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International Outsourcing and German Manufacturing Wages

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Abstract

This paper investigates the link between international outsourcing and wages utilising the German Socio-Economic Panel (SOEP) and combining it with industry-level information on industries' outsourcing activities. Instead of following the literature by differentiating between manual and non-manual workers, I also utilise data on educational attainment in order to distinguish between skill categories. While outsourcing proves to be statistically insignificant for manual and non-manual workers' wages, I find evidence that when applying a more accurate skill definition, a one percentage point increase in our outsourcing measure reduces the real wage for low-skilled workers by 1.7 percent while it increases real wages for high-skilled workers by 2.2 percent.

JEL Classifications: F16, L24, J31

1. Introduction

International outsourcing has become a widespread phenomenon, and in Germany, public anxiety about its effects on the wages and jobs of low-skilled workers in particular has been growing for some time. Against this background, the lack of academic research on international outsourcing and its labour market effects is surprising. The heated debate about the potential threat of international outsourcing to wages and employment in Germany and the allegedly "unpatriotic" behaviour of firms that shift production abroad reflects the intense public interest and highlights how little academic research has so far succeeded in contributing to the debate.[1]

Unfortunately, the theoretical literature on international outsourcing is not conclusive. Depending on the model setup and the set of assumptions, outsourcing increases or lowers the relative demand for low-skilled workers (e.g.

[1] See for example "Druck auf die Löhne, Angst um die Arbeitsplätze – wie die Osterweiterung die deutsche Wirtschaft verändert", Der Spiegel, 18 / 2004, "Wirtschaft weist Schröders Vorwürfe zurück", Handelsblatt, 23 March 2004.

Feenstra and Hanson 1996, Arndt 1997, Arndt 1999, Venables 1999; Jones and Kierzkowski 2001, Kohler 2004). How international outsourcing can be expected to affect labour markets is therefore essentially an empirical question, and very few studies of this issue have been done in the context of the German labour market. This paper is a first step towards filling this gap by focusing on the effects of international outsourcing on domestic wages. I am particularly interested here in whether wages for high- and low-skilled workers are affected differently.

In most existing studies, the impact of international outsourcing on labour markets is assessed by estimating the relative demand for skilled labour derived from a cost function, or mandated wage regressions using aggregate country or industry level data (see Feenstra and Hanson 1996, Feenstra and Hanson 1999a and Morrison-Paul and Siegel 2001 for the US, Anderton and Brenton 1999, Hijzen, Görg and Hine 2004 and Hijzen 2003 for the UK and Falk and Koebel 2002, Geishecker 2002 for Germany). This is somewhat unsatisfactory, as the use of aggregated data can seriously bias estimated coefficients (see Theil 1954, Misra 1969, Gupta 1971).

This paper investigates the link between outsourcing and wages from a different angle, utilising micro data from the SOEP and combining it with industry-level information on industries' outsourcing activities from input-output tables, and thus overcoming aggregation bias and other shortcomings of industry-level studies. The following section presents the empirical model. Section 3 discusses the skill definitions and outsourcing measure used and provides some notes on the design of the micro data used. Section 4 discusses the empirical findings and Section 5 draws conclusions and outlines further research.

2. The Empirical Model

In order to analyse the impact of international outsourcing on wages, I estimate Mincerian wage equations for low- and high-skilled workers (see Mincer 1974). According to the partial econometric approach, the findings should be interpreted as the immediate short-run impact of international outsourcing on wages within industries. Essentially I assume that in the short run, labour is immobile between sectors. Hence, the empirical findings can be expected to correspond to the theoretical implications of the one-sector model of Feenstra and Hanson (1996) with international outsourcing increasing wages for high-skilled and lowering wages for low-skilled workers. I estimate the following log wage equation:

$$\text{(1)} \qquad \ln WAGE_{ijt} = \alpha + \beta DEMOG_{it} + \gamma WORK_{it} + \delta EDUC_{it} + \theta IND_{jt} + \lambda OUT_{jt} + \tau_j + \mu_t + \iota_i + \epsilon_{it}$$

where coefficients partly denote coefficient vectors for control variable vectors. $WAGE_{ijt}$ denotes individual $i's$ hourly wages in industry j, which are defined in the next section below. I apply standard control variables. *DEMOG* denotes the demographic control variables for age, marital status, geographic region. The second set of control variables (*WORK*) contains characteristics related to the workplace such as size and ownership of the firm, tenure, occupational category. A third set of control variables (*EDUC*) contains educational dummies for high education (*edhigh*) and medium education (*edmed*); low education (*edlow*) is the omitted category. I also control for time changing industry characteristics (*IND*) by including industry output and two types of capital (plant and equipment). Furthermore, I control for the effects of technological change by including an industry-specific time trend.

I subsequently incorporate international outsourcing (OUT) as defined in equation 3. The error term is decomposed into general industry-specific effects (τ_j) and general time-specific effects (μ_t), which I estimate with a full set of industry dummies and time dummies respectively. This also makes it possible to control extensively for time-invariant industry-level wage determinants other than those captured by the outsourcing variable (OUT) and the additional time-varying industry variables. Furthermore the general time dummies also capture manufacturing-wide effects such as technological progress and business cycles. I also allow for individual fixed effects (ι_i) that take account of unchanging observable and unobservable individual characteristics.[2] The remaining error term (ϵ_{it}) is assumed to be normally distributed.

In order to avoid contemporaneous correlation due to combining industry-level and micro data, I adjust the standard errors to allow for an unspecified correlation of error terms across individuals within the same industry.

Outsourcing is likely to affect not only wages but also employment. When workers lose their jobs, their wages become unobservable. This incidental truncation of the sample could give rise to sample selection bias. Within the context of my fixed effects estimation, sample selection bias should, however, only be a problem if selection and the idiosyncratic errors are correlated. I apply the sample selection test suggested by Wooldridge (1995)[3], which extends Heckman (1976) for a fixed effects panel data model. My first step is to estimate a reduced form selection equation by pooled probit including all explanatory variables plus the mean of the respective explanatory variables. My second step is to estimate the fixed effects wage equation including the inverted mills ratio from the selection equation. In all model specifications, the Mills ratio is statistically insignificant[4], hence sample selection bias can be rejected.

2 Random effects were rejected in a Hausman specification test.

3 Also see Woolridge (2002) Chapter 17.7.2.

4 t-test values for columns I – IV in Table 2: 0.92; 0.99; 0.76; 0.58.

3. Data

The analysis is based on data from the German Socio-Economic Panel (SOEP)[5] for the years 1991 to 2000 (see Haisken-DeNew and Frick 2003, for a detailed description of the panel). For this analysis, I exclude subsample B (main foreigner group), subsample C (East Germany sample) and subsample D (Immigrant sample) in order to separate the effects of international outsourcing from other determinants (such as the massive restructuring of the economy in Eastern Germany or changing foreigner discrimination) that may determine wages for these population groups.[6]

My sample is further restricted to prime-age (18 to 65 years) male blue- and white-collar workers in full-time employment in the manufacturing industry (NACE 15-36). Accordingly, my results are only representative for the selected subpopulation. The sample covers 1,613 individuals yielding a total number of 5,268 observations.[7]

Wages are defined as average hourly gross labour earnings using generated data for gross yearly wages and yearly working hours from the cross-national equivalent files (CNEF). Observations with imputed wage information are disregarded in the subsequent analysis.

Here two different skill definitions are applied that only partly overlap. Firstly, I differentiate between blue- and white-collar employees. Secondly, I distinguish between high- and low-skilled workers based on information on educational attainment and vocational training. A description of the skill grouping can be found in Table 4.

Industry-level data on international outsourcing was obtained from input-output tables of the German Federal Statistical Office. I define international outsourcing as:

$$OUT_{jt} = \frac{IMP_{jt}}{Y_{jt}} \tag{2}$$

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5 The data used in this paper was extracted from the SOEP Database provided by the DIW Berlin using the Add-On package SOEPMENU for Stata (TM). SOEPMENU (http://www.soepmenu.de) was written by Dr. John P. Haisken-DeNew (Haisken-DeNew, 2005). Any data or computational errors in this paper are my own.

6 The innovation subsample F from 2000 cannot be used since the fixed effects models here require at least two observations for each individual, and outsourcing data is only available up to 2000.

7 In order to avoid selection bias with respect to item non-response that might be not completely at random, each explanatory variable was supplemented with a dummy for missing values. Subsequently, missing values were recoded to zero and the dummies generated for missing values also act as regressors in the model (Coefficients are not reported).

with j denoting the respective two-digit manufacturing industry ($j \epsilon J$), *IMP* the value of imported intermediate inputs from a foreign industry and Y the industry's output value. Data on industry output and plant and equipment was collected from the German Federal Statistical Office.

Table 1

Skill classification

low-skilled	no degree no degree + occupational training lower school degree lower school degree + additional occupational training intermediary school lower school degree + technical school intermediary school + additional occupational training degree for professional college
high-skilled	high school degree, high school + additional occupational training degree of professional college + additional occupational training higher technical college university degree

4. Results

In most industry-level studies, mainly due to data constraints, low- and high-skilled workers are normally equated with manual and non-manual workers respectively (e.g. Feenstra and Hanson 1996, Anderton and Brenton 1999, Hijzen et al. 2004). Following this skill approximation, I first estimate equation 1 for non-manual and manual workers respectively (results reported in columns 1 and 2 of Table 5).[8] The coefficients on the individual- and firm-level variables are largely as expected. However, with regard to international outsourcing, I find no statistically significant effect on wages for non-manual or manual workers. Arguably, classifying skills on the basis of manual and non-manual work is fairly inaccurate. In a second step, I therefore instead apply a skill definition based on educational and occupational attainment (see Section 3) and re-estimate the model. The coefficients presented in columns 3 and 4 of Table 5 significantly differ from my previous estimates. International outsourcing is found to have a marked impact on wages of high-skilled and low-skilled workers. A one percentage point increase in the outsourcing mea-

8 An alternative approach would be to pool manual and non-manual workers and regress equation 1 with appropriate interaction terms. A standard poolability test, however, casts doubt on the assumption of equal coefficients across manual and non-manual workers for all other variables.

sure increases wages for high-skilled workers by 2.2 percent, while wages for low-skilled workers are reduced by 1.7 percent. Accordingly, in line with the theoretical predictions of Feenstra and Hanson (1996), international outsourcing is indeed biased against low-skilled workers, who suffer absolute losses in their real wages, while high-skilled workers absolutely gain.

5. Conclusion

In this paper I investigate the impact of international outsourcing on wages for different skill groups. My approach is novel in that it is, to the best of my knowledge, the first paper using micro data to look at this issue. Applying the common skill classification that defines non-manual workers as high-skilled and manual workers as low-skilled, I find no statistically significant effect of outsourcing on wages. However, when utilising individual information on educational and occupational attainment and redefining skill groups on that basis, I find that outsourcing has a marked short-term impact on wages. A one percent increase in the outsourcing measure lowers wages for low-skilled workers by 1.7 percent, while wages for high-skilled workers rise by 2.2 percent. My results therefore highlight the sensitivity of the estimates with respect to what one defines to be high- or low-skilled. In future research, I intend to utilise a wider range of human capital indicators in the SOEP to test these results for robustness with respect to alternative skill classifications.

Table 2

Fixed Effects Log Wage Regression for Fragmentation

	Narrow Fragmentation		Wide Fragmentation	
	White-collar	Blue-collar	High-skilled	Low-skilled
Age: 18-24	-0.0392	0.1826	0.168	0.006
	(0.31)	(1.42)	(1.62)	(0.05)
Age: 25-34	0.0158	0.2119	0.119	0.069
	(0.16)	(1.69)*	(1.36)	(0.62)
Age: 35-44	0.0898	0.2584	0.136	0.151
	(1.07)	(2.51)**	(1.65)	(1.80)*
Age: 45-54	0.1102	0.2655	0.126	0.172
	(2.71)***	(3.18)***	(2.48)**	(3.30)***
Married	0.0819	-0.0102	-0.022	0.037
	(1.83)*	(0.18)	(0.90)	(0.98)
Number of Children	0.0261	-0.0290	0.039	-0.026
	(2.47)**	(1.64)	(1.59)	(2.26)**
Firm size: <20	-0.2548	-0.2109	0.224	-0.070
	(0.80)	(2.64)***	(1.89)*	(0.33)
Firm size: <200	-0.2226	-0.0902	-0.512	-0.100
	(2.39)**	(0.62)	(3.12)***	(0.92)
Firm size: <2000	-0.0794	-0.0667	-0.091	-0.068
	(1.04)	(0.75)	(2.03)**	(0.90)
Firm:Public Owner	-0.0211	-0.0014	0.007	-0.024
	(0.56)	(0.03)	(0.51)	(0.48)
Tenure	-0.0388	0.1132	-0.061	0.113
	(0.84)	(1.14)	(0.95)	(1.88)*
Occ: Managers / Legisl.	-0.0004	-0.0003	-0.001	-0.001
	(0.15)	(0.06)	(0.20)	(0.40)
Occ: Scientists	0.2560	-0.1945	-0.005	0.097
	(1.09)	(0.62)	(0.04)	(1.03)
Occ: Technicians	0.2374	-0.0376	-0.001	0.065
	(0.95)	(0.29)	(0.01)	(0.51)
Occ: Clerks	0.2415	0.0363	-0.033	0.078
	(0.95)	(0.47)	(0.22)	(1.00)
Occ: Service	0.2958	0.0113	0.115	0.042
	(1.17)	(0.14)	(2.08)**	(0.52)
Occ: Craft	0.1066	-0.1033	-	0.047
	(0.38)	(1.30)	-	(0.36)
Occ: Operators / Assembl.	0.1844	0.0236	0.004	0.038
	(0.77)	(0.47)	(0.04)	(0.57)
Industry: R\&D / Y	0.2840	0.0485	-0.064	0.079
	(1.21)	(1.06)	(0.96)	(1.45)
Industry: equipment / Y	0.7823	0.2727	0.578	0.587
	(0.95)	(0.27)	(0.62)	(1.08)

(Table 2 cont.)

	Narrow Fragmentation		Wide Fragmentation	
	White-collar	Blue-collar	High-skilled	Low-skilled
Industry: plant / Y	-2.5751	-1.4824	-0.260	-2.488
	(1.32)	(0.55)	(0.11)	(1.70)*
Industry: Output (Y)	-0.0081	-0.0203	0.0270	-0.0301
	(0.61)	(1.25)	(1.49)	(2.90)***
OUT	0.0022	-0.0167	0.022	-0.017
	(0.19)	(1.49)	(1.79)*	(2.48)**
Constant	27.4930	4.0898	-30.378	29.307
	(2.50)**	(0.23)	(1.37)	(2.27)**
Observations	2462	2806	1223	4045
R^2	0.81	0.66	0.89	0.71

T-statistics in parentheses * significant at 10 percent, ** at 5 percent, *** at 1 percent.

Not reported: full set of federal state dummies, year dummies, industry dummies and industry-specific time trends. Default categories: firm size: > 2000; occ: elementary; low education; *Industry Output*$*10^{10}$.

Source: Author's calculations, SOEP 1991 – 2000, subsamples A and E.

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