International Outsourcing and Wage Rigidity: A Formal Approach and First Empirical Evidence

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Abstract

In industrialized economies, International Outsourcing is often blamed for destroying jobs and thus, inducing unemployment. Since most contributions examining International Outsourcing assume flexible wages, they do not address these concerns directly. This paper adopts a rigid wage approach and investigates the differences occurring. As theoretical results and the empirical panel data estimations for Germany show, effects depend on industry aggregation, the industry's skill intensity, and the labor market institution. Only in industries characterized by wage rigidity, outsourcing significantly increases low skilled unemployment. Consequently, not International Outsourcing but inflexible labor market institutions instead should be blamed for destroying low skill jobs.

Keywords: International Outsourcing; wage rigidity; unemployment

JEL classification: F16, J64, F41

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1 Introduction

Referring to a survey of the German Marshall Fund (2007), Americans as well as Europeans see International Outsourcing as the main cause of job loss. 61 percent of the Europeans rank International Outsourcing as one of the factors most responsible for loosing their job. Among them, German, French, and Italian respondents fear International Outsourcing most. In the United States, the rate is slightly smaller at 59 percent. These numbers portray the impression we get from media and politics quite well. As e.g. the Times reports online: "The growing pressure on companies to transfer work to low-cost economies will leave poorly-qualified Britons without jobs".[1]

As economists, we need to challenge the accuracy of these statements seriously: Are these fears justified? Is International Outsourcing, the phenomenon of fragmenting production and relocating separated production blocks abroad in order to import foreign intermediates instead, really destroying jobs? And consequently, adopting an industrialized economies' perspective, is International Outsourcing really increasing unemployment of the low skilled? And thus, is International Outsourcing really the scapegoat it is so often blamed for? The answer that I find in this contribution is clearly "no". International Outsourcing is not significantly increasing low skill unemployment by its own. The way how International Outsourcing may affect low skill unemployment is strongly driven by the level of industry aggregation, the skill intensity of the respective industry, and the labor market institution. In industries characterized by flexible wages, outsourcing is not significantly affecting low skill unemployment. Only if low skilled wages are rigidified, e.g. due to some kind of minimum wages, outsourcing significantly increases unemployment of the low skilled. In this respect, the contribution illuminates that not International Outsourcing but inflexible labor market institutions instead should be blamed for harming low skilled labor. Or, in order to argue in terms of the numbers presented above, not International Outsourcing but wage rigidity should be feared most.

Methodologically, the paper adopts an industry level approach investigating implications of International Outsourcing. Thus, it bases i.a. on the contributions of Feenstra

[1] Times Online, November 8 2004, "Outsourcing to destroy unskilled jobs".

and Hanson (1996a,b, 1999), as well as Arndt (1997, 1998a,b). In what is called the "factor bias" of International Outsourcing, Feenstra and Hanson (1996a,b) first showed a significant impact of International Outsourcing on relative high skill wages. Assuming an industrialized economy that relocates its low skill intensive production part to a low wage country and imports the foreign intermediate inputs instead, demand for low skilled labor decreases. Consequently, since wages are assumed to react flexible, relative wages of the high skilled increase. Feenstra and Hanson support their formal hypothesis also empirically by estimating the effects on relative wages in the US. Arndt (1997, 1998a,b) extended the one sector model of Feenstra and Hanson and therefore, moved the focus towards more disaggregated industry levels. Adopting a traditional trade framework, he presents general equilibrium effects, also known as the "sector bias" of International Outsourcing. Assuming a 2x2 HO model, effects depend strongly on the industry where International Outsourcing takes place. If International Outsourcing takes place in the relative high skill intensive industry, the reduction in production costs is used to pay some high skill wage premium. Consequently, relative wages of the high skilled increase. By contrast, if International Outsourcing takes place in the relative low skill intensive industry, relative wages of the low skilled increase. These effects occur either if the industry relocates its low or its high skill intensive production pattern. The factor as well as the sector bias of International Outsourcing are discussed, extended, and empirically investigated within several contributions.[2]

Since most of these contributions assume flexible wage economies, they are not suitable for investigating outsourcing implications on unemployment and thus, for addressing the public fears mentioned above. In the major European economies, where people fear outsourcing most, labor markets are often characterized by inflexible labor market institutions that, compared to the more flexible US labor market, should convert the already mentioned effects on relative wages into unemployment. Thus, in order to examine the effects of International Outsourcing on unemployment, the flexible wage assumption needs to be replaced by some form of wage rigidity. In this respect, only few contributions emerged recently.

[2]See e.g. Glass and Saggi (2001), Deardorff (2001a,b), Egger and Falkinger (2003), Kohler (2008), or Horgos (2009).

Skaksen (2004) e.g. examines the effects of International Outsourcing occurring in unionized labor markets. As his model considers only one sector and one kind of labor, it is not able to address any relative effects or distributional issues. Additionally, it does not contribute to the discussion of the factor or the sector bias of International Outsourcing and thus, does not fit into the main part of the sectoral outsourcing literature. Nevertheless, results are quite interesting: If firms relocate production fragments abroad, the wage rate increases in tandem with unemployment. Considering one industry comprising a heterogeneous labor market, Koskela and Stenbacka (2007) investigate the effects of International Outsourcing and a solidaristically wage setting monopolistic labor union on the wage differential as well as unemployment for both skill groups. Following an increase of the wage differential due to outsourcing activities, unemployment of the high skilled increases while unemployment of the low skilled decreases. With unemployment arising not in hand, but as a consequence of wage settings, results conflict with traditionally assumed implications of International Outsourcing discriminating low skilled labor. Introducing a fair-wage approach (c.f. Solow, 1979; Akerlof, 1982; Akerlof and Yellen, 1988, 1990) in order to focus on a special characteristic of labor market imperfection, Egger and Kreickemeier (2008) present a model where wage inequality is able to coexists with unemployment. Introducing a novel diagrammatic tool (based on the Lerner-Pearce diagram), they are able to address major public concerns of International Outsourcing: With high skill intensive home production, International Outsourcing mitigates the unemployment problem and reduces the high skill wage premium. Additionally, they explore how preferences with respect to fair wages and the size of employment benefits govern employment effects.

Leaving the theoretical world and studying the empirical literature, there is a gap in research examining the differences of labor market implications occurring when International Outsourcing takes place in industries characterized by a rigid wage floor. Since macro-variables indicating the degree of an industry's labor market inflexibility do not exist, there is the need to generate these information. This statistical challenge may be one reason for the lack of empirical evidence examining the interaction of International Outsourcing, wage rigidity, and labor market outcomes. This paper tries to contribute to fill this gap.

The reminder of the paper is structured as follows: In order to discuss how general equilibrium effects of International Outsourcing differ if flexible wages are replaced by low skill wage rigidity, a formal model is presented in Section 2. To contribute to the discussion of the sector vs. the factor bias of International Outsourcing, the model assumes a traditional 2x2 HO framework. Using Shephard's Lemma (cf. Shephard, 1953, 1970), it builds on the modern duality approach in international trade theory and introduces International Outsourcing activities similar to skill biased technical change as in Jones (1965). In order to achieve a benchmark model, general equilibrium effects are investigated within the flexible wage case first. Afterwards, the flexible wage assumption is violated by introducing an asymmetric minimum wage for low skilled labor, as proposed in Brecher (1974a,b). As it turns out, results differ fundamentally: Since International Outsourcing takes place in the relative high skill intensive industry, relative wages of the high skilled still increase, however, not as strong as in the flexible wage scenario. In order to maintain the minimum cost level, the relative low skill intensive industry has to reduce output. This forces the industry to free low skilled labor that can not be absorbed completely by the expanding relative high skill intensive industry. Consequently, International Outsourcing increases unemployment of the low skilled. Section 3 presents a logistic panel data analysis supporting the theoretical findings. Results for Germany show that International Outsourcing does not significantly increase low skill unemployment. However, if outsourcing takes place in industries characterized by low skilled wage rigidity, the probability for low skilled labor to get unemployed increases significantly. Section 4 concludes by summarizing the major findings and addresses some questions of high political relevance.

2 Formalizing International Outsourcing Implications

In order to formally investigate industry level effects of International Outsourcing, this section uses the modern duality approach in international trade theory. Based upon an algebraic simplicity known as Shephard's Lemma, equilibrium conditions in the production sector are formulated in terms of unit cost functions rather than production functions. Following Uzawa (1964), Diewert (1971, 1974), Woodland (1977), and Mussa

(1979), a cost minimization problem in a factor-price space emerges. The advantage of minimizing unit costs rather than maximizing output can be derived from Shephard (1953, 1970): With unit cost functions differentiable at the factor price w^*, the cost minimizing input-output-coefficients can simply be obtained with the partial derivative of the unit cost functions with respect to wages.

Consider an economy facing given world prices p with two industries, a relative high skill intensive (X) and a relative low skill intensive one (Y). Both industries use two primary inputs, low skilled labor L and high skilled labor H to produce goods of quantity q_i (with $i = X, Y$). The production function is of a typical Cobb Douglas kind with constant returns to scale. Goods as well as factor markets are perfectly competitive with factors mobile between industries, but immobile between countries. The home country faces an inelastic supply of labor ($\bar{L}$, $\bar{H}$) and remains incompletely specialized ($q_i > 0$). In order to keep the model traceable, we focus on the supply side of the economy in setting the elasticity of demand unity ($\sigma^D = 1$). Thus, the world market is assumed to absorb changes in demand and, since $\hat{p} = 0$, possible effects from price changes. Thus, with free entry in both industries, we achieve the unit cost functions equaling the price

$$c_X = a_{XL}w_L + a_{XH}w_H = p \quad (1)$$

$$c_Y = a_{YL}w_L + a_{YH}w_H = 1 \quad (2)$$

with c_i as unit costs, a_{ij} as unit factor requirements ($j = L, H$), w_j as factor prices, the price of the relative low skill intensive good Y as numeraire, and the relative price of good X as $p \equiv p_X/p_Y$. When partially differentiating the unit cost functions with respect to the wages (Shepard's Lemma), we achieve

$$a_{XL} = \frac{\partial c_X(w_L, w_H)}{\partial w_L} \tag{3}$$

$$a_{XH} = \frac{\partial c_X(w_L, w_H)}{\partial w_H} \tag{4}$$

$$a_{YL} = \frac{\partial c_Y(w_L, w_H)}{\partial w_L} \tag{5}$$

$$a_{YH} = \frac{\partial c_Y(w_L, w_H)}{\partial w_H} \tag{6}$$

as cost minimizing labor unit requirements. Additionally, we have to consider

$$a_{XL}q_X + a_{YL}q_Y = \bar{L} \tag{7}$$

$$a_{XH}q_X + a_{YH}q_Y = \bar{H} \tag{8}$$

as labor market clearing conditions. With a system of eight endogenous variables (w_H, w_L, a_{XL}, a_{XH}, a_{YL}, a_{YH}, q_X, q_Y) in eight equations, the model is exactly determined.

In order to enable the industries relocating their production fragments abroad, we define φ_{ij} as an International Outsourcing parameter, similar to skill biased technical change as defined in Jones (1965). Since International Outsourcing is assumed to reduce labor unit requirements, the percentage change $\hat{\varphi}_{ij} \equiv -\frac{1}{a_{ij} \cdot (\partial a_{ij}/\partial IO)}$ is a measure showing the alteration in a_{ij} due to International Outsourcing activities (∂IO) that would take place at constant wages.[3] Thus, the unit cost functions (1) and (2) can be rewritten into

$$c_X(\vec{w}_L, \vec{w}_H) = \vec{a}_{XL}\vec{w}_L + \vec{a}_{XH}\vec{w}_H \tag{9}$$

$$c_Y(\vec{w}_L, \vec{w}_H) = \vec{a}_{YL}\vec{w}_L + \vec{a}_{YH}\vec{w}_H \tag{10}$$

[3] In this contribution, International Outsourcing is defined in a broad sense without considering organizational firm characteristics. Thus, International Outsourcing activities indicate a reduction in domestic labor unit requirements of the respective skill group, without distinguishing whether the production fragment relocated abroad is produced in-house or at arm's length. In order to keep the model traceable, determinants of International Outsourcing are also excluded. Thus, International Outsourcing here is modeled as illustrated in Arndt (1997, 1998a,b).

with $\vec{w}_j \equiv \frac{w_j}{\varphi_{ij}}$ and $\vec{a}_{ij} \equiv \varphi_{ij} a_{ij}$ as wages and labor unit requirements considering International Outsourcing activities. Taking the total differential in order to minimize unit costs we obtain

$$\theta_{XL}\hat{w}_L + \theta_{XH}\hat{w}_H = \theta_{XL}\hat{\varphi}_{XL} + \theta_{XH}\hat{\varphi}_{XH} \quad (11)$$

$$\theta_{YL}\hat{w}_L + \theta_{YH}\hat{w}_H = \theta_{YL}\hat{\varphi}_{YL} + \theta_{YH}\hat{\varphi}_{YH} \quad (12)$$

as equilibrium production in both industries with factor income shares $\theta_{ij} \equiv \frac{a_{ij}w_j}{p_i}$ and "hats" over variables denoting percentage changes. As (11) and (12) show, there are four International Outsourcing situations possible: Both industries can either outsource their low skill intensive or their high skill intensive production block.

General Equilibrium Effects with Flexible Wages

In the theoretical section of the paper we assume that International Outsourcing takes place in the relative high skill intensive industry by relocating its low skill intensive part of production.[4] Thus, with $\hat{\varphi}_{XL} > 0$ and $\hat{\varphi}_{XH} = \hat{\varphi}_{YL} = \hat{\varphi}_{YH} = 0$, (11) and (12) change to

$$\theta_{XL}\hat{w}_L + \theta_{XH}\hat{w}_H = \theta_{XL}\hat{\varphi}_{XL} \quad (13)$$

$$\theta_{YL}\hat{w}_L + \theta_{YH}\hat{w}_H = 0 \quad (14)$$

Wages and Labor Unit Requirements

Let's investigate the flexible wage benchmark scenario first. In order to examine the effects of International Outsourcing on wages, we can solve (13) and (14) for the change in low and high skilled wages and obtain

[4] As known from the sector bias of International Outsourcing (cf. Arndt, 1997, 1998a,b), low skilled wages are expected to increase if International Outsourcing would take place in the relative low skill intensive industry. Thus, a possible downward wage rigidity for low skilled labor would not be binding.

$$\hat{w}_L = -\frac{\theta_{XL}\theta_{YH}}{\Delta_\Theta}\hat{\varphi}_{XL} \tag{15}$$

$$\hat{w}_H = \frac{\theta_{XL}\theta_{YL}}{\Delta_\Theta}\hat{\varphi}_{XL} \tag{16}$$

with Δ_Θ as the determinant of the matrix of factor income shares $\Theta \equiv \begin{pmatrix} \theta_{XH} & \theta_{XL} \\ \theta_{YH} & \theta_{YL} \end{pmatrix}$ and

$$\hat{w}_H - \hat{w}_L = \frac{\theta_{XL}}{\Delta_\Theta}\hat{\varphi}_{XL} \tag{17}$$

as the percentage change in relative high skilled wages. Since $\Delta_\Theta > 0$, International Outsourcing of the low skill intensive production block in the relative high skill intensive industry increases the relative wage of the high skilled ($\hat{w}_H - \hat{w}_L > 0$), as depicted in the Mussa-Woodland-Figure 1.

- include Figure 1 around here -

Since the relative high skill intensive industry relocates its low skill intensive production block, it needs less low skilled labor to produce one unit of commodity X. As the economy faces given world prices, this induces a reduction of unit costs. Thus, the respective unit cost curve shifts horizontally outward. Since relative wages of the high skilled increase in both industries, high skilled labor gains from this International Outsourcing activity in receiving a wage premium.

As we know from Shephard's Lemma (3) - (6), equilibrium labor unit requirements can be obtained by differentiating the unit cost functions partially with respect to the wages. Considering International Outsourcing ($\vec{a}_{ij} = a_{ij}\varphi_{ij} = \frac{\partial c_i}{\partial \vec{w}_j}$ and thus, $a_{ij} = \frac{\partial c_i}{\partial \vec{w}_j \cdot \varphi_{ij}}$) we obtain

$$\hat{a}_{XL} = \theta_{XH}(\hat{w}_H - \hat{w}_L + \hat{\varphi}_{XL} - \hat{\varphi}_{XH}) - \hat{\varphi}_{XL} \quad (18)$$

$$\hat{a}_{XH} = -\theta_{XL}(\hat{w}_H - \hat{w}_L + \hat{\varphi}_{XL} - \hat{\varphi}_{XH}) - \hat{\varphi}_{XH} \quad (19)$$

$$\hat{a}_{YL} = \theta_{YH}(\hat{w}_H - \hat{w}_L + \hat{\varphi}_{YL} - \hat{\varphi}_{YH}) - \hat{\varphi}_{YL} \quad (20)$$

$$\hat{a}_{YH} = -\theta_{YL}(\hat{w}_H - \hat{w}_L + \hat{\varphi}_{YL} - \hat{\varphi}_{YH}) - \hat{\varphi}_{YH} \quad (21)$$

as the percentage change of the cost minimizing labor unit requirements. Now consider that only $\hat{\varphi}_{XL} > 0$ and substitute for the change in relative wages (17) we obtain

$$\hat{a}_H - \hat{a}_L = -\frac{\theta_{XL}}{\Delta_\Theta}\hat{\varphi}_{XL} \quad (22)$$

as the percentage change of relative labor unit requirements. Since International Outsourcing increases relative wages of the high skilled, relative labor unit requirements of the high skilled decrease in both industries. Thus, both industries shift skill requirements toward more low skilled labor.[5]

Output and Employment

To investigate the effects of International Outsourcing on output, take the total differential of the full employment conditions (7) and (8). In equilibrium, we obtain

$$\hat{q}_X\lambda_{XL} + \hat{q}_Y\lambda_{YL} = -(\hat{a}_{XL}\lambda_{XL} + \hat{a}_{YL}\lambda_{YL}) \quad (23)$$

$$\hat{q}_X\lambda_{XH} + \hat{q}_Y\lambda_{YH} = -(\hat{a}_{XH}\lambda_{XH} + \hat{a}_{YH}\lambda_{YH}) \quad (24)$$

with labor shares $\lambda_{iL} \equiv \frac{L_i}{L}$ and $\lambda_{iH} \equiv \frac{H_i}{H}$. Substituting for the changes of labor unit requirements and relative wages we can solve these equations for the percentage

[5]The unambiguity of this result depends strongly on the assumption of a Cobb Douglas production process and the flexible wage set-up. Since the shift toward more low skill intensive production does not hold empirically, this may be a first hint pointing to labor market rigidities. Then, firms would reduce low skill employment which adds to unemployment (cf. Dluhosch, 2008).

change in output of both industries, subject to the change in International Outsourcing activities

$$\hat{q}_X = \frac{\delta_H \lambda_{YL} + \delta_L \lambda_{YH}}{\Delta_\Theta \Delta_\Lambda} \theta_{XL} \hat{\varphi}_{XL} + \theta_{XL} \hat{\varphi}_{XL} \tag{25}$$

$$\hat{q}_Y = -\frac{\delta_H \lambda_{XL} + \delta_L \lambda_{XH}}{\Delta_\Theta \Delta_\Lambda} \theta_{XL} \hat{\varphi}_{XL} \tag{26}$$

with $\delta_L \equiv \lambda_{XL}\theta_{XH} + \lambda_{YL}\theta_{YH}$, $\delta_H \equiv \lambda_{XH}\theta_{XL} + \lambda_{YH}\theta_{YL}$, and the determinant of the matrix of labor shares $\Delta_\Lambda > 0$ with $\Lambda \equiv \begin{pmatrix} \lambda_{XH} & \lambda_{YH} \\ \lambda_{XL} & \lambda_{YL} \end{pmatrix}$. Since International Outsourcing makes the respective industry more competitive on world markets, output increases in the relative high skill intensive industry ($\hat{q}_X > 0$), whereas output of the industry remaining integrated decreases ($\hat{q}_Y < 0$).

As we know, assuming wage flexibility, high and low skilled labor remain fully employed. However, provided that labor can freely move between the industries, within industry employment effects arise. Taking the total differential of the full employment conditions and substituting for the change in relative wages, labor unit requirements, as well as output, we obtain

$$\hat{L}_X = \frac{\theta_{XH}\Delta_\Lambda + (\delta_H \lambda_{YL} + \delta_L \lambda_{YH})}{\Delta_\Theta \Delta_\Lambda} \theta_{XL} \hat{\varphi}_{XL} \tag{27}$$

$$\hat{L}_Y = \frac{\theta_{YH}\Delta_\Lambda - (\delta_H \lambda_{XL} + \delta_L \lambda_{XH})}{\Delta_\Theta \Delta_\Lambda} \theta_{XL} \hat{\varphi}_{XL} \tag{28}$$

$$\hat{H}_X = \frac{(\delta_H \lambda_{YL} + \delta_L \lambda_{YH}) - \theta_{XL}\Delta_\Lambda}{\Delta_\Theta \Delta_\Lambda} \theta_{XL} \hat{\varphi}_{XL} \tag{29}$$

$$\hat{H}_Y = -\frac{\theta_{YL}\Delta_\Lambda + (\delta_H \lambda_{XL} + \delta_L \lambda_{XH})}{\Delta_\Theta \Delta_\Lambda} \theta_{XL} \hat{\varphi}_{XL} \tag{30}$$

as the percentage change in within industry employment of low and high skilled labor. Since International Outsourcing increases employment of the low skilled in the relative high skill intensive industry ($\hat{L}_X > 0$), employment of the low skilled in the relative low skill intensive industry has to decrease ($\hat{L}_Y < 0$). The same pattern occurs for high skilled labor. With employment of the high skilled decreasing in the relative low skill intensive industry ($\hat{H}_Y < 0$) employment of the high skilled in the relative high

skill intensive industry has to increase ($\hat{H}_X > 0$). Thus, since International Outsourcing increases output in the relative high skill intensive industry, low as well as high skilled labor quit employment in the low skill intensive industry and move to the high skill intensive one.

The Curse of Wage Rigidity: Low Skill Unemployment

After examining general equilibrium effects of International Outsourcing with flexible wages, this section considers an empirically more realistic scenario for major European economies. There, powerful unions as well as high social standards induce some kind of wage rigidity for low skilled labor. As employees would not accept wages beneath the margin set by social standards, wages are prevented from adjusting to shocks. Thus, results are likely to differ fundamentally from the flexible wage benchmark model. In order to consider these differences we violate the flexible wage assumption and subject the entire labor market of the economy to a wage floor for low skilled labor. Following Brecher (1974a,b), labor market inflexibility is modeled with real wages for the low skilled rigid with respect to the numeraire.

The rigid wage, exogenously given in real terms, is specified at a fixed level denoted by $\bar{w}_L$, the real wage before the respective industry decides to relocate production fragments abroad. Thus, at $\bar{w}_L$ low skilled labor is fully employed but with downward inflexibility of the real wage

$$w_L \geq \bar{w}_L \text{ or } \hat{w}_L \geq 0 \tag{31}$$

To investigate the implications of International Outsourcing with wage rigidity assume again the case that the relative high skill intensive industry relocates its low skill intensive production fragment ($\hat{\varphi}_{XL} > 0$ whereas $\hat{\varphi}_{XH} = \hat{\varphi}_{YL} = \hat{\varphi}_{YH} = 0$). As we know from (15) and (17) real wages of the low skilled decrease in absolute as well as in relative terms. Thus, the above defined minimum wage (31) is binding, preventing low skilled wages from downward adjustment ($\hat{w}_L = 0$).

With wage rigidity we have to rewrite (13) and (14) and obtain

$$\theta_{XH}\hat{w}_H = \theta_{XL}\hat{\varphi}_{XL} \quad (32)$$

$$\theta_{YH}\hat{w}_H = 0 \quad (33)$$

as equilibrium conditions. Solving for the percentage change in high skill wages, different results ceteris paribus emerge for the two industries

- include Figure 2 around here -

As Figure 2 shows, International Outsourcing of the low skill intensive production fragment in the relative high skill intensive industry shifts the respective unit cost function horizontally outside. Due to the wage rigidity for the low skilled, wages of the high skilled increase in the same industry but, in a first step, remain unchanged in the relative low skill intensive industry. As we assumed labor to be completely mobile between industries, the high skilled employed in the relative low skill intensive industry would immediately move to the relative high skill intensive industry in order to achieve the wage premium. Thus, the low skill intensive industry would stop production. However, holding to the assumption of incomplete specialization, this is not an equilibrium anymore. Thus, in order to keep production positive, the relative low skill intensive industry is forced to accept the high skill wage premium paid in the relative high skill intensive industry ($\hat{w}_{YH} = \hat{w}_{XH} = \hat{w}_H = \frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL}$). Then, however, the relative low skill intensive industry is no longer producing at minimum costs. The only way for the relative low skill intensive industry to remain at the minimum cost level is to reduce output.

Wages and Labor Unit Requirements

Provided that the relative low skill intensive industry has to accept the high skill wage premium and since the wage floor for low skilled labor is binding ($\hat{w}_L = 0$), the change in relative wages of the high skilled equals the respective absolute change with

$$\hat{w}_H - \hat{w}_L = \frac{\theta_{XL}}{\theta_{XH}} \hat{\varphi}_{XL} \tag{34}$$

Thus, also with a wage floor for low skilled labor, International Outsourcing in the relative high skill intensive industry increases relative wages of the high skilled, however, not as strong as in the flexible wage scenario

$$(\hat{w}_H - \hat{w}_L)|_{\text{flex}} - (\hat{w}_H - \hat{w}_L)|_{\text{rigid}} = \frac{\theta_{XL}}{\Delta_\Theta} \hat{\varphi}_{XL} - \frac{\theta_{XL}}{\theta_{XH}} \hat{\varphi}_{XL} > 0 \tag{35}$$

since $\Delta_\Theta \equiv \theta_{XH} - \theta_{YH} < \theta_{XH}$. Thus, the minimum wage for low skill labor mildens the widening of the wage gap.

For the effects of International Outsourcing on relative labor unit requirements remember (18) - (21) and substitute for the change of relative wages assuming the binding minimum wage (34). Solving for the change in relative labor unit requirements, we obtain

$$\hat{a}_H - \hat{a}_L = -\frac{\theta_{XL}}{\theta_{XH}} \hat{\varphi}_{XL} \tag{36}$$

Since relative wages of the high skilled increase also with a minimum wage for low skilled labor, International Outsourcing again induces a skill shift towards more low skilled labor in both industries. However, the skill shift is, as the effects on relative wages, not as strong with wage rigidity as with flexible wages.

Output and Employment

In order to achieve the equilibrium pattern of output and employment, recall the endowment of the economy with fixed overall factor supplies ($\bar{L}$ and $\bar{H}$) constraining the employment conditions. With the assumption of wage rigidity, we have to rewrite (7) and obtain

$$L \equiv a_{XL}q_X + a_{YL}q_Y \leq \bar{L} \tag{37}$$

considering that unemployment of the low skilled may occur ($\hat{L} \leq 0$). Thus, there is the possibility of low skilled labor being not employed in the X or in the Y industry. Since high skill wages remain flexible, high skilled labor stays fully utilized

$$H \equiv a_{XH}q_X + a_{YH}q_Y = \bar{H} \tag{38}$$

Taking the total differential of the employment conditions (37 and 38), we obtain

$$\hat{q}_X\lambda_{XL} + \hat{q}_Y\lambda_{YL} = \hat{L} - (\hat{a}_{XL}\lambda_{XL} + \hat{a}_{YL}\lambda_{YL}) \tag{39}$$

$$\hat{q}_X\lambda_{XH} + \hat{q}_Y\lambda_{YH} = -(\hat{a}_{XH}\lambda_{XH} + \hat{a}_{YH}\lambda_{YH}) \tag{40}$$

as equilibrium condition. Considering the changes in labor unit requirements as well as relative wages, we can solve (39) and (40) for $\hat{q}_X$ and $\hat{q}_Y$ and achieve

$$\hat{q}_X = \frac{\lambda_{YL}(\lambda_{XH} + \theta_{YL}\lambda_{YH}) + \lambda_{YH}(\theta_{YH}\lambda_{YL})}{\Delta_\Lambda} \cdot \frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} - \frac{\lambda_{YH}}{\Delta_\Lambda}\hat{L} \tag{41}$$

$$\hat{q}_Y = -\frac{\lambda_{XL}(\lambda_{XH} + \theta_{YL}\lambda_{YH}) + \lambda_{XH}(\theta_{YH}\lambda_{YL})}{\Delta_\Lambda} \cdot \frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} + \frac{\lambda_{XH}}{\Delta_\Lambda}\hat{L} \tag{42}$$

as equilibrium output patterns for both industries. Since low skilled labor was fully employed before slicing up the value chain, employment of the low skilled can either remain unchanged or decrease ($\hat{L} \leq 0$). Thus, International Outsourcing increases output in the relative high skill intensive industry and leads to a contraction of the relative low skill intensive one. By contrast to the benchmark-case of flexible wages, the change in output occurring with rigid wages is due to two different forces, one "normal" effect of the International Outsourcing activity as well as an "additional" effect as the low skill intensive industry sets low skilled labor free ($\hat{L}_Y \leq 0$), in order to maintain the

minimum cost level. Since $\lambda_{XH} > \lambda_{YH}$, the change of low skilled employment decreases the output in the relative low skill intensive industry (Y) by more than it expands output in the relative high skill intensive industry (X) (i.e. $\frac{\lambda_{YH}}{\Delta_\Lambda}\hat{L} < \frac{\lambda_{XH}}{\Delta_\Lambda}\hat{L}$).

To examine the effects on employment, consider again the change within the industries. Substituting for the change in relative wages, the change in labor unit requirements as well as the change in output, we obtain

$$\hat{H}_X = -\frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} + \frac{\lambda_{YL}(\lambda_{XH} + \theta_{YL}\lambda_{YH}) + \lambda_{YH}(\theta_{YH}\lambda_{YL})}{\Delta_\Lambda}\frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} - \hat{L}\frac{\lambda_{YH}}{\Delta_\Lambda} \tag{43}$$

$$\hat{H}_Y = -\frac{\theta_{YL}\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} - \frac{\lambda_{XL}(\lambda_{XH} + \theta_{YL}\lambda_{YH}) + \lambda_{XH}(\theta_{YH}\lambda_{YL})}{\Delta_\Lambda}\frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} + \hat{L}\frac{\lambda_{XH}}{\Delta_\Lambda} \tag{44}$$

as the effects of International Outsourcing on within industries' high skill employment. Provided that high skilled wages stay flexible, the relative low skill intensive industry (Y) again decreases employment of the high skilled ($\hat{H}_Y \leq 0$), whereas the relative high skill intensive industry increases high skilled employment. For the within industries' change in low skill employment we achieve

$$\hat{L}_X = \frac{\theta_{XL}}{\theta_{XH}}\hat{\varphi}_{XL} - \frac{\lambda_{YH}}{\lambda_{YL}}\hat{L}_Y \tag{45}$$

as the long run equilibrium. Thus, after some painful adjustment processes in the short run, some of the low skilled labor set free in the relative low skill intensive industry (Y) is absorbed by the relative high skill intensive industry (X). However, since not all of the unemployed low skilled can be absorbed at given wages by the relative high skill intensive industry (X), International Outsourcing of the low skill intensive parts in the relative high skill intensive industry increases unemployment of the low skilled as long as we move down the Rybczynski line to find the new equilibrium situation.

3 Empirical Evidence for Germany

In order to support the theoretical findings stated above empirically, this section provides a micro-econometric panel data analysis investigating the implications of International Outsourcing on low skill unemployment. Thereby, a special focus is set on the differences occurring when labor market institutions are characterized by flexible wages, or rigid wages for the low skilled instead.

Data and Econometric Methodology

The analysis bases on microeconomic panel data for the German economy between 1991 and 2000. Using a random effects logit model, individual unemployment is regressed on the International Outsourcing activity of the industry the individual was employed in, as well as several variables controlling for observable individual-specific as well as industry-specific characteristics. Therefore, we estimate

$$\begin{aligned} U_{ijt} &= \beta_0 + \beta_1 \text{i\_VS\_flex}_{jt} + \beta_2 \text{i\_VS\_rigid}_{jt} \\ &\quad + \beta_3 Y_{jt} + \beta_4 \text{age}_{it} + \beta_5 \text{deast}_{it} + \beta_6 \text{dmale}_{it} + \tau_j + \delta_t + \epsilon_{it} \end{aligned} \tag{46}$$

and

$$\begin{aligned} U_{ijt} &= \beta_0 + \beta_1 \text{i\_dVS\_flex}_{jt} + \beta_2 \text{i\_dVS\_rigid}_{jt} \\ &\quad + \beta_3 dY_{jt} + \beta_4 \text{age}_{it} + \beta_5 \text{deast}_{it} + \beta_6 \text{dmale}_{it} + \tau_j + \delta_t + \epsilon_{it} \end{aligned} \tag{47}$$

with U as a binary variable indicating if individual i is unemployed at time t. In order to focus on the International Outsourcing activity of industry j, two interaction variables i_VS_flex and i_VS_rigid are generated and included as exogenous variables. Since we conduct the level-analysis in equation (46), equation (47) investigates the implications of the percentage changes of International Outsourcing. Thus, the interaction variables differ slightly: i_VS_flex interacts a dummy indicating flexible wage industries with

the level of the industry's International Outsourcing activity.[6] By contrast, *i_VS_rigid* replaces the dummy with one indicating industries with a rigid wage structure for low skilled labor. *i_dVS_flex* and *i_dVS_rigid* interact the dummies with the percentage change of the International Outsourcing index instead. Y is the output of industry j (dY refers to the percentage change again) and *age* the age of individual i. The dummy variable deast indicates if the individual's residence is in East Germany, and the dummy variable dmale the gender of the individual. Additionally, we control for time specific effects (δ) as well as industry specific effects (τ). Thus, with the error term ϵ allowing for unspecified correlation of errors within industries, the regression cares for contemporaneous correlation even though maximum likelihood estimation is used instead of OLS.[7]

The data is taken from the German Socio Economic Panel GSOEP and from input-output tables provided by the German Federal Statistical Office. The input-output tables are used to calculate the VS-index and the output of each two-digit NACE industry for the period 1991 to 2000. The endogenous variable U, indicating the employment status of an individual, is taken from the GSOEP (waves H/8, 1991 to Q/17, 2000). The GSOEP additionally provides information on the age of an individual, the individual's residence, gender, as well as the education of each individual with respect to the international comparable ISCED from UNESCO (1997).[8]

In order to generate the interaction variables, it is necessary to distinguish between flexible wage industries and industries characterized by low skill wage rigidity. However, since wage rigidity is typically not observable on a more aggregated sectoral bases, there is a need to proxy wage rigidity at the industry level. This, however, is an empirical challenge and thus, may be the reason why there is no empirical evi-

[6] On a more aggregated industry level it is necessary to proxy International Outsourcing activities. Therefore, several indices are developed and some of them are very common in use. One of these indices, called the VS-index, is a proxy of imported inputs in production and can be calculated using $VS_t = \sum_{j=1}^{n} \sum_{w=1}^{z} \frac{(m_{wt}/s_{wt}) \cdot q_{wjt}}{p_{jt}}$ with q as total inputs from industry w used in industry j, p as production value in industry j, m as total imports and s as the domestic use of goods w. For a descriptive overview of International Outsourcing activities in Germany, measured by the VS-index, and an empirical investigation of often used International Outsourcing indices, see Horgos (2009).

[7] See Moulton (1990) for the necessity to include industry controls in order to account for correlation of errors within groups and thus, to provide spurious regression when estimating the effects of macro-variables on micro-units.

[8] In line with the ISCED, low skill educated workers are defined as individuals with primary, lower secondary or second stage of basic education, whereas high skilled workers are individuals with some form of post secondary education.

dence for wage rigidities affecting the implication of economic phenomena, like e.g. International Outsourcing activities. In order to generate an indicator denoting if an industry is characterized by a rigid wage structure or not, the analysis follows a similar procedure as in Holden (2004), Goette et al. (2007), Knoppik and Beissinger (2005), and Bauer et al. (2007).[9]

In order to obtain the information whether an industry is characterized by rigid wages for the low skilled or not, the percentage change of the mean wage $\hat{w}_{it}$ of the low skilled is calculated for each year in each two-digit NACE industry as a first step. Based on the percentage changes, a normalized distribution of the corresponding wage changes per industry-year is generated by adjusting the empirically observed wage changes with the industry specific median and standard deviation $\hat{w}^n_{it} \equiv \frac{\hat{w}_{it} - \mu(\hat{w})_i}{sd(\hat{w})_i}$. Afterward, the industry-year specific samples of the empirical distribution need to be calculated. As the empirical samples and their moments are stochastic and thus burdened with unknown uncertainty, a bootstrap method is used. Thus, we create a distribution of the low skilled wage changes in bootstrapping the empirically observed percentage changes for each industry-year sample. Based on the generated empirical distribution, the number of wage cuts per industry is calculated and, in this regard, the respective probability of a wage cut occurring in this industry is computed. The empirically observed probability of wage cuts needs to be related to a normalized probability of wage cuts (assuming no wage rigidity). Therefore, a notional distribution of the normalized wage cuts is created by adjusting the normalized wage changes with the bootstrapped mean and standard deviation $\tilde{w}_{it} \equiv \hat{w}^n_{it} sd^B + \mu^B$. Based on this notional normalized distribution, the number of wage cuts and the respective probability of these wage cuts occurring per industry are calculated. The notional normalized probability of wage cuts per industry can then be related to the empirically observed probability of wage cuts per industry. If the empirically observed probability of wage cuts per industry is smaller than the notional normalized one, it is assumed that the respective industry is characterized by rigid wages for low skilled labor.[10]

[9] For more papers on the measurement of wage rigidities see the special edition of the Economic Journal, Vol. 117, Iss. 524, Nov. 2007.

[10] Table 3 in the Appendix provides an overview of the two-digit NACE industries in Germany characterized as rigid-wage industries due to this classification (considering the period 1991-2000).

Table 1: Effects on Low Skilled Unemployment in Germany

	Whole Economy		Manufacturing Industry	
	level analysis	perc. change	level analysis	perc. change
VS / dVS (flex)	19.3272	3.9556	−77.9434	2.2663
	(1.15)	(1.46)	(−.1.06)	(.19)
VS / dVS (min)	13.2004	−.8210	15.2684	4.6875
	(1.47)	(−.58)	(1.06)	(1.52)
Y / dY	3.95*e*-06	2.7972*	−5.70*e*-07	4.1480
	(1.04)	(1.78)	(−.06)	(1.43)
age	−.0597***	−.0659***	−.0662***	−.0701***
	(10.03)	(−8.78)	(−6.14)	(−5.45)
d East Ger.	.2583	.2525	.4108	.4119
	(1.42)	(1.21)	(1.11)	(1.04)
d Male	−.3568**	−.3420*	−.4203*	−.2644
	(−2.31)	(−1.90)	(−1.71)	(−.92)
cons	−3.1580***	−2.2504***	8.5099	−3.0578***
	(−3.42)	(−4.62)	(.85)	(−3.52)
Observations	16,107	13,008	5,810	5,013
Groups	5,009	4,343	1,831	1,698
Prob > chi2	0.0000	0.0000	0.0005	0.0098
Industry Controls	YES	YES	YES	YES
Year Controls	YES	YES	YES	YES

endogenous variable: low skill unemployment; z-Statistics in parantheses
* / ** / *** significant at 10 / 5 / 1 percent

Results

In order to empirically test the effects of wage rigidity on the implications of International Outsourcing activities, (46) and (47) are first regressed for the whole economy.[11] The results are presented in the first two columns of Table 1.

As the results show, International Outsourcing (measured with the VS index) is not significantly affecting unemployment of the low skilled, neither in flexible wage industries, nor in industries characterized by low skill wage rigidity. This insignificance occurs in the level analysis as well as in the analysis of percentage changes. Output is also not at a common level of statistical significance in the level analysis, however, when assessing percentage changes, an increase in the output of an industry increases unemployment of the low skilled significantly at 10 percent. This could indicate some kind of skill biased technical progress. If the industry gets more productive and

[11] Since it can not be assumed that the individuals exhibit a systematic intercept, but instead, that they are randomly drawn from a binomial distribution, all the models below are tested using a random-effects logit estimator. Additionally, since the data consists of a huge amount of observations and a comparably small amount of years, the random effects logit model can be assumed to be much more efficient than its fixed effects variant. When regressing the unemployment status on the contemporaneous industries' output, a possible endogeneity problem could be assumed. Therefore, Durbin-Wu-Hausman tests are applied to assure that possible endogeneity does not significantly affect the consistency of the estimated coefficients.

increases output, more capital or high skilled labor could be employed that replaces low skill intensive workers. However, the significance of the output effect diminishes when moving forward to more disaggregated industry levels. If individuals get older, there is a significant reduction of the possibility to get unemployed. The age effect is mostly significant at the 1 percent level. Also the male dummy shows a reducing effect on low skilled unemployment that is in most of the regressions statistically significant. Therefore, being a female increases the probability to get unemployed. The dummy for east Germany is overall of positive tendency, however, not at a level of common statistical significance. With more than 15,000 individuals and strongly significant chi2-values, the model seems to be necessarily representative to derive generalizable results.

When analyzing the effects occurring within the manufacturing industry, results are quite similar than in the aggregate. The effects of International Outsourcing on low skill unemployment is not statistically significant, wether in flexible wage industries, nor in industries characterized by low skill wage rigidity. However, a tendency of the coefficients gets obvious, that will be even stronger when moving towards more disaggregated industries. While there is tendency that International Outsourcing increases the probability of low skill unemployment when taking place in rigid wage industries, there is a decreasing tendency when outsourcing occurs in flexible wage industries. However, as there are several forces counter affecting each other in more aggregated industry levels, results will be much clearer when moving forward to more disaggregated industry levels.

The results presented in Table 2 occur when International Outsourcing takes place in the high or the low skill intensive industries of the manufacturing sector. The empirical results strongly support the theoretical picture of Section 4. If International Outsourcing takes place in high skill intensive industries, the implications on low skill unemployment differ strongly with respect to the labor market institution characterizing the respective industries. In more flexible wage industries, International Outsourcing shows a tendency to decrease unemployment, even when not at a common level of statistical significance. By contrast, in industries characterized by low skill wage rigidity, International Outsourcing increases the probability of low skilled to get

Table 2: Effects on low skilled unemployment in Germany

	High Skill Industries		Low Skill Industries	
	level analysis	perc. change	level analysis	perc. change
VS / dVS (flex)	−108.8451	−6.0917	−31.6075	−4.3762
	(−.51)	(−.00)	(−.36)	(−.37)
VS / dVS (min)	60.3768**	11.5757**	−4.0444	2.9884
	(2.16)	(1.95)	(−.19)	(.72)
Y / dY	−4.22*e*-06	4.8931	1.03*e*-04	2.1571
	(−.31)	(1.36)	(1.37)	(.37)
age	−.0701***	−.0634***	−.0617***	−.0768***
	(−4.18)	(−3.42)	(−4.65)	(−3.61)
d East Ger.	.3586	.4448	.3884	.3518
	(.66)	(.81)	(.82)	(.59)
d Male	−.0992	.1799	−.6602**	−.6198
	(−.25)	(.39)	(−2.16)	(−1.46)
cons	−13.9453**	−4.0429***	−15.6500	−2.6521*
	(−2.31)	(−3.42)	(−1.41)	(−1.67)
Observations	2,768	2,377	3,042	2,636
Groups	1,018	942	1,085	1,017
Prob > chi2	0.0056	0.0254	0.0429	0.7443
Industry Controls	YES	YES	YES	YES
Year Controls	YES	YES	YES	YES

endogenous variable: low skill unemployment; z-Statistics in parantheses
* / ** / *** significant at 10 / 5 / 1 percent

unemployed significantly at the 5 percent level. The results of the other control variables do not change compared to the aggregated sectors, however, the gender dummy variable is outside the statistically significant range here.

When International Outsourcing takes place in the relative low skill intensive industries, the probability for the low skilled to get unemployed mostly decreases, however, not at a statistically significant level. This result, occurring even in industries with wage rigidity, supports the expected results known from the sector bias of International Outsourcing (cf. Arndt, 1997): Since low skilled labor gains when International Outsourcing occurs in relative low skill intensive industries, the demand for low skilled labor increases as does employment and wages. Thus, a possible wage floor would not be binding and unemployment would be expected to decrease. The results of the included control variables again confirm the findings. One interesting point to mention additionally is that the increasing effect of being a female on the probability of the low skilled to get unemployed is statistically significant in relative low skill intensive industries, however, not significant in flexible wage industries.

4 Conclusion

In industrialized economies, International Outsourcing is often blamed for relocating low skill intensive jobs abroad and thus, increasing low skill unemployment. Since politics and media strongly support this few, lots of people fear International Outsourcing for being one main force for job losses. This contribution shows that these fears are are not necessary: If wages are allowed to react flexible, workers do not need to fear International Outsourcing to destroy jobs. By contrast, if the industry is characterized by low skill wage rigidity, as they e.g. would be when frequently discussed minimum wages are adopted, International Outsourcing significantly increases unemployment of the low skilled.

Since most theoretical contributions investigating implications of International Outsourcing assume flexible wage set-ups, they are not directly capable for addressing the issue of unemployment. Thus, this contribution formalizes the sector bias of International Outsourcing and enriches the framework with an asymmetric minimum wage for low skilled labor: If outsourcing takes place in the relative high skill intensive industry, the low skill intensive industry is forced to set labor free in order to cope with wage markups payed in the relative high skill intensive industry (the one where outsourcing takes place). Since not all of the low skilled can be absorbed by the expanding high skill intensive industry, low skill unemployment occurs. Using a random effects logistic panel data estimator, the paper additionally provides first empirical evidence: International Outsourcing by its own is not significantly affecting employment. Only if labor market institutions are characterized by rigid wages, outsourcing significantly increases low skill unemployment. Thus, in this respect, not International Outsourcing but inflexible labor market institutions instead should be feared most.

Addressing policy implications, this contributions has far reaching results. In times where politicians frequently claim to rigidify labor markets, the results highlight, that this is exactly the wrong way. In order to cope with Globalization and the enormous unemployment rates in developed economies, an economy should do everything to keep their labor markets flexible.

This contribution tries not to explain the main causes for unemployment in major European economies. Instead, the paper highlights the importance of labor market institutions to gain from a non-stoppable economic process, International Outsourcing. Policy makers can either stand for more flexibility, and accept a larger wage gap, or for more rigid labor markets, and buying a decrease in the wage gap dearly with low skilled unemployment. Since this contribution is just a first step to investigate effects of outsourcing with labor market rigidities, there are several aspects worth being investigated further. There is e.g. the need for empirical cross country studies to investigate which institutions keep best with International Outsourcing activities. Additionally, different forms as well as the degree of labor market rigidities would also be worthwhile to examine.

Appendix: Wage Rigidity at the 2-digit NACE Industry Level

Table 3: 2-digit NACE industries with a rigid wage structure

NACE	Industry	Wage Rigidity	NACE	Industry	Wage Rigidity
1	Agriculture	1	41	Water collection, treatment and supply	0
2	Forestry	0	45	Construction of buildings	1
5	Fishing	0	50	Wholesale and retail trade and repair of motor vehicles	0
10	Mining of cole and lignite	1	51	Wholesale trade	1
11	Extraction of crude petroleaum and natural gas	0	52	Retail trade	1
12	Mining of iron ores	0	55	Accomodation	1
13	Mining of non-ferrous metal ores	0	60	Land transport and transport via pipelines	1
14	Quarrying of stone, sand and clay	0	61	Water transport	0
15	Manufacture of food products and beverages	1	62	Air transport	0
16	Manufacture of tobacco products	0	63	Warehousing and support activities for transportation	1
17	Manufacture of textiles	1	64	Postal and courier activities	1
18	Manufacture of wearing apparel	1	65	Financial service activities, except insurance	1
19	Manufacture of leather and related products	1	66	Insurance, reinsurance and pension funding	1
20	Manufacture of wood except furniture	0	67	Activities auxiliary to financial services	0
21	Manufacture of paper and paper products	1	70	Real estate activities	1
22	Printing and reproduction of recorded media	1	71	Rental and leasing activities	0
23	Manufacture of coke and refined petroleum products	0	72	Data processing and data warehouse	0
24	Manufacture of chemicals and chemical products	1	73	Scientific research and development	0
25	Manufacture of rubber and plastic products	1	74	Office administrative and other business support activities	0
26	Manufacture of other non-metallic mineral products	0	75	Public administration and defence; compulsory social security	1
27	Manufacture of basic metals	1	80	Education	0
28	Manufacture of fabricated metal products, except machinery	1	85	Human health activities	0
29	Machinery	1	90	Activities of households as employers of domestic personnel	0
30	Manufacture of computer, electronic and optical products	1	91	Activities of membership organisations	1
31	Manufacture of electrical equipment	1	92	Culture, sports, and entertainment	1
32	Radio, TV, and telecommunications	1	93	Other services	1
33	Manufacture of machineryand equipment	1	95	Sewerage	0
34	Manufacture of motor vehicles, trailers and semi-trailers	1	96	Industry - not assigned	1
35	Manufacture of other transport equipment	0	97	Handcraft - not assigned	0
36	Manufacture of furniture	1	98	Services - not assigned	1
37	Repair and installation of machinery and equipment	1	99	Activities of extraterritorial organisations and bodies	0
40	Electricity, gas, steam and air conditioning supply	1	100	Undifferentiated goods and services producing activities	0

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