9)$$

The wage is the fall-back wage plus a share in rents, and rents are a mark-up on the real resource cost of production. The corresponding employment level is given by

$$n(k) = (1 - k) y(k) = (1 - k) \gamma^{\sigma-1} \Gamma (1 + \mu)^{-\sigma} (1 + \alpha \mu)^{-\sigma} \bar{w}^{-\sigma}, \quad (10)$$

where $\bar{w} := kc + (1 - k) \bar{w}$. Finally, inserting (9) into (5), we derive the optimal price level

$$p(k) = \gamma^{-1} (1 + \mu) (1 + \alpha \mu) \bar{w}, \quad (11)$$

which reflects the 'double marginalization' feature of the model.

²¹ See Dowrick and Spencer (1994) and Lommerud, Meland and Straume (2006) for more detailed analyses of the labour demand effect of introducing labour-saving technologies.

Considering the effect of outsourcing on wages, our first important result – which provides a building block for the subsequent results of the paper – follows directly from (9):

Proposition 1 *Outsourcing increases the bargained wage*

This result illustrates a main mechanism of the model. If a firm outsources more production, the domestic trade union will respond by enforcing higher wages for the remaining in-house production. The intuition follows from the aforementioned effect of outsourcing on the wage elasticity of labor demand. Increased outsourcing has the effect of ‘exogenizing’ a larger share of marginal production costs. This means that a wage increase has a smaller effect on marginal production costs and thus causes a smaller decrease in labor demand. Consequently, increased outsourcing makes labor demand less elastic. When labor demand gets less elastic, the wage/employment trade-off becomes more favorable for the trade union, with a higher bargained wage as the result. It also follows directly from (9) that the size of the wage response to increased outsourcing is an increasing function of the market power of firms (μ) and the relative bargaining power of unions (α).²²

The effect of outsourcing on firm-level employment is the sum of a direct and an indirect effect:

$$\frac{\partial n(k)}{\partial k} = \frac{\partial n(w, k)}{\partial k} + \frac{\partial n(w, k)}{\partial w} \frac{\partial w(k)}{\partial k}. \quad (12)$$

For a given wage level, outsourcing has an ambiguous effect on employment, given by the sum of two opposing effects:

$$\frac{\partial n(w, k)}{\partial k} = \gamma^{-1} \left[-y(w, k) + (1 - k) \frac{\partial y(w, k)}{\partial k} \right]. \quad (13)$$

More outsourcing implies a direct export of domestic jobs, represented by the first term in the square brackets. However, as long as $w > c$, the subsequent decrease in marginal production costs has an output expanding effect which increases labor demand for the non-outsourced tasks. This effect is given by the second term, where $\partial y/\partial k > 0$. Which

²²Grossman and Rossi-Hansberg (2006, 2007) also emphasize that international outsourcing can increase the wages of low-skilled domestic workers. They share with us the assumptions that some tasks are easier to move out than others. When the tasks that are most easily moved abroad have disappeared, this might for various reasons increase the labor demand directed towards the remaining low-skilled workers. This is not incompatible with the present analysis, only that we make the added point that if the remaining workers are unionized, this also can explain why remaining low-skilled workers benefit from international outsourcing.

effect is stronger, depends predominantly on the product demand elasticity, σ , and the initial degree of outsourcing, k . The more elastic demand is, the larger is the output expanding effect of outsourcing, making it more likely that the second (indirect) effect dominates. However, the effect of output expansion on domestic labor demand depends crucially on the degree of outsourcing. The lower the share of total production that takes place domestically, the lower the effect of output expansion on domestic labor demand. Thus, a higher degree of outsourcing reduces the scope for further outsourcing to increase domestic labor demand. A more explicit expression is obtained by using (6), yielding

$$\frac{\partial n(w, k)}{\partial k} = \gamma^{-1} y(w, k) \left[\frac{\sigma(1-k)(w-c)}{\omega} - 1 \right]. \quad (14)$$

Here we see directly that outsourcing will increase domestic labor demand if σ is sufficiently high; more precisely, if $\sigma > \frac{\omega}{(1-k)(w-c)}$. It is also straightforward to confirm that the term in the square brackets of (14) is monotonically decreasing in k , and we see directly that the possibility of an outsourcing-induced increase in domestic labor demand is ruled out for $k \rightarrow 1$. However, it can also be shown that, if product demand is very elastic, $\sigma > \frac{\omega+c}{(w-c)(1-k)}$, there is an inverse U-shaped relationship between the degree of outsourcing and the labor demand effect of further outsourcing: For low initial levels of k , outsourcing increases labor demand, and more so as the outsourcing process continues, until a critical point where further outsourcing reduces the positive labor demand effect and eventually makes it negative.

Taking the wage effect into account, we already know from Proposition 1 that the second term in (12) is negative. Using (6) and (9), the *total* effect of international outsourcing on domestic employment is given by

$$\frac{\partial n(k)}{\partial k} = \gamma^{-1} y(k) \left[\frac{\sigma(1-k)(\bar{w}-c)}{\bar{\omega}} - 1 \right], \quad (15)$$

which closely parallels (14). Provided that $\bar{w} > c$, a higher degree of product market competition (σ) will increase labor demand elasticity and enhance the probability of a positive relationship between international outsourcing and domestic employment. When seen in conjunction with Proposition 1, it follows that the possibility of direct exports of jobs (in the form of international outsourcing) being unambiguously positive for the trade union – due to higher wages *and* increased domestic employment – cannot be ruled out. We return to this issue in Section 6.

4 Outsourcing

In this Section, we turn to the optimal outsourcing decisions of firms. The first-period problem facing the firm is to choose the degree of outsourcing that maximizes present-value profits, Π . Abstracting from discounting, the optimal degree of outsourcing is given by

$$k^* = \arg \max \{ \Pi(k) = \pi(k) - G(k) \}. \quad (16)$$

Inserting (9) and (11) into (3)-(4), we have that

$$\pi(k) = \Gamma \gamma^{\sigma-1} \mu (1 + \mu)^{-\sigma} (1 + \alpha \mu)^{1-\sigma} \bar{w}^{1-\sigma}, \quad (17)$$

from which we derive the first-order condition for (16), given by²³

$$\frac{\partial \Pi}{\partial k} = (1 + \alpha \mu) \gamma^{-1} (\bar{w} - c) y(k^*) - G'(k^*) = 0. \quad (18)$$

An interior solution, i.e., $k^* > 0$, requires that the first term in (18) is positive. We see that this is only the case if $\bar{w} > c$. This establishes the following result:

Proposition 2 *A firm will not outsource the production of any input unless it can be obtained at a price lower than the domestic reservation wage.*

Whether or not a firm finds it profitable to outsource any parts of production is, perhaps surprisingly, not determined by the actual in-house production costs but rather by the reservation wage of domestic workers. This result is a consequence of the union response to outsourcing (Proposition 1). As long as some part of production remains in-house, outsourcing does not impede the union's ability to extract rents. The union will simply respond by enforcing higher wages for the remaining domestic production. Consequently, the profitability of outsourcing depends on total available rents – not actual production costs – in the industry. If $\bar{w} < c$, outsourcing implies that total rents are reduced, which harms both the union *and* the firm.

In the following, we will assume that the condition $\bar{w} > c$ is satisfied, implying that firms will outsource parts of production to foreign sub-contractors in equilibrium.²⁴ Note

²³Our assumptions on $G(\cdot)$ ensure that the second-order condition is satisfied.

²⁴Here we see that *international* outsourcing is the natural assumption. Since potential subcontractors must have production costs below domestic reservation wages for outsourcing to be an option for domestic firms, it is natural to interpret this as outsourcing from 'high-cost' to 'low-cost' countries.

also from (15) that $\bar{w} > c$ is a necessary (but not sufficient) condition for outsourcing to increase in-house employment. However, although international outsourcing may not always increase employment, the intuition behind Proposition 2 suggests that unionized workers nevertheless benefit in terms of total union rents. From (9) and (10) we derive the expression for union utility:

$$U(k) = [w(k) - \bar{w}] n(k) = \alpha \mu \bar{w}^{1-\sigma} \Gamma \gamma^{-1} (1 + \mu)^{-\sigma} (1 + \mu \alpha)^{-\sigma}. \quad (19)$$

It is easily confirmed that $\partial U(k) / \partial k > 0$, implying that a higher degree of outsourcing always increases union rents.

4.1 Deunionization

How does union strength affect firms' incentives for international outsourcing? On a more general level, it is reasonable to assume that the bargaining power of trade unions is related to a number of different features of the labor market, ranging from union membership and coverage of collective agreements to regulatory features such as legal rules on the right to strike. However, in addition to the considerable increase in the prevalence of international outsourcing, the last few decades have also witnessed a process of *deunionization* in several countries – particularly in the US and UK – where labor market deregulation has been accompanied by a decline in union membership. Can these two empirical trends be theoretically reconciled? In our model, interpreting the parameter α as an inverse measure of deunionization, we can establish the following causal relationship between deunionization and outsourcing:

Proposition 3 *Deunionization leads to increased international outsourcing.*

Proof. By total differentiation of (18) we obtain

$$\frac{\partial k^*}{\partial \alpha} = \frac{(\bar{w} - c) y(k^*)}{\gamma (\partial^2 \Pi / \partial k^2)}.$$

Using the second-order condition, it follows that $\partial k^* / \partial \alpha < 0$ when $\bar{w} > c$. ■

The more bargaining power unions possess, the higher are wages and thus in-house production costs. Nevertheless, more powerful unions reduce the incentives for outsourcing. In other words, what make in-house production costs higher – stronger domestic trade unions – also make international outsourcing less profitable. This apparently counter-intuitive result can be explained along the same lines as Proposition 2. When $\bar{w} > c$,

outsourcing increases total rents and yields higher operating profits. However, a more powerful union is able to capture a larger share of this rent increase by enforcing higher wages for the remaining in-house production, thereby making outsourcing less profitable. A process of deunionization, with a subsequent reduction of union bargaining strength, will consequently increase the degree of international outsourcing in equilibrium.

It should be noted that there are also alternative ways to interpret deunionization. One obvious interpretation – which is perhaps more consistent with the empirical use of union coverage as a measure of the degree of unionization – is that some firms become non-unionized while others continue to be unionized with equally strong unions.²⁵ However, this changes only the interpretation, and not the substantive content, of our results. In this case, equilibrium outsourcing intensity will increase in firms that become non-unionized (due to the monotone relationship between α and k^*), and remain constant in other firms. Consequently, the overall level of outsourcing increases.

Technology

How are outsourcing incentives and the impact of deunionization affected by productive efficiency? From (18) we can derive

$$\frac{\partial k^*}{\partial \gamma} = -\frac{(1 + \alpha\mu)^{-1} (\bar{w} - c) y(k^*)}{\mu\gamma^2 (\partial^2 \Pi / \partial k^2)} > 0,$$

implying that more efficient firms have stronger incentives for outsourcing. The reason is simply that firms with better technology have a larger share of the market, which, in turn, implies that *total* variable cost savings from cutting *marginal* production costs are larger. Thus, incentives for international outsourcing – which is precisely a way to reduce marginal production costs – are stronger for the more efficient firms.

For the same reason, increased outsourcing incentives due to deunionization are more pronounced in firms with superior technology.²⁶ In other words, the main bulk of the increased outsourcing due to deunionization is undertaken by the technologically stronger firms. Since outsourcing incentives are stronger for the more efficient firms to begin with,

²⁵Machin (2000) underlines that union decline in Britain typically has taken the form that union membership falls because new firms in ‘new’ industries are not unionized, while many existing firms in traditional industries keep their level of unionization. Checci and Visser (2005) broadly confirm this view for Western Europe, but also point at other factors that have driven deunionization.

²⁶It is easily shown that the absolute value of $\partial k^* / \partial \alpha$ increases in γ .

this means that, for a given technological distribution, deunionization increases the differences in outsourcing intensities between efficient and inefficient firms.²⁷

5 Globalization and outsourcing

Having established the main results of the paper, the purpose of this Section is to discuss how our model can be used to say something about the relationship between globalization and outsourcing. Of course, international outsourcing can in itself be considered as a characteristic of the broad term ‘globalization’. Our aim, though, is to see whether we can identify increased outsourcing as a causal consequence of some typically identified product market characteristics of globalization.

Globalization may of course reduce the direct costs of international outsourcing, by reducing both the variable cost c (e.g., through reduced transportation costs) and the fixed costs $g(j)$. It is straightforward to show that both types of cost reductions will lead to increased outsourcing. We will, however, focus on two commonly observed, and partly related, features of globalization with respect to the final goods market, namely *market integration* and *increased competition*.

Market integration

The effects of market integration have been extensively studied in the literature on international trade,²⁸ where the focus is typically on how market expansion affects product variety through entry of new firms. But how does an increase in the size of the market affect incentives for international outsourcing? The obvious strategy in the context of the present model is to interpret market integration as an increase in the demand parameter Γ . From the first-order condition for the optimal outsourcing decision, we derive

$$\frac{\partial k^*}{\partial \Gamma} = -\frac{(1 + \alpha\mu)(\bar{w} - c)y(k^*)}{(\partial^2 \Pi / \partial k^2)\gamma\Gamma} > 0, \quad (20)$$

which implies that market integration increases the optimal degree of outsourcing. The intuition follows the above discussion of productive efficiency and outsourcing incentives.

²⁷ Technological differences may also apply to in-house production of inputs. With this interpretation, the relationship between productive efficiency and outsourcing incentives is generally ambiguous. In addition to the indirect effect through total output, better technology also directly implies that the firm is more efficient *relative to foreign sub-contractors*, which – all else equal – reduces outsourcing incentives.

²⁸ For some early studies, see Krugman (1979, 1980) and Helpman (1981).

A larger market increases demand and thus output for each firm, which increases incentives for cutting marginal production costs. This result is also closely related to the literature on process innovation, where firms undertake R&D investments in order to reduce marginal production costs.²⁹ In our model, international outsourcing resembles process innovation in that it requires a costly investment to reduce marginal production costs.

Increased competition

Within the context of product market competition, globalization does not only imply that markets expand, but also that firms face fiercer competition in their respective markets. How does increased competition affect incentives for outsourcing? We can use the parameter σ (the price elasticity of demand) as a direct measure of the degree of competition between firms. In a similar type of model, Blanchard and Giavazzi (2003) argue that economic integration is likely to increase σ as a result of the elimination of tariff barriers, or standardization measures that increase the substitutability among products.³⁰

If we consider the demand function (3), an increase in σ has two different effects. In addition to an increase in demand elasticity, it also generally increases or reduces demand depending on whether p is below or above unity. We are only interested in the former effect, though, since the demand effect on outsourcing incentives has been captured by the above discussion of market size. We can isolate the elasticity effect by evaluating the effect of a marginal change in σ at $p(k^*) = 1$. By total differentiation of (18), and after some manipulation, the effect of increased competition on outsourcing incentives can be expressed as

$$\left. \frac{\partial k^*}{\partial \sigma} \right|_{p(k^*)=1} = - \frac{\mu [1 + \alpha (1 + \mu)] (\bar{w} - c) y(k^*)}{\gamma (\partial^2 \Pi / \partial k^2)} > 0.$$

Thus, increased competition between firms will also increase incentives for international outsourcing. Two different mechanisms contribute to this result. First, fiercer competition forces the firms to lower their prices and expand output, which, similar to the case of market expansion, increases the gain of reducing marginal production costs. In addition, increased competition increases labor demand elasticity. This reduces the wage response to outsourcing, as can be seen from (9), making outsourcing more profitable for firms.

²⁹A standard result from this literature is that R&D expenditures per firm increase with the size of the market (see, e.g., Dasgupta and Stiglitz, 1980).

³⁰It is important to notice that by interpreting an increase in σ as a result of globalization or economic integration, one should think of σ not as a taste parameter in a utility function, but rather interpret the underlying CES function as a reduced form reflecting the substitutability among products.

This result nicely complements the result found by Shy and Stenbacka (2005), who shows that intensified competition increases the degree of outsourcing in a Cournot oligopoly. The underlying mechanisms are quite different, though, reflecting the different model set-ups. While Shy and Stenbacka show how intensified competition increases firms' strategic incentives for reducing marginal costs through outsourcing, the mechanisms triggering outsourcing in our model do not stem from (horizontal) strategic interaction among firms (which we assume away), but rather from (vertical) strategic interaction between firms and trade unions.

6 Extensions and discussion

In this section we perform a robustness check to our main results by extending the model in four different directions: i) efficient bargaining, ii) employment oriented unions, iii) outsourcing subsequent to wage bargaining, and iv) substitutability in production. In the latter parts of the section, we also relate our analysis to recent empirical work on the relationship between outsourcing and labour demand elasticities, and briefly discuss the implications of introducing heterogeneous workers in domestic production.

6.1 Efficient bargaining

The 'right-to-manage' model of wage bargaining (henceforth RTM) is widely used in trade union models, for fairly convincing reasons. Not only does it correspond to the real-world observation that firms usually set employment unilaterally; it also ensures incentive compatibility by producing wage-employment outcomes on the labor demand schedule. However, the RTM model is sometimes criticized on the grounds that it does not yield Pareto-efficient outcomes for the bargaining parties. Let us therefore consider the alternative assumption of efficient bargaining (henceforth EB), where each firm-union pair bargains over both wages and employment.

In our model, bargaining over employment is equivalent to bargaining over price levels, so the bargaining game under EB is characterized by

$$\max_{w,p} \Omega = \alpha \ln U + (1 - \alpha) \ln \pi,$$

where U and π are given by (2) and (4), respectively. The solution to this maximization

problem yields the following equilibrium wage and price levels:

$$w(k) = (1 + \alpha\mu)\bar{w} + \left(\frac{k}{1-k}\right)\alpha\mu c, \quad (21)$$

$$p(k) = \gamma^{-1}(1 + \mu)\bar{w}. \quad (22)$$

Comparing with the RTM model, we see that the wage level is the same under EB, but the price is lower, since the double marginalization effect of RTM bargaining is eliminated under EB. For a given level of outsourcing, an expression for the operating profit is found by inserting (21) and (22) into (3) and (4), yielding

$$\pi(k) = (1 - \alpha)\mu(1 + \mu)^{-\sigma}\gamma^{\sigma-1}\Gamma\bar{w}^{1-\sigma}. \quad (23)$$

The first-order condition for the optimal degree of outsourcing is then given by

$$\frac{\partial\pi}{\partial k} = (1 - \alpha)(\bar{w} - c)\gamma^{-1}y(k^*) - G'(k^*) = 0. \quad (24)$$

We immediately see that $\bar{w} > c$ is a necessary condition for $k^* > 0$. Furthermore, since the output price (and thus output) does not depend on α , it follows directly from (24) that a weaker trade union will increase incentives for outsourcing. Thus, all our main results (Propositions 1-3) hold also under the assumption of EB. More interesting, perhaps, is a direct comparison between RTM and EB with respect to outsourcing incentives.

Proposition 4 *If $\alpha > 0$, the optimal degree of outsourcing is lower under EB, compared with RTM.*

Proof. $k^*|_{EB} < k^*|_{RTM}$ if $\frac{\partial\pi}{\partial k}|_{RTM} > \frac{\partial\pi}{\partial k}|_{EB}$ for all $k \in [0, 1]$. From (18) and (24), it is easily shown that this condition is satisfied if $D(\alpha) := (1 + \alpha\mu)^{1-\sigma} - (1 - \alpha) > 0$. This holds for all $\alpha > 0$, since $D(0) = 0$ and $\frac{\partial D}{\partial \alpha} = -(1 + \alpha\mu)^{-\sigma} + 1 > 0$. ■

Stronger outsourcing incentives under RTM bargaining are explained by the fact that RTM bargaining provides the firms with an extra rent-extracting instrument, namely the possibility to freely adjust employment in response to a wage change. We know that outsourcing leads to increased wages for the remaining in-house production, because the trade unions will capture parts of the rent increase by enforcing higher wages. Under RTM, the firms can partly offset this effect by reducing output (increase prices). Under EB, though, this is no longer possible, implying that outsourcing incentives are reduced. Furthermore, the difference between outsourcing incentives under RTM and EB increases with the relative bargaining strength of unions. This is most clearly seen for the limit case of $\alpha = 1$, where the unions capture all monopoly rents under EB.

6.2 Employment-oriented unions

Our result that a rent-maximizing trade union always benefit from outsourcing appears to run contrary to the observation that trade unions often oppose outsourcing. Thus, it may be that many unions place a larger emphasis on employment, relative to wages. We can incorporate this possibility by considering the following union utility function:

$$U = (w - \bar{w})^\theta n, \quad \theta > 0. \quad (25)$$

An *employment oriented* union would now be characterized by $\theta < 1$.

Retreating now to the basic model of RTM bargaining, and using the modified utility function (25) in the Nash maximand (8), the bargained wage is given by³¹

$$w(k) = \Psi \left[\bar{w} + \left(\frac{k}{1-k} \right) \left(\frac{\theta \alpha c}{\mu^{-1} + \alpha} \right) \right], \quad (26)$$

where $\Psi := \frac{\mu^{-1} + \alpha}{\mu^{-1} + \alpha(1-\theta)}$. We see that the bargained wage is still an increasing function of the degree of outsourcing, but the strength of the wage response to outsourcing is lower the more employment oriented the union is. Using (26), it can also be shown that the union will oppose outsourcing, i.e., $\frac{\partial U}{\partial k} < 0$, if $\theta < \theta^* := \sigma - (\sigma - 1) \frac{\bar{w}}{c}$. If the union is sufficiently concerned about employment, relative to wages, an employment loss due to outsourcing cannot be fully compensated for by the subsequent wage increase for the remaining union workers.³²

From (26) we can derive the equilibrium values of prices and profits:

$$p(k) = \Psi \gamma^{-1} (1 + \mu) \bar{w}, \quad (27)$$

$$\pi(k) = \mu \Gamma \gamma^{\sigma-1} \Psi^{1-\sigma} \bar{w}^{1-\sigma} (1 + \mu)^{-\sigma}. \quad (28)$$

The first-order condition for the optimal level of outsourcing is

$$\frac{\partial \Pi_i}{\partial k_i} = \Psi^{1-\sigma} (\bar{w} - c) \gamma_i^{\sigma-1} \Gamma \bar{w}_i^{-\sigma} (1 + \mu)^{-\sigma} - G'(k_i^*) = 0. \quad (29)$$

Once more, $\bar{w} > c$ is a necessary condition for $k^* > 0$. Furthermore, it is easily shown that $\partial \Pi^2 / \partial k \partial \alpha < 0$, which confirms the robustness of Proposition 3: weaker unions lead to stronger outsourcing incentives. A related result is the following:

³¹Fulfillment of the second-order condition requires that $\mu^{-1} > -\alpha(1-\theta)$. This is always true if $\theta \leq 1$.

³²Since $c < \bar{w}$, we see that $\theta^* < 1$.

Proposition 5 *More employment oriented unions lead to increased international outsourcing.*

Proof. By total differentiation of (29) we derive

$$\frac{\partial k^*}{\partial \theta} = \frac{\Psi^2 \alpha \mu^{-1} (\bar{w} - c) y(k^*)}{(\partial^2 \Pi / \partial k^2) \gamma (\mu^{-1} + \alpha)} < 0.$$

■

The intuition behind this result lies in the union's wage response to outsourcing. As (26) clearly shows, the more concerned a union is about employment, the smaller is the wage increase triggered by outsourcing. Obviously, the firms' outsourcing incentives will be correspondingly stronger. This result also implies that the potential for a conflict of interest between the firm and its unionized workers is larger when the union is employment oriented, not only because outsourcing is then more likely to reduce union utility, but also because more employment oriented unions increase the firms' outsourcing incentives.

6.3 Outsourcing subsequent to wage bargaining

We have worked with the key assumption that the number of outsourced tasks represents a choice of organizational structure with a long-term commitment, implying that unions cannot credibly commit to keep wages low in order to prevent outsourcing. Let us now briefly consider the reverse case, where the firm's outsourcing decision is taken subsequent to the wage bargaining. This makes the number of outsourced tasks, k , a function of the bargained wage, w . The optimal degree of outsourcing is then given by

$$k^*(w) = \arg \max \Pi(w, k) = \{\pi(w, k) - G(k)\}. \quad (30)$$

Using the previously derived expressions for optimal price setting and corresponding labor demand, the first-order condition for k^* is given by

$$\gamma^{-1} (w - c) y(w, k^*) - G'(k^*) = 0, \quad (31)$$

while the second-order condition is

$$\frac{\partial^2 \Pi(w, k^*)}{\partial k^2} = y \gamma^{-1} \omega^{-1} \sigma (w - c)^2 - G''(k^*) < 0. \quad (32)$$

Our main result relies on a derived negative relationship between outsourcing and domestic wages: A lower domestic wage is – in equilibrium – accompanied by a higher

degree of international outsourcing. What is the nature of this relationship when the order of decisions is reversed? By total differentiation of (31), the relationship between k^* and w is given by³³

$$\text{sign} \left(\frac{\partial k^*(w)}{\partial w} \right) = \text{sign} \left(\frac{\partial^2 \pi(w, k^*)}{\partial w \partial k} \right) = \text{sign} \left(\frac{\partial n(w, k^*)}{\partial k} \right) \quad (33)$$

Thus, a negative relationship between domestic wages and outsourcing can be obtained also in the case where the order of decisions is reversed, but only if outsourcing leads to an increase in domestic labor demand: $\partial n(w, k)/\partial k > 0$. The intuition for this result is found by considering how outsourcing affects domestic labor costs. For a given output level, outsourcing reduces domestic labor costs through a smaller domestic share of production. However, the subsequent reduction in marginal production costs triggers an output expansion. If this output expansion is sufficiently large so that domestic labor demand increases, outsourcing will increase domestic labor costs in equilibrium. Now, the higher the domestic wage is, the higher is this outsourcing-induced increase in domestic labor costs. Consequently, if outsourcing increases domestic labor demand, a higher wage implies that the reduction in marginal production costs from outsourcing is smaller, inducing the firm to outsource less.

Notice that this scenario is less likely if the initial degree of outsourcing is high, and is ruled out for $k \rightarrow 1$. However, recent empirical evidence suggests that a positive relationship between outsourcing and domestic labor demand is far from being an extreme case. For example, in an empirical study using industry-level data for 17 OECD countries, Hijzen and Swaim (2007) explicitly investigate the link between direct job losses ("relocation effect") and output expansion ("scale effect") and show that offshoring (which in their terminology corresponds identically to our definition of international outsourcing) has no effect or a slight positive effect on sectoral employment. Similar results are found by Amiti and Wei (2005, 2006).

Given the relationship between wages and outsourcing as given by (33), the condition for our main result (Proposition 3) to hold also in the case where the outsourcing decision takes place subsequent to wage bargaining, follows directly from the positive monotonic relationship between α and w .³⁴ Deunionization reduces the domestic wage level, and

³³Notice that $\frac{\partial^2 \pi(w, k^*)}{\partial w \partial k} = \frac{y(w, k^*) + (w-c)(\partial y(w, k^*)/\partial w)}{\gamma} = \frac{\partial n(w, k^*)}{\partial k}$.

³⁴It is straightforward to confirm that the bargained wage is monotonically increasing in union bargaining strength.

this leads to more international outsourcing if such outsourcing increases domestic labor demand.

6.4 Substitutability in production

In this extension, we briefly explore how some of our results may change if we relax the assumption of Leontief production technology. With $z(j)$ measuring the amount used of input j , let the production function be of the following CES type:³⁵

$$y = \left[\int_0^1 (z(j))^\beta dj \right]^{\frac{1}{\beta}}, \quad \beta \in (-\infty, 1) \setminus \{0\}, \quad (34)$$

where β measures the degree of substitutability in production.³⁶ In line with the previous analysis, we assume $\bar{w} > c$.

The marginal costs are equal for all inputs that are, respectively, outsourced or produced in-house. Given the symmetry of the production function, this implies that the firm will purchase equal amounts of all inputs within the two categories. Letting z_f and z_d denote the amount of each outsourced (foreign) and non-outsourced (domestic) input, respectively, cost minimization reduces to

$$\min_{z_f, z_d} (cz_f k + wz_d(1-k)) \quad | \quad y = [z_f^\beta k + z_d^\beta(1-k)]^{\frac{1}{\beta}}, \quad (35)$$

which yields the solution

$$z_f(w, k) = \frac{yw^{\frac{1}{1-\beta}}}{[kw^{\frac{\beta}{1-\beta}} + (1-k)c^{\frac{\beta}{1-\beta}}]^{\frac{1}{\beta}}}, \quad (36)$$

$$z_d(w, k) = \frac{yc^{\frac{1}{1-\beta}}}{[kw^{\frac{\beta}{1-\beta}} + (1-k)c^{\frac{\beta}{1-\beta}}]^{\frac{1}{\beta}}}, \quad (37)$$

and the cost function $C(y) = \xi y$, where $\xi := \frac{cw}{[kw^{\frac{\beta}{1-\beta}} + (1-k)c^{\frac{\beta}{1-\beta}}]^{\frac{1-\beta}{\beta}}}$ is the average marginal production cost.

The profit maximizing output price is then found simply by replacing ω with ξ in Eq. (5), yielding $p(w, k) = (1 + \mu) \xi$, with the corresponding output $y(w, k) = \Gamma(1 + \mu)^{-\sigma} \xi^{-\sigma}$. Domestic labor demand is given by

$$n(w, k) = (1 - k) z_d(w, k), \quad (38)$$

³⁵For simplicity, we set $\gamma = 1$.

³⁶Notice that $\beta \rightarrow 0$ corresponds to the Cobb-Douglas production function while $\beta \rightarrow -\infty$ is the Leontief case.

while profits are given by

$$\pi(w, k) = [p(w, k) - \xi] y(w, k). \quad (39)$$

The first-order condition for the wage bargaining problem can be written as

$$\frac{\alpha w}{w - \bar{w}} - \alpha \varepsilon - (1 - \alpha) \eta = 0, \quad (40)$$

where ε and η are the wage elasticities (in absolute values) of, respectively, domestic labor demand and profits. From (38)-(39), these elasticities are given by

$$\varepsilon := -\frac{\partial n(w, k)}{\partial w} \frac{w}{n(w, k)} = \sigma - \left(\sigma - \frac{1}{1 - \beta} \right) \left(\frac{1}{1 + \frac{1-k}{k} \left(\frac{c}{w} \right)^{\frac{\beta}{1-\beta}}} \right) > 0 \quad (41)$$

and

$$\eta := \frac{\partial \pi(w, k)}{\partial w} \frac{w}{\pi(w, k)} = (\sigma - 1) \left[1 - \left(\frac{1}{1 + \left(\frac{1-k}{k} \right) \left(\frac{c}{w} \right)^{\frac{\beta}{1-\beta}}} \right) \right] > 0. \quad (42)$$

Consider first the effect of outsourcing on the wage elasticity of profits. It is straightforward to see that $\partial \eta / \partial k < 0$. Intuitively, the higher k is, the smaller is the profit response to a wage increase. In isolation, this effect contributes to a positive relationship between outsourcing and wages.

The effect of outsourcing on the labor demand elasticity is ambiguous. The latter factor in (41) is clearly increasing in k . Whether this leads to a higher or lower labor demand elasticity, depends on the price elasticity of output demand (σ) and the degree of substitutability in production (β). When the former is high relative to the latter, specifically, if $\sigma > \frac{1}{1-\beta}$, there is a negative relationship also between ε and k . In this case, increased outsourcing unambiguously increases domestic wages, confirming Proposition 1.

These results are fairly intuitive. As before, a higher level of k reduces, all else equal, the weight of domestic labor in average production costs. However, with substitutability in production, it also increases the scope for substituting (expensive) domestic for (cheap) foreign labor. Thus, if the incentive for substitution is sufficiently high, increased outsourcing will increase the wage elasticity of domestic labor demand, potentially reversing the result in Proposition 1. The incentive for substitution is of course increasing in the degree of substitutability in production. A lower price elasticity of output demand will also give stronger incentives for substitution. The lower σ is, the higher is the mark-up, implying that the firm has stronger incentive to reduce production costs by substituting domestic for foreign labor.

Even though Proposition 1 may be reversed when β is high and/or σ is low, this situation is less likely when α is low. When wages are to a higher degree determined by the wage elasticity of profits, the effect of outsourcing on η becomes more important in determining the relationship between outsourcing and wages. As we have seen above, this effect is unambiguous. It is also worth noticing that, since $\sigma > 1$, Proposition 1 holds for the Cobb-Douglas case $\beta \rightarrow 0$. For this case, it is also possible to solve for the stage 2 wage equilibrium analytically. In the rest of this extension, we therefore concentrate on this case.

6.4.1 Cobb-Douglas technology

With $\beta \rightarrow 0$, the labor demand and profit elasticities are given by, respectively, $\varepsilon = \sigma - k(\sigma - 1)$ and $\eta = (\sigma - 1)(1 - k)$. Using these expressions in (40) and solving for the wage yields

$$w(k) = \bar{w} \left(1 + \frac{\mu\alpha}{1-k} \right). \quad (43)$$

At Stage 1, the firm chooses the level of outsourcing based by maximizing $\Pi(k) := \pi(k) - G(k)$, where operating profits in the Cobb-Douglas case reduce to

$$\pi(k) = \Gamma\mu(1+\mu)^{-\sigma} [w(k)]^{(\sigma-1)(k-1)} c^{-(\sigma-1)k}, \quad (44)$$

from which we derive

$$\frac{\partial\pi(k)}{\partial k} = \xi y(k) \left[\ln\left(\frac{w(k)}{c}\right) - \frac{\alpha}{(\sigma-1)(1-k) + \alpha} \right]. \quad (45)$$

Notice that $\xi = c^k w^{1-k}$ in the Cobb-Douglas case. We see that an interior solution requires that the expression in the square brackets of (45) is positive.³⁷

We want to explore when our main result (Proposition 3) holds also in the Cobb-Douglas case. Using implicit differentiation on the first-order condition for the optimal degree of outsourcing, and assuming an interior solution, we know that the sign of $\partial k^*/\partial\alpha$ is given by the sign of $\partial^2\pi(k^*)/\partial\alpha\partial k$. From (45) we derive

$$\frac{\partial^2\pi(k^*)}{\partial\alpha\partial k} = \xi y(k^*) \left[\frac{\alpha(k + \sigma(1-k))}{((1-k)(\sigma-1) + \alpha)^2} - \left(\frac{\bar{w}}{w(k^*)}\right) \ln\left(\frac{w(k^*)}{c}\right) \right], \quad (46)$$

implying that Proposition 3 holds (i.e., $\partial k^*/\partial\alpha < 0$) if the expression in the square brackets is negative. The two terms in the square brackets represent the two forces at

³⁷It can easily be shown that, in contrast to the Leontief case, $\bar{w} > c$ is not a necessary condition for an interior solution (cf. Proposition 2).

work. As in the Leontief case, since wages are increasing in the number of outsourced tasks, this naturally decreases the firm's incentives for outsourcing, and more so when the union has a lot of bargaining power. This effect is represented by the second term. The first term represents an effect that was not present in the Leontief case: Since inputs are substitutable, there is now a scope for substituting expensive inhouse production with cheap foreign supplied inputs through outsourcing. This incentive is weakened by deunionization, which reduces the domestic-foreign cost gap.

The relative strength of the two effects depends on the parameter configuration. It is straightforward to show that the expression in square brackets in (46) is monotonically increasing in α , k and c , while monotonically decreasing in σ and \bar{w} . Furthermore, it is easily confirmed that $\lim_{\alpha \rightarrow 0} (\partial k^* / \partial \alpha) < 0$, $\lim_{\sigma \rightarrow 1} (\partial k^* / \partial \alpha) > 0$, $\lim_{k^* \rightarrow 1} (\partial k^* / \partial \alpha) > 0$ and $\lim_{\bar{w} \rightarrow c} (\partial k^* / \partial \alpha) > 0$. Thus, in the Cobb-Douglas case, Proposition 3 is more likely to hold if: i) α is lower, which means that the domestic-foreign cost gap is lower; ii) σ is higher, which means that, due to the lower mark-up, the firm has lower incentives to substitute domestic for foreign input production; iii) k^* is lower, which means that an outsourcing-induced wage increase has a larger effect on average production costs; and iv) $(\bar{w} - c)$ is higher, which means that outsourcing rents are higher, implying that the increase in outsourcing profitability due to deunionization is higher.

6.5 Outsourcing and labor demand elasticities

Our analysis may also shed some new light on recent empirical work on the relationship between international outsourcing and domestic labor demand elasticities. For example, Senses (2006) shows that increased possibilities of outsourcing lead to increased domestic labor demand elasticities, and supports this theoretical result by empirical findings on U.S. manufacturing data. This appears to contradict our analysis, since an important feature of our model is a derived negative relationship between outsourcing and domestic labor demand elasticities. However, our model rather illustrates that there are different forces that can trigger international outsourcing, with different implications for labor demand elasticities. In fact, a positive correlation between outsourcing and labor demand elasticity is perfectly consistent with our model framework; it all depends on the triggering forces. To illustrate this, let us take the theoretical model of Senses (2006) as a starting point. In her model, increased possibilities of outsourcing is measured as (i) a reduction in the price of foreign intermediate inputs and (ii) increased substitutability between domestic

and foreign inputs. Let us briefly consider these two mechanisms separately.

(i) A decrease in the price of intermediate inputs corresponds in our model to a reduction in c . From the definition of labor demand elasticity, (7), it is straightforward to show that

$$\frac{\partial \varepsilon}{\partial c} = -\frac{\sigma k (1-k) w}{\omega^2} < 0.$$

Thus, a reduction in c makes labor demand more elastic. As previously mentioned in Section 5, it is also straightforward to show that this leads to increased outsourcing in equilibrium.

(ii) With a CES production function, as in Section 6.4, increased substitutability between domestic and foreign inputs corresponds to an increase in the parameter β . In this case, labor demand elasticity is given by (41), from which we derive

$$\frac{\partial \varepsilon}{\partial \beta} = \frac{(\sigma(1-\beta) - 1) \Phi \left(\ln \frac{c}{w} \right) \rho_1 + \left(k(\Phi + \rho_2) + (1-k)^2 \right) (1-\beta)}{\left((1-k)^2 + k(\Phi + \rho_2) \right) (k + \rho_1) (1-\beta)^3} k.$$

where $\rho_1 := (1-k) \left(\frac{c}{w} \right)^{\frac{\beta}{1-\beta}}$, $\rho_2 := (1-k) \left(\frac{w}{c} \right)^{\frac{\beta}{1-\beta}}$ and $\Phi := \rho_2 + k \left(\frac{w}{c} \right)^{\frac{2\beta}{1-\beta}}$. This expression is clearly positive for $\beta < 0$. By numerical simulations, it is also possible to show that it is positive for $\beta \in (0, 1)$, apart from in rather extreme cases.

Thus, when seen in conjunction with recent empirical literature, we believe our model highlights the importance of causality and different triggering mechanisms when studying the relationship between outsourcing and labor demand elasticities. If foreign input prices go down, or if inputs become more substitutable, this will increase the domestic labor demand elasticity and stimulate international outsourcing. In our model, however, outsourcing reduces the domestic labor demand elasticity *all else equal* (given a sufficient degree of complementarity in production). Thus, our analysis illustrates that if outsourcing is instead triggered by a force that does not affect the labor demand elasticity directly, such as deunionization, then increased outsourcing and less elastic labor demand might go hand in hand. This also implies that the empirical correlation between outsourcing and labor demand elasticities could give an indication of the relative importance of different mechanisms when outsourcing are driven by several different forces simultaneously.

6.6 Heterogeneous workers

More complex issues arise if one should introduce heterogenous workers in the model. For example, would there be a systematic tendency that tasks that are easy to outsource also

are the ones that are least intensive in skills? Moreover, would it be natural to retain the one-union-per-firm assumption? Perhaps some workers with a very high skill level can bargain successfully on the individual level? Modelling options are many. What could threaten the main logic behind the present results would be if workers were sorted in different unions – and that there was a systematic tendency that the more tasks that were outsourced, the weaker is the bargaining strength of the remaining workers. However, that would not nullify the mechanisms we have highlighted here, but would introduce an effect that run counter to the effects we have studied.

Antràs, Garicano and Rossi-Hansberg (2006) present a model of international outsourcing where there are two types of work to be performed: less skilled agents specialize in production while more skilled agents specialize in problem-solving. Speculating, one could assume that trade unionism was more prevalent among production workers. This paper has stressed a job preserving effect of trade unionism. Could it be that this means that in an enlarged framework production jobs rather than problem solving jobs are preserved domestically? What would this imply for skill formation incentives and investments in technology? Perhaps we here see the contours of an argument saying that trade unionism is good in the short-term – because it paradoxically can keep low-skilled jobs in rich countries – but that the more dynamic and long-term effects are less desirable. We find that these are very interesting questions for future research.

7 Concluding remarks

By way of conclusion, we would like briefly to mention one important underlying assumption that has not yet been discussed. A main result of our analysis is that deunionization can trigger international outsourcing. In its literal version, this result builds on the assumption that it is not economically possible to outsource the last task performed by unionized workers. So whenever a task is outsourced, there are always some workers that remain and experience that the demand for their labor becomes less elastic, which makes them push their wages up.

What if this was not the case? The organizational structure decision of the firm would then be a two-tier one in the following sense: First, the firm would have to decide how many tasks that should be outsourced and how many should remain at home, given that the firm should keep some domestic presence. Then it would have to decide whether to

go for this solution of partial outsourcing – or choose to offshore the firm in its entirety to a foreign location. Weaker unions would then presumably imply that given that the firm retains its domestic presence, the level of outsourcing goes up – but the likelihood that the whole firm is offshored goes down.

Finally, let us briefly make some comments about the efficiency properties of the model. A central result in our analysis is that strong unions can protect an economy from outsourcing of jobs, and even more so in high-tech industries. This is seemingly at odds with the idea that trade unions constitute a departure from free market competition, but only seemingly so. Grout (1984) and Manning (1987) pointed out that strong unions could deter investments prior to a unionized wage-employment settlement. The same type of inefficiency is present here. The firms invest in setting up import channels for inputs, but if unions are too strong, the firm owners capture too little of the total gains from this investment. In consequence, domestic employment is inefficiently *high*. Of course, one could speculate that there are positive externalities from the saved jobs, which would overturn the inefficiency result, but this discussion is outside the scope of this paper.

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