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# The labor market effects of trade unions – Layard meets Melitz\*

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## Abstract

Trade unions are typically able to convert their industrial power into political power. We show that, depending on the parameter constellation, stronger trade unions may be welfare-improving in terms of an increase in aggregate employment and output, if they successfully lobby for lower trade barriers set by the government.

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# 1 Introduction

This paper explores the labor market effects of trade unions, which have both the power to bargain over a wage hike and the power to influence the degree of trade protection set by the government. To this end, we set up a general equilibrium model which incorporates the wage bargaining model of Layard and Nickell (1990) and Layard et al. (2005) into the open economy framework of Melitz (2003).

Our approach is motivated by the observation that the conventional wisdom – trade unions lobby for a higher degree of trade protection – seems to erode. By introducing labor market rigidities into the protection for sale model proposed by Grossman and Helpman (1994), Matschke (2010) shows that these imperfections do not necessarily increase equilibrium trade protection. Hassel (2014) emphasizes that, in Germany, the process of liberalization is very much driven by coalitions of export-oriented firms and core workers’ representatives. This is in line with Beaulieu and Magee (2004), who find evidence that the industry net export position significantly affects labor unions’ trade policy preferences.

Our main finding: Depending on the parameter constellation stronger trade unions may be good for the economy. If trade unions demand for a higher wage and successfully lobby for a trade liberalization, then the equilibrium real wage increases, aggregate employment and aggregate output may increase.

## 2 Model

### 2.1 Set-up

The world consists of two fully symmetric countries, each endowed with  $L$  identical individuals. There are two sectors, the final goods sector, which produces a homogeneous (non-tradable) good  $Y$  under perfect competition, and the monopolistically competitive intermediate goods sector, which produces a continuum of (tradable) differentiated varieties. Final output is a CES aggregate of all the available intermediate goods.

To enter the intermediate sector, firms have to pay  $f_e > 0$  units of final goods as entry costs. In the subsequent Melitz lottery, firms draw their productivity  $\phi$  from a Pareto distribution with  $G(\phi) = 1 - (\phi_{\min}/\phi)^k$ , ( $\phi \geq \phi_{\min} = 1$ ,  $k > 1$ ). If a firm starts production, it has to pay fixed per-period production costs,  $f > 0$ . If it starts to export, it has to pay, in addition to  $f$ , fixed per-period export costs,  $f_x > 0$ , and  $\tau \geq 1$  variable (iceberg-type) trade costs.  $\tau$  includes governmental trade barriers, it thus serves as a measure for the degree of trade protection set by the government. Each firm produces one variety, the technology is  $q(\phi) = h(\phi) \cdot \phi$  with  $q$  and  $h$  denoting firm’s output and employment, respectively. Each active firm faces a probability of death  $\delta > 0$  in each period. This set-up very much follows Melitz (2003).

The modelling of the labor market builds on Layard and Nickell (1990) and Layard et al. (2005). In particular, we assume a Nash wage bargain at the firm

level.

## 2.2 Partial equilibrium

The sequence of events is as follows. First, firms learn about their productivity  $\phi$ . Then, the wage bargain takes place and the government decides on the level of trade costs  $\tau$ . In the final stage, firms set employment. Solving the recursive game, we have first to consider the firms' decision, which is summarized by the negatively sloped labor demand schedule

$$h_t(\phi) = h(\phi) + I \cdot \tau^{1-\sigma} h(\phi) = (1 + I \cdot \tau^{1-\sigma}) \phi^{\sigma-1} (\kappa/w)^\sigma Y/M_t, \quad (1)$$

where the indicator variable  $I$  equals one if a firm exports and zero if a firm produces for the domestic market only.  $M_t$  denotes the total number of firms selling in one market (domestic firms and foreign exporters),  $\sigma > 1$  is the price elasticity of demand, and  $\kappa \equiv 1 - 1/\sigma$  is the degree of competitiveness in the intermediate goods sector. Note that a firm with higher productivity  $\phi$  charges a lower price, attracts a larger product demand and thus develops a higher labor demand.

In stage two, firm-specific trade unions and firms bargain over the wage rate  $w$ . The trade unions' behavior is driven by the maximization of the utilitarian utility function  $U_t(\phi) = h_t(\phi)(w - b)$ , where  $b$  denotes the fallback income, which is exogenously given at the firm level. If the bargain fails, unions' utility drops to zero, firms incur a loss amounting to the fixed costs. Maximizing the Nash product subject to (1) yields the well-known result that the bargained wage is a mark-up over the workers' fallback income:

$$w = \theta \cdot b \quad \text{with} \quad \theta \equiv 1 - \gamma_w + \frac{\gamma_w}{\kappa} > 1. \quad (2)$$

The mark-up is increasing in the unions' relative wage bargaining power  $\gamma_w$  ( $0 < \gamma_w < 1$ ) and increasing in product market rents.<sup>1</sup>

The equilibrium level of trade protection is determined by the interaction of politicians, interest groups and voters. We do not want to develop a fully fledged political economy framework, but simply state that trade unions influence the government's choice of the trade costs parameter:  $\tau = \tau(\gamma_\tau)$  with  $\gamma_\tau$  as political power of the trade unions. The sign of  $\partial\tau/\partial\gamma_\tau$  is far from clear. Trade unions are no homogenous interest group. There are the trade unions of import-competing firms, they worry about market shares and jobs and thus call for protection. And there are the trade unions of the exporting firms. These unions gain from lower trade costs and thus favor trade liberalization. If the call for protection (liberalization) prevails, we have  $\partial\tau/\partial\gamma_\tau > 0$  ( $< 0$ ).

In stage one, firms draw their productivity  $\phi$ . From the free-entry condition (expected profits must equal the entry costs in equilibrium) and the zero-cutoff-

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<sup>1</sup>Because of the assumption of identical workers, all firms pay the same wage. If workers are allowed to differ, for instance with respect to their abilities, firms with different  $\phi$  will pay different wages (see de Pinto and Michaelis, 2014).

profit condition (the marginal firm with  $\phi = \phi^*$  has a zero profit), we can calculate the cutoff productivity:

$$\phi^* = \left[ (1 + \tau^{-k}) \frac{f}{\delta f_e} \frac{\beta}{k - \beta} \right]^{1/k} \quad \text{with } \beta \equiv \sigma - 1. \quad (3)$$

The cutoff export productivity where a firm breaks even into the export market is given by  $\phi_x^* = \tau \phi^*$ . Firms can be divided into three groups: (i) for  $\phi < \phi^*$ , firms shut down their business immediately, (ii) for  $\phi^* \leq \phi < \phi_x^*$ , firms produce only for the domestic market, and (iii) for  $\phi \geq \phi_x^*$ , firms additionally export. In our setting, the average productivity of all domestic firms,  $\tilde{\phi}$ , coincides with the average productivity of all firms engaged in one country (domestic firms and foreign exporters),  $\tilde{\phi}_t$ . We get

$$\tilde{\phi}_t = \tilde{\phi} = \left( \frac{k}{k - \beta} \right)^{1/\beta} \phi^*. \quad (4)$$

The derivation of (3) and (4) makes use of the simplifying assumption  $f = f_x$ ; for a step-by-step derivation we refer to Melitz (2003) and Egger and Kreickemeier (2009).

### 2.3 General equilibrium

In order to pin down the general equilibrium, we make use of the concepts of "target" and "feasible" real wages; see Layard et al. (2005). The target real wage is the wage intended by the wage-setters (trade unions). The feasible real wage is the wage firms are willing to concede to the workers. In the general equilibrium, the real income claims of workers are consistent with those of firms.

To derive the general equilibrium, the relationship between the fallback income  $b$  and the unemployment rate  $u$  has to be taken into account. We express this in the standard way:  $b = uB + (1 - u)\bar{w}$ , where  $B$  denotes (exogenous) non-labor income and  $\bar{w}$  the outside wage. Since all firms pay identical wages, we have  $\bar{w} = w$ . Inserting  $b$  into (2) and normalizing  $B$  to one delivers the target real wage as

$$w = \frac{\theta u}{1 - \theta(1 - u)}. \quad (5)$$

The target real wage is increasing in the wage mark-up  $\theta$  and, due to a lower probability of finding a job, decreasing in the unemployment rate  $u$ .

The real wage firms are willing to concede is firm-specific, since productivity  $\phi$  is firm-specific. However, the aggregate variables have an important property (see Melitz, 2003): they are identical to what they would be if the economy were endowed with  $M_t$  identical firms with productivity  $\tilde{\phi}_t$ . Therefore, it is possible to treat the firm with productivity  $\tilde{\phi}_t$  as the representative firm for the economy. Inserting aggregate output  $Y = M_t q(\tilde{\phi}_t)$  and  $q(\tilde{\phi}_t) = h(\tilde{\phi}_t) \cdot \tilde{\phi}_t$  into (1) yields the feasible real wage of the representative firm as

$$w = \kappa \tilde{\phi}_t. \quad (6)$$

The feasible real wage is independent of employment, which is no surprise because of our assumptions of a linear production function and a constant price elasticity of product demand.

In the general equilibrium, the target and the feasible real wage coincide. From (5) and (6), we get the equilibrium unemployment rate. Inserting the result into  $u \equiv 1 - H/L$  delivers equilibrium aggregate employment:

$$H = \frac{\kappa \frac{\tilde{\phi}_t}{\theta} - 1}{\kappa \tilde{\phi}_t - 1} L. \quad (7)$$

Aggregate output and the equilibrium number of firms can be computed as:

$$Y = H \tilde{\phi}_t, \quad M_t = \frac{k - \beta}{k\sigma f} Y. \quad (8)$$

### 3 The two dimensions of trade union power

#### 3.1 Wage bargaining power

Suppose trade unions become more powerful in the wage bargain. Such an increase in  $\gamma_w$  raises the wage mark-up  $\theta$ , the target real wage will be pushed. At the initial level of employment the sum of the income claims now exceeds output. The firms' profit-maximizing response to the increase in their labor costs is a decline in labor demand, aggregate employment drops, see (1) and (7), respectively. Because of the declined probability of finding a job, workers expect a longer spell of unemployment. The income, a union member obtains when he is not employed by the firm in question (fallback income  $b$ ) declines, which in turn lowers the wage claim. Since the feasible real wage does not depend on employment, the real wage in the new general equilibrium is identical to the initial real wage. The equilibrium real wage does not depend on the unions' wage bargaining power. The impact of a higher  $\gamma_w$  is on quantities only: aggregate employment, aggregate output, and the number of firms  $M_t$  decline (see (8)).

The change in  $M_t$  sheds some more light on the adjustment process. Workers extract a larger part of the product market rent by raising the real wage, a redistribution from firms to workers. The profit-maximizing response is the decline in labor demand. However, firms are not able to restore the initial level of profits, all firms face a decline in their profits. The least productive firms cannot absorb such a shock, they make a loss and leave the market. But leaving the market generates a positive spillover effect on the still operating firms, aggregate product demand splits between a lower number of firms, demand per firm goes up. It is this channel, which allows the operating firms to restore the pre-shock levels of employment, production, revenues and profits. The decline in aggregate employment and output does not mirror a shrinking size of each firm, but a decline in the number of firms. To put it different: neither the free-entry

condition nor the zero-cutoff-profit condition are affected by more powerful trade unions, so neither the cutoff productivity  $\phi^*$  nor the average productivity  $\tilde{\phi}_t$  varies with  $\gamma_w$ ; see (3) and (4).

We summarize our results in

**Proposition 1** *Suppose trade unions become more powerful in the wage bargain. Then, in general equilibrium, (i) the cutoff productivity, the average productivity and the real wage remain constant; (ii) all aggregate variables (employment, output, number of firms) decline.*

### 3.2 Political power

Suppose now that trade unions become more powerful in the political arena. In our setting, an increase in  $\gamma_\tau$  translates into a change in the trade costs  $\tau$  set by the government. As explained above, the sign of the change is ambiguous. Let us focus on the case of a call for liberalization,  $\partial\tau/\partial\gamma_\tau < 0$ . Lower import (and export) barriers lead to an increase in expected profits; market entry becomes more attractive. A higher number of firms operating in the market strengthens competition. Thus, both the cutoff productivity  $\phi^*$  and the average productivity  $\tilde{\phi}_t$  increase; see (3) and (4).

The increase in  $\tilde{\phi}_t$  increases the feasible real wage, see (6). Firms bargain less aggressive, or equivalently, at the initial level of wages and employment it is profit-maximizing to hire some workers. The equilibrium unemployment rate goes down, aggregate employment goes up. From (8) immediately follows a hike in both  $Y$  and  $M_t$ . It is interesting to note that employment of the representative firm decreases, since  $\tilde{\phi}_t$  increases and  $q(\tilde{\phi}_t)$  remains constant.

**Proposition 2** *Suppose that the political power of the trade unions increases and that trade unions call for liberalization,  $\partial\tau/\partial\gamma_\tau < 0$ . Then, in general equilibrium, (i) the cutoff productivity and the average productivity increase, (ii) the real wage increases, (iii) aggregate employment, aggregate output and the number of firms increase.*

**Proposition 3** *If trade unions with a higher degree of political power call for trade protection,  $\partial\tau/\partial\gamma_\tau > 0$ , then all effects described in Proposition 2 change their sign.*

### 3.3 Connecting political and wage bargaining power

Trade unions are typically able to convert their industrial into political power. There is a strong positive correlation between these two dimensions of trade union power. We take this observation to the limit and assume  $\gamma_\tau = \gamma_w \equiv \gamma$ .

A higher wage mark-up  $\theta$ , due to stronger trade unions, will now be combined with either higher trade costs  $\tau$  (call for protection) or lower trade costs (call for liberalization). If stronger trade unions demand for protection, the labor market effects immediately follow from the combination of Propositions 1 and

3: firm-selection weakens, i.e.  $\phi^*$  and  $\tilde{\phi}_t$  decrease, and aggregate employment as well as output fall.

More interesting is the case of stronger trade unions which call for trade liberalization. The lowering of trade barriers raises the number of competitors and thus  $\phi^*$  and  $\tilde{\phi}_t$ . The increase in  $\tilde{\phi}_t$  is good news for the wage struggle, the feasible real wage goes up. However, the unions' target real wage also rises. If the increase in the target real wage exceeds (falls short of) the increase in the feasible real wage, the equilibrium unemployment rate will increase (decrease), aggregate employment will decrease (increase).

Which scenario is more plausible? From (7), the condition for a positive effect on aggregate employment ( $\partial H/\partial\gamma > 0$ ) is calculated to be

$$\varepsilon_{\tau\gamma} > \tau^k(1 + \tau^{-k})\frac{\kappa\tilde{\phi}_t - 1}{\theta}, \quad (9)$$

where  $\varepsilon_{\tau\gamma} \equiv -\frac{\partial\tau}{\partial\gamma}\frac{\gamma}{\tau}$  denotes the elasticity of trade costs with respect to the unions' bargaining strength. If the decline in trade costs exceeds the threshold (9), then stronger trade unions are good for aggregate employment. Otherwise,  $H$  declines.

In order to get some intuition for the magnitude of (9), we calibrate our model. We follow Felbermayr et al. (2011) and choose  $\sigma = 3.8$ ;  $f = 1.77$ ;  $f_e = 39.57$ ;  $\delta = 0.025$  and  $\gamma = 0.5$ . As implied by Eaton et al. (2004) we set  $k = 4.2$ . For trade costs  $\tau = 1.3$  ( $\tau = 1.6$ ), the elasticity  $\varepsilon_{\tau\gamma}$  must be larger than 1.98 (3.65) to generate a positive overall employment effect. Unfortunately, to the best of our knowledge, there is no empirical estimation of the elasticity  $\varepsilon_{\tau\gamma}$ . Intuitively, condition (9) seems to be quite strong, so that a negative employment effect of stronger trade unions is the more likely scenario.

Concerning aggregate output, which typically serves as indicator for welfare, the condition for a positive overall effect is less strong. As we know from (8), aggregate output is equal to aggregate employment  $H$  times the average productivity  $\tilde{\phi}_t$ . Any reduction in trade costs pushes  $\tilde{\phi}_t$ . The push may be too small to generate a positive overall employment effect, but for some parameter constellations the increase in  $\tilde{\phi}_t$  overcompensates the decline in  $H$ . Stronger unions are good for aggregate output and welfare ( $\partial Y/\partial\gamma > 0$ ), iff

$$\varepsilon_{\tau\gamma} > \tau^k(1 + \tau^{-k})\frac{\kappa\tilde{\phi}_t - 1}{\theta} \frac{\kappa\tilde{\phi}_t(\theta - 1)}{(\kappa\tilde{\phi}_t - 1)^2 + \theta - 1}. \quad (10)$$

For trade costs  $\tau = 1.3$  ( $\tau = 1.6$ ), the elasticity  $\varepsilon_{\tau\gamma}$  must be larger than 1.08 (2.19) to generate a positive overall output effect. The main results of this section are described in

**Proposition 4** *Suppose  $\gamma_\tau = \gamma_w \equiv \gamma$ . (i) Trade unions, which demand for a wage hike and trade protection, lower the equilibrium real wage as well as aggregate employment and output. (ii) Trade unions, which demand for a wage hike and trade liberalization, raise the real wage. Aggregate employment [output] increases, iff the decline in the trade costs exceeds the threshold (9) [(10)].*

## 4 Concluding remark

Our analysis is silent on the question how trade unions coordinate in order to speak with one voice in the political arena. Such a coordination is a difficult task, since due to heterogenous firms different trade unions are affected differently by trade liberalization. Further research (and a fully fletched political economy framework) is needed to tackle this point. In a similar vein, solid econometric work is needed to shed some more light on unions' trade preferences and their impact on the trade policy outcome.

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